ADDIS ABABA UNIVERISTY SCHOOL OF GRADUATE STUDIES

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Anxiety, Attitude towards Mathematics and Mathematics Achievement of Tenth Grade Students at Government and Private Schools in kolfe keranio sub city of Addis Ababa

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ABBREVIATIONS

The following abbreviations were used in this study.

ATM - Attitude towards mathematics

MA - Mathematics Anxiety

MAC - Mathematics Achievement

GS - Government School

PS - Private School

Abstract

The aim of this study was to investigate differences in attitudes towards mathematics, mathematics anxiety, and mathematical achievement due to sex, and school type, and to display how well anxiety and attitude towards mathematics determine students' mathematical achievement controlling for sex and school type. Attitude and anxiety mathematics scales were administered to 307 tenth grade students (128 private and 179 government) and the data collected were analyzed using statistical techniques of mean, standard deviation, independent samples t-test and multiple regression analyses. Results revealed significant differences in attitude, in anxiety and in mathematics scores with respect to type of schools, but no significant sex differences with respect to private schools, government schools and both types of the schools combined together. The multiple regression analysis displayed that sex, school type, attitude towards mathematics and mathematics anxiety had statistically significant contribution on students' mathematics achievement explaining 45.8% of the variance in mathematics achievement. Of the variables treated in the study, attitude towards mathematics and mathematics anxiety were the best predictor variables of the student mathematics achievement. Based on the findings, valuable suggestions were forwarded for stakeholders. Thus, to decrease the students' negative attitude towards mathematics and mathematics anxiety students, parents, teachers, school administrators and education planners work together cooperatively; government schools learn best practices from private schools especially in the use of instructional time and teachers create student-centered teaching methods.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Mathematics is a core subject in secondary schools. The study of mathematics was established to produce competent person who is able to apply knowledge of mathematics in everyday life effectively and responsibly in solving problems and making decisions. Weaknesses among students in learning mathematics in particular will affect the efforts of various sectors in making our country a fully developed nation. Mathematics anxiety is a psychological dimension of learning that is important for educators to identify .Much research has been done to investigate the extent of mathematics anxiety in primary school (Sherman &Wither,2003;Jackson & Leffingwell, 1999; Steele & Arth, 1998; Yuksel-ahin,2008; and at the secondary level Mohamed & Tarmizi, 2010; Karimi and Venkatesan, 2009; Khatoon and Mahmood, 2010; as cited in Zakaria *et al*., 2012).Research has shown that mathematics achievement in students is influenced by psychological factors such as mathematics anxiety. In the mathematical context, it appears that many students who are weak in mathematics worry while attempting to use math skill to solve problems (Mohamed & Tamizi , 2010; Arem ,2003; Rahim,2002; Tobias,1995; as cited in Zakariai *et al*., 2012). The findings of(Marsh & Tapia ,2002; as cited in Zakaria *et al*., 2012) indicate that students with low level of math anxiety feel more exited, more confident and highly motivated to learn mathematics when compared to students who have high anxiety levels.

Math anxiety is loosely regarded as feelings of fear, avoidance and dread when dealing with any situation relating to mathematics. Mathematics anxiety can be defined as

a feeling of tension and anxiety that appears when someone is engaged in the manipulation of figures to solve mathematical problems in both academic and daily-life situations (Tobias, 1995; as cited in Zakaria *et al*., 2012).It is easy to forget math equations and to lose confidence when one is experiencing mathematics anxiety. Mathematics anxiety is found to be associated with beliefs. The research of Tobias revealed that there are many female students at the university level who change their majors to avoid mathematics. This has happened not because the women have a lower intellectual level than men, but because of the belief factor among female students in mathematics. Female students reported that they were not able to understand and solve mathematical problems that they had previously studied.

Mathematics anxiety was defined as the level of discomfort that occurs among students in response to situations involving mathematical tasks, which is seen as a threat to their self-ability(Trujillo & Hadfield, 1999;as cited in Zakaria *et al*., 2012). It is described as a construct that involves cognitive and affective behaviors. This construct is related to personality type, negative attitudes toward mathematics, math avoidance, math background, teaching behavior, achievement levels, lack of confidence and negative experiences in school(Harper & Daane, 1998; Hembree, 1990; Sloan *et al*.,2002; as cited in Zakaria *et al*., 2012). Mathematics anxiety describes as a repetitive process that is based on information gathered by individuals from their surroundings (Puteh, 2002; as cited in Zakaria *et al*., 2012). This information is accumulated and becomes the personal experience of individuals, which finally informs their beliefs toward mathematics. These beliefs produce behavioral situations to escape mathematics because of an overriding fear of being unable to master mathematics. According to Puteh, teachers, peers and parents are responsible for triggering anxiety among students of mathematics .If students perceive that "mathematics is difficult" during their formative years, mathematics anxiety will be

triggered. Due to the presence of mathematics anxiety, such students will strive to escape from any situation that involves mathematics. This will strengthen their belief that they are not capable and lack the knowledge to engage in mathematics and they will continue to lose confidence in their math skills as a result. Although these students will continue their course of study in mathematics, most likely failure will again occur because of their prescribed belief system.

Mathematics anxiety is an emotional, mental and physical act related to the mathematical thinking and problem-solving process and resulting from uncomfortable past experiences related to mathematics (Arem, 2009; as cited in Zakaria *et al*., 2012). Feelings and experiences like this will further affect a student's ability to learn mathematics. Based on the study, students who have experienced disappointment in their mathematical abilities will have difficulty believing in their abilities in the future. According to Arem, the contributing factors to mathematics anxiety are bitter experiences in mathematics, social pressure and the expectation to achieve outstanding results, the desire to excel, myths about the study of math, societal gender stereotypes and negative self-talk. These factors give rise to feelings of deep shame for the student experiencing mathematics anxiety in the classroom setting. Arem also said that, students with math anxiety will often appear preoccupied with something else to avoid meeting face-to-face with their teachers. They are afraid to look up in class and quickly panic when their name is called. They are also afraid to raise their hands and when the teacher is waiting for an answer from them, they become even more afraid.

In addition to this, attitude towards mathematics plays an important role in mathematics achievement. The direct relationship between mathematics achievement and attitudes, as well as their reciprocal influences are well documented (Aiken, 1970; Johnson, 1984; Sherman, Tsai &

Walberg, 1983 as cited in Seleshi, 2001). The studies have shown, especially for high school students that the more favorable students' attitudes are toward mathematics, the better their achievement would be. That is, if students have positive attitudes toward mathematics, it is likely that they will allot a considerable portion of their study time to the subject and strive to master the knowledge and skills necessary at that level and can thus have better achievement scores than students with negative attitudes.

In the context of Ethiopia, little or no researches are not interested on test anxiety in Mathematics Achievement .But the problem of test anxiety is already existed in our country and still has great impact on Mathematics Achievement. That is why the researcher is highly interested to figure out differences in anxiety, attitude, and mathematics achievement due to sex and school type; and to display how well anxiety and attitudes towards mathematics predict students' mathematics achievement controlling for sex and school type.

And the research examined the students' attitudes towards mathematics, their levels of mathematics anxiety, and their mathematical achievements differ with respect to types of schools (government and private), sex of students from school types, sex of students from government schools and sex of students from private schools.

1.2 Statement of the Problem

Secondary education has been implemented in Ethiopia for many years, in two cycles: grades 9-10 and grades 11-12.A national examination (the Ethiopian General Secondary Education Certificate Examination) is given in grade 10, to certify completion of general secondary education and to select students that qualify for the next higher level of education. At this stage, the government applies 70/30 policy according to the students result and choices. Based on the policy, 70% of the students who passed the exam enrolled for natural science

stream and 30% of them enrolled for social science stream. This action forced most students to enroll for natural science stream which is not their choices because of highest amount of percentage is covered by natural science stream. But the researcher real observation, most students need to apply for social science stream because of negative attitude towards mathematics and anxiety in mathematics. Mathematics anxiety and negative attitudes towards mathematics can be considered as two serious problems in mathematics education. Because of high anxiety and negative attitudes associated with mathematics, students avoid taking or attending mathematics classes. This study was conducted to figure out the nature of the relationship between these two psychological constructs and mathematics achievement of tenth grades students in kolef keranio sub city of Addis Ababa Administration.

It is from this back ground that the researcher is initiated to figure out differences in anxiety, attitude, and mathematics achievement due to sex and school type; and to display how well anxiety and attitudes towards mathematics predict students' mathematics achievement controlling for sex and school type.

To examine this problem the following leading research questions were formulated.

1. How do the students' attitudes towards mathematics, mathematics anxiety, and mathematical achievements differ with respect to
   a. types of schools (government and private)?
   b. sex of students from both types of schools?
   c. sex of students from government schools?
   d. sex of students from private schools?
2. How attitudes towards mathematics and mathematics anxiety of students do relates with mathematical achievement controlling for sex and school types?

1.3 Objective of the Study

The general objective of the research is to figure out the nature of the relationship between mathematics anxiety and attitudes towards mathematics and mathematics achievement. In addition to this, the research has the following specific objectives.

1. to examine differences of the students attitudes towards mathematics, their level of mathematics anxiety, and their mathematical achievements with respect to sex and school types.

2. to investigate how attitudes and anxiety levels of students towards mathematics predict students' achievement controlling for sex and school types.

1.4 Significance of the Study

As the researcher said earlier mathematics is a major subject in Ethiopia education system. The study of mathematics was performed to produce competent professionals who apply mathematics concepts in day to day life activities in solving problems and making decisions. The student's weakness and unwillingness in learning mathematics will hinder our country development especially in science and technology.

Although there are many different reasons for the poor performance in mathematics, two prevalent variables worth considering are mathematics anxiety and negative attitude towards mathematics. Math anxiety is loosely regarded as feelings of fear, avoidance and dread when dealing with any situation relating to mathematics. And also mathematics anxiety is a psychological dimension of learning that is important for educators to identify and negative attitude towards mathematics also a problem of mathematics achievement. To maximize students performance in mathematics education professionals must know math anxiety and negative attitude towards mathematics so that to give solutions based on levels of anxiety. And also teachers and educators apply different technique of reducing mathematics anxiety and maximize

positive attitude. It is from this background that the researcher is interesting to assess the nature of the relationship between mathematics anxiety and negative attitudes towards mathematics and its achievement. Since little or no research has been done locally in the area of mathematics anxiety of students and attitude, this study was undertaken to add to that body of knowledge.

1.5 Delimitation of the Study

Basically this research is designed to examine the nature of the relationship between mathematics anxiety and attitudes towards mathematics with mathematics achievement among government and private schools of grade ten students which are found in kolfe keranio sub city, which is one of the sub cities of Addis Ababa Administration .The achievement scores of mathematics are collected from students' mark list of the schools record offices. And mathematics attitude and math anxiety scores for mathematics by using mathematics attitude and mathematics anxiety scales are given for grade ten students will taken to be analyzed in this research. It was possible to include the achievement scores of students in other subjects as well but time, energy and financial constraints were the factors that forced the researcher to take only mathematics achievement scores of students together with math attitude and math anxiety scores of student's of grade ten.

All female & male students of grade ten students of two government and four private schools in kolfe keranio sub city are taken to be the population of the study to examine the nature of the relationship between mathematics anxiety and negative attitudes towards mathematics and mathematics achievement among these government and private secondary schools.

1.6 Definition of Terms

For clarity and consistency in the study, the following definitions of terms are used.

Test Anxiety: Test anxiety is when a student continuously worries about doing well on a test.

Mathematics Anxiety: refers to a nervous disorder marked by excessive uneasiness when dealing with any situation relating to mathematics.

Mathematics Achievement Scores: refers to mathematics achievement scores of students taken from mark lists of students from each school.

Attitude towards mathematics: refers to as a matter of like or dislike of mathematics.

