MATHEMATICS ANXIETY AND PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN IMENTI SOUTH SUB-COUNTY, KENYA.

CASTY MUKAMI MUTEGI

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS OF EDUCATION IN EDUCATIONAL ADMINISTRATION AND PLANNING OF THE UNIVERSITY OF EMBU.

SEPTEMBER, 2021.

DECLARATION

This thesis is my original work and has not been presented elsewhere for a degree or any other award.

Signature……………………   Date………………………….

Mutegi M. Casty

E551/1203/2018

Department of Education

University of Embu

This thesis is submitted for examination with our approval as the University Supervisors

Signature…………………….   Date …………………………

Dr. Ciriaka Gitonga

Department of Education

University of Embu

Signature………………………   Date………………………….

Dr. Peter Rugano

Department of Education

University of Embu

DEDICATION

This thesis is dedicated to my lovely husband, Eutycus Muchui for moral support throughout the research work. Thank you for persevering with the long hours of my absence which was an ingredient towards my success. To my beloved daughter Brylynn Nkatha may this thesis be an inspiration in all your endeavors.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

AIR   American Institute for Research.

ATMI   Attitude towards Mathematics Anxiety.

AU   African union.

CEDAW   Convention on the Elimination of all forms of Discrimination Against Women.

CIDP   County Integrated Development Plan.

EFA   Education for All.

KCSE   Kenya Certificate of Secondary Education.

KICD   Kenya Institute of Curriculum Development

KNBS   Kenya National Bureau of Statistics

MA   Mathematics Anxiety

MAS   Mathematics Anxiety Scale.

MOEST   Ministry of Education, Science, and Technology

NACOSTI National Commission for Science, Technology, and Innovations

NAEP   National Assessment of Education progress

NECTA   National Education Commission of Tanzania

SDG   Sustainable Development Goal

SMASE   Strengthening Mathematics and Science Education

SPSS   Statistical Package for Social Science.

STEM   Science, Technology, Engineering, and Mathematics.

TIMSS   The International Trends in Mathematics and Science Study

UN   United Nations.

UNESCO   United Nations Educational, Scientific and Cultural Organization.

OPERATIONAL DEFINITION OF TERMS

Mathematics anxiety- according to the study, it is the feeling of tension and fear for Mathematics that can be manifested in students through sweating, lack of concentration, avoiding Mathematics lessons, anger, and others.

Mathematics attitude- according to the study, it is the negativity or the positivity that the students have towards mathematics as a subject.

Mathematics performance -is the students' score and achievement in Mathematics during evaluation.

Teaching methods- according to the study they are the methods and ways that Mathematics teachers use to impart skills and knowledge to students. They may or not elicit Mathematics anxiety in students.

ABSTRACT

Mathematics is an essential subject worldwide though it is one of the poorly performed subjects in Kenya. There are many reasons that have been attributed to poor performance in Mathematics. While some studies have examined Mathematics test anxiety, it is not clear on the role of Mathematics anxiety on performance. Mathematics anxiety is caused by several factors and it manifests itself in different ways among students. This study explored the Mathematics anxiety and performance among secondary school students. Specifically, the study explored on gender differences towards mathematics anxiety, relationship between Mathematics anxiety and attitude, relationship between Mathematics anxiety and performance and strategies used to reduce Mathematics anxiety. The study employed descriptive research survey design and was guided by arousal performance theory by Yerkes Dodson. The study targeted 70 public secondary schools, 113 Mathematics teachers and 18,514 students in Imenti South Sub-County. The sample size was computed using Yamane's formula $n = N/[1+N(e)^2]$. The study participants consisted of 59 schools, 367 students and 77 Mathematics teachers. Stratified sampling technique was used to select the schools, purposeful sampling technique was used for Mathematics teachers and simple random sampling was used to select the students. The researcher administered the questionnaires personally. The data was collected using standardized questionnaires consisting of Mathematics Anxiety Scale and Attitude Towards Mathematics Inventory. A checklist was used to get the information from teachers about the strategies they employed to reduce Mathematic anxiety in students. The data from the questionnaire was analyzed through the use of descriptive statistics, the independent samples t-tests and Spearman's correlation coefficients. The study found out that the students experienced anxiety in low, moderate and high levels. The t test analysis results showed that there were no gender differences between males and females in respect to low mathematics anxiety (t (365) = -.433, $p = .665$), moderate anxiety level (t (365) = .353, p = .724) and high anxiety level (t (365) = .520, p = .603). The Spearman's correlation coefficient revealed that there was a statistical association between Mathematics anxiety and Mathematics attitude (r= 0.538, p< 0.05). The Spearman's correlation coefficient revealed a significant relationship between mathematics anxiety and Mathematics performance (r= -0.723, p< 0.05). The checklist results showed that there are common strategies used by teachers to reduce mathematics anxiety. These strategies included assessment of different varieties, encouraging active participation, group discussions, boosting positive attitude towards mathematics and others. The study recommends that further studies be carried out in both private and more public sec schools for a broader perspective on mathematics anxiety and performance.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Mathematics learning is essential in daily life of a student as it acquaints one with an understanding of logic and dealing with life problems that require simple calculations. Geist (2008) states that children start to develop the foundations of Mathematics concepts during the fourth stage of child development. Mathematics is important since; it helps one recognize patterns, helps one seek evidence, conclusion, and proof and again it helps one solve problems and seeking absolutes when open to new information.

Despite the role played by mathematics in the society, Keskin et al. (2018) posit that Mathematics teaching and learning is threatened by factors such as classroom management and organization and assessment of student learning for beginning teachers. These factors may arouse anxiety in students towards mathematics which contribute to poor performance in Mathematics. According to Chabulembwa (2014), a study carried out in Zambia found out that, Mathematics teaching and learning is faced by the following challenges; negative attitude towards Mathematics, poor foundations of Mathematics, inadequate resources and ineffective teaching strategies by teachers. All the above factors have been contributing to Mathematics performances being low and the study seeks to find whether Mathematics anxiety may be a contributing factor towards the performances in Mathematics. However, several studies suggest that Mathematics anxiety is a contributory factor. Tobias (1993) stated that Mathematics anxiety, a feeling of tension and fear affects a students' ability to understand and to do Mathematics, thus interfering with performance. Students exhibit low levels of concentration and inability to answer Mathematics questions correctly due to anxiety during and before Mathematics lesson.

In addition, several studies show that Mathematics anxiety is characterized by low marks, physical, psychological and behavioral symptoms (Plaisance, 2009). To avoid embarrassments from teachers, students avoid face-to-face meetings with the teachers (Yeo, Tan & Lew 2015). Other students are restless and show low levels of concentration in Mathematics classes, sweating in hands and also answering questions poorly. When students avoid meeting their teachers, consulting in cases of difficulties and become

restless then this may initiate more anxiety towards Mathematics which may stimulate different Mathematics performances.

Students can either be in less anxious (low), moderately anxious(moderate) or highly anxious(high) levels (Khesht-Masjedi et al., 2019). Students who portray high anxiety may fear to fail in potentially frightening circumstances (Rodarte-Luna & Sherry, 2008). Subsequently, students avoid examinations, delay in taking assignments and fear to prepare for tests (Macher et al., 2012, 2013; Papousek et al., 2012). Motivation enables students to display moderate levels of anxiety which results to high performances. In contrast, when there is low anxiety level, a relationship concerning mathematics anxiety and performance in math is evident (Wang et al., 2015).

Researchers have shown that female students experience more anxiety towards mathematics as compared to their male counterparts. Dorn et al. (2009) In fact, two out of every three teenagers with general anxiety disorder are girls. Females are said to report high anxiety levels compare to males (Bieg et al., 2015; Cipora et al., 2015; Erturan and Jansen, 2015; Dowker et al., 2016). Khesht-Masjedi et al. (2019) postulated that girls were more anxious with mathematics as compared to boys. Their study found a significant difference between anxieties for girls and boys (p=0.000). At different levels of anxieties boys and girl's levels were not equal, implying that the levels varied with the gender. Goetz *et al* (2013) posited that a girl experience high level of mathematics anxiety when linked to the male counterparts.

Researchers advocate the following reasons as to why female students experience high anxiety than their male counterparts. Firstly, the different ways of socializing of boys and girls during childhood may later affect their anxieties in certain circumstances (Devine *et al*., 2012). Since mathematics is viewed as an area for men, female may think that they are incompetent in math and therefore experience anxieties with mathematics (Kombe *et al*., 2016; Sarouphim & Chartouny, 2017).

Another possible explanation for the gender difference in MA is that females openly display feelings of anxiety since their emotions are accepted whereas those of men are seen as unacceptable (Chaplin, 2015; Pajares, 2005). Another account for gender

differences may be mathematics experience whereby the differences between the different genders anxiety levels disappears when mathematical background is put into considerations (Devine et al., 2012; Dowker *et al*., 2016). Implying the amount of interacting with mathematics(practices) and the number of positive or negative experiences with mathematics may influence mathematics anxiety levels differently for each gender.

Studies shows that there is a link between anxiety and attitude and also with performance. According to Kargar et al. (2010) there exist a correlation between anxiety and attitude in mathematics. He further argued that students who portrayed high mathematics anxiety had a habit of having negative attitude towards mathematics. This is further reinforced by the findings that there exist a correlation between anxiety and attitude of mathematics when variables are studied in relation to perceptions of undergraduate students' competence at numeracy skills (Durani & Tariq, 2009). Further, there is a link between mathematics anxiety and attitude (Chaman & Callingham, 2013; Sahri et al., 2017; Recber et al., 2018).

The consequences of being anxious towards mathematics are avoiding mathematics and poor performance in mathematics (Kargar et al., 2010). Further, Zhang et al 2019 postulated that there was a negative association between mathematics anxiety and performance. This implied that high mathematics anxiety resulted to poor performance and the performance was good at moderate/low levels. Namkung et al. (2019) postulated mathematics anxiety was related to performance (Sahri et al., 2017; Recber et al., 2018). This implied that moderate anxiety results to high performance and high anxiety in students results to low performance. High test anxiety is experienced in all subjects (Muola, Kithuka, & Nassiuma, 2009). This study shows that students experience anxiety during examinations and text in all other related subjects. The anxiety may be as an outcome of previous poor performance in exams. Syokwaa, Aloka, and Ndunge (2014) argue that personality anxiety level is 79% and that of test anxiety is 27%. They further argue that high anxiety levels in any subject affected performance negatively.

There are different techniques that can be employed by instructors to reduce Mathematics anxiety in students whenever its symptoms appear in students. Firstly, the teachers should

always instill positive attitude towards Mathematics. Siew (2018), postulated that positive attitude exists among students towards learning Mathematics concepts and hence the teacher should come up with ways of motivating them and this will reduce the fear they have for Mathematics. According to Wallace (2018), teachers should display a positive attitude for the students, focus the lesson to be student-centered, making students more active and using manipulatives or multiple ways of solving a problem. Teachers should show excitement when teaching Mathematics and they should be motivated, this is because students adopt their teacher's interest in and passion for teaching Mathematics. A positive attitude can be instilled in students by use of motivating words such as good, better, a nice trial and so on, these make the students accept their Mathematics positions and work toward doing better.

Secondly, provision of a conducive learning environment may help reduce Mathematics anxiety. According to Hughes et al. (2018), teachers should create a non-threatening environment for learning Mathematics, such a learning environment should allow students to feel free when participating in mathematics activities. This will enhance students' achievement and attitudes according to Taylor and Fraser, (2013). During a Mathematics lesson, the teacher should initiate an interactive session where students are free to ask a threatening question regarding Mathematics. During these interactions peers can be used to mentor the Mathematics anxious students through group discussions (Cropp, 2017) this implies that teachers can match the Mathematics anxious students with their peers who are good at Mathematics and who show positive attitude. The teachers should always instill confidence in learners by willing to teach them when the students ask questions and correcting them politely without causing them embarrassment (Yeo et al., 2015). In addition, Smith (2004) argues that teachers should make Mathematics testing unthreatening as much as possible. Conducive environment makes the students to concentrate on the task hence eliminating Mathematics anxiety and improving performance.

Thirdly, there should be use of a variety of assessment for students' mathematics anxiety reduction. Timely and often assessment may help reduce the fear towards mathematics and again help student gain interest and confidence at all times when faced with

mathematical problem. Background pre- assessment of the students may help to reduce mathematics anxiety. Alkan (2013) argued that to reduce Mathematics anxiety one should use pre-assessment to identify students who lack the concept background and using students' questions as teaching tools. When a teacher does all these strategies then the students may feel encouraged and change their negative feeling about Mathematics. This increases students' commitment to Mathematics. According to a study carried out in Lynchburg –Virginia by Smith (2004) teachers should review basic math skills of the students and this can be done using different assessment tools. This builds a foundation for complex contents in Mathematics.

A study by American institute for research (AIR) together with that of national assessment of education progress to follow on how the 4th and 8th grade students performed in mathematics showed that the results for grade 4 were below the average mark from 1996 to 2007 (Rampey et al., 2009). TIMSS (2003) reported that mathematics performance was poor between year 1999 to 2003 in Egypt, Tunisia, Ghana and South Africa (Mullis & Martin, 2017). In Tanzania, it is evident that the national form four examinations of 2014 mathematics performed poorly as compared to other subjects (Kisakali & kuznetsov, 2015).

Despite the essentiality of Mathematics in a students' learning the performance has been consistently dismal for years. Kenya National Bureau of Statistics (KNBS) (2018) shows that the average mean marks for Mathematics performance national wide between the year 2011 and 2017 is 24.94. Within the period, the highest national mean was 28.7 and the lowest mean mark was 20.7. Mathematics poor performance has been said to be contributed by factors such as social cultural factors that include cultural factors, school based factors that include methods of teaching and attitude of teachers and also personal factors that include gender and attitude (Mbugua et al., 2012). Poor performances in Mathematics in Kenya according to (Wachira, 2016) is associated with a poor attitude towards Mathematics, inadequate teaching and learning resources and poor methods of assessments. Mathematics performance has remained poor in Meru County (Kirikua et al, 2020).

1.2 Statement of the problem

The KNEC annual reports have shown that Mathematics remains one of the poorly performed subjects in Kenya in spite of the government's effort to improve its performance. It is evident that there are programs like SMASE and the curriculum provides Mathematics with many lessons compared to other subjects. Schools offer remedial classes and some holding symposiums with other schools for Mathematics in an effort to improve their performance and with all these efforts there is no improvement in performance of Mathematics. Several factors have been attributed to the poor performance over years with most studies suggesting a negative attitude towards Mathematics. Very few studies have examined Mathematics anxiety among students and how this affects performance, in particular, psychological symptoms associated with lack of concentration during the lesson, behavioral symptoms such as avoiding Mathematics classes and assignments and as well as physical symptoms such as sweating. What is not known is if Mathematics anxiety is a significant factor in poor performance in schools in Imenti South. This research seeks to specifically establish the relation between Mathematics anxiety and performance and the strategies adopted by teachers to reduce Mathematics anxiety among student.

1.3 General objective

This study sought to examine Mathematics anxiety and students' performance in public secondary schools in Imenti South Sub County, Meru county.

1.4 Specific Objectives

1. To determine gender differences in Mathematics anxiety levels among students.
2. To find out the relationship between Mathematics attitudes and Mathematics anxiety among students.
3. To examine the relationship between Mathematics anxiety and performance.
4. To determine the common strategies adopted by teachers to reduce Mathematics anxiety.