Sex difference: refers to the difference between males and females in their mathematics achievement, attitude and math anxiety scores.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The impact of mathematics anxiety and attitude towards mathematics on mathematics achievement among boys and girls across different grade levels has been an issue of great concern for different investigators. This part of the study, thus, reviews the contentions of various studies in the area. To this effect, the following themes have been dealt with: attitude towards mathematics, sex & mathematics achievement, test Anxiety, mathematics anxiety, mathematics anxiety & sex difference, mathematics anxiety & mathematics achievement.

2.1. Attitude towards Mathematics, Sex and Mathematics Achievement

2.1.1 Attitude towards Mathematics

Attitude is a central part of human identity. Everyday people love, hate, like, dislike, favour, oppose, agree, disagree, argue, persuade etc. All these are evaluative responses to an object. Hence attitudes can be defined as a summary evaluation of an object of thought (Bohner & Wänke ,2002; as cited in Mohammed & Waheed ,2011).They are inclinations and predispositions that guide an individual's behavior (Rubinstein ,1986; as cited in Mohammed & Waheed ,2011) and persuade to an action that can be evaluated as either positive or negative (Fishbein & Ajzen,1975; as cited in Mohammed & Waheed ,2011). Attitudes develop and change with time Rubinstein (1986). According to multi component model of Attitude (Eagly & Chaiken ,1993; as cited in Mohammed & Waheed ,2011) attitudes are influenced by three components. They are cognitive (beliefs, thoughts, attributes), affective (feelings, emotions) and behavioral information (past events, experiences) (Maio, & Haddock, 2010; as cited in Mohammed & Waheed, 2011). When reviewing literature on student's attitude towards mathematics, it reveals that several factors play a vital role in influencing student's attitude. These factors can be categorized

into three distinctive groups. Firstly, factors associated with the students themselves. Some of these factors include student's mathematical achievement score (Köğce et al.,2009; as cited in Mohammed & Waheed ,2011) anxiety towards mathematics, student's self efficacy and self concept, extrinsic motivation (Tahar et al., 2010;as cited in Mohammed & Waheed ,2011) and experiences at high school (Klein,2004; Bobis & Cusworth, 1994; as cited in Mohammed & Waheed ,2011).

Secondly, the factors those are associated with the school, teacher and teaching. Some of these factors that influence attitudes are teaching materials used by teacher, teachers' classroom management, teachers' content knowledge and personality, teaching topics with real life enriched examples, other student's opinions about mathematics courses (Yilmaz, Altun & Olkun,2010; as cited in Mohammed & Waheed ,2011), teaching methods, reinforcement (Papanastasiou ,2000; as cited in Mohammed & Waheed ,2011), receiving private tuition (Köğce et al.,2009; as cited in Mohammed & Waheed,2011) teachers' beliefs towards mathematics (Cater & Norwood ,1997; as cited in Mohammed & Waheed ,2011) and teachers' attitude toward mathematics(Ford ,1994; & Karp ,1991; as cited in Mohammed & Waheed ,2011).

Thirdly, factors from the home environment and society also affect students' attitude towards mathematics. Factors such as educational background of parents, occupation of parents and parental expectations (Köğce et al., 2009; Tobias, 1993; as cited in Mohammed & Waheed, 2011) play a crucial role in influencing students' attitude towards mathematics. Due to these several factors students have different attitude towards mathematics. More often, the public image of mathematics is labeling it as a difficult, cold, abstract, theoretical and ultra rational subject (Ernest, 2004; as cited in Mohammed & Waheed, 2011). However, some studies show that students have a relatively positive attitude towards mathematics (Tezer & Karasel, 2010; Yilmaz

et al., 2010; Fan, Quek, Yan, Mei, Lionel & Yee, 2005; as cited in Mohammed & Waheed ,2011). Sometimes, Mathematics is also considered as very important and largely masculine subject (Ernest, 2004; as cited in Mohammed & Waheed, 2011).Several studies gives evidence that compared to boys, girls lack confidence in doing mathematical sums and viewed mathematics as a male domain (Meelissen & Luyten, 2008; Odell & Schumacher,1998; Hyde, Fennema, Ryan, Frost, & Hopp, 1990; as cited in Mohammed & Waheed ,2011).

2.1.2 Attitude towards Mathematics and Mathematics Achievement

There are many studies that suggest there is no significant difference between attitude towards mathematics among male and female students (Mohd et al., 2011; Köğce et al., 2009; Nicolaidou & Philippou, 2003; as cited in Mohammed & Waheed, 2011). And there are some other studies which suggest that the attitude of the participants of their study towards mathematics was more positive in the third year than the first year (Grootenber & Lowrie ,2002 ;as cited in Mohammed & Waheed ,2011) and there is a difference between attitude in the grades 6, 7 and 8 (Köğce et al., 2009; as cited in Mohammed & Waheed ,2011).Hence it can be said that students' attitude towards mathematics are very subjective and varies among the students. Several studies had been conducted to find out the relationship between attitude towards mathematics and academic achievement of the students. Most of these studies showed that there is a positive correlation between student's attitude towards mathematics and academic achievement of students (Mohd et al., 2011; Bramlett & Herron 2009; Papanastasiou, 2000; Ma & Kishor, 1997; as cited in Mohammed & Waheed, 2011) and also achievement in problem solving. The studies has also shown that students attitude towards problem solving in terms of patience, confidence and willingness has a positive relation with students' mathematics achievement(Mohd et al., 2011; as cited in Mohammed & Waheed ,2011).

2.1.3 Sex Difference in Mathematics Achievement

One of the most common explanations for sex disparities in mathematics achievement has focused on attitude that students have towards mathematics. Several studies have reported that there are sex differences in attitude towards mathematics with girls showing more negative attitudes than boys. In general, most of the studies reported that, compared with boys, girls lacked confidence, had debilitating causal attribution patterns, perceived mathematics as a male domain, and were anxious about mathematics (Vermeer *et al.*,2000; as cited in Mubeen et al.,2013).The causes of the gender difference were found to be multifaceted. Students' attitude towards mathematics tended to be more positive in classroom where students perceived greater leadership and helping/friendly behaviors in their teachers, and more negative in their classrooms where students perceived their teachers as admonishing and enforcing strict behaviors (Fisher and Rickards , 1998; as cited in Mubeen et al.,2013).Other researchers have compared the effect of separate (single-sex) and co- educational classrooms upon students' attitude (Norton & Rennie,1998; as cited in Mubeen et al.,2013).

Studies that compared gender differences in mathematics' self confidence have mostly reported that girls had lower self-confidence in mathematics than boys (Case et al., 1997; Norton and Rennie, 1998; as cited in Mubeen et al., 2013). In some cases, boys were more confident than girls even when their mathematics achievement was similar to that of girls (Casey et al., 1997; as cited in Mubeen et al., 2013). Further studies shown that the gender differences in self confidence were more marked for application problems than computation problems, with girls showing significantly lower confidence for application problem (Vermeer et al. ,2000; as cited in Mubeen et al.,2013).

Despite such consistent findings of girls' low confidence in mathematics, studies of

classroom environment have shown that the girls' confidence in mathematics improved greatly in classes which actively involved girls in the learning of mathematics (Boaler, 2000; as cited in Mubeen et al., 2013).

In another study girls would enjoy math, increase their time on math asks, and have positive emotional reactions to math if math were taught in a cooperative setting (Bono, 1991; as cited in Mubeen et al., 2013). The study explored the impact of cooperative learning on sixth grade girls. The results showed that girls had more positive attitudes towards math when it was taught in cooperative settings.

As far as differences in attitude development are concerned, girls' positive attitudes towards mathematics decline as they grow older. Initially girls have more positive attitudes towards mathematics than boys, but as they continue in school, girls' attitudes become more negative. In order to improve girls' performance in math, teachers need to facilitate positive attitude in girls towards math (Swetman, 1995; as cited in Mubeen et al., 2013).

In a comprehensive cross- sectional study (Norman, 1977; as cited in Yoseph ,1997) the investigator administered an attitude scale to 1974 randomly selected students of grades 2, 6, 7, 8, 9, 10 and college. The investigator's main objectives were to assess the developmental course of gender differences in attitudes towards mathematics and to pinpoint precisely the point of origin of significant differences employing unweighted means of analysis of variance. He found significant gender differences in favor of boys from grade 9 on .Males have better attitudes towards mathematics from grade 6 on as compared with girls, though the differences were not significant. Furthermore, the researcher reported that favorable attitudes showed consistent decline among both sexes from grades 2 to college levels.

Regarding Ethiopian context, in a study that involved 847 students in grades 8 to 11 in Northern Shoa region Seleshi (1995) found no gender differences in attitude towards mathematics among eighth grades. Nonetheless he found significant gender differences in favor of boys at subsequent grade levels (9, 10 and 11).

One of the major reasons for sex differences in mathematics achievement and attitudes seems to be the stereotyped belief that mathematics is a male domain. Many researchers e.g. (Fennema 1974; Fennema and Sherman 1976; Kaplan 1986; Stipek and Gralinski 1991; Tocci and Englehard, 1991; as cited in Yoseph ,1997) have indicated that historically mathematics has been a masculine discipline. Besides, some investigators (Fennema & Sherman, 1977, 1978; as cited in Yoseph, 1997) have consistently found using a subscale for this variable that boy more than girl rated mathematics as a male domain (in grades 6 to 12). Supporting Fennema and Sherman's finding a recent study (Tocci & Engelhard,1991; as cited in Yoseph,1997) revealed gender differences in attitudes toward mathematics among 13- year old students in the US and Thailand particularly on the mathematics as a male domain scale. There is further evidence to suggest that the stereotyped belief was significantly related to both females achievement and course taking (Fennema & Sherman ,1978; as cited in Yoseph,1997) that is the less the girls stereotyped the higher their score and the more their course taking. It may also be noted that stereotyped mathematics as a male domain has some apparent influences on the altitudes of significant other people (e.g. teachers and peers) toward one as a learner of mathematics.

In line with teachers' role,(Aiken ,1970; as cited in Yoseph ,1997) has offered research evidence that teacher attitudes toward mathematics and effectiveness in teaching mathematics are important determinants of student attitude and performance in the subject. In spite of this evidence, it has been suggested that teachers treat boys and girls differently in mathematics

classes and this differential treatment reinforces the sex typing of mathematics as a male domain (Fennema, 1980; Fox 1981; Fennema and Leder ,1990; as cited in Yoseph ,1997). Besides, along with teachers, one possible social determiner of attitude toward mathematics is the attitudes of one's peers (Aiken, 1970; as cited in Yoseph, 1997).

2.2 Test Anxiety

Some comprehensive reviews of the literature on test anxiety show that, test anxiety is a multi-dimensional phenomenon that involves worry, emotionality, and behavioral reply to being preoccupied by the possible negative outcome of academic scores(Chapell, Blanding, Silverstein, Takahashi, Newman, Gubi, & McCann, 2005; Mulkey & O' Neil, 1999; as cited in Barrows et al.,2013) . Students' level of test anxiety can cause a variety of negative outcomes, mainly low academic scores. But, overall self-efficacy may moderate this effect.

Test anxiety negatively affects students; more so if the anxiety is dealt with in an unhealthy manner and extends over a long period of time. Approximately 10 million primary and secondary students' test anxiety causes decreased test performance (Hill & Wig field, 1984; as cited in Barrows et al., 2013).

Test anxiety is detrimental to overall academic success. Test anxiety negatively impacts memory and the ability to retrieve information from memory storage, and thus makes it difficult to retrieve information when needed on exam to correctly answer questions (Pintrich & De Groot's, 1990; as cited in Barrows et al., 2013).

Similarly, more recent studies show the same outcome. In the first study,(Lang & Lang ,2010; as cited in Barrows et al., 2013) studied 219 secondary and vocational school students (122 female, 97 male) and 232 students (132 female, 100 male) secondary students in a second study. Students in the first study completed the Test Anxiety Inventory and in the second study,

the students completed a test performance measure. Both groups showed a decrease in test performance, regardless of measure, with increased worry about the test. In short, the students' level of test anxiety can cause the students' academic performance and test anxiety prevent students' ability to focus on academics which negatively influences grades.