1.5 The research questions

1. Do gender differences exist between male and female students in mathematics anxiety levels?

2. What is the relationship between Mathematics attitudes and Mathematics anxiety?
3. What is the relationship between Mathematics anxiety and students' Mathematics performance?
4. What are the strategies adopted by teachers to reduce the incidences of Mathematics anxiety in schools?

1.6 Justification of the study

Mathematics is an important subject in all career pathways though it is poorly performed by the students in Kenya. The low performance in Mathematics is attributed to features such as negative attitude, inadequate resources and also the methods used by teachers when teaching Mathematics. Few studies have examined how Mathematics anxiety influences performance of the students. The outcomes of this study adds to the existing works and create awareness to teachers and the policymakers to use more suitable strategies to reduce Mathematics anxiety so as to enhance good performance.

1.7 Significance of the study

The study findings will help the students and Mathematics teachers to curb Mathematics anxiety enhancing improvements and achievement in Mathematics. Enhanced improvement and achievement in Mathematics results to improvement of the transition rate from secondary schools to tertiary institutions with many students pursuing Mathematics oriented courses. These courses will later help in the achievement of the big 4 agendas since this will foster manufacturing, innovation, and industrialization since the students are more creative.

The study findings will enable the teachers to understand their students better and capture their attention which may help change their emotions towards Mathematics. This is because the findings will help Mathematics teachers to use different strategies of teaching Mathematics which will enable the students to develop the skill of flexibility and again be information literate which will help them discern their own formulas of solving a Mathematics problem. This will foster innovation and communication in students hence promote the achievement of the SDGs and the Kenyans vision 2030.

The study finding will help the policymakers to understand how Mathematics anxiety affects Mathematics performance and hence put up policies that create an enabling

environment for learning Mathematics. This promote the achievement of the SDGs and the vision 2030 since the policies can be strengthened through quality education and training and also provision of in-service training for teachers. These policies help the students to develop leadership qualities in themselves and again to develop technology skills to discern what is right for them or not.

1.8 Assumptions of the study

The researcher assumed that the student and teacher respondents were honest and truthful while giving the data needed. The data from the Sub-County education offices about the target population was true and reliable. The anxiety levels were not affected by an attempt to measure them using the questionnaires.

1.9 Limitations of the study

There were fixed schedules of the student respondents and the teacher respondents in the school hence there was a consensus to curb the limitation either the data to be collected during the evening hours after lessons.

The study was limited to use only Mathematics teachers and students in the school ignoring the other personnel in the school premises and yet they can affect students' performance. The study only focused on one county, one Sub-County and only public secondary schools.

There could be a degree of biasness since the research relied on self-reported data of students and teachers. However, the researcher guaranteed confidentiality which encouraged the respondents' honesty.

1.10 Delimitations of the study

Secondary schools' mathematics performance is largely affected by numerous factors. However, the study only engrossed in mathematics anxiety and only in Imenti South sub county public secondary school and only teachers and students took part.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section presents reviewed literature as per the objectives studied, theoretical framework, conceptual framework and summary of literature review.

2.2 Mathematics anxiety and Gender.

According to Plaisance (2009), the Mathematics anxiety manifestations can be grouped into three; the physical, the psychological and the behavioral symptoms. Physical symptoms include irregular breathing, increased heart rates, sweating profusely, shakiness, feeling of emptiness in stomach and others (Finlayson, 2014). Some of the physical symptoms may be moderate and students may be able to control them. According to Wallace (2018), students also experience headaches and increased heart rates. These symptoms make the students loose concentration on the task and hence resulting to low performance in the same task. The students fight to regain their normal heart rates forgetting to balance the task at hand and this may lead to poor performance on Mathematics task.

Psychological symptoms are associated with students losing concentration in class during the Mathematics lesson, having a sense of powerlessness, being discouraged when trying something, fearing to be called to answer a question in front of others (Finlayson, 2014). According to Yeo, Tan, and Lew (2015), students avoid having face to face meetings with the teachers and it becomes difficult for them to consult the teachers in case of a problem, this is all to avoid embarrassment from the teachers (Arem, 2009). Students lack of concentration on the task may promote failure in the Mathematical task given. According to Rollins (2016) students may have fear when answering questions asked by teachers or peers, become nervous and also become restless in a class. When students become nervous then it means that they cannot do the task as expected and hence failure in the same since they concentrate much on ways of relieving the nervousness in them. According to a study carried out in Lynchburg-Virginia by Smith (2004) Mathematics anxious students are tense, unable to sit unmoving and unable to look at the teacher.

Behavioral symptoms may involve students avoiding Mathematics lessons as reported by Buckley, Reid, Goose, Vipp and Thompson (2016), who argue that students may avoid Mathematics courses and careers involving Mathematics later in life. Students become confused and may feel to quit and do something else other than Mathematics (Finlayson, 2014) the students quit the mathematical tasks and situations and engage in other matters that are not related to Mathematics. Once the students avoid mathematics tasks it means that they will have more negative attitude towards Mathematics hence cannot handle Mathematics tasks easily and this promote failure in Mathematics performance. In addition, (Wallace, 2018) further states that a negative attitude towards Mathematics leads to avoidance tendencies. Avoidance tendencies makes students to loose concentration on mathematical task and concentrate on other issues other than mathematical tasks. Chang and Beilock (2016) found that Mathematics anxiety results to avoidance tendencies towards Mathematics and its related situations. Studies shows that mathematics anxiety exists and its manifestations are biased towards behavior during Mathematics lessons and tests.

There are three levels of mathematics anxiety; low, moderate and high anxiety level (Khesht-Masjedi et al., 2019). Students with high anxiety levels fear to fail on potentially threatening situations (Rodarte-Luna & Sherry, 2008). Further, students avoid certain mathematical activities, such as preparation and taking of examinations and delayed assignment taking which result to less achievement (Macher et al., 2012, 2013; Papousek et al., 2012). Motivated students exhibit moderate levels of anxiety towards mathematics which result to improved achievement. In contrast, when students have low anxiety level, their mathematics performance is also affected (Wang et al., 2015).

Researchers have shown that female students experience more anxiety towards mathematics as compared to their male counterparts. Dorn et al. (2009) In fact, two out of every three teenagers with general anxiety disorder are girls. Females portray higher anxiety levels that their male counterpart (Dowker et al., 2016; Khesht-Masjedi et al., 2019). Khesht-Masjedi et al. (2019) postulated that girls were more anxious with mathematics as compared to boys. Their study found a significant difference between anxieties for girls and boys (p=0.000). This meant that at different levels of anxieties,

significant differences were observed between the different genders. Goetz *et al* (2013) posited that females exhibit high mathematics anxiety as compared to their male counterparts (Devine et al, 2012; Else-Quest et al., 2010; Jain & Dowson, 2009; Kyttala & Bjorn, 2010).

Researchers suggest the following reasons as to why female students experience high anxiety than their male counterparts. Firstly, it is suggested that the different ways of boys and girl's socialization during childhood may affect their anxiety levels in certain situations (Devine et al., 2012). Since mathematics is traditionally viewed as a male domain, females tend to think that they are incompetent mathematically which result to them avoiding mathematical activities which result to anxiety and low achievement. (Kombe et al., 2016; Sarouphim & Chartouny, 2017).

Another possible explanation for the gender difference in MA is that females openly display their anxieties since they express their emotions whereas expression of emotions because of anxiety to males is unaccepted (Chaplin, 2015; Devine et al, 2012; Pajares, 2005). Another account for gender differences may be mathematics experience whereby the differences between male and female anxiety levels disappears when mathematical background is put into considerations (Devine et al., 2012; Dowker et al., 2016). Implying the amount of interacting with mathematics(practices) and the number of positive or negative experiences with mathematics may influence mathematics anxiety levels differently for each gender.

2.3 Mathematics attitude versus Mathematics anxiety

The Mathematical attitude is said to be associated with Mathematics anxiety. According to Soni and Kumari (2017) parental Mathematics anxiety and attitude acts as a precursor to their children Mathematics anxiety and attitude hence influencing Mathematics performance. This means that the parents' attitude can influence that of their children and hence influence the performance in Mathematics. According to Mutisya, Kinai, Dinga, and Mutweleli (2018), there is an underlying relationship between Mathematics achievement and the students' emotions towards it. A study by Wasike (2013), 58,9% of female students had a negative attitude towards Mathematics, the students who had

positive Mathematics attitude had achieved a mean of 37.9% and those with a negative attitude towards Mathematics had a mean of 12.7%. This shows that there is high performance in Mathematics if the attitude is positive and if the attitude is negative then the performance is low in Mathematics. The students' attitude can be promoted by their own factors of the family background in connection to Mathematics. There is no clear outline of how attitude influences Mathematics anxiety in students hence the study will explore how different attitudes affect the anxiety levels.

According to Yeo et al. (2015), teachers can influence Mathematics attitude in students when they embarrass them in front of others, assign many complex assignments and when they delay in helping students solve problem after consultation. The teacher's mode of introducing a concept to students plays a great role in a students' performance. If a teacher uses difficult terms to teach the students, then this may bring disengagement with the students causing Mathematics anxiety. Teachers should always curb Mathematics anxiety by encouraging students and motivating them to achieve more in Mathematics. Teachers should avoid increasing the anxiety levels of Mathematics in students. The mathematical language can influence Mathematics concepts understanding and interpretation hence stimulating fear for Mathematics problems and task which may result to poor performance in Mathematics (Manyara, 2012; Mberia 2018). The language can be either for teachers while instructing learners or students themselves when tackling mathematical problems.

According to Maloney et al. (2015), attitude can be transmitted socially to students during early learning. When the parent's anxiety is high that of their children increases especially if they help them to do their homework. This is because parents' anxiety can rebound to children and decrease their Mathematics learning bringing about low achievement in Mathematics by those students.

Both mathematics anxiety and mathematics attitudes affect the students' mathematics perceptions and willingness to solve mathematical problems. Ayob and Yasin, (2017) argued that Negative attitudes towards mathematics is characterized by disengagement from the content matter, too much fear and lack of courage to try to improve skills. Further, Bayaga & Wadesango, (2014) posited that students who show negative sentimental feeling about mathematics usually have a feeling of like or dislike for mathematics which

result to change in learning and performance in mathematics (Mahanta, 2012; Mensah et al., 2013). Mata et al. (2012) postulated that a feeling of like for mathematics reflects a good and positive feeling about Mathematics. Further, students with positive feeling in relation to mathematics learning have a like for mathematics which result to improvement in performance. It is due to this reason that a like for mathematics is good and can result to one having some interest in mathematics and know its benefits in life (Eshun, 2004).

Mathematics anxiety affects the students' behavior, psychology and also physical appearances (Plaisance, 2009). Behavioral effects are mostly avoidance tendencies towards Mathematics, psychologically is associated with being restless, worried and also being nervous and tensed while physical effects are headache, increased heart rate and sweating (Finlayson, 2014).

When students' mathematics attitude is positive they are in a position to tackle all the mathematics related tasks since they experience low/moderate levels of anxiety. Akin & Kurbanoglu, (2011) postulated that math anxiety is related to attitudes. This is supported by Vinson, (2001) who postulated that a dislike for mathematics results to mathematics anxiety. Also, when one takes mathematics anxiety to be a state of discomfort in presence of mathematical tasks and activities which are frightening and unconducive (Zettle, Raines, 2002), the relationships between math anxiety and math attitudes are easily understandable (Chaman & Callingham, 2013).

2.4 Mathematics anxiety and performance

Math anxiety is caused by factors such as poor grades of the past, avoidance of completing assignment given, attitudes towards mathematics, and even the mathematics teaching methods. It is believed that instructors and parents who are mathematically anxious transmit it to the students (Furner & Duffy, 2002). Students may feel it will be good for them since their parents are also successful yet they did not find mathematics important hence avoid mathematics. If the teacher does not value mathematics, then this can backfire to the student. This can be promoted by teachers being angry when the class does not understand the problem, teacher's eagerness to cover the syllabus can turn the students off from learning and understanding math, discouraging multiple methods of problem solving, and punishing students with mathematics problems (Furner & Duffy, 2002).

Math is a male domain stereotype. There is the promotion of an idea that females perform poor in mathematics than males (Jackson & Leffingwell, 1999). Teachers feel that only boys can be able to succeed in mathematics hence causing girls to give up easily. Any teacher should be willing to encourage, show interest of math to girls and advice female students to pursue mathematics careers later in life. The teacher needs to give both girls and boys a chance to try mathematics.

Mathematic Anxiety is manifested in both male and female students as either physical, psychological, or behavioral symptoms (Plaisance, 2009). The physical symptoms an anxious student may experience include increased heart rates, sweating profusely, trembling, eating finger nails, feeling of emptiness in the stomach, among others (Finlayson, 2014). Finlayson (2014) argues that as students fight to regain standard heart rates, there is a tendency to forget to get the balance between what they are feeling and the task at hand, leading to poor performance in a Mathematics task.

Psychological symptoms commonly reported in highly anxious students include loss of concentration, having a sense of powerlessness, being worried, being discouraged and fearing to be called upon to answer a question in front of others (Finlayson, 2014). Yeo *et al*., (2015) argue that highly anxious students avoid direct eye contact with the teachers for fear of embarrassment. Arem (2009) found that nervous students may have fear answering questions in a class. These students are often restless, making it challenging to complete mathematical tasks as expected.

Behavioral problems are also commonly reported in students who experience Mathematics anxiety. Anxious students exhibit avoidance tendencies by deliberately missing Mathematics lessons, avoiding mathematical tasks and quitting situations that will cause them to engage in Mathematics activities (Buckley et al., 2016; Finlayson, 2014). Further, a student who forms the habit of avoiding the Mathematics class and even quitting often forms a negative attitude towards Mathematics. Finlayson (2014) states that a negative attitude towards Mathematics subject aggravates avoidance tendencies.

Mathematics anxiety has been found to make students avoid Mathematics lessons (Buckley et al., 2016), which consequently leads to poor performance. Individual and environment factors contribute to Mathematics anxiety and again lead to poor

performance (Chang & Beilock, 2016). They further argued that individual factors may be the memory coordination while solving mathematical problems and again how one is motivated to undertake the problem at hand. Environmental factors that stimulate Mathematics anxiety include the students' perception about the classroom environment, the parental support and also the teachers' classroom activities. The reasons for avoidance are often associated with fears and worries about their abilities to pass in Mathematics (Maloney & Beilock, 2015). These fears results to difficulties in basic numerical processing and again low performance in courses related to numerical reasoning (Nunez-Pena, Suarez-Pellicioni & Bono, 2013; Maloney, Ansari & Fugelsang, 2011).

There is evidence that (Radišić, Videnović, & Baucal, 2015), students displaying Mathematics anxiety symptoms score low marks, while the lower levels of anxiety arte characterized by; the achievement and interest in Mathematics, and high Mathematics self-concept. This is because high anxiety results in less achievement in the performance of mathematical related problems (Ifamuyima & Rosanwo, 2016). They further argue that when the students have moderate anxiety they settle down and face the task at hand and this results to better outcome in mathematics content and performance.

Moderate level of anxiety is portrayed by achievement and interest in Mathematics, high Mathematics self-drive, and conducive learning atmosphere. Again the atmosphere in which the learning takes place is essential for students' Mathematics anxiety determination. On the same, Macher et al., (2012) postulates that Mathematics anxiety holds a crucial role in Mathematics performance.