2.3. Mathematics Anxiety

2.3.1 Historical Background of Mathematics Anxiety

Interest in math anxiety started with the observations of the math teachers in the early 1950's. Math anxiety as a new term to describe student's attitudinal difficulties with math. It defines as the presence of syndrome of emotional reactions to arithmetic and mathematics (Dreger & Aiken, 1957; as cited in Mahmood & Khatoon, 2011).

Mathematics anxiety refers to the negative reaction that many people experience when placed in situations that require mathematical problem solving (Richardson & Suinn, 1972; as cited in Maloney et al., 2013). This reaction can range from seemingly minor frustration to overwhelming emotional and physiological disruption (Ashcraft & Moore, 2009; as cited in Maloney et al., 2013).In fact, it has been argued that mathematics anxiety can be considered a genuine phobia given that it is a state anxiety reaction, shows elevated physiological arousal, and is a stimulus-learned fear (Faust, 1992; as cited in Maloney et al., 2013). Strong negative reactions to mathematics have long caught the attention of educators. For example, in an anecdotal report, (Gough, 1954; as cited in Maloney et al., 2013) a school teacher, noted that many of her students, predominantly the females, were exhibiting emotional difficulties with mathematics and were failing to learn the material. While this was one of the first mentions of what is now known as mathematics anxiety in an education or psychology journal, it was not until years later that (Richardson & Suinn ,1972; as cited in Maloney et al., 2013) created the

Mathematics Anxiety Rating Scale (MARS) which served as a catalyst for further investigation of math anxiety, spurring a plethora of research into the topic.

In addition to this, using self-report scales such as the MARS, researchers have been able to grasp a firm understanding of the construct of mathematics anxiety and its consequences. Indeed, much of the early work on this topic is eloquently summarized in (Hembree's, 1990; as cited in Maloney et al., 2013) meta-analysis. Highlights from Hembree include the findings that people high in mathematics anxiety (as measured by the MARS) hold several negative attitudes about mathematics; they believe that mathematics is not useful, they are unmotivated to engage in mathematics, and they tend to avoid elective mathematics courses and mathematics intensive careers (i.e., science, technology, engineering, and mathematics: STEM). Not only do people high in mathematics anxiety dislike and avoid mathematics, they also perform poorly in their mathematics courses and on standardized tests, which can greatly limit a person's options for universities and career paths. Interestingly, research indicates that once students have developed mathematics anxiety, their levels of anxiety tend to remain relatively constant (at least throughout middle and high school).

While much research has focused on developing reliable tools to assess mathematics anxiety, there is considerably less work on its causes. However, studies assessing the impact of various teaching styles on student anxiety may provide insight into the development of mathematics anxiety. For example,(Turner et al., 2002; as cited in Maloney et al., 2013) examined factors that led children to avoid mathematics and concluded that one cause of avoidance was having a teacher who conveyed a high demand for correctness in mathematics but provided little cognitive or motivational support during lessons. Further research by (Beilock et al., 2010; as cited in Maloney et al., 2013) suggests that highly mathematics-

anxious teachers affect their student's endorsement of negative stereotypes about mathematics. They assessed mathematics anxiety in a sample of American teachers (all female) of first- and second- grade (7- 9 year old) students, as well as the mathematics achievement and gender stereotype endorsement of the students in these teachers' classrooms. There was no relation between a teacher's mathematics anxiety and her student's mathematics achievement at the beginning of the school year. However, by the end of the year, the more mathematics-anxious a teacher was, the lower her student's mathematics achievement and the higher the likelihood that her students would endorse the stereotype that ''boys are good at mathematics, and girls are good at reading''. Interestingly, this pattern was limited to female students, suggesting that seeing female teachers anxious about mathematics provided information to same-gendered students about their own ability in mathematics.

2.3.2 Features of Mathematics Anxiety

Mathematics anxiety may be socially transmitted (Maloney et al., 2010, 2011, 2012; as cited in Maloney et al., 2013) have argued that some people may, in fact, be cognitively predisposed to develop mathematics anxiety. Maloney and colleagues argue that students who present with deficits in the basic building blocks of mathematics are likely to struggle with mathematics and consequently develop a great deal of anxiety when engaging in mathematics tasks. This theory is based on evidence that high mathematics-anxious adults perform more poorly than their low mathematics- anxious peers on tests of basic numerical and mathematical abilities. For example, when presented with a display of squares, ranging in number from 1- 9, and asked to enumerate the set (i.e., how many squares are there?), high and low mathematics-anxious adults perform equally well when a small number of squares is presented (1- 4). However, as the number of squares increases from 5 - 9, the high mathematics- anxious

students become increasingly slower and less accurate than their low anxious peers (Maloney et al., 2010; as cited in Maloney et al., 2013) . Maloney and colleagues also demonstrated that when adult students were shown a number ranging from 1- 4 or 6- 9 and were asked to simply indicate whether that number was lower or higher than 5, the high mathematics-anxious students took longer to do so than the students low in mathematics anxiety . It is against this background that Maloney and colleagues argue that mathematics anxiety is associated with and possibly driven by a low-level deficit in numerical processing.

The above findings may appear to suggest that mathematics anxiety is simply a proxy for poor mathematics achievement, and while this may have some validity, it is certainly not the entire story. Indeed, high mathematics-anxious students tend to perform poorly on tests of mathematics ability, but interventions that are designed to reduce anxiety (and provide no additional mathematics training, e.g., cognitive behavioral therapy) have been shown to yield significant increases in mathematics test scores for highly mathematics-anxious individuals (Hembree ,1990; as cited in Maloney et al., 2013) .Thus, for highly anxious students, their scores on mathematics tests are not simply a representation of their mathematics knowledge, but rather their scores are likely depressed as a result of their anxiety.

Mathematics anxiety is clearly an impediment to mathematics achievement (e.g., Ashcraft & Ridley, 2005; Maloney et al., 2010; as cited in Maloney et al., 2013). That said, not all people with high mathematics anxiety perform poorly in mathematics. (Lyons & Beilock ,2011; as cited in Maloney et al., 2013) used functional magnetic resonance imaging (fMRI) to investigate whether neural differences exist between the high mathematics-anxious students who perform poorly in mathematics and those who, despite their anxiety, perform well in mathematics.

On average, high mathematics-anxious individuals performed worse than their non-mathematics-anxious peers on the mathematics questions (Lyons & Beilock's, 2011; as cited in Maloney et al., 2013). In contrast, both groups performed the same on the word problems. This distinction is important in that it demonstrates that the poor performance associated with mathematics anxiety is specific to mathematics and mathematics-related tasks. In other words, high mathematics-anxious students are not simply underachieving across the board.

Crucially, in the (Lyons & Beilock, 2011; as cited in Maloney et al., 2013) study, before each set of problems, individuals saw a cue (a colored box) which indicated whether the next set of trials was going to be a mathematics set or a word set. The beauty of this paradigm is that it allowed the researchers to separate the neural activity associated with the anticipation of doing mathematics from the neural activity of actually doing the mathematics. They found that, when faced with the prospect of an upcoming mathematics problem, some highly mathematics-anxious individuals showed more activation of a front parietal network known to be involved in the control of negative emotions than others. In fact, the activation of this region predicted success among the highly mathematics-anxious individuals. The more the highly mathematics-anxious individuals activated this front parietal network before they even engaged in the mathematics, the better they performed on the mathematics task. To explain their finding, Lyons and Beilock suggested that the successful high mathematics-anxious participants may be engaging in some degree of reappraisal (or reframing the situation) before they begin the mathematics task, and that this reappraisal helps them control their anxiety and ultimately perform up to their potential on the mathematics test.

2.3.3 Effects of Mathematics Anxiety

The negative effects of math anxiety on students' achievement in mathematics have

interested researchers for several years. They discussed how certain features of math, such as its precision, logic, and emphasis on problem solving, make it particularly anxiety provoking for some individuals. Studies have documented the negative effects of math anxiety on math performance and achievement (Richardson & Suinn, 1972; Suinn, Edie, Nicoletti, & Spinelli, 1972; as cited in Wigfield &Meece, 1988). Several researchers also have proposed that math anxiety contributes to observed sex differences in mathematics achievement and course enrollment patterns e.g.(Fennema ,1977; Fox ,1977; Tobias & Weissbrod ,1980; as cited in Wigfield &Meece,1988).

Various questions concerning math anxiety have received scant research attention. First, the dimensionality of math anxiety has not been explored fully. In the test anxiety area (Liebert & Morris, 1967; as cited in Wigfield & Meece, 1988) distinguished two components of test anxiety, worry and emotionality. Worry is the cognitive component of anxiety, consisting of self-deprecatory thoughts about one's performance. Emotionality is the affective component of anxiety, including feelings of nervousness, tension, and unpleasant physiological reactions to testing situations. Morris and Liebert showed that these two components of anxiety are empirically distinct, though they are correlated, and that worry relates more strongly than emotionality to poor test performance (see Morris, Davis, & Hutchings, 1981, for a review of the work on worry and emotionality). Anxiety theorists (e.g. Sarason, 1986; Wine, 1971, 1980; as cited in Wigfield &Meece, 1988) believe that the worry or cognitive component of test anxiety interferes most with achievement performance.

2.3.4 Features of Mathematics Anxiety Scales

Most measures of math anxiety focus on affective reactions to math. For instance, 98 item Mathematics Anxiety Scale (MARS), the most frequently used measure of math anxiety, is designed to assess anxious reactions to using mathematics in ordinary life and academic situations

(Richardson & Suinn's, 1972; as cited in Wigfield & Meece, 1988). Researchers assessing the dimensionality of the MARS and its counterpart for use with adolescents, the MARS-A have obtained somewhat mixed results. In (Richardson &Woolfolk's ,1980; as cited in Wigfield &Meece,1988) factor analysis of the MARS, one major factor emerged. This factor may be characterized best as an emotionality factor, insofar as the MARS is primarily a measure of negative affective reactions to mathematics. By contrast, (Rounds & Hendel, 1980; as cited in Wigfield &Meece, 1988) found evidence for two factors in their analysis of responses to the MARS. They labeled one factor Math Test Anxiety and the other Numerical Anxiety, the latter referring to anxiety about math in everyday situations. Each factor contained about an equal number of items. Using the MARS-A, also found evidence for these two factors, though 89 of the 98 items loaded on the Numerical Anxiety factor and only 9 on the Test Anxiety factor. However, these two factors distinguish between negative affective reactions in no evaluative versus testing situations, not between affective and cognitive aspects of math anxiety (Suinn & Edwards, 1982; as cited in Wigfield &Meece, 1988).

Second, questions concerning the distinctiveness of math anxiety as a psychological construct have been raised. Using their math attitudes scales, found that math anxiety and math ability concepts were highly correlated *(r* = -.89) in a sample of high school students. More work is needed to see whether these constructs can be distinguished more clearly (Fennema & Sherman ,1976; as cited in Wigfield &Meece, 1988).

Third, most studies of math anxiety have been conducted with high school and college-age students, and thus little is known about its prevalence in younger populations. The few studies of math anxiety in younger students show that math anxiety scores, like test anxiety scores, increase across age (Brush, 1980; Meece, 1981; as cited in Wigfield &Meece, 1988).

We also know little about whether there are sex differences in math anxiety among younger

students, though it appears that during the elementary and junior high school years, boys express slightly more positive affect about math than do girls (Aiken, 1976; as cited in Wigfield &Meece, 1988). During the high school and college years, female students report more anxiety about math than do male students. However, grade-level differences in math anxiety were stronger and more prevalent than gender differences (Betz, 1978; Brush, 1980; Meece, 1981; as cited in Wigfield &Meece, 1988).

2.3.5 Content of Mathematics Anxiety

When one thinks about mathematics anxiety, two things may come to his or her mind: one is 'anxiety as progressive thinking' and the other is 'anxiety as regressive thinking'. To me all anxieties are not worthless things. Anxieties can be both good and worthless. If it promotes progressive thinking (like when one is puzzling in a mathematics problem for a few days and he or she is trying to solve it in a variety of ways without losing the passion), then certainly it is a good thing. Anxiety is mostly taken as regressive thinking in which a person having anxiety tries to go away or get rid of mathematical problem simply by avoiding it and taking it negatively (Belbase,2013).

Mathematics anxiety is an anxious state in response to mathematics-related situations that are perceived as threatening to self-esteem. A model of mathematics anxiety reaction consisting of environmental antecedents (e.g., negative mathematics experiences, lack of parental encouragement), dispositional antecedents (e.g., negative attitudes, lack of confidence), and situational antecedents (e.g., classroom factors, instructional format) are seen to interact to produce an anxious reaction with its physiological manifestations (e.g., perspiring, increased heartbeat, and restlessness) proposed by (Cemen,1987; as cited in Belbase,2013). Many researchers (e.g., Ma & Kishor, 1997; Richardson & Suinn, 1972; Tobias

& Weissbrod, 1980) as cited in (Belbase, 2013) reported the consequences of being anxious toward mathematics, including the inability to do mathematics, the deterioration in mathematics achievement, the escaping of mathematics courses, the limitation of students in selecting college mathematics majors and related future careers, and the extremely deleterious feelings of guilt and humiliation. Some researchers claimed that mathematics anxiety is usually associated with mathematics achievement individually. A student's level of mathematics anxiety can significantly predict his or her mathematics performance (Fennema & Sherman, 1977; Wigfield & Meece ,1988; as cited in Belbase,2013) probably both in negative and positive ways .

Miller and Bichsel (2004; as cited in Belbase,2013) claimed that math anxiety appears to primarily impact one's visual working memory that contradicts previous research findings that mathematical anxiety is primarily processed in verbal working memory and supporting the hypothesis that math anxiety does not function similarly to other types of anxiety. They identified two general types of anxiety: trait and state. They clarified that individuals experiencing trait anxiety have a characteristic tendency to feel anxious across all types of situations. In contrast, individuals possessing state anxiety tend to experience it only in specific personally stressful or fearful situations. Trait anxiety is more related to a wide range of situations to which one feels a kind of threat, unsecured, and challenge all the time. In mathematics, students under this anxiety have a fear of mathematics class, homework, exam and any situation when comes to mathematics. According to (Spielberger et al., 1970; as cited in Belbase, 2013) state anxiety reflects a temporary emotional state characterized by personal, deliberately perceived feelings of mental tension and uneasiness with a greater sensitiveness in the nervous system. Several past studies demonstrated that both state and trait anxiety affect task performance in mathematics (e.g., MacLeod & Donnellan, 1993; Miller & Bichsel, 2004;

as cited in Belbase, 2013) .Concluding the findings from these researches, Miller and Bichsel stated that individuals with high trait anxiety show poorer performance on various tasks than low trait anxiety individuals. This difference tends to be exacerbated in a high state anxiety condition. With reference to research on the impact of sex on math anxiety, (Hembree, 1990; as cited in Belbase, 2013) found math anxiety being more predictive of math performance in males than in females. However, further study is necessary to re-confirm this claim.

2.4 Mathematics Anxiety and Sex Difference

Mathematics anxiety is one of the most important problems of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations (Richardson & Suinn, 1972; as cited in Pourmoslemi et al., 2013). However, (Byrd, 1982; as cited in Pourmoslemi et al., 2013) accepted this kind of definition as deficient both from conceptualization of mathematics and also from conceptualization of anxiety perspectives. Thus, it should be regarded from a larger perspective as a complex construct consisting of "affective, behavioral and cognitive responses to a perceived threat to self- esteem which occurs as a response to situations involving mathematics"(Atkinson ,1988; as cited in pourmoslemi et al,2013).Generally, high level of anxiety is more closely associated with lower performance among low ability students (Sena et al., 2007;as cited in pourmoslemi et al,2013).

Several studies have been conducted to investigate the level of mathematics anxiety among male and female students. Some researchers have argued that females have higher mathematics anxiety than males (Salwani & Salleh, 2001; Woodard, 2004; Yukselahin, 2008; Karimi & Venkatesan, 2009; Khatoon & Mahmood, 2010; as cited in Zakaria et al., 2012).In addition, female students are often labeled as shy and this characteristic can harm their ability to

learn. Male students were found to be more active in a wider range of social activities than female students. The study on secondary school students in Turkey reported that the stereotypical view of this issue has a powerful impact. Female students believed boys were blessed with the advantage of mastering mathematics, while the boys felt they were better able to perform in mathematics when compared with their female counterparts. Such beliefs negatively affect the ability of female students and their initial assumptions about mathematics achievement can have a long-term impact on their math achievement. However, other studies do not support this theory. Based on several studies, some researchers have argued that there is no significant difference in mathematics anxiety between males and females (Marsh & Tapia,2002; Elenchothy,2007; Mohamed & Tarmizi , 2010; Khatoon & Mahmood, 2010; Yukselahin ,2008; as cited in Zakaria et al.,2012).

The studies concerning the relationship between gender and mathematics anxiety show different results. Some studies report that women have higher mathematics anxiety than men (Anglin, Pirson, & Langer, 2008; Hall, Davis, Bolen, & Chia, 1999; Meelissen & Luyten ,2008; Penner & Paret ,2008; Baloglu & Koçak2006; as cited in pourmoslemi et al.,2013) . As (Aiken ,1970; as cited in pourmoslemi et al.,2013) pointed out, ‘’no one would deny that sex can be an important moderator variable in the prediction of achievement from measures of attitude and anxiety’’. Specifically, he stated that ‘’measures of attitude and anxiety may be better predictors of the achievement of females than that of males’’. Similarly,(Eccles & Jacobs,1986; as cited in pourmoslemi et al.,2013) asserted that sex differences in mathematics anxiety are directly attributable to sex differences in mathematics achievement. However, some studies indicated that the achievement disparity in mathematics is “small and declining” with competence beliefs as a stronger driver of performance outcomes (Frenzel, Pekrun, & Goetz, 2007; as cited in

pourmoslemi et al., 2013). Ma's (1999; as cited in pourmoslemi et al., 2013) meta-analysis concluded that sex differences are not statistically significant in mathematics anxiety.

2.5 Mathematics Anxiety and Mathematics Achievement

According to (Sherman & Wither, 2003;as cited in Zakaria et al.,2012) a five-year study conducted on students from the age of 6 to the age of 10 revealed that the level of mathematics anxiety in students is strongly related to student achievement. This is supported by studies by (Elenchothy ,2007; as cited in Zakaria et al.,2012) which showed an inverse relationship between mathematics anxiety and student achievement. His findings were based on the results of Lower Secondary Assessments for students in the district of Klang, Malaysia. This inverse relationship means that students with high mathematics anxiety will realize low achievement in mathematics. The results conform to the findings of(Khatoon & Mahmood ,2010; Yukselahin ,2008; and Satake & Amato, 1995; as cited in Zakaria et al.,2012) . Students will often feel worried, tired and afraid or feel that mathematics is not important and will generally refuse to learn mathematics, even though it is the primary gateway to engineering, science and technology. According to Arem (2009; as cited in Zakaria et al., 2012), students with high mathematics anxiety levels engage in negative thinking about their self-ability. These students will exhibit less confidence in working with numbers and mathematical concepts through a problem-solving process. Zakaria (1997; as cited in Zakaria et al., 2012) also explained that students with high performance levels in mathematics have a positive attitude toward mathematics. This is in line with several researchers who reported that teachers' interest and self-confidence play an important role in student success. A student who has a deep interest can be encouraged to work and train without being asked by the teacher. Interest and confidence in this

aspect are very important in learning to reduce anxiety in mathematics and eventually being able to obtain good results on examinations.

Researchers have made efforts to examine individual differences in the relationship between mathematics anxiety and mathematics achievement. The relationship between Mathematics anxiety and mathematics achievement was studied by Ma & Jiangming Xub (2004; as cited in pourmoslemi et al., 2013) .In addition this Tocci & Engelhard (1991; as cited in pourmoslemi et al., 2013) found that students with a higher level of mathematics anxiety perform at a lower level of mathematics achievement. Similarly, Hembree's (1990; as cited in pourmoslemi et al., 2013) meta-analysis reported an average correlation of -.34 between mathematics anxiety and mathematics achievement. In a more recent meta-analytic review on the relationship between mathematics anxiety and mathematics achievement, Ma (1999; as cited in pourmoslemi et al.,2013) found that the common population correlation for this relationship is -.27. This magnitude was associated with a prediction that ''measures (or treatments) that resulted in the movement of a typical student in the group of high mathematics anxiety in the group of low mathematics anxiety would be associated with improvement of the typical student's level of mathematics achievement from the 50th to the 71st percentile''. Also a negative correlation between mathematics anxiety and mathematics achievement was reported by (Ashcraft, 2002; Ashcraft & Kirk, 2001; Bandalos, Yates, & Thorndike- Christ, 1995; Cates & Rhymer ,2003; Miller & Bichsel ,2004; as cited in pourmoslemi et al., 2013).

A review of current research suggests that low achievers in mathematics frequently accompany the incidence of mathematics anxiety. Ma (1999; as cited in Zakaria & Mohd Nordia, 2008) found that the relationship between mathematics anxiety and mathematics achievement is significant. It was also found that once math anxiety takes shape, its relationship with math

achievement is consistent across grade levels. Satake and Amato (1995; and Hardfield et al., 1992; as cited in Zakaria & Mohd Nordia, 2008) also reported similar findings. A high level of anxiety is associated with a lower level of achievement. Other than achievement, students having little or no math anxiety scored significantly higher in motivation than students with some or high math anxiety, and students with some math anxiety scored significantly higher than students with high math anxiety (Quilter & Harper, 1988; Tapia, 2004; as cited in Zakaria & Mohd Nordia, 2008). Bretscher et al. (1989; as cited in Zakaria & Mohd Nordia, 2008) found that students who were involved in learning because wanted to be, scored significantly higher than their counterparts. They further contended that effectance motivation was a predictor of mathematics achievement. This influence is understandable since students with high motivation usually enjoy doing mathematics, stick at problems unit they are solved and become absorbed in their mathematical problem solving activities.

Levine (1995; as cited in Zakaria & Mohd Nordia, 2008) described math anxiety as involving feelings of anxiety and tension that interfere with doing mathematical operations. Math anxiety existed around a set of circumstances in which students suffered from fears that were based upon years of painful experiences with mathematics (Miller & Mitchell, 1994; as cited in Zakaria & Mohd Nordia, 2008).

Norwood (1994; as cited in Zakaria & Mohd Nordia, 2008) emphasized that math anxiety did not appear to have single cause, but was, in fact, the result of many different factors such as truancy, poor self image, poor coping skills, teacher attitude and emphasis on learning math through drill without understanding. However, Greenwood (1984; as cited in Zakaria & Mohd Nordia, 2008) further stated that the principal cause of mathematics anxiety has been in teaching methodologies. He said math classes did not encouraged reasoning and understanding. The

problems with math anxiety would not go away until teachers applied the problem solving process to the teaching of arithmetic and mathematics. Butterworth (1999; & Stuart, 2000; as cited in Zakaria & Mohd Nordia, 2008) believes that a lack of understanding is the cause of anxiety and avoidance and that understanding based learning is more effective than drill and practice. A lack of confidence when working in mathematical situations is the cause of math anxiety. Highly math anxious individuals will be less fluent in computation, less knowledgeable about mathematics, and less likely to have discovered special strategies and relationships within the mathematics domain Ashcraft Faust (1994; as cited in Zakaria & Mohd Nordia, 2008). In order to reduce mathematics anxiety and increase achievement, Miller & Mitchell (1994; as cited in Zakaria & Mohd Nordia, 2008) suggested that teacher should create a positive learning environment, free from tension and possible causes of embarrassment or humiliation.

CHAPTER THREE

METHOD AND DESIGN OF THE STUDY

As described in the introduction part of the study the primary objective of the study is to figure out the nature of the relationship between mathematics anxiety and attitudes towards mathematics and mathematics achievement scores in reference to grade ten students with this general objective therefore, this research has been conducted in Kolfe Keranio sub city of two government and four private schools of grade ten students. The design of the study includes the following points.