In Kenya, Mathematics has remained to be poorly performed for years. This is supported by Mbugua et al., 2012 who postulate mathematics to be caused by personal, school based and social cultural factors.

2.5 Strategies managing mathematics anxiety.
Provision of a conducive learning environment may help reduce Mathematics anxiety. According to Hughes et al., (2018), teachers should create a non-threatening environment for learning Mathematics. This will enhance students' achievement and attitudes according to Taylor and Fraser, (2013). During a Mathematics lesson, the teacher should initiate an interactive session where students are free to ask a threatening question

regarding Mathematics. During these interactions peers can be used to mentor the Mathematics anxious students (Cropp, 2017) this implies that teachers can match the Mathematics anxious students with their peers who are good at Mathematics and who have positive mathematics attitude. The teachers should always instill confidence in learners by willing to teach them when the students ask questions and correcting them politely without causing them embarrassment (Yeo et al., 2015). In addition, Smith (2004) argues that teachers should make Mathematics testing unthreatening as much as possible. Conducive environment makes the students to concentrate on the task hence eliminating Mathematics anxiety and improving performance.

The background pre-assessment may reduce Mathematics anxiety. According to a study done in Turkey by Alkan (2013), to reduce Mathematics anxiety one should use pre-assessment to identify students who lack the concept background and using students' questions as teaching tools. When a teacher does all these strategies then the students may feel encouraged and change their negative feeling about Mathematics. This increases students' commitment to Mathematics. According to a study carried out in Lynchburg – Virginia by Smith (2004) teachers should review basic math skills of the students. This builds a foundation for complex contents in Mathematics.

Instilling positive attitude towards Mathematics may reduce anxiety. According to a study carried out in Malaysia by Siew (2018), positive attitude exists among students towards learning Mathematics concepts and the teacher should come up with ways of motivating them and this will reduce the fear they have for Mathematics. According to Wallace (2018), teachers should display a positive attitude for the students, focus the lesson to be student-centered, making students more active and using manipulatives or multiple ways of solving a problem. Teachers should show excitement when teaching Mathematics and they should be motivated, this is because students adopt their teacher's interest in and passion for dealing with Mathematics. A positive attitude can be instilled in students by use of motivating words such as good, better, a nice trial and so on, these make the students accept their Mathematics positions and work toward doing better.

According to Anderson et al. (2015), teachers should focus on the areas of interest to students by changing the modes of presenting any Mathematical content in a class.

According to a study done by Papadakis, Kalogiannakis, and Zaranis (2016), Mathematics should be started in the early years of development and taught in reality. Mathematics should be taught using strategies that show reality like using figures, objects, pictures or teaching aid for reality in Mathematics (blazer, 2011). These types of teaching aids reduce the boredom in Mathematics lessons and also Mathematics anxiety in students hence attracting more interest and liking for Mathematics.

2.6 Theoretical Framework: The arousal and performance theory.

Yerkes and Dodson (1908) in their theory posits that; if arousal increases, performance will also increase but if the arousal becomes excess and continuous then performance would decline. The theory has two assumptions namely; increase or decrease in arousal result to decrease in performance and moderate arousal results in optimal performance. During the onset of arousal, the student is confident to have the ability to control the arousal pressure and this may increase the performance. Once the arousal becomes excessive the student would become less confident on the skill to regulate the pressure and the performance would drop. For good performance, there is a need for little arousal. The arousal can be linked to a task that can influence anxiety levels. If there is no arousal then there is low anxiety which allows students to be relaxed and not engage in any Mathematics task resulting to poor performance, when the anxiety is mild or moderate the students enjoys the ability to control it and work towards the Mathematics task which results to high performance and when the anxiety is very high then the students' performance of the Mathematics task is threatened since he/she is unable to deal with the high anxiety together with the task hence low performances.

2.7 Conceptual Framework

Independent variable   **Dependent variable**

Mathematics anxiety

High
• Low concentration
• Low communication

Moderate
• Self-drive
• Assistance seeking

Low
• Low engagement
• Low self-drive

Academic performance

Social backgrounds
School resources
School programs

Intervening variables
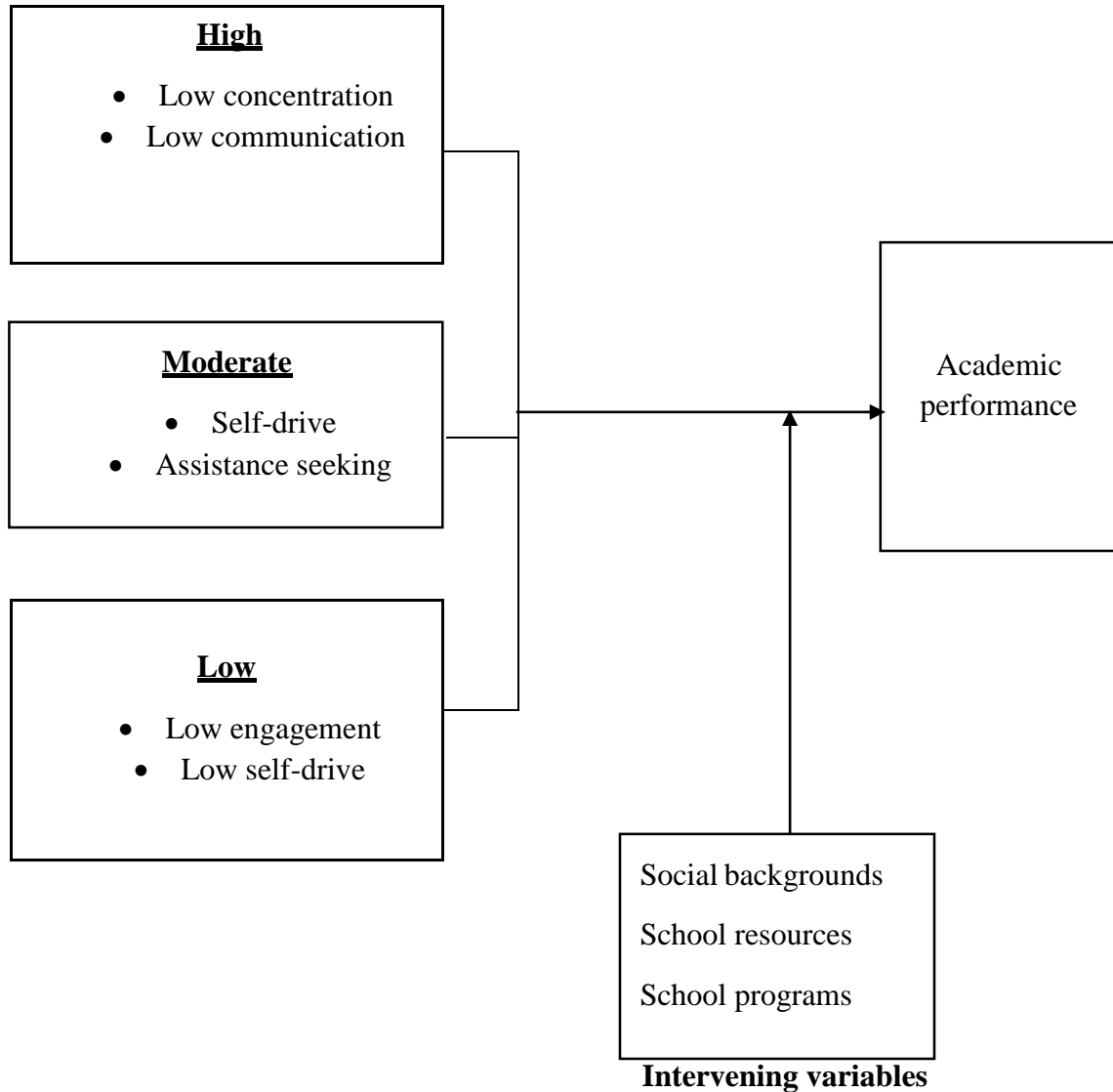
Figure 2. 1: Conceptual framework.

It is evident from the figure above that mathematics anxiety which is the independent variable which can exist in three levels that are low, high and moderate level. Low or high levels can cause low communication, inhibited engagement and low concentration on the task which results in low Mathematics performance but moderate level can cause students to seek Mathematical assistance, have increased learning drive and have an enhanced

concentration on the task which results to high Mathematics performance, the low and high Mathematics performance are the dependent variable. The study wanted to examine the influence of Mathematics anxiety on performance and how Mathematics anxiety can be reduced by the teachers.

2.8 Summary of the Literature Review and Research Gaps

Mathematics anxiety is essential in the determination of the academic performance especially on mathematics. It influences students' attitude towards mathematics hence affecting mathematics performance either negatively (low performance) or positively (high performance). From the literature reviewed, no broad studies were linking to the mathematics anxiety levels in connection to gender, an association of mathematics anxiety, mathematics attitude of students and performances and the strategies used by teachers to bring mathematics anxiety to required levels within the area of study. Hence the researcher wanted to fill these gaps.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter describes the study design, study area, study target population, sampling, data collection tools, data analysis, and the ethical considerations.

3.2 The research design

A descriptive survey research design was adopted. It was used to collect the information concerning the students' anxieties towards Mathematics and their attitudes towards mathematics (Mugenda & Mugenda, 2013), the design is suitable for evaluating present practices. The survey was used to generate the characteristics of large populations (schools, teachers and students) and ensuring a more accurate sample to gather targeted results in which to draw conclusions. The study used mixed methodologies of data collection which included: qualitative method by the use of checklists and document analysis and quantitative methods which used questionnaires.

3.3 The study area

Research was conducted in Meru county, Imenti South Sub-County. Meru County Integrated Development Plan (2018-2022) shows that the Sub-County covers an area of 393.87 km^2. Agricultural activities such as crop farming and livestock keeping are carried out so as to provide for and support education. The Sub-County has 6 wards consisting of 70 public secondary schools. The Sub-County was chosen because of it continued poor mathematics performance (Manyara, 2012; Mberia, 2018).

3.4 The target population

The population of the study involved all the students and teachers of Mathematics of public secondary schools in Imenti South Sub-County. They were selected so as to provide the information needed about Mathematics anxiety in the respective schools.

Table 3. 1: Target population

Type of school	No. of schools	No. of students	No. of teachers
Boys boarding	10	3,407	23
Girls boarding	14	4,301	33
Mixed boarding	6	1,235	9
Mixed day	40	9,507	48
Total	**70**	**18,514**	**113**

Source: Imenti South Sub-County Education Offices.

3.5 Sampling methods

The study employed convenience sampling to select Sub-County because it is accessible. Stratified method of sampling was used to sample schools in the Sub-County to represent all the schools in the Sub-County. According to Jackson (2015) this sampling technique helps in representing all the populations and since it could ensure balanced gender distribution of the students. Purposeful sampling was used to sample Mathematics teachers and this is because this study dealt with only Mathematics teachers. Lastly, random sampling was done to get the sample students from the selected schools since it made every student have an equal chance to take part in the study.

3.6 Sample sizes.

Using Yamane's (1967) formula $n=N/[1+N(e)^2]$, a sample of 59 public secondary schools, 88 Mathematics teachers and 392 students (204 girls and 188 boys) was used in the study. This formula was used as it could give the acceptable sample size for a social science study. The figures from Yamane's formula correspond to those from the tabulated samples by Israel (1992); Krejcie and Morgan, (1970).

Table 3. 2: Sample size.

Type of school	No. of schools	No. of girls	No. of boys	No. of teachers
Boys boarding	8	_	72	18
Girls boarding	12	91	_	26
Mixed boarding	5	13	15	7
Mixed day	34	100	101	37
TOTAL	**59**	**204**	**188**	**88**

Source: Imenti South Sub-County Education Offices.

3.7 Data collection instruments

The study used questionnaires to collect the data about mathematics anxiety and attitude. Mugenda and Mugenda (2013) postulated that this method of data collection is suitable since it gives the individual students room to express themselves and give their detailed information to the researcher. The questionnaire comprised of demographic data, the Mathematics anxiety scale (MAS) and the attitude towards mathematics inventory (ATMI).

The MAS was linked together with students' gender for objective one to examine gender differences towards mathematics anxiety levels. For the second objective, ATMI and MAS were combined to establish the correlation between mathematics anxiety and attitude of the students. About the third objective, the students' scores together with the MAS were combined to find out the relationship between mathematics anxiety and mathematics performance. The fourth objective used checklists that consisted of a list of strategies used by teachers to reduce Mathematics anxieties in students. The main instruments are discussed below.

3.7.1 Mathematics Anxiety Scale.

Mathematics anxiety was measured using an adapted 14 item Mathematics Anxiety Scale (Mahmood & Khatoon, 2011). It is consisted of seven negatively, and seven positively

worded items. The Mathematics Anxiety Scale (MAS) is 5- point Likert scale that was scored as 1- never, 2- rarely, 3- sometimes, 4-often, and 5- always for the negative items, and the scoring was reversed for the positive items in MAS. The scores ranged from 14-70, with the high scores signifying high levels of math anxiety. The students who scored 14-32 were classified as having a low level of Anxiety, and 33-51 were classified as having moderate anxiety, while those who scored between 52-70 were high in Anxiety.

3.7.2 Attitude Towards Mathematics Inventory.

Mathematics attitude was measured using an adapted 40 item Attitude Towards Mathematics Inventory (Tapia & Marsh, 2004). The ATMI is 4- point Likert scale that were scored as 1- Strongly agree, 2- agree, 3- disagree, 4-strongly disagree. The scores ranged from 40-160 with high score indicating negative anxiety.

3.8 Piloting of the study instruments

The pilot was done to enable the determination of validity and reliability of study tools. The instruments were tested in 3 secondary schools from Tharaka Nithi County which did not take part in the real study. The pilot was done in Tharaka Nithi County since they experienced the same conditions of resources and teachers with Meru County. This was done before the real study was carried out. During the pilot study 38 questionnaires were administered to students.

3.8.1 Reliability of the instruments

Cronbach alpha values were computed to test for was validity and reliability of the instruments. The testing aimed at determining the threshold point of 0.7 and above. The Cronbach alpha for sessions were as follows: demographic information consisting of 3 items was 0.84, that of MAS consisting of 14 items was 0.719 and that of ATMI consisting of 40 items was 0.744. The study realized an alpha (α) of 0.768 which showed the study tools were reliable. The results are presented below.

Table 3. 3: Cronbach alpha values.

Sessions	Cronbach alpha	No. of items
Demographic information	0.84	3
MAS	0.719	14
ATMI	0.744	40
Average	0.768	

3.8.2 Validity of the instruments.

To determine the content validity of research instrument for the study the researcher sought opinions from members of academic staff working at University of Embu School of Education and Social Sciences. This enabled the requisite revision and modification of research instrument to improve the validity.

3.9 Data collection procedure

An introductory letter from the University of Embu was given to the researcher. The research permit from the National Commission of Science, Technology, and Innovation(NACOSTI) from the Ministry of Education, Science and Technology (MOEST) was also acquired. With these permits, the researcher sought permission from the County Director of Education so as to carry out the research with the sampled schools. The researcher made arrangements with the school principals on the schedule to administer the questionnaires and the checklists. On the scheduled day the researcher gave the instructions to both the teacher students and the student respondents on how to handle the checklists and the questionnaire. The questionnaires and the checklists were distributed by the researcher and later they were collected them after being dully filled.