3.1 Subjects

A pilot study was conducted in order to test and make improvement on the instruments .To do a pilot study, 60 tenth grade students from the two school type were randomly selected from one Government and one Private secondary school in kolfe keranio sub city from which 30 students were selected from each school types. The subjects were 30 (male= 15 and female=15) from government school, 30 (male=15 and female=15) form private school.

A multistage random sampling technique was used to select the subjects. In the first stage among the 10 sub-cities of Addis Ababa, kolfe keranio sub city was randomly selected. Participants selected for this study were tenth grade secondary school students who were at the last stage of general secondary education. The population for this study comprises the entire tenth grade students of six secondary schools. The researcher has selected only grade 10 students because they are the last stage of secondary education and are in position to decide their future

career .Study was conducted in both government and private secondary schools. In the second stage to obtain the sample schools, the names of 8 government and 18 private secondary schools were put an alphabetic list and were assigned consecutive numbers for each school and for each school type. By the use of a random number table, two government and four private schools were randomly selected. In the two government secondary schools, there were 13 classes with a total of 701 tenth grade students. There were7 classes of tenth grade students in the four private secondary schools with a total of 300 students. In the third stage subjects were also selected in the same way from the two school types, 169 from private and 248 from government schools based on the (Research Advisors, 2006). The main study was carried out on 417 subjects. But 41 subjects from private schools and 69 subjects from government schools were not included because they failed to give complete information and absenteeism. Hence; the main study is comprised of 307 subjects. There were 69 females and 59 males participants from private schools, and 87 females and 92 males participants from government schools were selected on the basis of the proportions of males and females in each school type and each section.

3.2 Instruments

3.2.1 Mathematics Attitude Scale

A Likert type five point scale was used to examine attitudes of student toward mathematics. The scale comprised of 22 items (or statements). Students responded to the items of the scale by choosing one of the five alternatives presented on a five point Likert scale set as “Strongly Agree”, “Agree”, “undecided”, “Disagree” and “Strongly Disagree”

Equal number of positively and negatively stated items included in the scale. The odd numbered items are positive attitude items and the even numbered items are negative attitude

items. Eleven items in the Mathematics Attitude Scale which reflected positive attitudes towards mathematics were coded as Strongly Agree=5, Agree=4, undecided=3, Disagree=2, strongly Disagree=1. The remaining eleven items which reflected negative attitudes towards mathematics were reverse coded as Strongly Agree=1, Agree=2, undecided=3, Disagree=4, Strongly Disagree=5. Scores obtained from twenty two items were added to get a total score from the attitude scale. The maximum total score for attitude scale was 110, and the minimum total score for the attitude scale was 22. A score which was above the average (66) was interpreted as a positive attitude. A score which was below the average was interpreted as a negative attitude.

The main criterion for selection was that the items should be easy to understand. The statements or items were translated from English into Amharic in order to make them comprehensible to all students. 44 items was administered to the pilot sample, the internal consistency reliability of attitude scale (using Cronbach alpha) were found to be, r =.85.But the researcher selected only 22 items which have greater than 0.3 corrected item total correlation for main study(see appendix A). The main study reliability for attitude scale were r=.72.

The scale was adopted from Yoseph (1997) and Seleshi (1995).

3.2.2 Mathematics Anxiety Scale

The second instrument was Mathematics Anxiety Scale which included fourteen items. The odd numbered items are worded positively and the even numbered items are worded negatively .Seven items were worded negatively in the Mathematics Anxiety Scale were coded as Strongly Agree=5, Agree=4, undecided=3, Disagree=2, Strongly Disagree=1.The remaining seven items were worded positively in the mathematics anxiety scale were coded as Strongly Agree=1, Agree=2, undecided=3, Disagree=4, Strongly Disagree=5.The math anxiety score is calculated by adding the individual scores of all the items together, where possible range can be between

14-70 with 42 mean, the higher the score more anxiety of the students towards math.5-point Likert type instrument that assess positive and negative dimensions of math anxiety. This tool produced two factors, the first representing concerns about doing well in math and second representing strong negative effective reactions to math. 30 items was administered to the pilot sample, the internal consistency reliability of mathematics anxiety scale (using Cronbach alpha) were found to be, r =.80 But the researcher selected only 14 items which have greater than 0.3 corrected item total correlation for main study(see Appendix B).But the main study reliability for anxiety scale were r=.74.

The scale was adopted from Mahmood & Khatoon (2011) and Wigfield & Meece (1988).

3.2.3 Mathematics Achievement Scores

The participants' first semester final mathematics exam scores were obtained from the schools administrators record offices. The exam scores were assigned out of 100. It was assumed that the evaluation of the final exam results was based on the same criteria in both government and private secondary schools.

3.3 Data Collection Procedure

In the pilot study, the two instruments (attitude scale and mathematics anxiety scale) were administered in one session. The session was conducted in students' break and lunch time. On the basis of the pilot information, the instruments were improved.

In the main study the two instruments, the attitude and anxiety scales were administered consecutively. Both sessions were conducted depending on the free time of the students which were supported by the school administrative body, teachers and also supervised by the researcher himself.

3.4 Method of Data Analysis

Quantitative research methods have been used in this study. Primarily, correlational and comparative research methods have been implemented. The study concentrated on collecting and analyzing data to find answers to the research questions specified above. Independent samples t-tests to search for significant differences between government and private school of grade ten students in their attitude, anxiety, and mathematics scores were performed. And the independent samples t-tests also used to examine differences in attitude, anxiety, and mathematics scores between the two gender groups in government and private schools. To see if there were significant correlations among study variables the researcher used person product moment correlations.

A multiple regression analysis for two ordered sets of predictors was conducted to predict the mathematical achievement from attitudes and anxiety of students controlling for the effects of sex and the types of schools on attitude and anxiety of students. The first set of predictors included sex and the types of schools, and the second set included anxiety and attitudes towards mathematics. Statistical analyses have been computed by statistical package for social science (SPSS) version 20. Finally, all differences were tested for statistical significant at the 0.05 level.

CHAPTER FOUR

RESULTS OF THE STUDY

The data were analyzed in accordance with the research questions by using descriptive statistics, independent sample t-test, person product moment correlation and multiple regression analysis methods. The results of the study are presented in the following order.

4.1 Types of schools differences among the variables

Means, standard deviations and t-value for types of schools (private and government) on attitude towards mathematics, mathematics anxiety and mathematics achievement are given in Table 1 below.

Table 1: Means, SD and t-values for PS and GS students on ATM, MA and MAC

Variable	School type	N	Mean	SD	t	P
ATM	Private	128	75.30	16.855	2.741	.007*
	Government	179	70.51	12.655		
MA	Private	128	37.00	11.985	-2.089	.038**
	Government	179	39.75	10.904		
MAC	Private	128	64.47	17.549	4.101	.000*
	Government	179	56.96	13.013		

**P <.05 (2-tailed) *P <.01 (2-tailed)

Independent samples t-tests to search for significant differences between private and government schools students in their attitude, anxiety, and mathematics scores were performed

and the results were recorded in Table 1. It was assumed that the samples had a normal distribution since the sample size was large enough.

Independent sample t- test results suggested that there exist significant differences have been specified in the attitude scores, anxiety scores and mathematics scores of students from private and government schools, t(305)=2.714,p=.007; t(305)= -2.089 ,p=.038 and t(305) =4.101,p=.000,respectively.Thus,it is concluded that the private school students have better attitude towards mathematics (Mean=75.30,SD=16.855) than government school students(Mean=70.51,SD=12.655).In addition to this, students from private schools have lower anxiety level(Mean=37.00,SD=11.985) than government school students (Mean=39.75,SD=10.904).And also, students from private schools have higher mathematical achievement (Mean=64.47,SD=17.549) than government school students (Mean=56.96,SD=13.013).The implies that there was a statistically significant difference between private and government school students with those variables (attitude, anxiety and achievement in mathematics).

4.2 Sex Differences in the two types of schools

Means, standard deviations and t-values for males and females on attitude towards mathematics, mathematics anxiety and mathematics achievement for both types of schools are given in Table 2.

Table 2: Means, SD and t-values for males and females Students on ATM, MA and MAC for both types of schools

Variable	Sex	N	Mean	SD	t	p
ATM	Male	151	72.61	14.874	.122	.903
	Female	156	72.40	14.615		
MA	Male	151	39.07	11.769	.699	.485
	Female	156	38.15	11.110		
MAC	Male	151	59.30	16.009	-.875	.382
	Female	156	60.85	14.990		

When students from the two schools (private and government) were combined no significant differences were specified in attitude towards mathematics, mathematics anxiety and mathematic achievement t (305) =.122, p=.903; t (305) =.699, p=.485 and t (305) = -.875, p=.382, respectively as you can seen from Table 2.

In general, male students had no more positive attitude (Mean=72.61, SD=14.615) than female (Mean=72.40, SD=14.615). Again male students had similar anxiety level (Mean=39.07, SD=11.769) with female students (Mean=38.15, SD=11.110).In addition to this, male students mathematical achievement scores (Mean=59.30, SD=16.009) had no significant differences with female students (Mean=60.85, SD=14.990) from both schools. To conclude, there is no significant sex difference between male and female students for both types of school with those variables (attitude, anxiety and achievement in mathematics).

4.3 Sex Differences in private schools

Means, standard deviations and t-values for males and females on attitude towards mathematics, mathematics anxiety and mathematics achievement in private schools are given in Table 3.

Table 3*: *Means, SD and t-values for males and females in PS students on ATM, MA and MAC

Variable	Sex	N	Mean	SD	t	p
ATM	Male	59	74.39	17.093	-.561	.575
	Female	69	76.07	16.734		
MA	Male	59	38.80	12.412	1.577	.117
	Female	69	35.46	11.474		
MAC	Male	59	63.10	17.363	-.814	.417
	Female	69	65.64	17.748		

When students from private schools were taken no significant differences were specified in attitude towards mathematics, mathematics anxiety and mathematic achievement t(126)= -.561,p=.575 ;t(126)=1.577,p=.117 and t(126)= -.814,p=.417 respectively as you observe Table 3. Besides this, male students had on more better attitude (Mean=74.39, SD=17.093) than female (Mean=76.07, SD=16.734).Again, male students had similar anxiety level (Mean=38.80, SD=12.412) with female students (Mean=35.46, SD=11474).In addition to this, male students mathematical achievement scores (Mean=63.10, SD=17.363) had no significant differences with female students (Mean=65.64, SD=17.748) from private schools. In short, there is no significant sex difference between male and female students in private school among the study variables (attitude, anxiety and achievement in mathematics).

4.4 Sex Differences in government schools

Means, standard deviations and t-values for males and females on attitude towards mathematics, mathematics anxiety and mathematics achievement in government schools are given in Table 4.

Table 4: **Means*, SD and t-values for males and females in GS students on ATM, MA and MAC***

Variable	Sex	N	Mean	SD	t	P
ATM	Male	92	71.47	13.232	1.043	.298
	Female	87	69.49	12.008		
MA	Male	92	39.24	11.403	-.642	.522
	Female	87	40.29	10.389		
MAC	Male	92	56.87	14.662	-.097	.923
	Female	87	57.06	11.090		

When students from government schools were taken no significant differences were specified in attitude towards mathematics, mathematics anxiety and mathematics achievement t (177)= 1.043,p=.298; t (177) = -.642, p=.522 and t (177) = -.097, p=.923 respectively as you observe in Table 4.

In general, male students had no more better attitude (Mean=71.47, SD=13.232) than female (Mean=69.49, SD=12.008).Again, male students had similar anxiety level (Mean=39.24, SD=11.403) with female students (Mean=40.29, SD=10.389).In addition to this, male students mathematical achievement scores (Mean=56.87, SD=14.662) had no significant differences with female students (Mean=57.06, SD=11.090) from government schools. To conclude, there is no

significant sex difference between male and female students from government schools among attitude, anxiety and achievement in mathematics.

4.5 Correlation Analysis of the Variables

Person product moment correlations among study variables were computed as you can see in Table 5 below.

Table 5: Inter-correlations among the study variables

Variables	1	2	3	4	5
Sex(1)	1.00				
School type(2)	-.052	1.00			
ATM(3)	-.007	-.161**	1.00		
MA(4)	-.040	-.119*	-.635**	1.00	
MAC(5)	.050	-.239**	.636**	-.547**	1.00

******correlation is significant at the .01 level (2-tailed)

*****correlation is significant at the .05 level (2-tailed)

Table 5 describe the inter correlation between the variables treated under the study. As shown, there were inter- correlation between the independent and the dependent variable. Attitude towards math has shown better statistically significant relation with math achievement (r=.636). It indicates that the students attitude towards math increases, their math achievement increases. But attitude towards math has negative relation with math anxiety (r =-.635).This indicates that as the students attitude towards math increase, their level of math anxiety decrease and vise verse. In addition to this math achievement also has negative relation with math anxiety (r =-.547).This also indicate that the students their level of math anxiety increase, their math achievement also decrease and vise verse. Similarly, there were negative relation between

attitude towards math and school type (r =-.239). But, math anxiety was negatively and significantly related with school type (r =-.119). However, the relation of sex with others study variables was failed to reach the significant level.

4.6 Effects of Independent Variables on Mathematics Achievement

The contribution of the independent variables to the prediction of mathematics achievement score can be seen in table 6 below.

Table 6: The results of the regression analysis on MAC

Sources of Variations	df	SS	MS	F	R^2	Adj R^2
Regression	**4**	**33670.763**	**8417.691**	**63.894***	**. 458**	**. 451**
Residuals	**302**	**39786.683**	**131.744**			
Total	**306**	**73457.446**				

*p<.01

As revealed in Table 6, the predictor variables of sex, types of school ,anxiety and attitude all together contributed for the variation of students' mathematics scores by 45.8%.It implies that 45.8% proportion of mathematics achievement variance accounted for by the independent variables. The remaining proportion could not be known in this study. The adjusted R-squared which represents the unbiased estimate of R-squared was .451.It indicated that there were overall relationships between the predictors and the outcome variables. This proportion of variance was statistically significant ($F_{(4,302)}$=63.894, p<.01).

Table 7: Result of regression analysis on MAC in general

Variable	Regre.Coef. (b)	Std.E	Beta Coef. (B)	T	P	VIF
Sex(x_1)	1.140	1.314	0.037	.867	.386	1.006
School Type (x_2)	- 4.226	1.348	- .135	- 3.135	.002*	1.030
Attitude towards Math(x_3)	. 490	.058	. 465	8.440	.000*	1.695
Math Anxiety(x_4)	-.319	. 074	- .235	- 4.285	.000*	1.676

Constant =41.846 *P<.05

As can be seen in Table 7, in the summary of multiple regression analysis we can observe statistically significant relation between the predictor and the outcome variables. For instance, t-test showed in the multiple regression analysis as there was statistically significant relation between school type and mathematics achievement scores ($t(306) = -3.135$,$p<.005$); attitude towards math and mathematics achievement scores ($t(306) = 8.440$,$p<.05$) and math anxiety and mathematics achievement scores ($t(306)=-4.285$,$p<.05$) .On the other hand ,there was no statistically significant relation between sex and mathematics achievement scores. In general, attitude towards mathematics had highly dominant and very much influential for the variation of students' mathematics achievement among other variables.

The relative contributions of each independent variable can be shown as follows.

$R^2=ß_1r_{y1}+ß_2r_{y2}+ß_3r_{y3}+ß_4r_{y4}$

=.037x.050+ (-.135)(-.239)+.465x.636+(-.235)(-.547)

=.00185+.032265+.29574+.128545

=.4584

Sex(x_1) = .00185x100=.185% ATM(x_3) = .29574x100 =29.57%

School type(x_2) =.032265x100=3.22% MA(x_4) = .128545x100 =12.85%

Regarding the multicollinearity problem, it can be observed from table 7 that VIF values for all independent variables are less than 2.5.Hence, multicollinearity was not considered as a problem for performed regression analysis.

Table 8: Result of regression analysis on MAC as sex and school type the first set of predictors

Sources of Variation	**df**	**SS**	**MS**	**F**	**R^2**
Regression	2	4310.497	2155.248	9.457*	.059
Residual	304	69146.949	227.457		
Total	306	73457.446			

*P<.01

As shown in Table 8,sex and school type as the first set of predictors, accounted for a significant amount of mathematical achievement variability, R^2=.059, $F_{(2,304)}$ =9.475, P=.000<.01.

Table 9: Result of regression analysis on MAC as ATM and MA the second set of predictors

Sources of Variations	**df**	**SS**	**MS**	**F**	**R^2**
Regression	2	3223.252	16117.626	118.862*	.439
Residual	304	41222.195	135.599		
Total	306	73457.446			

*P<.01

Table 9 provides the results of the regression analysis as attitude and anxiety , the second set of predictors accounted for a significant proportion of mathematical achievement variance after controlling for gender and school type ,R^2 change=.439,$F_{(2,304)}$=118.862,P=.000<.01. These results suggest that attitude and anxiety are strong predictors of mathematics achievement over and above gender and school type.

CHAPTER FIVE

DISCUSSION

The main concern of this study was to investigate the relationship of sex, school type (government and private), student attitude towards mathematics, mathematics anxiety with mathematics achievement. Secondly, it was design to see the impact of the independent variables upon the students' mathematics achievement scores.

5.1 School type Differences among variables

In this section an attempt was made to answer the specific research questions whether private and government schools students differ significantly on mathematics achievement, attitude and anxiety scores. Independent sample t- test results provide that there exist significant differences in the attitude scores, anxiety scores and mathematics achievement scores of students from private and government schools, t(305)=2.714,p=.007; t(305)= -2.089 ,p=.038 and t(305) =4.101,p=.000,respectively.Thus, it is concluded that the private schools students have better attitude towards mathematics than government schools students. In addition to this, students from private schools have lower anxiety scores than government school students'. And also; students from private schools have higher mathematical achievement than government school students. This implies that there was a statistically significant difference between private and government schools students with those variables (attitude, anxiety and achievement in mathematics).In general private schools students have better results and performance than government schools students in all of the study variables attitude, mathematics achievement and anxiety. The possible reasons for these significant differences can be school qualities which includes teacher qualities, suitability of class room and availability instructional materials, better

characteristics of students, character of the teachers, teaching conditions, facilities (building, texts and materials), motivation of teachers, teachers behavior in classroom, efficient use of instructional time, organization of the school (i.e. the management capability),parental expectations and school parent relationship. In private schools, teachers' or parents' expectations might be higher than the expectations in government schools. Therefore, students are forced to study more. Additionally, private lessons are more frequent in private schools so that students get extra help with their mathematics lessons. According to the researcher real observation and experience the above mentioned points better applied in private schools than government schools. This idea supported by, for example, (Yilmaz, Altun & Olkun,2010; as cited in Mohammed & Waheed ,2011) found that factors that influence attitudes are teaching materials used by teacher, teachers' classroom management, teachers' content knowledge and personality, teaching topics with real life enriched examples, other student's opinions about mathematics lesson.

Similarly, study findings of (Köğce et al., 2009; Tobias ,1993; as cited in Mohammed & Waheed ,2011) showed that educational background of parents, occupation of parents and parental expectations play a crucial role in influencing students' attitude towards mathematics.

On the other hand, students in government schools have high anxiety level than private schools due to varies reasons like negative classroom experiences, poor mathematics performance ,negative teacher behaviors and performance, highly mathematics-anxious teachers, environmental pressure, and parental factors. The studies, done in the area that increases anxiety level also showed similar results. For example,(Turner et al., 2002; as cited in Maloney et al., 2013) examined factors that led children to avoid mathematics and concluded that one cause of avoidance was having a teacher who conveyed a high demand for correctness

in mathematics but provided little cognitive or motivational support during lessons. Similarly, (Beilock et al., 2010; as cited in Maloney et al., 2013) said that it is likely that such characteristics in teachers (i.e., a high demand for correctness with little cognitive or emotional support, a high degree of mathematics anxiety themselves) are risk factors for the development of mathematics anxiety in their students. In addition to this (Beilock et al., 2010; as cited in Maloney et al., 2013) suggests that highly mathematics-anxious teachers affect their student's endorsement of negative stereotypes about mathematics.

Researchers have also observed that student's mathematics anxiety and mathematics achievement were highly correlated. For example, using their math attitudes scales, found that math anxiety and math ability concepts were highly correlated (r = -.89) in a sample of high school students. More work is needed to see whether these constructs can be distinguished more clearly (Fennema & Sherman, 1976; as cited in Wigfield &Meece, 1988).

Different studies also have shown that there was the negative relationship of math anxiety on math achievement. This idea supported by (Richardson & Suinn, 1972; Suinn, Edie, Nicoletti, & Spinelli, 1972; as cited in Wigfield &Meece, 1988). They discussed how certain features of math, such as its precision, logic, and emphasis on problem solving, make it particularly anxiety provoking for some individuals. Studies have documented the negative effects of math anxiety on math performance and achievement.

5.2 Sex Difference among Variables

In this section the researcher was made an attempt to answer the specific research question of whether male or female students differ significantly on math achievement, attitude towards math and math anxiety. To analyze the result the independent sample t-test was used.

5.2.1 Sex Difference in private schools

Although the score of attitude towards mathematics for sample female students is higher than male students, the results of the t-test revealed that the variable attitude towards mathematics was not a statistically significant difference between male and female students. This indicates there is no significant difference in the level of their attitude towards mathematics between males and females in private school.

The t-test of the students' attitude towards mathematics based on their gender difference was not significant for attitude ($t_{(126)} = -.561$, $p>.05$).The t-test for attitude towards mathematics was also failed to reach significant differences between the groups.

In line with the present finding, (Mohd et al., 2011; Köğce et al., 2009; Nicolaidou & Philippou, 2003; as cited in Mohammed & Waheed, 2011) that suggest there is no significant difference between attitude towards mathematics among male and female students. And there are some other studies which suggest that the attitude of the participants of their study towards mathematics was more positive in the third year than the first year (Grootenber & Lowrie ,2002; as cited in Mohammed & Waheed ,2011) and there is a difference between attitude in the grades 6, 7 and 8 (Köğce et al., 2009; as cited in Mohammed & Waheed ,2011).Hence it can be said that students' attitude towards mathematics are very subjective and varies among the students.

Studies in Ethiopia Seleshi(1995) revealed that attitude difference have been observed with gender differences among eighth grades. Nonetheless he found significant gender differences in favor of boys at subsequent grade levels (9, 10 and 11).

There was no statistically significant difference between males and females students on mathematics anxiety. When the mean differences of males and females were tested, no significant differences between males and females ($t_{(126)} =1.577$, $p>.05$) for mathematics

anxiety. But the score of mathematics anxiety for sample female students is lower than male students.

The result of the present study is supported by other research works. Based on several studies, some researchers have argued that there is no significant difference in mathematics anxiety between males and females (Marsh and Tapia, 2002; Elenchothy, 2007; Mohamed and Tarmizi, 2010; as cited in Zakaria et al., 2012).

In the contrary to the above descriptions and the present finding, there are research works which show significant difference between males and females with mathematics anxiety. For examples, the studies concerning the relationship between gender and mathematics anxiety show different results (Anglin, Pirson, & Langer ,2008; Hall, Davis, Bolen, & Chia ,1999; Meelissen & Luyten ,2008; Penner & Paret ,2008; as cited in Pourmoslemi et al.,2013). Some studies report that women have higher mathematics anxiety than men Baloglu & Koçak(2006; as cited in Pourmoslemi et al.,2013).

Tests of mean differences in students' mathematics achievement on students' sex differences was insignificant in private schools. The findings indicate that there was no significant sex difference on mathematics achievement ($t_{(126)} = -.814$, $p>.05$), even though female students have better mathematics achievement than male students. The results of many studies are opposed this finding. For example, Studies that compared gender differences in mathematics' self confidence have mostly reported that girls had lower self-confidence in mathematics than boys (Casey et al., 1997; Norton and Rennie ,1998; as cited in Mubeen et al., 2013). In some cases, boys were more confident than girls even when their mathematics achievement was similar to that of girls (Casey et al., 1997; as cited in Mubeen et al., 2013).