3.10 Data analysis

For objective one, the MAS was analyzed by getting the frequencies of the various levels of manifestations of mathematics anxiety in students. The frequencies of the different manifestations of the questionnaire was calculated using the descriptive statistics. The

data about the frequencies was presented in tables, graphs, and charts. Later, an independent t-test was used test for any significance difference between males and females in respect to different mathematics anxiety levels.

ATMI was analyzed by first getting the frequencies of various attitudes towards mathematics. Again it was later analyzed together with MAS scores using a scatter diagram to show the linearity of the relationship between the two variables. Later the relationship was determined using Spearman's correlation coefficient to determine the relationship between mathematics attitude and mathematics anxiety. For objective three, the documents were analyzed together with the MAS results and a scatter diagram drawn to show the linearity of the relationship between the two variables. Later Spearman's correlation coefficient was used to determine the relationship between mathematics anxiety and performance of mathematics. For objective four, descriptive were run and the coding of the emerging strategies from different Mathematics teachers' checklists was done. From the checklist, the options that were ticked by teachers represented the strategies they used to reduce Mathematics anxiety in their students.

3.11 Ethical consideration

The researcher got the research permit from National Commission for Science Technology and Innovation (NACOSTI) from the Ministry of Education Science and Technology (MOEST). The researcher also made arrangements with the respective school principals on the appropriate time for data collection. The researcher sought consent from the students, asked them to sign the consent forms and assured them of total confidentiality.

CHAPTER FOUR

RESULTS, FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter outlines the response rates, demographic data, descriptive findings and inferential findings. The data that was analyzed was done according to the subject that reflect research objectives.

4.2 Response Rates

The total questionnaires issued were 400 to student respondents and 100 teacher respondents. A total of 367 questionnaires for respondent students and 86 for respondent teachers were dully filled. This results to a response rates of 91.75% student respondents and 86% teacher respondents which was sufficient to give findings adequate trustworthiness and reliability. According to Nulty, (2008) a response rate of more than 70% is acceptable to give sufficient findings. Return rates of 50% are satisfactory, 60% is good and 70% is very good for analyzing the data (Babbie, 2004) and hence the response rate (91.75% and 86%) of the study was considered adequate.

4.3 Demographic Data

The demographic data from the students and teachers is discussed by gender and age in the section below.

4.3.1 Gender distribution of student respondents

The study was establishing the gender distribution of student to determine the extent of gender disproportion and ensure the study was representative. The results in form of percentages are represented in figure 4.1.

Figure 4. 1: Gender distribution of students respondents.

The results of the study shown that most (53.7%) of the student were female, while (46.3%) were male. This implied that in secondary school females are more compared to males. According to KNBS (2019) females were 24,014,716(50.5%) who are many compared to males 23,548,056(49.5%). This implies that female students in secondary school are likely to be more than male students.

4.3.2 Age distribution of student respondents.

The study wanted to examine the age distribution of student respondents. The findings on age are represented in table 4.1.

Table 4. 1: Age distribution of student respondents.

Age bracket	Frequency	Percent
13-15	55	15.0
16-20	301	82.0
Above 20	11	3.0
Total	**367**	**100.0**

The findings revealed that most students (82%) were between the age of 16-20 years, 15% were between 13-15 years while (3%) were above 20 years. The majority 97% are the recommended secondary school students age (UNESCO, 2012) the entry age for secondary education is 14 years lasting for 4 years. This shows that the students (3%) who were in age gap of above 20 were not supposed to be in secondary school which could be associated with class repetition and poor background that lead to drop out for short durations then the students go back to continue from where they left (Basic Education Statistics, 2014).

4.3.3 Gender distribution of teacher respondents

The study aimed at establishing the gender distribution of teachers to determine the extent of gender disproportion and ensure the study was representative. The results in form of percentages are represented in figure 4.1.
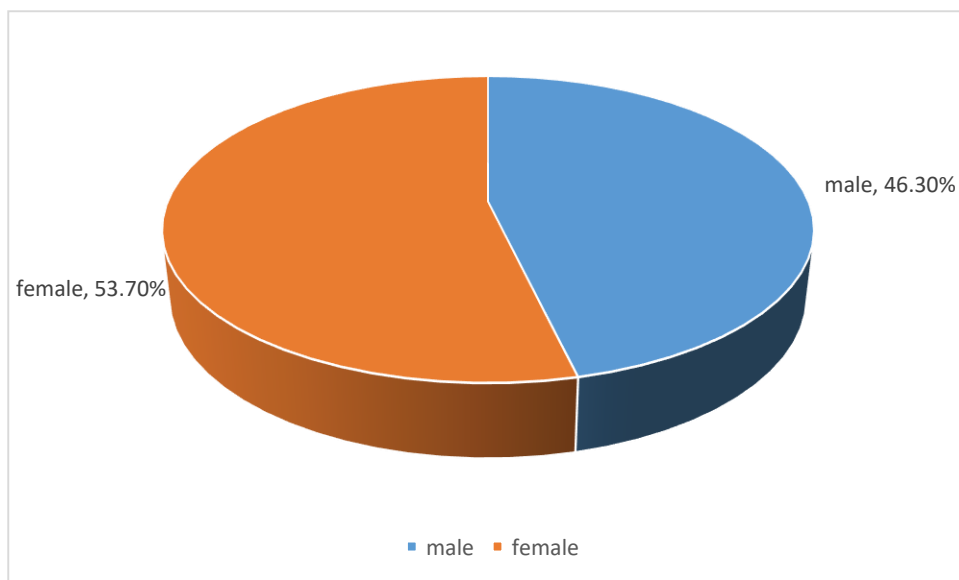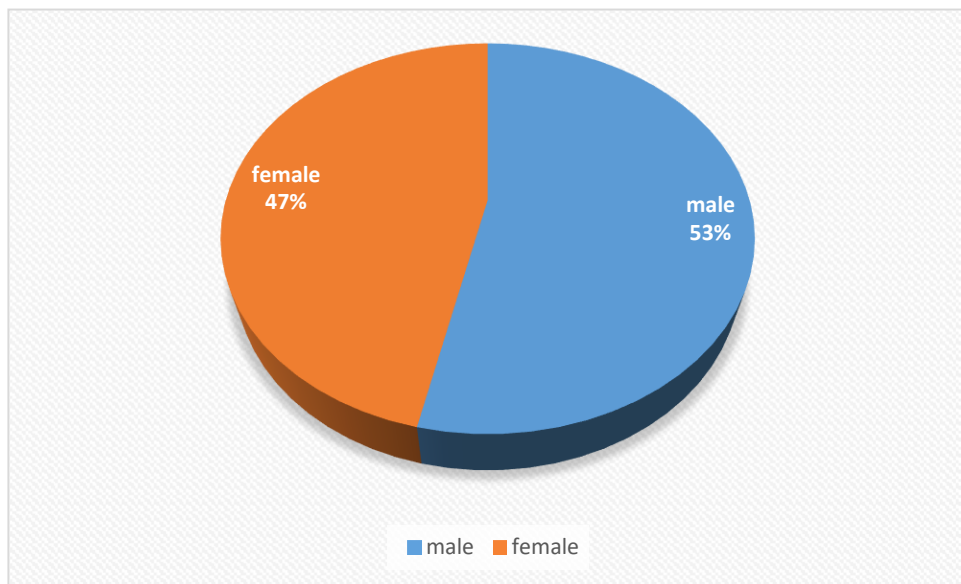

figure 4. 2: Gender distribution of teacher respondents.

The findings as per the figure 4.2 shows revealed that most (53%) of the teachers were male, while (47%) were female. This reveal that in secondary schools there are more male mathematics teachers compared to female teachers.

4.3.4 Distribution of years of experience of teacher respondents.

The study intention was to establish the distribution of teacher respondent's years of experience. The findings on years of experience are represented in table 4.4.

Table 4. 2: Distribution of years of experience of teacher respondents.

Years of experience	Frequency	Percentage
Less/equal to 5	52	60.5
Greater than 5	34	39.5
Total	**86**	**100**

The study findings outlined that majority (60.5%) of the teacher respondents had experienced teaching mathematics for not more than 5 years (X≤ 5) while 39.5% had experienced teaching mathematics for more than 5 years (X> 5).

4.4 Gender differences in students' mathematics anxiety.

The study aim was to examine the different mathematics anxiety levels of the students in relation to gender. The sampled students were expected to complete a 5 point Likert scale that consisted of never, rarely, sometimes, often and always on statements that indicated signs of anxiety. The responses were summed up to give a sum range of 14-70. The levels were derived after dividing the highest total sum expected by 3 (Manhood & Khartoon, 2011; Klein et al, 1968) where the highest value indicated high level of anxiety. These levels were compared to gender using an independent t-test. The results are as shown below.

Table 4. 1: Gender distribution of student respondent in respect to anxiety levels.

Levels of anxiety	Total F (%)	Levels of anxiety (mean)	Levels of anxiety (SD)	Male F (%)	Female F (%)
14-32 (low)	121(33%)	.3297	.4708	58(15.8%)	63(17.2%)
33-51 (moderate)	120(32.7%)	.6540	.9395	55(15%)	65(17.7%)
52-70 (high)	126(34.3%)	1.030	1.4264	57(15.5%)	69(18.8%)
Total	**367(100%)**			**170(46.3%)**	**197(53.7%)**
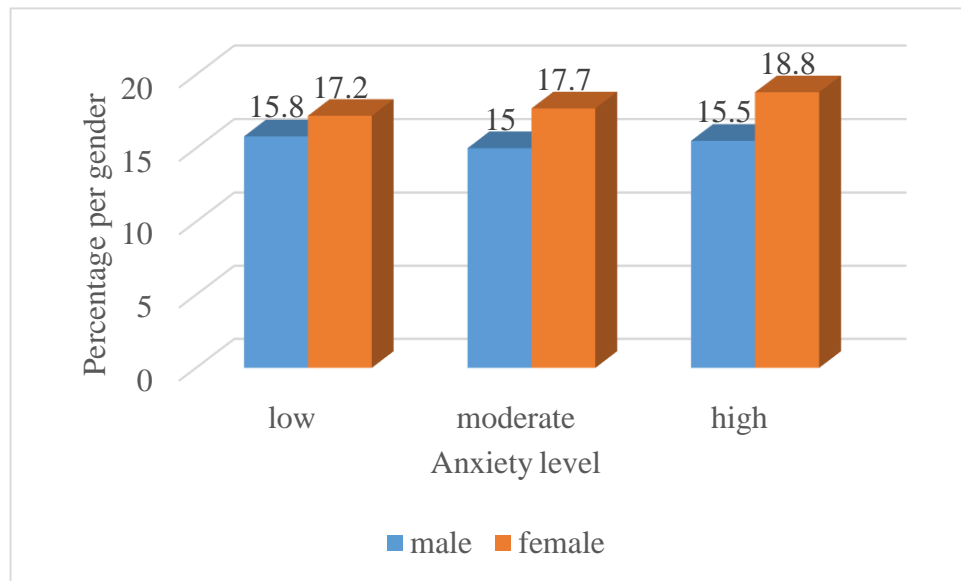
Figure 4. 3: Gender distribution of student respondent in respect to anxiety levels.

Table 4. 2: An independent samples t-test results.

levels	t	Df	Sig.(2-tailed)	95% confidence interval of the difference	
				Lower	Upper
low	_ .433	365	.665	.1184	.0756
moderate	.250	365	.724	-.1686	.2178
high	.538	365	.603	-.2126	.3730

The study found out that mathematics anxiety manifest in three forms of levels which include low, moderate and high anxiety levels as postulated by Khesht-Masjedi et al., 2019. From table 4.3, low level of anxiety students (Mean= .3297, SD= .4708) were 33%, moderate anxiety level students (Mean= .6540, SD= .9395) were 32.7% and high anxiety level students (Mean= 1.030, SD= 1.4264) were 34.3%. From table 4.4, P>0.005 which implies no significance difference between mathematics anxiety levels (low, moderate and high level) and gender (t (365) = -.433, *p* = .665; t (365) = .353, p = .724; t (365) = .520, p = .603). The students experienced all the three levels of mathematics anxiety. This implies there was no significant difference between gender and any of the levels of anxiety since the p values were greater than .05.

The results revealed that 33% of the students had low level of mathematics anxiety. Among these 15.8% were males while 17.2% were females. The findings of the study is that there was no variation between males and females in terms of low mathematics anxiety (t (365) = -.433, *p* = .665). The students showed low mathematics anxiety as a result of there being no task ahead of them, no stimulus towards something and again as

a results of less effort put towards a task (Yerkes-Dodson, 1908). when the anxiety is mild or moderate the students enjoys the ability to control it and work towards the Mathematics task which results to high performance and when the anxiety is very high then the students' performance of the Mathematics task is threatened since he/she is unable to deal with the high anxiety together with the task hence low performances.

The results revealed that 32.7% of the respondent students had moderate levels of anxiety. Among these students 15% were males while 17.7% were females. There is no significance relationship between females and males with regard to moderate levels of anxiety (t (365) = .250, p = .802). The students could have experienced moderate levels of anxiety as a result of more controlled effort, having mathematics concepts which could drive them to do mathematics with a lot of ease and again positive encouragement towards mathematics. According to Yerkes- Dodson 1908, when the anxiety is moderate the students enjoys the ability to control it and work towards the Mathematics task. which results to high performance and when the anxiety is very high then the students' performance of the Mathematics task is threatened since he/she is unable to deal with the high anxiety together with the task hence low performances.

It is revealed that 34.3% of the students experienced high levels of mathematics anxiety. Among these students 15.5% were males while 18.8% were females. There was no significance relationship between female and males in regard to high levels of anxiety (t (365) = .538, p = .591). The students experience high levels of anxiety as a result of complicated task ahead of them, overconfidence towards their ability to do mathematics and also inadequate mathematical concepts to help them do the tasks ahead. Yerkes Dodson 1908 postulated that when the anxiety is very high then the students undergoes a lot of tension and fear towards mathematics and this results to inability to deal with the task ahead of them and hence concentrate on ways of bringing the high levels to normal.

The study results showed that the students experienced mathematics anxiety in three levels. Under low mathematics anxiety the students have no drive or stimulus to help them work towards mathematical task. Moderate mathematics anxiety means that there is anxiety but this is the optimum required for the students to be able to perform the task ahead of him or her. When a student experience high levels of anxiety then it means that

the students cannot concentrate on the task ahead because of the high levels of tension and fear of the task. When students are anxious they experience the following symptoms which may be physical, psychological or behavioral (Plaisance, 2009). Under physical symptoms the students would have increased heart rates, sweating profusely, restlessness, trembling and nausea (Marshall et al, 2016; Finlayson, 2014). According to Wallace (2018), students also experience headaches and increased heart rates. These symptoms make the students loose concentration on the task as a result of high levels of anxiety.

Under the psychological symptoms the students are associated with a feeling of helplessness, always discouraged and fear of getting things wrong (Marshall et al, 2016). This is supported by Finlayson (2014) who posited that Psychological symptoms are associated with students losing concentration in class during the Mathematics lesson, being discouraged and fear of being asked to answer any question in class. According to Rollins (2016) students may have fear when answering questions asked by teachers or peers, become nervous and also become restless in a class. According to a study carried out in Lynchburg-Virginia by Smith (2004) Mathematics anxious students are nervous and fear looking at the teacher directly.

Under behavioral the student is associated with avoidance tendencies. These tendencies include avoiding mathematics teachers, mathematics assignment, avoiding answering mathematics questions in class and also avoid any mathematics discussion or activity (Buckley, Reid, Goose, Vipp and Thompson, 2016). Under any level of mathematics anxiety students become confused and may feel to quit and do something else other than Mathematics (Finlayson, 2014) the students quit the mathematical tasks and situations and engage in other matters that are not related to Mathematics. Chang and beilock (2016) found that Mathematics anxiety results to avoidance tendencies towards Mathematics and its related situations.

The results that there were no gender differences with respect to any mathematics anxiety level. This supports the results that there was no gender difference towards mathematics anxiety level (Dowker et al., 2012; Young et al., 2012; Jansen et al., 2013; Ramirez et al., 2013; Erturan and Jansen, 2015; Schleepen and Van Mier, 2016; Kucian et al., 2018). These results could have been contrasting with results by (Bieg et al., 2015; Cipora et al.,

2015; Erturan and Jansen, 2015; Dowker et al., 2016) who postulated that female student experience high levels of mathematics anxiety as compared to their male students counterparts.

This contrast could have been due to the interventions that have been put in place towards promoting the girl child education all over the world. These intervention are; the goal to promote gender equality in basic education levels by 2005, and in all other levels of education by 2015**.**, the UN women which aims to promote security for all genders and allow both women and girls and men and boys to acquire quality education, the convention on elimination of all forms of discrimination against women (CEDAW) the organization enables realization of equality of men and women in rights such as those of education and the common wealth gender management system who aim at promoting the improvement of gender equality in the broader civil society.

Under the African continental level, there was solemn declaration of 2004 which ensures specific measures are taken to ensure that girls and women are enlightened to achieve the goal of "Education for All" (EFA) (AU, 2004). There are also regional unions like East African Community which has the aim of promoting gender equality and equal opportunities for both males and females.

In Kenya there are strategies like introduction of free education which ensures free primary education and secondary education so as to increase school access for both boys and girls. Introduction of automatic promotion between grades, Re-entry policy for teenage mothers in secondary education (Otieno, 2013). UNESCO, 2015, the Ministry of Education has embraced a STEM mentorship program in partnership with UNESCO and other stakeholders to inspire more girls to go into STEM fields (Chege & Sifuna, 2006).

At school levels girls are encouraged to participate in stem subject by the following ways; involving them in guidance and Counseling sessions to encourage them on STEM subjects abilities, Physical facilities that promote conducive environment for girls in schools encouraging girls to participate in co-curricular activities that mentor them more on the importance of stem subjects like science and mathematics fair conferences (Otieno, 2013), having learner centered classrooms, training teachers to be gender sensitive and eliminating gender bias from textbooks and learning materials. All these strategies could have been the reason for girls alleviating from being mathematics anxious as compared to

boys and giving out the results that the variations in anxiety for both boys and girls are the same.

4.5 Relationship between mathematics attitude and mathematics anxiety.

The study intended to examine how mathematics attitude and mathematics anxiety are related. The MAS enabled in identification of the levels of students' mathematics anxiety which were low, moderate and high anxiety level. The ATMI was used to indicate students' attitude towards mathematics. A scatter plot diagram tested whether the two variable had a linear relationship and later Spearman's correlation used to test for the association between the two variables. The results were presented below.
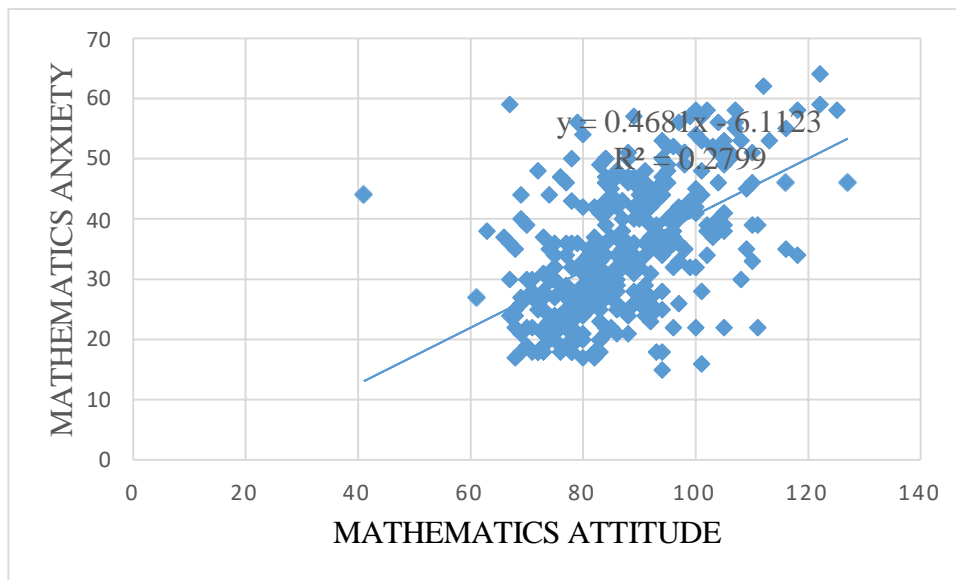
Figure 4. 4: Scatter plot diagram showing the relationship between mathematics attitude and mathematics anxiety.

The scatter plot above shows that R^2 linear =.280 which means that a variation of 28% of mathematics anxiety is influenced by mathematics attitudes with other factors influencing mathematics anxiety with 72%. The linear regression equation implies that a unit increase in mathematics attitude results to a 0.47 increase in mathematics anxiety.

Table 4. 3: Spearman's correlation coefficient between mathematics attitude and mathematics anxiety.

		Mathematics attitude
Mathematics anxiety	Spearman's Correlation coefficient	0.538
	Sig. (2-tailed)	0.000
	N	367

From table 4.8, 367 students were given two questionnaires (MAS and ATMI) to provide their information about mathematics anxiety and mathematics attitude. They had a mathematics attitude mean of 87.1(SD=12.3) and a mathematics anxiety mean of 34.7(SD=10.9). The link between mathematics anxiety and mathematics attitude was statically significant (r=.538, P>0.05) suggesting that the more the students are anxious (high anxiety level) the high the mathematics attitude (negative mathematics attitude) and the lower the anxiety of students towards mathematics the lower the attitudes (positive attitude).

The study revealed that the students experienced mathematics anxieties at low and high levels and mathematics attitude which were positive and negative for others. Past studies postulated that the two contrasts could have been caused by the environment, the family background, personal factors, teaching methods and also the peers. Students' anxiety and attitude towards mathematicshave largely been contributed to by the following traditional teaching practices; teachers expecting on correct answers from students always, students fear making errors, students memorize mathematical concepts and practice rote calculations (Haciömeroğlu, 2017).

The students' attitude and anxiety towards mathematics can be promoted by their own family background factors in connection to Mathematics. Soni and Kumari, (2017) asserts that mathematics anxiety and attitude of the parent's acts as a precursor to their children feeling and interest towards mathematics. When the parent's anxiety is high that of their children increases especially if they help them to do their homework. According to

Maloney et al. (2015), attitude can be transmitted socially to students during early learning.

According to Yeo et al. (2015), teachers can influence Mathematics attitude and anxieties in students when they embarrass them in front of others, assign many complex assignments and when they delay in helping students solve problem after consultation. The teacher's mode of introducing a concept to students plays a great role in a students' performance. If a teacher uses difficult terms to teach the students, then this may bring disengagement with the students causing Mathematics anxiety. Teachers should avoid increasing the anxiety levels of Mathematics in students. The mathematical language can influence Mathematics concepts understanding and interpretation hence stimulating fear for Mathematics problems and task which may result to poor performance in Mathematics due to a feeling of dislike for math and math anxiety by students (Manyara, 2012; Mberia 2018).

Results have revealed significant relationship between mathematics anxiety and mathematics attitude. Students who happened to be very anxious about mathematics scored high in mathematics attitude (negative attitude). On the other hand, less anxious students had low mathematics attitude (positive attitude). The study results are consistent with previous research (Chaman & Callingham, 2013; Akin & Kurbanoglu, 2011; Haciömeroğlu, 2017; Sahri *et al*., 2017). Mathematics anxiety and mathematics attitude were related positively. For instance, students with positive attitude towards mathematics will be so strongly committed to their mathematics class as compared to those with negative attitude (Kargar, Tarmizi & Bayat, 2010). Mathematics attitudes of high school students were linked to their Mathematics anxiety (Haciömeroğlu, 2017) and the results showed that students with positive attitude wards mathematics had low anxiety towards mathematics.

The two contrasts of mathematics anxiety and mathematics attitude should be given more attention since they can be components for the secondary school students learning mathematics. When the two are in contrary to what is the best of them the following can be done to reduce their negative effects towards mathematics; retesting, demonstrating

the value of math to students and arranging for family conferences to involve the parents in reducing anxiety and negative attitude towards mathematics (Willis, 2010).

4.6 The relationship between mathematics anxiety and mathematics performance.

The study objective was to establish the relationship between mathematics anxiety and mathematics performance. The MAS intended to show the levels of students' mathematics anxiety which were low, moderate and high anxiety level and these were from the range of 14-70 whereby the highest score indicated high anxiety and the lowest scores indicated the low anxiety levels. The students' academic scores were used to give their performance in mathematics. The academic scores ranged from 0-100 where by the highest marks indicated high performance and the lower marks indicated low performance in mathematics. A scatter plot diagram was used to test whether the two variable had a linear relationship and later Spearman's correlation test was done to test for the relationship between the two variables. The results were presented below.
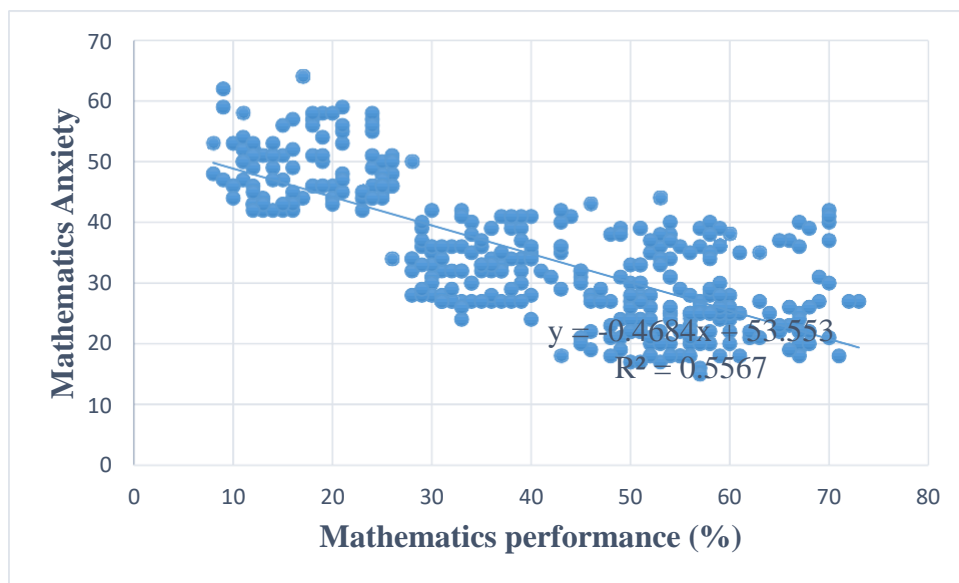

Figure 4. 5: Scatter plot diagram showing the relationship between mathematics anxiety and mathematics performance.

From the scatter plot above, R^2 linear =.557 which means that a variation of 56% of mathematics performance is influenced by mathematics anxiety with the remaining percentage (44%) of other factors influencing mathematics performance. The linear regression equation implied a unit increase in mathematics anxiety results to reduction of mathematics performance by 0.47.

Table 4. 4: Spearman's correlation coefficient between mathematics anxiety and mathematics performance.

		Mathematics performance
	Spearman's Correlation coefficient	-0.723
Mathematics anxiety	Sig. (2-tailed)	0.000
	N	367

From the results above, 367 students had a mathematics performance mean of 40.3(SD=17.3) and a mathematics anxiety mean of 34.7(SD=10.9). The correlation analysis shown a negative correlation between mathematics anxiety and mathematics performance (r= -.723) which was statistically significance (P>0.05) suggesting that the more the students are anxious (high anxiety level) the lower the mathematics performance (low mathematics performance) and as the anxiety goes down the performance shift high.

With the study revealing a negative correlation ($r = -0.723$), the findings were same as those of (Reali et al., 2016; Lauer et al., 2018). For instance, Reali et al. (2016) found out that mathematics anxiety and math performance were related but negatively ($r = -0.27$). further, Justicia-Galiano et al.,(2017) studied anxiety and performance in mathematics among children aged 8 to 12 years and found a negative correlation between the variables.

To explain this negative link, a theory –arousal performance theory- was posed. The theory claims that high mathematics anxiety would lead to low performance. This means high anxiety makes the students to concentrate much on trying to bring down the anxiety hence do not put effort on the mathematical task. Again moderate mathematics anxiety would lead to high mathematics performance since the student is able to control

him/herself hence much effort is put on doing the mathematical task ahead hence high performance. Low anxiety levels also lead to high performance but when it is at lowest extreme end then the performances become low. The low performance under low anxiety levels means that the student has no self-drive, does not put any effort to perform a mathematical task ahead and again there are no arousing factors for the students to try the task ahead.

Further, Namkung et al. (2019) posited that there was a significant negative relationship between mathematics anxiety and mathematics performance (Gunderson and colleagues, 2018) which was contributed by factors such as how they measured mathematics anxiety, problems encountered in attempt to perform mathematics and how important the performance measurement instruments are perceived to be. This is further supported by the findings that there is a negative association between math anxiety and math achievement when they were studied simultaneously (Ganley & McGraw, 2016; Ramirez, Gunderson, Levine, & Beilock, 2013) and longitudinally (Cargnelutti, Tomasetto, & Passolunghi, 2017; Vukovic, Kieffer, Bailey, & Harari, 2013), postulated that the association between math anxiety and mathematics performance develops from childhood to adulthood.

For good and high performance in mathematics there is need to give attention to the high anxiety levels or negative attitudes and try to bring them to moderate or the required levels. These anxieties and attitudes can be stabilized by students, teachers and parents by use of strategies such as encouraging group work, active learning, use of a variety of assessment and also dispelling harmful misconception about mathematics in societies during socialization activities.

4.7 Management of mathematics anxiety
The study aimed establishing the strategies that the respondent teachers used to reduce anxiety in students whenever it is beyond the appropriate level. The word yes indicated the strategy that they usually employ to reduce mathematics anxiety in students. The responses are presented in table 4.7.

Table 4. 5: Management of mathematics anxiety.