5.2.2 Sex Differences in government schools

Even though the score of attitude towards mathematics for sample male students is higher than female students, the results of the t-test revealed that the variable attitude towards mathematics was not a statistically significant difference between male and female students. This indicates there is no significant difference in the level of their attitude towards mathematics between males and females in government school.

The t-test of the students' attitude towards mathematics based on their sex difference was not significant for attitude ($t_{(177)} = 1.043$, $p>.05$).The t-test for attitude towards mathematics was also failed to reach significant differences between the groups in government schools.

In contrast to the findings of the study, (Vermeer *et al.*, 2000; as cited in Mubeen et al., 2013) reported that there are sex differences in attitude towards mathematics with girls showing more negative attitudes than boys. In addition to this, in a comprehensive cross- sectional study (Norman, 1977; as cited in Yoseph, 1997) found significant sex differences in favor of boys from grade 9 on .Males have better attitudes towards mathematics from grade 6 on as compared with girls, though the differences were not significant. Furthermore, the researcher reported that favorable attitudes showed consistent decline among both sexes from grades 2 to college levels.

There was no statistically significant difference between males and females students on mathematics anxiety. When the mean differences of males and females were tested, on significant differences between males and females ($t_{(177)} = -.642$, $p>.05$) for mathematics anxiety. But the score of mathematics anxiety for sample female students is higher than male students. In line with the present finding, Ma's (1999; as cited in pourmoslemi et al., 2013) meta-analysis concluded that sex differences are not statistically significant in mathematics anxiety.

In addition to this, tests of mean differences in students' mathematics achievement on

students' sex difference was insignificant in government schools, even though female students have better mathematics achievement than male students. The findings indicate that there was no significant sex difference on mathematics achievement ($t_{(177)} = -.097$, $p>.05$). The result of some studies support this finding, for example, (Frenzel, Pekrun, & Goetz, 2007; as cited in pourmoslemi et al., 2013) indicated that the achievement disparity in mathematics is "small and declining" with competence beliefs as a stronger driver of performance outcomes.

In general, studies showed that there is a positive relation between attitude and achievement but a negative relation between anxiety and achievement. This idea is supported by different studies. For example, (Mohd et al., 2011; Bramlett & Herron ,2009; Papanastasiou, 2000; Ma & Kishor, 1997; as cited in Mohammed & Waheed,2011) showed that there is a positive correlation between student's attitude towards mathematics and academic achievement of students and also achievement in problem solving. The studies has also shown that students attitude towards problem solving in terms of patience, confidence and willingness has a positive relation with students' mathematics achievement (Mohd et al., 2011; as cited in Mohammed & Waheed ,2011). However, (Tocci & Engelhard, 1991; as cited in pourmoslemi et al., 2013) found that students with a higher level of mathematics anxiety perform at a lower level of mathematics achievement. Similarly, meta-analysis reported an average correlation of -.34 between mathematics anxiety and mathematics achievement (Hembree's, 1990; as cited in pourmoslemi et al., 2013)

5.2.3 Sex Difference in both types of schools

When we combined the two school types (private and government) no significant sex differences were specified in attitude towards mathematics, mathematics anxiety and mathematic achievement $t (305) =.122$, $p=.903$; $t (305) =.699$, $p=.485$ and $t (305) = -.875$, $p=.382$,

respectively.

The possible reasons for such insignificant differences between male and female students' of attitude towards mathematics, mathematics anxiety and mathematics achievement may be, positive attitude towards mathematics and less math anxiety level of males and females students. In addition to this, insignificant difference raised may be due to both sexes attends classes and do homework regularly, parents play an important role in shaping their children's attitudes and anxiety, student-centered teaching methods creates better opportunities for both sexes, schools becoming more conscious of gender bias and stereotype practices, parents give equal educational chance & support and also government polices and strategies that give more attention specially for females students.

5.3 Effects of Independent Variables on Mathematics Achievement

According to the results of the multiple regression analysis in the study, the proportion of mathematics achievement accounted for by the independent variables varies from variable to variable.

The present study tested the predictive of sex and school type on mathematics achievement of grade 10 students. It was an initial effort to test the independent variables sex and school type effect on mathematics subject performance in grade 10 students. The variables sex and school type as the first set of predictors, accounted for 5.9% of the variance in mathematical achievement $F_{(2,304)} = 9.475$, $P = .000 < .01$.

Similarly, the result of multiple regression analysis of mathematics achievement accounted for by the independent variables attitude towards mathematics and math anxiety as the second set of predictors taken together was 43.9% of the total variance of the students' mathematics performance $F_{(2,304)} = 118.862$, $P = .000 < .01$.From this finding, attitude towards mathematics and

math anxiety are strong predictor of mathematics achievement greater than sex and school type.

The result of many studies (Mohd et al., 2011; Bramlett & Herron, 2009; Papanastasiou, 2000; Ma & Kishor, 1997; as cited in Mohammed & Waheed, 2011) confirmed that there is a positive correlation between student's attitude towards mathematics and academic achievement of students. And a review of current research suggests that low achievers in mathematics frequently accompany the incidence of mathematics anxiety. Ma (1999; as cited in Zakaria &Mohd Nordia, 2008) found that the relationship between mathematics anxiety and mathematics achievement is significant.

The predictor variables of sex, types of school ,anxiety and attitude all together contributed for the variation of students' mathematics scores by 45.8%.It implies that 45.8% proportion of mathematics achievement variance accounted for by the independent variables. The multiple regression results indicated that sex, school type, attitude toward mathematics and math anxiety accounted for about half of the variance in mathematics in mathematics achievement. Yet, the other half of the variability in mathematics achievement is accounted for by other independent variables. In order to figure out these variables, further research should be conducted.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary

The purpose of this study was to examine the relationships and influences of sex, school types, mathematics anxiety, attitudes towards mathematics on students' mathematics achievement particularly in secondary schools grade 10 students. Therefore, at the very beginning the study was designed to answer the following basic questions.

1. How do the students' attitudes towards mathematics, their levels of mathematics anxiety, and their mathematical achievements differ with respect to

a. types of schools (government and private) ?

b .sex of students from both types of schools?

c sex of students from government schools?

d. sex of students from private schools?

2. How well the attitudes towards mathematics and mathematics anxiety of students do relates mathematics achievement controlling for sex and school types?

The main study is comprised of 307 grade 10 secondary school students. There were 69 females and 59 males participants selected from 4 private schools; and 87 females and 92 males participants selected from 2 government schools. A multistage random sampling technique was used to select the students from all sample schools.

The instruments used in the study were mathematics attitude scale adopted by (Seleshi, 1995) and (Yoseph, 1997) and prepared to measure student attitudes towards mathematics. In addition

to this, mathematics anxiety scale developed by (Mahmood & Khatoon, 2011) was used to measure student's mathematics anxiety. Moreover, students' mathematics achievement scores were collected from school record office of the sample schools. Initially, the instruments were administered on a pilot sample n=60.Then, the instrument were improved and identified the reliability.

The data were analyzed by using simple correlation, independent sample t-test and multiple regressions.

The independent sample t-test employed to show there was significant mean difference between private and government schools students in attitude towards mathematics, mathematics anxiety and mathematics achievement. Similarly, the t-test showed insignificant sex difference between male and female students in both types of school (private and government) with those variables attitude towards mathematics, mathematics anxiety and mathematics achievement. Again, the independent sample t-test showed no significant sex difference between male and female students with attitude towards mathematics, mathematics anxiety and achievement of mathematics in private and in government schools separately.

Person Product Moment correlation was used to examine inter-correlations between sex, school type, attitude towards mathematics, mathematics anxiety and mathematics achievement. These relations implied that those independent variables had significant correlation with other and dependent variables as well.

To determine the overall relationship of independent variables and mathematics achievement multiple regressions was used. The results of multiple regression analysis indicated when mathematics achievement was regressed on all the independent variable (sex, school type, attitude towards mathematics and mathematics anxiety), the multiple coefficient of determination

was 45.8%.The results suggest that the independent variables, when combined together, have a significant relationship with mathematics achievement of the students.

6.2. Conclusions

From the above findings and discussions the following conclusions may be drawn:

- There were statistically significant mean difference between private and government schools students in attitude towards mathematics, mathematics anxiety and mathematics achievement. Private schools students are better than government schools students in all those independent variables (attitude, anxiety and achievement).
- There was no significant sex difference between male and female students when students in both types of schools private and government combined together.
- There was no significant sex difference between male and female in private schools students.
- There was no significant sex difference between male and female in government schools students.
- Sex, school type, attitude towards mathematics and mathematics anxiety jointly explained students' mathematics achievement.
- Mathematics achievement was highly correlated with students' attitude towards mathematics and mathematics anxiety.
- Students' attitude towards mathematics and mathematics anxiety are strong predictors of mathematics achievement.

6.3. Recommendations

Based on the findings of this study and conclusions, the following recommendations are forwarded.

- In order to decrease the students' negative attitudes towards mathematics and mathematics

anxiety, students, parents, teachers, school administrators and education planners work together cooperatively.

- To build positive attitudes and lower the level of anxiety in mathematics, students concentrate on understanding the concepts rather than memorizing them, attend classes and does homework regularly, pay extra attention to the problem solving strategies.

To decrease school gap between private and government:

- School administrators adjust classes to reasonable sizes and organized the physical structure of the classrooms to make it possible for implementing student-centered methods.
- School administrators report the needs of their schools, regularly to the Ministry of Education and based on these reports, the Ministry supply the demands.
- Teachers, parents and the community should make discussion about their educational weakness to solve their problems
- Government schools learn best practices from private schools especially in the use of instructional time, proper utilization of teaching materials and aids, text books, technological tools etc.

To decrease sex gap between males and females in mathematics lesson constantly throughout the country:

- Parents play an important role in shaping their children's attitudes and anxiety.
- Parents start to help their children to gain basic mathematical skills from the early years of childhood by using math games, numerical activities and engaging their children in daily mathematical situations
- Parents do not make their children believe that mathematics is a difficult subject and force them to study mathematics against their will.

- Teachers always concentrate on the comprehension of the main concepts, use of mathematical terminology correctly, communicating mathematically, developing problem solving skills, transferring mathematical knowledge to real life situations.
- Teachers create student-centered teaching methods such as group work, mathematics projects and group discussion.