	Yes	No
I usually encourage a positive attitude toward Mathematics.	84(97.7)	2(2.3)
while in class I relate Mathematics to real life.	80(93)	6(7)
I encourage critical thinking during Mathematics computations.	57(66.3)	29(33.7)
I encourage active learning during Mathematics lessons.	85(98.8)	1(1.2)
I usually accommodate students' varied learning styles.	63(73.3)	23(26.7)
I organize students into cooperative learning groups.	83(96.5)	3(3.5)
I always provide support and encouragement to students concerning Mathematics.	62(72.1)	24(27.9)
I avoid putting students in embarrassing situations.	74(86)	12(14)
I usually use Mathematics as punishment whenever my students do wrong.	28(32.6)	58(67.4)
I encourage the use of manipulatives for students	77(89.5)	9(10.5)

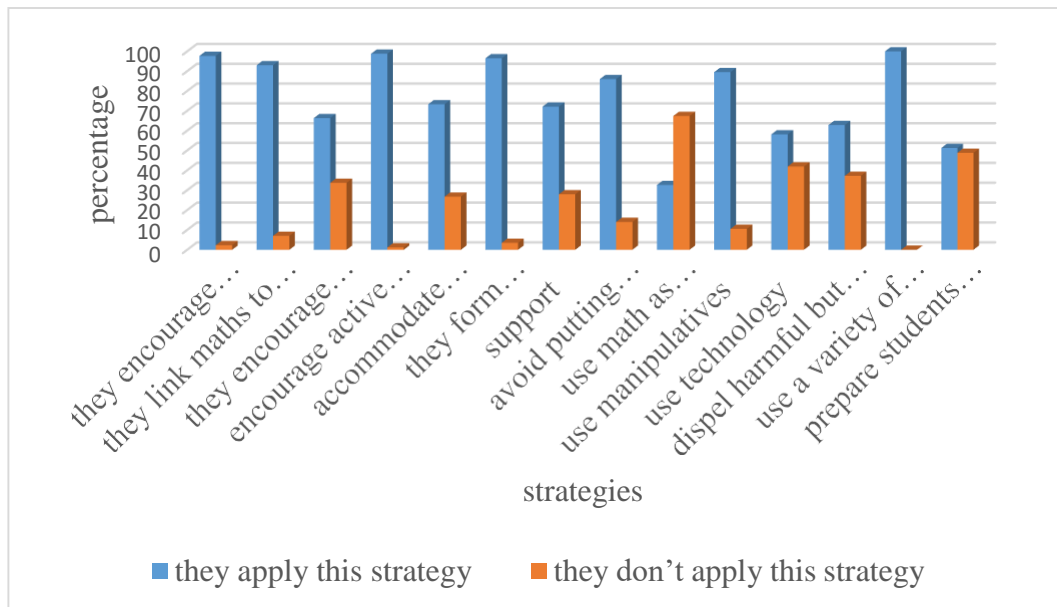|		
to gain interests in Mathematics.		
I usually use technology to gain students attention during a Mathematics lesson	50(58.1)	36(41.9)
I usually dispel harmful but popular misconceptions.	54(62.8)	32(37.2)
I usually use a variety of assessments.	86(100)	0(0%)
I usually prepare students for high-stakes testing sessions.	44(51.2)	42(48.8)

Figure 4. 6: Percentage distribution of different strategies.

The study results revealed that most of the respondent teachers were of the opinion that use of variety of assessments (100%) would aid in reducing students' mathematics

anxiety. A critical component of effective instruction includes personal reflection of assessment practices and overall beliefs in the classroom (taylor,2017). Blazer (2011) found that a variety of assessments to evaluate students aided students with a variety of learning styles. These assessments may include oral questioning which helps learners who have problems in reading and writing, observation and demonstrations which is good for learners who are best in use of hands and other motor activities. Time to time tests and examinations help to reduce anxiety since it helps students to reflect on what they know.

The study revealed that 98.8% of the respondent teachers encourage active learning in mathematics class to reduce mathematics anxiety. this is supported by a finding by (Taylor, 2017) which postulated that teachers should encourage constructivist approach by students to reduce mathematics anxiety. This approach involves allowing students to participate in all the activities during learning of mathematics let it be calculations, demonstrations, drawing sketching and others (Sun & Pyzdrowski, 2009). Alexander, (2010) postulated that discussion groups helps students to be active in class and helps students to understand the contents more. Students should be aalowed to explore, think practice and use knowledge instead of just listening to verbal descriptions of the content matters (blazer, 2011).

The study results revealed that 97.7% of the respondent teachers encourage positive attitude towards mathematics. this result confirms the findings by (Taylor, 2017; Blazer, 2011) who argued teachers can design strategies that enable students to cooperate on a task. Students shoul always be allowed to set goals they can achieve themselves then be guided on how to easily achieve them. Chapline and Newman (1984) reported that for students to have positive attitude towards mathematics they should be able to choose their own strategies, ask questions, think and interpret the conclusions. Positive attitude is also promoted when they work and answer questions correctly and with their own efforts (Blazer, 2011). All these ways of promoting positive attitude of students also promote their anxiety towards mathematics to be moderate.

The results revealed that 96.5% of the respondent teachers organize students into groups. Discussion groups enables students to be free and active during mathematics computations and enables content understanding instead of following certain procedures (Geist, 2010;

Hellum-Alexander, 2010). Taylor, (2017) postulated that encouraging students to work with their peers in discussion groups helps to eliminate mathematics anxiety. It is believed that people learn from other people's ideas and perspectives. Students may be grouped into ability groups to allow room for free participations during solving questions, and other mathematical computations (Blazer, 2011).

The results revealed that 93% of the respondent teachers relate mathematics with real life situations. Geist, 2010, postulated that Mathematics should always be linked with real life activities and applications such as making computations when given change in a shop, running using the shorter route to show the Pythagoras theorem (Blazer, 2011). Students should be encouraged to apply the mathematical concepts to their real life activities, put into practice the activities and be able to solve the problem they encounter with mathematics.

The results revealed that 89.5% of the respondent teachers encourage the use of manipulatives when teaching mathematics to reduce mathematics anxiety in students. These manipulatives include pictures and diagrams illustrating certain concepts, video demonstrations and aid visuals to help the students understand more without memorization which reduces the anxiety levels of a student (Blazer, 2011; Muro, 2006). Things that create interest of the learners should be practiced more such as introducing humor which relieves tension from students. Stories and riddles linked to mathematics are much memorable to students than procedures of computing tasks. All these ways help student to recall information during examinations and tests. Students of teachers who show interest and passion about mathematics are much successful and always look forward to attend mathematics class (Taylor, 2011).

Results revealed that 86% of the respondent teachers avoid putting students in embarrassing situations which confirms the finding by blazer, (2011) who postulated that teachers should create conducive atmosphere which enables students to feel free and worth when called to answer a question. Teachers should help and encourage the lower performing students by avoiding situations that can embarrass them in front of others so as to boost their confidence levels (Ashcraft et al., 2007).

The study revealed that 73.3% of the respondent teachers accommodate varied students learning styles. Learning style such as individual math tutoring (Supekar et al., 2015) helps reduce mathematics anxiety. Different students use different ways of learning with their speed differing from each other and this should be considered so as to allow all the students to learn. Each student should be allowed to learn and be taught according to his/her ability and need. All this should be aligned to the student method of learning (Blazer, 2011)

The study results revealed that 72.1% of the respondent teachers provide support and encouragement concerning mathematics to students. In a similar study, Alexander (2010) found that there was supportive classroom environment. Supportive teachers are respectful to their students, have passion and interest of teaching mathematics, take mathematics as good and worth for learning, allow students to work in discussions and always ready to follow the procedure of the workings when marking mathematics tests and examinations (Blazer, 2011).

The study results revealed that 66.3% of the respondent teachers encourage critical thinking during mathematics computation. Students should always be allowed to think and improvise different methods of solving mathematical problems instead of following what is strictly on the syllabus (Blazer, 2011). Students should be encouraged o understand instead of memorizing content. Instead, teachers should present math as an interesting subject and allow student to make their own decisions and allow them think critically (Geist, 2010; Hellum-Alexander, 2010).

The study results revealed that 62.8% of the respondent teachers dispel harmful but popular misconception about mathematics. This finding is supported by Blazer (2011) who posited that once math anxiety is identified it is influenced by the cultural attitude that undermine the performance. These attitudes include; math is a male domain, if someone is not good in math that can't be changed by hard work, one should follow a certain procedure to solve a math problem and every mathematician solve the problem in their head and very fast. Teachers should always discourage these believes and always encourage students to be more serious with math (Jackson, 2008; Ashcraft & Krause,

2007). Teachers should send away harmful beliefs that may affect mathematics computations and achievement in students.

The study findings reveal that 58.1% of the respondent teachers use technology to gain students attention during mathematics class. These techniques include; smartphone applications, laptops, and other mobile devices that support 3D level graphics. These could be good and they create a conducive environment for mathematics working and computations since they create attention and interest of the student towards the content (Zeng et al., 2018). Other practices to reduce math anxiety include (Chang & Beilock, 2016; Jansen et al., 2013), following and listening to mathematics computation clips and videos (Gan et al. 2015). It is also supported by Blazer (2011) who argued that teachers should assign students work that is associated with computers since it creates more attention and interest to a learner and hence give an instant feedback. Much engagement with internet provides students with more learning resources (Hellum-Alexander, 2010).

The study results revealed that 51.2% of the respondent teachers prepare students for high stakes testing sessions. This confirms the study finding by Cavanaugh (2007) who argued that teachers ask learners to do assignment ahead of syllabus for faster syllabus coverage. Students can be asked by the teacher to try a certain topic yet it is not covered so as to make students more vibrant and feel that the work is doable when they reach there. This implies that students require frequently timed test for them to be used to doing mathematics within the stipulated time and reduce any form of anxiety in them.

The study results revealed that 67.4% of the respondent teachers never use Mathematics as punishment whenever the students do wrong. Blazer (2011) stressed that using math assignment to punish students divert their intentions of doing math and this create a negative attitude towards math and can easily result to math anxiety. Instead of punishing students using mathematics problems the teachers should be in a position to encourage the student to have interest in mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

5.1 Introduction

This chapter gives a summary of the findings, conclusions, limitations and recommendations of the study. It also highlights suggestions of further studies on mathematics anxiety and performances.

5.2 Summary of research findings.

This section presents the summary of the study findings based on the specific objectives of the study which were the gender differences in mathematics anxiety, the relationship between Mathematics attitude and Mathematics anxiety, relationship between Mathematics anxiety and performance and strategies used to manage or reduce Mathematics anxiety in students.

5.2.1 Gender differences in mathematics anxiety.

Based on the findings of the study math anxiety in students is exist in three levels which include; low, moderate and high anxiety. These are much characterized by; worries, frustrations, avoidance, stress, negative attitude and others. There was no gender difference towards low, moderate and high anxiety. The t-test results revealed no gender differences in low mathematics anxiety (t (365) = -.433, p = .665), no gender differences in moderate anxiety level (t (365) = .353, p = .724) and no gender differences towards high anxiety level (t (365) = .520, p = .603).

5.2.2 Relationship between Mathematics attitude and Mathematics anxiety

Based on the findings of this study, mathematics attitude influences mathematics anxiety. The Spearman's correlation coefficient (r= 0.538, p< 0.05) revealed that mathematics anxiety and mathematics attitude were related to each other. The attitude towards mathematics include those of students towards their teachers, mathematics tasks, assignment and also tests. These attitudes are transmitted from parents, teachers and peers to students. The results from the scatter plot diagram revealed that when there is negative

attitude towards mathematics there is high mathematics anxiety and when the students' attitude towards mathematics is positive their mathematics anxiety is low or moderate. These two factor influences performances because they alleviate the students mind from the task or else make them concentrate on the task which may result to performance being low or high respectively.

5.2.3 Relationship between Mathematics anxiety and Mathematics performance

The findings reveal that Mathematics anxiety influences performance. The Spearman's correlation coefficients (r= -0.723, p< 0.05) revealed a relationship between mathematics anxiety of the students and their mathematics performance. The scatter plot diagram revealed that when the level of anxiety is moderate/low then the performance in mathematics is high and when the level of anxiety is high then the performance in mathematics is low.

5.2.4 Strategies to reduce Mathematics anxiety

It is evident that mathematics anxiety is reduced by the following measures; use of a variety of assessment, incorporating group discussions, encouraging positive attitude towards mathematics, incorporating different students learning styles and also active participation during mathematics class.

5.3 Conclusion.

It is apparent that students' mathematics performance can be influenced by their anxieties and attitude towards it. Too much anxiety by the student towards mathematics results to ow mathematics performance while moderate level of anxiety result to high performance in mathematics. Mathematics anxiety is characterized by the following; worries, stress, frustrations, avoidance behaviors, headaches and others. All these manifestations are grouped into either physical, psychological or behavioral symptoms. On physical students experience headache during Mathematics lessons or whenever they here about Mathematics, the behavioral symptoms include avoidance tendencies whereby the students may avoid math assignment, Mathematics teachers ,Mathematics lessons , avoiding to take Mathematics courses in institutions of higher learning and on

psychological symptoms include students being stressed by Mathematics, frustrations with Mathematics and worrying about not understanding math and others understanding math better than them. The symptoms of mathematics anxiety occur under three levels of low, moderate and high anxiety. The t-test results revealed no gender differences towards the levels of anxiety towards mathematics.

Mathematics anxiety, Mathematics attitude and Mathematics performance are associated to each other. Mathematics attitude and anxiety are influenced by environment or personal factors. Environment is from teachers, peers and parents. These attitudes are transferred from the environment to students thus bring about either negative attitude or positive attitude towards Mathematics hence influence Mathematics anxiety to be either at high or moderate levels. When the math attitude is negative students experience high anxiety towards it and later this may bring about low performance by the anxious students. When students experience positive attitude towards Mathematics they can have either low or moderate anxiety. When the anxiety levels are moderate/low then the performance are high. Again from the study findings teachers may recognize the anxiety symptoms from their students and hence may practice different strategies to reduce the same. Teachers have shown to use variety of assessment (100%) to make students have low or moderate anxiety. Others use group discussions, active participation during math lessons and they also encourage positive attitude towards Mathematics.

These findings support the performance arousal theory since moderate anxiety level resulted to high mathematics performance and high anxiety level resulted to low performance in mathematics. These findings agree with the assumptions of the theory that; increase or decrease in arousal result to decrease in performance and moderate arousal results in optimal performance.

5.4 Recommendations.

The study recommends; Teachers should make use of real life examples when teaching mathematics to reduce boredom and fear for mathematics. These examples may include item costs and prices and also measuring and covering distances. Further mathematics anxieties should be identified from early years of school by the instructors with an aim of curbing them and preventing the transition to higher levels of study. Students should always be encouraged to perceive mathematics as a core subject and do away with the negative attitude associated with it.

5.6 Suggestion for further research.

The researcher further suggests a study to focus on mathematics anxieties and mathematics performance in Meru county as well as the perception of teachers and parents on the effect of mathematics anxiety on performance. Further mathematics anxiety can be studied in primary schools so as to understand the transition of mathematics anxiety from lower levels of education to higher levels.

REFERENCES

Akey, T. (2006). "School context, students' attitudes and behavior and academic achievement: an exploratory analysis," Tech. Rep., MDRC.

Akin, A., Kurbanoglu, I. N., (2011). The relationships between math anxiety, math attitudes, and self-efficacy: A structural equation model. *Studia Psychologica 53*(3):263.

Alkan, V. (2013). Reducing Mathematics anxiety: The ways implemented by teachers of primary schools. *International journal of social science and education*, *3*(3), 795-808.

Anderson, A., Valero, P., & Meaney, T. (2015). "I am [not always] a Maths hater": Shifting students' identity narratives in context. *Educational Studies in Mathematics*, *90*(2), 143–161. https://doi.org/10.1007/s10649-015-9617-z.

Arem, C. (2009). *Conquering Math Anxiety. 3rd Edn.,* Cengage Learning, ISBN10:0495829404. Belmont.

Ashcraft, M. H., Krause, J. A., & Hopko, D. R. (2007). Is math anxiety a mathematical learning disability? In D. B. Berch & M. M. M. Mazzocco (Eds.), Why is math so hard for some children? (pp 329–348). Baltimore, MD: Brookes Publishing.

Ayob, A., & Yasin, R. M. (2017). Factors affecting attitudes towards mathematics. *International Journal of Academic Research in Business and Social Sciences*, *7*(11), 1100-1109

Bayaga, A., & Wadesango, N. (2014). Analysis of students' attitudes on mathematics achievement - factor structure approach. *International Journal of Educational Science, 6*(1), 45–50.

Blazer, C. (2011). Strategies for Reducing Math Anxiety. Information Capsule. Volume 1102. *Research Services, Miami-Dade County Public Schools*.

Beilock, S. L., & Maloney, E. A., (2015). Math Anxiety: A Factor in Math Achievement Not to Be Ignored, *Policy Insights from the Behavioral and Brain Sciences*, *2*(1), 4-12.

Bieg, M., Goetz, T., Wolter, I., & Hall, N. C. (2015). Gender stereotype endorsement differentially predicts girls' and boys' trait-state discrepancy in math anxiety. *Frontiers in Psychology, 6*, 1401.

Buckley, S., Reid, K., Goos, M., Lipp, O. V. &Thomson (2016). Understanding and addressing Mathematics anxiety using perspectives from education, psychology, and neuroscience. *Australian Journal of Education, 60* (20), 157-170. https:\\doi.org\10.1177\00049441166653000.

Cargnelutti, E., Tomasetto, C., Passolunghi, M. C., (2017). How is anxiety related to math performance in young students? A longitudinal study of Grade 2 to Grade 3 children. *Cognition and Emotion 31*:755-764. http://dx.doi.org/10.1080/02699931.2016.1147421

Cavanaugh, S. (2007). Understanding 'Math Anxiety.' Education Week, February 21, 2007. http://www.edweek.org.

Chabulembwa, M. D. (2014). Challenges of teaching and learning Mathematics at the Copper Belt University**.** A dissertation submitted to the University of Zambia in fulfillment of the requirements for the degree of Master of Education in Mathematics Education.

http://dspace.unza.zm:8080/xmlui/bitstream/handle/123456789/3778/Main%20 Document.pdf;jsessionid=FE3E6AC1D1526A389E0AD52941183F45?sequence =1.

Chaman M, Callingham R (2013). Relationship between Mathematics Anxiety and Attitude towards Mathematics among Indian Students. *Mathematics Education Research Group of Australasia*.

Chang, H., & Beilock, S. L. (2016). The math anxiety-math performance link and its relation to individual and environmental factors: A review of current behavioral and psychophysiological research. *Current Opinion in Behavioral Sciences*, *10,* 33-38.

Chaplin T. M. (2015). Gender and Emotion Expression: A Developmental Contextual Perspective. *Emotion review: journal of the International Society for Research on Emotion*, *7*(1), 14–21. https://doi.org/10.1177/1754073914544408

Chege, F. & Sifuna, D. (2006). *Girls' and women's education in Kenya: gender perspectives and trends.* Nairobi: UNESCO.

Cipora, K., Artemenko, C., & Nuerk, H. C. (2019). Different ways to measure math anxiety. In *Mathematics Anxiety*. Routledge.

Cropp, I.(2017). Using peer mentoring to reduce mathematical anxiety. *Research paper in education, 32*(4), 481-500. https://doi.org/10.1080/02671522.2017.1318808.

Devine, A., Fawcett, K., Szűcs, D. & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions 8*(33).

Dorn, L. D., Negriff, S., Huang, B., Pabst, S., Hillman, J., Braverman P, & Susman, E. J., (2009). Menstrual symptoms in adolescent girls: Association with smoking, depressive symptoms, and Anxiety. *Journal of Adolescent Health. 44*:237-43.

Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics Anxiety: What Have We Learned in 60 Years? *Frontiers in Psychology, 7.* Https://doi. org/DOI:10.3389/fpsyg.2016.00508

Erturan, S., & Jansen B. (2015). An investigation of boys' and girls' emotional experience of math, their math performance, and the relation between these variables. *European Journal of Psychology of Education. 30*. Https://doi.org/10.1007/s10212-015-0248-7

Else-Quest, N.M., Hyde, J. S., & Linn, M. C. (2010) Cross-national patterns of gender differences in mathematics: a meta-analysis. *Psychol Bull* 136:103– 127.

Eshun, B. (2004). Sex-differences in attitude of students towards mathematics in secondary schools. *Mathematics Connection*, *4*(1), 1-13.

Finlayson, M. (2014). Addressing math anxiety in the classroom. *improving Schools. 17*(1): 99–115

Gan, S. K. E., Lim, K. M. J., & Haw, X. (2015). The relaxation effects of stimulative and sedative music on mathematics anxiety: a perception to physiology model. *Psychol Music*. http:// dx.doi.org/10.1177/0305735615590430.

Ganley, C. M., Mc Graw, A. L., (2016). The development and validation of a revised version of the math anxiety scale for young children. *Frontiers in Psychology 7*(1181). http://dx.doi.org/10.3389/fpsyg.2016.01181.

Geist, E. (2008). *Children are born mathematicians: Encouraging and supporting development in young children,* (1e ed.). Upper Salle River, NJ: Prentice-Hall.

Geist, E. (2010). The Anti-Anxiety Curriculum: Combating Math Anxiety in the Classroom. *Journal of Instructional Psychology, 37*(1). http://www.faqs.org/periodicals/201003/ 2011820081.html.

Gugliotta, Katie F., "Gender Differences in Attitudes toward Math and Science among Elementary Students: An Exploration of the Role of Teachers" (2010). *University of Tennessee Honors Thesis Projects.* https://trace.tennessee.edu/utk_chanhonoproj/1386

Gunderson, E. A., Park, D., Maloney, E. A., Beilock, S. L., & Levine, S.C., (2018). Reciprocal relations among motivational frameworks, math anxiety, and math achievement in early elementary school. *Journal of Cognition and Development 19*(1):21-46. https://doi.org/10.1080/15248372.2017.1421538.

Haciömeroğlu G (2017). Reciprocal relationships between mathematics anxiety and attitude towards mathematics in elementary students. *Research gate*. Https:// doi.org/10.24193/adn.10.3.6.

Hellum-Alexander, A. (2010). Effective Teaching Strategies for Alleviating Math Anxiety and Increasing Self-Efficacy in Secondary Students. Master's Thesis, The Evergreen State College, Olympia, WA. Retrieved from http://archives.evergreen.edu/masterstheses/Accession89-   10MIT/Hellum-Alexander_AMIT2010.pdf

Hughes, P., Swars Auslander, S., Stinson, D. W., & Fortner, C. K. (2018). Elementary teachers' mathematical beliefs and Mathematics anxiety: How do they shape instructional practices? *School Science and Mathematics*, *11*9(4), 213–222. https://doi.org/10.1111/ssm.12329.

Ifamuyima, S. A. & Rosanwo, E. I. (2016). Improving Mathematics achievement of junior secondary school students using masterly learning instructional strategy. *International journal of innovation in science and Mathematics*, *4*(2).

Israel, G. D. (1992). *Determining Sample Size*. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS, Florida.

Jackson, E. (2008). Mathematics Anxiety in Student Teachers. *Practitioner Research in Higher Education, 2*(1), 36-42.

Jackson, S. L. (2015). Research methods and statistics: a critical thinking approach, second edition. Jacksonville University, *Cengage learning*.

Jackson, C. D., & Leffingwell, R. J. (1999). The role of instructors in creating math anxiety in students from kindergarten through college. *Mathematics Teacher, 92*(7), 583-587.

Jacobs, J. E., Davis-Kean, P. E., Bleeker, M. M., Eccles, J. S., & Malanchuk, O. (2005). "I can do it but I don't want to." The impact of parents, interests and activities on gender differences in math. In A. Gallagher & J. Kaufman (Eds.), *Gender difference in mathematics* (pp.246-263). New York: Cambridge University Press.

Justicia-Galiano, M. J., Martín-Puga, M. E., Linares, R., & Pelegrina, S. (2017). Math anxiety and math performance in children: The mediating roles of working memory and math self-concept. *British Journal of Educational Psychology 87*:573-589. https://doi.org/10.1111/bjep.12165

Jansen, B. R., Louwerse, J., Straatemeier, M., Van der Ven, S. H., Klinkenberg, S., & Van der Maas, H. L. (2013). The influence of experiencing success in math on math anxiety, perceived math competence, and math performance. *Learning and Individual Differences*, *24*, 190–197. Https://doi. org/10.1016/j.lindif.2012.12.014

Kargar, M., Tarmizi, R. A., & Bayat, S. (2010). Relationship between mathematical thinking, mathematics anxiety and mathematics attitudes among university students. *Procedia-Social and Behavioral Sciences* 8:537-542. https://doi.org/10.1016/j.sbspro.2010.12.074

Keskin, Ö., Çorlu, M. S., & Ayas, A. (2018). Voicing Mathematics teachers: A holistic overview of their early career challenges. *Educational Sciences: Theory & Practice, 16,* 331–371. http://dx.doi.org/10.12738/estp.2018.2.0025.

Khesht-Masjedi, M. F., Shokrgozar, S., Abdollahi, E., Habibi, B., Asghari, T., Ofoghi, R. S. & Pazhooman, S. (2019). The relationship between gender, age, Anxiety, depression, and academic achievement among teenagers. *Journal family medicine and primary care*. *8*: 799-804.

Kirikua, H. T. M., Maithya, P., & Ronoh, A. To Examine the Effects of The Principals' Invitation of Mathematics Specialists On Students' Performance in Mathematics in KCSE Examination in Meru County, Kenya.

Kisakali, J., & Kuznetsov, D. (2015). Modeling factors influencing mathematics learning and performance in Tanzanian secondary schools. *Asian journal of mathematics and applications*.

Kombe, D., Che, S. M., Carter, T. L., & Bridges, W. (2016). Student Academic Self-Concept and Perception of Classroom Environment in Single-Sex and Coeducational Middle Grades Mathematics Classes. *School Science and Mathematics, 116*(5), 265–275. Https://doi. org/10.1111/ssm.12178.

Kothari, C. R. (2011). *Research methodology, methods, and techniques*. New Delhi: New Age International Publishers.

Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement, 30*(3), 607–610. doi:10.1177/001316447003000308.

Kyttälä, M., & Björn, P. M. (2014). The role of literacy skills in adolescents' Mathematics word problem performance: Controlling for visuospatial ability and Mathematics anxiety. *Learning and Individual Differences, 29*, 59–66. http://dx.doi.org/10.1016/j. lindif.2013.10.010.

Lauer, J.E., Esposito, A.G., Bauer, P.J., (2018). Domain-Specific Anxiety Relates to Children's Math and Spatial Performance. *Developmental Psychology. Advance Online Publication*. http://dx.doi.org/10.1037/dev0000605

Leder, G. C., & Forgasz, H. J. (2010). I liked it till Pythagoras: The public's view of mathematics. In L. Sparrow, B. Kissane, & C. Hurst (Eds.), *Shaping the future of mathematics education* (Proceedings of the 33rd annual conference of the Mathematics Education Research Group of Australasia, pp.328-325). Fremantle, WA: MERGA

Lee, K. J., & Anderson, J. A. (2014). Who is really interested in mathematics? An investigation of lower secondary students' mathematical role models. In J. Anderson, M. Cavanagh, & A. Prescott (Eds.), *Curriculum in focus: Research*

guided practice (Proceedings of the 36th Annual Conference of the Mathematics Education Research Group of Australasia, pp. 397-404). Sydney: MERGA.

Lim, S. Y., & Chapman, E. (2013). Development of a short form of the attitudes toward Mathematics inventory. *Educational Studies in Mathematics*, *82*(1), 145-164.

Maat, S. & Zakaria, E. (2010). "The learning environment, teacher's factor and students' attitudes towards mathematics amongst engineering technology students," *International Journal of Academic Research*, *2*(2), 16–20.

Macher, D., Paechter, M., Papousek, I. & Ruggeri, K. (2012). Statistics anxiety, trait anxiety, learning behavior, and academic performance. *European Journal of Psychology of Education*, *27*,483-498.

Mahanta, D. (2012). Achievement in mathematics: effect of gender and positive/ negative attitude of students. International Journal of Theoretical & Applied Sciences, 4(2), 157–163.

Maloney, E. A., Ansari, D., Fugelsang. J. A. (2011). The effect of Mathematics anxiety on the processing of numerical magnitude. *Quartery Journal of Experimental Psychology, 64*, 10-16.

Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science*. doi:10.1177/0956797615592630.

Mahmood, S., & Khatoon, T. (2011). Development and validation of the Mathematics anxiety scale for secondary and senior secondary school students. *British Journal of Arts and Social Sciences*, *2*(2), 169–179.

Manyara, S. M. (2012). Influence of students' English language competence on performance in secondary schools in Meru Central District, Meru County. *Unpublished* thesis Nairobi University.

Marshall, E., Mann. V., & Wilson, D. (2016). Maths anxiety: A collaboration. HEA STEM conference, Nottingham.

Mberia, F. K. & Mwangi, B. N. (2018). Influence of Mathematical English on Performance of Standard Eight Learners in Public Primary Schools in Miriga Mieru, Meru County, Kenya. *African Research Journal of Education and Social Sciences*, *5*(2).

Mbugua, Z. K., Kibet, K., Muthaa, G. M., & Nkonke, G. R. (2012). Factors contributing to students' poor performance in mathematics at Kenya certificate of secondary education in Kenya: A case of Baringo county, Kenya.

Mensah, J., Okyere, M., & Kuranchie, A. (2013). Student attitude towards mathematics and performance: does the teacher attitude matter? Journal of Education and Practice, 4(3), 132–139.

Mugenda, O. M. & Mugenda, A. G. (2013). *Research Methods. Qualitative and Quantitative Approaches*. Nairobi: Africa Centre for Technology Studies Press

Mullis, I. V., & Martin, M. O. (2017). *TIMSS 2019 Assessment Frameworks*. International Association for the Evaluation of Educational Achievement. Herengracht 487, Amsterdam, 1017 BT, The Netherlands. & PIRLS.

Muola, J. M, Kithuka, M. R. Ndirangu, W. G & Nassiuma, D. K (2009). Relationship

between test anxiety and academic performance in secondary schools in Nyeri District, Kenya. *Global Journal of Educational Research, 8*(1&2), 1-7. Co. Ltd. Printed in Nigeria.

Mutisya, N. E., Kinai, K. T., Dinga, N. J., & Mutweleli, M. S., (2018). Relationship between Academic Emotions, Self-efficacy and Mathematics achievement of secondary school students in Central Division, Machakos County, Kenya. retrieved from https://journal.ku.ac.ke/index.php/msingi/article/view/51.

Namkung, J. M., Peng, P., & Lin, X., (2019). The Relation Between Mathematics Anxiety and Mathematics Performance Among School Aged Students: A Meta-Analysis. Review of Educational Research. https://doi.org/10.3102/0034654319843494.