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APPENDIX A

1. Attitude towards mathematics Scale Final reliability analysis scale

Item total statistics

	Scale Mean If item Deleted	Scale variance if item Deleted	Corrected Item total Correlation	Alpha if item Deleted
item3	132.0000	477.724	.356	.849
item4	132.2333	472.875	.419	.848
item6	132.3667	461.551	.622	.843
item10	131.8333	468.282	.626	.844
item12	131.9667	453.826	.768	.840
item14	132.1333	457.292	.593	.843
item16	132.3333	460.506	.632	.843
item17	132.2000	458.993	.696	.842
item18	132.1000	459.472	.623	.843
item21	132.5333	450.947	.681	.840
item22	132.1333	454.533	.625	.842
item24	132.3333	460.506	.632	.843
item25	132.2000	458.993	.696	.842
item26	132.1000	459.472	.623	.843
item29	132.5333	450.947	.681	.840
item30	132.1333	454.533	.625	.842
item33	132.0000	477.724	.356	.849
item34	132.2333	472.875	.419	.848
item36	132.3667	461.551	.622	.843
item40	131.8333	468.282	.626	.844
item42	131.9667	453.826	.768	.840
item43	132.1000	459.472	.623	.843

Reliability Coefficients

Number of cases=44 **Number of items=22** **Alpha=.853**

APPENDIX B

2. Mathematics Anxiety Sub-Scale reliability analysis scale

Item-Total Statistics

	Scale Mean If item Deleted	Scale Variance if item Deleted	Corrected Item total Correlation	Alpha if item Deleted
item3	87.8000	222.510	.407	.787
item4	88.0333	222.999	.376	.788
item6	88.1667	214.902	.589	.778
item10	87.6333	220.930	.548	.782
item12	87.7667	210.392	.717	.772
item14	87.9333	211.030	.583	.777
item16	88.1333	213.154	.627	.776
item17	88.0000	210.276	.743	.772
item18	87.9000	215.541	.540	.780
item21	88.3333	207.126	.663	.772
item22	87.9333	210.478	.586	.776
item24	88.1333	213.154	.627	.776
item25	88.0000	210.276	.743	.772
item28	87.8000	222.510	.407	.787

Reliability Coefficients

Number of cases =30 Number of items=14 Alpha=.797

Appendix C

Distribution of the Sample of students of private and government schools involved in the study by name of schools and gender

Types of schools	Name of the School	Number of Students		Total
		Male	Female	
Private	Bashewam preparatory school	17	18	35
	Asco progressive preparatory school	14	17	31
	Africa dreams preparatory school	14	17	31
	Family preparatory school	14	17	31
Government	Millennium Secondary and preparatory school	42	40	82
	Asco Secondary school	50	47	97
	Total	151	156	307

Appendix D

SCALE USED TO MEASURE ATTITUDE TOWARDS MATHEMATICS

ADDIS ABABA UNIVERSTY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF PSYCHOLOGY

Attitude scale to be rated by students

The purpose of this scale is to examine attitudes of students towards mathematics in grade 10.The success of the study highly depends on your honesty in rating the scale. Hence, you are kindly requested to rate the scale carefully and honestly.

Thank You in Advance

For your cooperation

Grade &section……. Roll No……..

Sex…… Name of the School……

Age……

Directions:

Each of the statements in this scale expresses a feeling or attitude towards mathematics .You are to indicate, on a five point scale, the extent of agreement between the attitudes expressed in each statement is: Strongly Disagree(SD), Disagree(D) ,Undecided(U), Agree(A),and Strongly Agree(SA). Mark (X) the point which best indicates how closely you agree or disagree with the attitude expressed in each statement as it concerns you.

No.	Mathematics Attitude Item	SD	D	U	A	SA
1	I would like to spend more time in school working on mathematics.					
2	I avoid mathematics because I am not very good with figures.					
3	I like mathematics because it is practical.					
4	I feel a sense of in security when attempting mathematics.					
5	Mathematics is fascinating and fun.					
6	I detest mathematics and avoid using it at all times.					
7	Mathematics is very interesting to me, and I enjoy arithmetic course.					
8	I do not get upset when trying to work mathematics problems.					
9	Sometimes I enjoy the challenge presented by a mathematics problem.					
10	I am not motivated to work very hard on mathematics problem.					
11	I like trying to solve new problems in mathematics.					
12	Mathematics is dull and boring.					
13	I feel at ease in mathematics, and I like it very much.					
14	Mathematics is not especially important in everyday life.					
15	I am happier in a mathematics class than in any other class.					
16	It makes me nervous to even think about having to do a mathematics problem.					
17	Mathematics is a course in the school that I have always enjoyed studying.					
18	I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do math.					
19	I have seldom liked studying mathematics.					
20	I am not willing to take more than the required amount of mathematics.					
21	Mathematics helps to develop the mind and teaches a person to think.					
22	Mathematics is not one of the most important subjects for people to study.					

Appendix E

SCALE USED TO MEASURE MATHEMATICS ANXIETY

ADDIS ABABA UNIVERSTY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF PSYCHOLOGY

Anxiety scale to be rated by students

The purpose of this scale is to examine mathematics anxiety of grade 10 students. The success of the study highly depends on your honesty in rating the scale. Hence, you are kindly requested to rate the scale carefully and honestly.

Thank You in Advance

For your cooperation

Grade &section……. Roll No……..

Sex…… Name of the School……

Age……

Directions:

Each of the statements in this scale expresses mathematics anxiety. You are to indicate, on a five point scale, the extent of agreement between the attitudes expressed in each statement is: Strongly Disagree(SD), Disagree(D) ,Undecided(U), Agree(A),and Strongly Agree(SA). Mark (X) the point which best indicates how closely you agree or disagree with the attitude expressed in each statement as it concerns you.

No.	Mathematics Anxiety Item	SD	D	U	A	SA
1	Math makes me feel comfortable and easy.					
2	Math is most dreaded subject for me.					
3	I find math interesting.					
4	I feel worried before entering the math class					
5	Math is one of my favorite subjects.					
6	I am always afraid of math exams.					
7	Solving math problems is always pleasant for me.					
8	I feel nervous when I am about to do math homework					
9	I feel happy and excited in a math class as compared to any other class.					
10	Math is a headache for me					
11	I would prefer math as one of my subjects in higher studies.					
12	I am afraid to ask questions in math class.					
13	Math doesn't scare me at all					
14	My mined goes when teacher asks math questions.					

Appendix F

Distribution of Attitude scores, Anxiety scores and Mathematics Achievement scores of sample students by school type

1. Private Schools

Attitude scores	Anxiety Scores	Mathematics Scores
85	20	86
93	25	46
72	38	46
65	29	46
96	15	53
65	28	63
81	32	64
82	30	54
85	18	81
90	21	86
96	22	84
64	61	45
97	20	94
110	16	97
72	38	61
88	24	45
105	43	90
51	56	46
53	46	53
65	48	58
62	46	42
80	29	53
57	50	49
104	51	91
46	49	46
54	53	51
69	39	50
87	19	95
57	52	52
92	29	39
74	43	58
49	51	60
65	33	62
70	35	51
65	23	63
59	50	59
44	56	51
62	38	42

50	**41**	**56**
57	**27**	**57**
55	**47**	**67**
48	**49**	**38**
57	**42**	**52**
72	**34**	**72**
75	**56**	**62**
66	**45**	**43**
66	**43**	**75**
83	**29**	**65**
69	**46**	**64**
72	**31**	**58**
44	**55**	**61**
88	**28**	**72**
71	**46**	**55**
88	**32**	**73**
81	**28**	**94**
58	**56**	**59**
78	**29**	**90**
61	**44**	**86**
80	**46**	**68**
81	**53**	**75**
107	**36**	**95**
67	**47**	**61**
89	**37**	**59**
106	**16**	**90**
61	**34**	**65**
105	**16**	**86**
79	**36**	**65**
83	**31**	**57**
76	**35**	**66**
105	**19**	**92**
73	**41**	**63**
68	**34**	**57**
50	**49**	**61**
100	**27**	**82**
75	**29**	**71**
102	**26**	**90**
108	**18**	**99**
53	**44**	**59**
72	**43**	**61**
74	**37**	**67**
102	**21**	**87**
75	**23**	**63**
108	**23**	**100**
104	**28**	**96**
67	**47**	**58**
67	**51**	**70**

82	**31**	**69**
52	**41**	**45**
71	**41**	**53**
68	**44**	**67**
69	**48**	**58**
50	**44**	**41**
48	**62**	**40**
93	**27**	**65**
62	**46**	**53**
105	**21**	**100**
98	**33**	**85**
83	**23**	**37**
67	**41**	**46**
96	**20**	**85**
62	**42**	**43**
82	**24**	**71**
67	**36**	**52**
68	**38**	**36**
58	**68**	**31**
71	**42**	**64**
66	**50**	**45**
80	**25**	**72**
73	**38**	**35**
105	**27**	**100**
79	**36**	**45**
66	**30**	**92**
62	**42**	**76**
82	**37**	**78**
81	**29**	**80**
67	**56**	**37**
89	**42**	**71**
90	**20**	**81**
67	**55**	**61**
91	**25**	**70**
74	**51**	**48**
85	**30**	**52**
50	**38**	**48**
72	**53**	**46**
65	**58**	**61**
70	**40**	**64**
81	**26**	**79**
104	**25**	**96**

2. Government Schools

Attitude scores	Anxiety Scores	Mathematics Scores
37	50	50
58	47	46
67	42	59
77	28	49
98	20	69
84	24	81
67	28	57
65	47	56
71	35	56
77	32	56
58	40	56
66	49	59
85	37	66
95	26	52
70	23	67
65	46	53
65	32	52
85	56	49
58	44	51
72	44	55
57	43	55
78	23	52
89	47	68
62	37	66
74	52	60
55	48	45
73	47	58
72	42	51
50	47	56
60	42	52
52	44	53
45	33	53
91	26	85
79	39	66
83	25	75
57	45	50
81	26	65
87	38	46
83	26	51
71	29	60
89	26	43
98	21	86

85	**48**	**81**
71	**29**	**62**
77	**28**	**60**
68	**41**	**69**
58	**46**	**49**
77	**20**	**62**
79	**24**	**57**
69	**40**	**57**
82	**26**	**76**
79	**29**	**55**
72	**44**	**47**
64	**47**	**52**
74	**31**	**62**
77	**47**	**74**
73	**29**	**60**
71	**34**	**50**
68	**48**	**51**
76	**42**	**49**
77	**35**	**50**
81	**30**	**85**
71	**38**	**59**
88	**23**	**52**
45	**43**	**44**
76	**47**	**43**
61	**38**	**73**
53	**68**	**19**
81	**30**	**79**
63	**42**	**55**
62	**42**	**57**
63	**43**	**51**
63	**39**	**50**
61	**49**	**55**
63	**32**	**42**
72	**40**	**55**
64	**40**	**51**
58	**44**	**56**
45	**42**	**41**
63	**31**	**72**
75	**32**	**43**
65	**33**	**53**
64	**37**	**72**
84	**40**	**66**
62	**43**	**48**
93	**58**	**47**
62	**30**	**47**
68	**49**	**50**

68	**42**	**36**
61	**52**	**78**
70	**57**	**40**
66	**44**	**56**
74	**52**	**58**
84	**26**	**55**
58	**48**	**43**
52	**42**	**39**
45	**68**	**18**
75	**49**	**60**
84	**15**	**82**
74	**56**	**55**
88	**23**	**80**
58	**50**	**42**
64	**56**	**39**
83	**39**	**62**
80	**44**	**59**
78	**37**	**65**
78	**34**	**58**
86	**53**	**48**
72	**40**	**67**
45	**42**	**39**
45	**61**	**42**
66	**60**	**48**
73	**34**	**50**
89	**42**	**53**
69	**45**	**62**
57	**55**	**52**
60	**39**	**45**
65	**41**	**61**
81	**39**	**52**
59	**56**	**43**
78	**39**	**52**
76	**40**	**62**
92	**23**	**87**
72	**50**	**57**
72	**43**	**70**
93	**19**	**62**
75	**29**	**65**
69	**55**	**43**
74	**39**	**50**
58	**56**	**42**
51	**48**	**51**
64	**45**	**48**
68	**46**	**47**
81	**39**	**66**

67	**42**	**36**
60	**55**	**47**
67	**61**	**53**
66	**46**	**35**
56	**44**	**58**
69	**29**	**53**
58	**54**	**56**
67	**44**	**67**
84	**33**	**81**
61	**42**	**60**
86	**16**	**83**
89	**61**	**39**
65	**45**	**56**
82	**42**	**56**
75	**36**	**52**
58	**50**	**37**
80	**34**	**47**
79	**25**	**61**
56	**47**	**46**
64	**38**	**60**
58	**41**	**68**
68	**38**	**47**
49	**65**	**46**
85	**20**	**74**
73	**34**	**61**
60	**59**	**65**
63	**48**	**47**
75	**30**	**52**
99	**22**	**96**
68	**29**	**51**
96	**21**	**65**
75	**22**	**56**
76	**31**	**58**
95	**22**	**93**
90	**35**	**83**
75	**37**	**67**
70	**40**	**52**
45	**49**	**43**
60	**40**	**66**
59	**42**	**68**
71	**44**	**71**
52	**49**	**50**
100	**25**	**95**
80	**39**	**79**
51	**50**	**48**

Declaration

This Thesis is my original work and has been presented for a degree in any other University and all sources of the material used for the Thesis has been acknowledged.

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