Nu´ n˜ ez-Pen˜ a, M. I., Sua´rez-Pellicioni, M., Bono, R. (2013). Effects of Mathematics anxiety on student success in higher education. *International Journal of Education Research, 58*, 36-43.

Otieno, H. (2018). *Improving Kenyan Secondary School students' relationship with mathematics through self-regulated learning* (Doctoral dissertation, Sheffield Hallam University).

Pajares, F. (2005) Gender differences in mathematics self-efficacy beliefs. In Gender differences in mathematics: An integrative psychological approach. Edited by Gallagher AM, Kaufmann JC. New York: Cambridge University Press: 294–315

Papadakis, S. K., & Zaranis, N. (2016). Improving Mathematics Teaching in Kindergarten with Realistic Mathematical Education. *Early Childhood Education Journal*, *45*, 369-378. https://doi.org/10.1007/s10643-015-0768-4.

Plaisance, D. V. (2009). A Teachers' Quick Guide to Understanding Mathematics Anxiety. *Lousiana Association of Teachers of Mathematics Journal, 6*(1*)*,1-8.

Radisic, J., Videnovic, M. & Baucal, A. (2015). Mathematics anxiety – contributing to the school and individual-level factors. *European journal of psychology of education*, *3* (1), 1-20.

Ramirez G, Gunderson EA, Levine SC, Beilock SL (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development 14*(2):187-202. http://dx.doi.org/10.1080/15248372.2012.664593.

Rampey, B. D., Dion, G. S., & Donahue, P. L. (2009). NAEP 2008: Trends in Academic Progress. NCES 2009-479. *National Center for Education Statistics*.

Recber, S., Isiksal, M., & Koç, Y. (2018). Investigating self-efficacy, anxiety, attitudes and mathematics achievement regarding gender and school type. *anales de psicología, 34*(1), 41-51. http://dx.doi.org/10.6018/analesps.34.1.229571.

Rodarte-Luna B, Sherry A (2008). Sex differences in the relation between statistics anxiety and cognitive/learning strategies. *Contemporary educational psychology 33*(2): 327-344. https://doi.org/10.1016/j.cedpsych.2007.03.002

Rollins, S. (2016). A phenomenological study of Florida elementary pre-service teachers with Mathematics anxiety. dissertation completed at Northcentral University. https://www.google.com/search?rlz=1C1CHZL_enKE827KE827&q=Rollins,+S.+(2016).+A+phenomenological+study+of+Florida+elementary+pre-service+teachers+with+Mathematics+anxiety.+dissertation+completed+at+North

central+University&tbm=isch&source=univ&sa=X&ved=2ahUKEwiqlsyr9d7jA
hXDyIUKHZhuCAwQsAR6BAgJEAE&biw=1350&bih=591.

Sahri, N. A., Kamaruzaman, W. N. F. W., Jamil, J. M., & Shaharanee, I. N. M.,
(2017). Exploring mathematics anxiety and attitude: Mathematics students'
experiences in AIP Conference Proceedings 1905(1).

Sarouphim, K.M., & Chartouny, M. Mathematics education in Lebanon: gender
differences in attitudes and achievement. *Educational Studies in
Mathematics. 94*, 55–68 (2017). https://doi.org/10.1007/s10649-016-9712-9

Schleepen T. M., & Van Mier H. I. (2016). Mathematics anxiety differentially affects
boys' and Girls' arithmetic, reading, and fluid intelligence skills in fifth
graders. *Psychology 7*, 1911– 1920. Https://doi. Org/10.4236/psych.2016.714174

Siew, H. P. (2018). Pedagogical change in Mathematics learning: Harnessing the
power of digital game –based learning. *International forum of education
technology and society*, *20*(4), 259-276.

Smith, R. M., (2004). Math Anxiety: Causes, Effects, and Preventative Measures.
A Senior Thesis submitted in partial fulfillment of the requirements for graduation
in the Honors Program Liberty University Fall Semester 2004.

Soni A & Kumari s (2017). The Role of Parental Math Anxiety and Math Attitude in
Their Children's Math Achievement. International journal of science and math
education, 15(2), 331-347. https://doi.org/10.1007/s10763-015-9687-5.

Sun, Y., & Pyzdrowski, L. (2009). Using Technology as a Tool to Reduce

Mathematics Anxiety. *The Journal of Human Resource and Adult Learning, 5*(2),
38-44.

Supekar, K., Iuculano, T., Chen, L., & Menon, V. (2015). Remediation of
childhood math anxiety and associated neural circuits through cognitive tutoring.
Journal of Neuroscience, 35, 12574–12583. doi:10.1523/jneurosci.0786-15.2015

Syokwaa, K. A., Aloka, O. J. P. & Ndunge, F. N. (2014). The relationship
between anxiety levels and academic achievement among students in selected
secondary schools in Langáta district- Kenya. *Journal of educational and social
research*, *4*(3), 403. doi.10.3901\jesr. 2014.v4n3p403.

Tapia, M., & Marsh, G. E., (2004). An instrument to measure mathematics attitudes.
Academic Exchange Quarterly 8(2):16-22.

Taylor, S.R. (2017). Successful teacher practices for reducing mathematics
anxiety in secondary students: A dissertation presented to faculty of the
education department Carson Newman university.

Taylor, B. A., & Fraser, B. J. (2013). Relationships between learning environment and
Mathematics anxiety, *Learning Environ Res*, *16*, 297-313.
http://dx.doi.org/10.1007/s10984-013-9134-x.

Tobias, S. (1993). *Overcoming Math Anxiety*. New York: W. W. Norton & Company.

Vinson, B. M. (2001). A comparison of preservice teachers' mathematics anxiety
before and after a methods class emphasizing manipulatives. *Early Childhood
Education Journal 29*(2):89-94. http://dx.doi.org/10.1023/A:1012568711257

Vukovic, R. K., Kieffer, M. J., Bailey, S. P., & Harari, R. R., (2013). Mathematics

anxiety in young children: Concurrent and longitudinal associations with mathematical performance. *Contemporary Educational Psychology*

Wang, Z., Lukowski, S. L., Hart, S. A., Lyons, I. M., Thompson, L. A., Kovas, Y., ... & Petrill, S. A. (2015). Is math anxiety always bad for math learning? The role of math motivation. *Psychological Science, 26*, 1863–1876. doi:10.1177/0956797615602471

Watt, H. M. G. (2007). A trickle from the pipeline: Why girls under participate in maths. *Professional Educator, 6*(3), 36-41.

Wachira, N. C. (2016). Causes of poor performance in Mathematics in secondary schools: a case of Nyandarua North Sub County, Kenya. a research project submitted to the school of education and social sciences in partial fulfillment of the requirements for the award of the degree of executive masters in educational management in leadership and policy in education. Retrieved from https://karuspace.karu.ac.ke/bitstream/handle/20.500.12092/1981/CHARLES%20NDIRITU%20WACHIRA.pdf?sequence=1&isAllowed=y.

Wallace, A. (2018). The path to Mathematics: Analysis of student mathematical stories. A thesis submitted to the faculty of the University of Mississippi. retrieved from http://thesis.honors.olemiss.edu/1131/1/WallaceThesisFINAL.pdf.

Wasike, A. (2013). Effects of attitudes of female students on the performance in Mathematics in various types of secondary school in Teso district- Kenya. *Journal of education and practices, 4*(5). 148-160.

Wigfield, A. & Meece, J. L. (1988). Math anxiety in elementary and secondary school students. *Journal of Educational Psychology, 80*(2), 210-216.

Willis, J. (2010). A study guide for learning to love mathematics: teaching strategies that change student attitudes and get results: Oxford

Yamane, T. (1967). *Statistics: An Introductory Analysis (*2nd ed.). New York: Harper and Row.

Yeo, L.W., Tan, K.C & Lew, L.S. (2015). Mathematics anxiety among male and female students. *International journal of social, behavioral, educational, economics, business, and industrial engineering*, *9*(8).

Yerkes, R. M., & Dodson, J.D. (1908). The relation of strength of stimulus to rapidity of habit-formation*. J Comp Neurol Psychol*, *18*, 459–482.

Young, C. B., Wu, S. S., & Menon, V. (2012). The neurodevelopmental basis of math anxiety. *Psychological Science, 23*, 492–501. http://dx.doi.org/10.1177/0956797611429134.

Zakariya, Y. F. (2018). Development of Mathematics Anxiety Scale: Factor Analysis as a Determinant of Subcategories. *Journal of Pedagogical Research*, *2*(2), 135-144.

Zan, R., & Di Martino, P. (2007). Attitude toward mathematics: Overcoming the positive/negative dichotomy. *The Montana Mathematics Enthusiast*, *3*(1), 157-168.

Zettle R, Raines S (2002). The relationship of trait and test anxiety with mathematics anxiety. *College Student Journal 34*(2):246-258

APPENDICES
Appendix A: Students Questionnaire

I am a student from the University of Embu pursuing a Master's Degree in Educational Administration and Planning. I want to know about your feelings towards Mathematics since they may influence the performances. Being a student in this school, you have known about different Mathematics dynamics and hence the information that you will provide would contribute much to this study.

Kindly, write only your admission number on the questionnaire instead of your name. Be honest and the information you provide will be treated with much confidence. Tick on the alternative that suitably describes you and towards Mathematics and fills in the blank spaces where applicable.

SECTION A: Demographic Data

1.Student gender

Male [ ]   Female [ ]

2.Student age (in years)

   Age 13-15 [ ]   age 16-20 [ ]   age above 20 [ ]

SECTION B: Mathematics Anxiety scale by (Mahmood & Khatoon, 2011).

Indicate how often each statement describes you by ticking only one of the five terms next to the statement.

No.	Item	Never	Rarely	Sometimes	Often	Always
1.	I feel happy and excited in a Mathematics class as compared to any other class					
2.	I worry that other students might understand					

	Mathematics problems better than me					
3.	I feel stressed when I'm about to take a Mathematics test.					
4.	I have "butterflies" in my stomach before I go to Mathematics class.					
5.	Being called on to answer a Mathematics question scares me.					
6.	I feel frustrated when working on Mathematics problems.					
7.	Solving Mathematics problems is always pleasant for me.					
8.	I avoid my Mathematics homework.					
9.	Mathematics is one of my favorite subjects.					
10.	I am afraid to ask questions in Mathematics class.					
11.	Mathematics makes me feel comfortable and easy.					
12.	Mathematics is a headache for me.					

13.	I would prefer Mathematics as one of my subjects in higher studies.					
14.	I find Mathematics interesting					

SECTION C: Attitude towards Mathematics Inventory.

Indicate how often each statement describes you by ticking only one of the options next to the item statement.

s. No	Item	Strongly agree	Agree	Disagree	Strongly disagree
1.	I get a great deal of satisfaction out of solving a Mathematics problem.				
2.	1 am comfortable answering questions in Mathematics class				
3.	1 am comfortable expressing my own ideas on how to look for solutions to a difficult problem in Mathematics.				
4.	Mathematics is a very interesting subject				
5.	I am happier in a Mathematics class than in any other class.				
6.	I really like Mathematics..				
7.	I would prefer to do an assignment in Mathematics than to write an essay...				

8.	I like to solve new problems in Mathematics.				
9.	Mathematics is dull and boring.				
10.	1 have usually enjoyed studying Mathematics in school.				
11.	1 am confident that I could learn advanced mathematic				
12.	1 would like to avoid using Mathematics in university				
13.	I am willing to take more than the required amount of Mathematics.				
14.	I plan to take as much Mathematics as I can during my education				
15.	The challenge of Mathematics appeals to me				
16.	Mathematics makes me feel uncomfortable.				
17.	Studying Mathematics makes me feel nervous				
18.	1 believe I am good at solving Mathematics problems				
19.	I learn Mathematics easily.				
20.	1 feel a sense of insecurity when attempting Mathematics				

21.	I am able to solve Mathematics problems without too much difficulty.				
22.	I have a lot of self-confidence when it comes to Mathematics.				
23.	1 expect to do fairly well in any Mathematics class I take.				
24.	Mathematics does not scare me at all.				
25.	It makes me nervous to even think about having to do a Mathematics problem				
26.	When 1 hear the word Mathematics, 1 have a feeling of dislike				
27.	1 am always under a terrible strain in a Mathematics class				
28.	1 believe I am good at solving Mathematics problems				
29.	Mathematics is one of my most dreaded subjects				
30.	My mind goes blank and 1 am unable to think clearly when working with Mathematics.				
31.	Mathematics is a very worthwhile and necessary subject.				
32.	I want to develop my mathematical skills.				

33.	Mathematics helps to develop the mind and teaches a person to think.				
34.	Mathematics is important in everyday life.				
35.	Mathematics is one of the most important subjects for people to study.				
36.	College Mathematics lessons would be very helpful no matter what 1 decide to study in future.				
37.	I can think of many ways that 1 use Mathematics outside of school.				
38.	I think studying advanced Mathematics is useful.				
39.	I believe studying Mathematics helps me with problem solving in other areas.				
40.	A strong Mathematics background could help me in my professional life.				

I am a student from the University of Embu pursuing a Master's Degree in Educational Administration and Planning. I am conducting research on the influence of Mathematics anxiety on students Mathematics performance. This section focuses on strategies employed by teachers to reduce Mathematics anxiety. Being a Mathematics teacher in this school, you have known about Mathematics dynamics in your students and hence the information that you will give will contribute so much on this study.

Kindly, do not write your name on the checklist. Be honest and your information will be treated with confidence. Tick all the strategies that you have ever used and fill in the blank spaces where applicable.

SECTION A: Demographic Data

1. Teachers gender

   Male [ ]   Female [ ]

2. Years of experience
   Less or equal to 5 years [ ]   More than 5 years [ ]

SECTION B: Strategies for Reducing Mathematics Anxiety

Please tick what describes the strategy that you use to reduce Mathematics anxiety in your students.

I usually encourage a positive attitude toward Mathematics.   [ ]

while in class I relate Mathematics to real life.   [ ]

I encourage critical thinking during Mathematics computations.   [ ]

I encourage active learning during Mathematics lessons.   [ ]

I usually accommodate students' varied learning styles.   [ ]

I organize students into cooperative learning groups.   [ ]

I always provide support and encouragement to students concerning Mathematics. [ ]

I avoid putting students in embarrassing situations.   [ ]

I usually use Mathematics as punishment whenever my students do wrong.   [ ]I

encourage the use of manipulatives for students to gain interests in Mathematics. [ ]I

usually use technology to gain students attention during a Mathematics lesson. [ ]

I usually dispel harmful but popular misconceptions.   [ ]

I usually use a variety of assessments.   [ ]

I usually prepare students for high-stakes testing sessions.   [ ]

List any **other strategies** that you use to reduce Mathematics anxiety in your students?

…………………………………………………

…………………………………………………

……………………………………………....

…………………………………………………

………………………………………………….

………………………………………………….

Appendix C: Map of Meru County

MERU COUNTY CONSTITUENCY WITH EXISTING WARDS

Appendix D: Research Permit

RepubIic of Kenya

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 259254

Date of Issue: 03/February/2020

RESEARCH LICENSE

This is to Certify that Ms.. casty Mutegi of University of Embu, has been licensed to conduct research in Meru on the topic: **MATHEMATICS ANXIETY AND PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN IMENTI SOUTH SUB- COUNTY. for the period ending : 03/February/2021.**

License No: **NACOSTI/P/20/3685**

259254

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY &
INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document,
Scan the QR Code using QR scanner application.