

**EFFECT OF MATHEMATICS ANXIETY ON GRADE 10 STUDENTS'
ACADEMIC ACHIEVEMENT: IN THE CASE OF AMEYA WOREDA
SECONDARY SCHOOLS, SOUTH WEST SHOA ZONE, OROMIA
REGIONAL STATE**

MSc THESIS

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MARCH 2019

HARAMAYA UNIVERSITY, HARAMAYA

**Effect of Mathematics Anxiety on Grade 10 Students' Academic
Achievement: In The Case of Ameya Woreda Secondary Schools, South
West Shoa Zone, Oromia Regional State**

**A Thesis Submitted to the Department of Mathematics, Postgraduate
Program Directorate**

HARAMYA UNIVERSITY

**In Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN MATHEMATICS (OPTIMIZATION)**

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March 2019

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DEDICATION

My Thesis is dedicated to my loving wife, son, three daughters, extended family, supportive friends and colleagues.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this Thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the Thesis has been given recognition through citation.

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ACKNOWLEDGEMENTS

I would like to express my deepest and heartfelt gratitude to my major advisor, Dr. Getinet Alemayehu for his insightful and constructive comments and unreserved guidance. His comments were valuable not only for this study but also in my future career as well.

I would also like to express my special appreciation to my co-advisor, Dr. Yilfashewa Seyoum for his guidance and professional expertise.

I am particularly grateful to my wife Aberash Takele, extended family and supportive friends and colleagues for their continuous encouragement and support in all my education life. They have been a constant source of energy to help me pursue my studies all the way through.

Finally, I am very much obliged to express my indebtedness to Haramaya University, Gindo preparatory and Secondary school principals, vice principals, mathematics teachers, Kota Secondary school vice principal and grade 10 mathematics teachers who took part in supporting me to collect data and questionnaire from the students by taking their time. Would also like to thank my friends, Solomon Fufa and Eshetu Degefa for their genuine assistance, moral support and encouragement during my graduate study with all their kindness and affection.

ACRONYMS AND ABBREVIATIONS

ATM:	Attitude Towards Mathematics
ATMT:	Attitude Towards Mathematics Teacher
FEL:	Father's Education Level
GSS:	Gindo Secondary School
KSS:	Kota Secondary School
MA:	Mathematics Anxiety
MACH:	Mathematics Achievement
MAQ:	Math Anxiety Questionnaire
MARS:	Mathematics Anxiety Rating Scale
MoE:	Ministry of Education
MEL:	Mother's Education Level
MOSS:	Motivation and Study Skill
SAT:	Standard Assessment Test
SES:	Socio-economic status
STEM:	Science, Technology, Engineering and Mathematics

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ABSTRACT

Mathematics Anxiety is a negative emotional reaction to mathematics that can be debilitating. It has been defined as “a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in ordinary life and academic situations.” The severity of Mathematics Anxiety can range from a feeling of mild tension all the way to experiencing a strong fear of mathematics. people with higher levels of mathematics anxiety tend to perform more poorly on assessments of mathematics skills whilst those with better performance in mathematics tend to report lower levels of mathematics anxiety The study was conducted to analyze the prevalence and level of mathematics anxiety and the association between mathematics anxiety and students achievement among grade 10 students in South West Shoa Zone of Ameya Woreda secondary schools. The study sample was 105 male and 87 female students which were selected from the population of 412 male and 340 female students using systematic sampling method from two secondary schools. The descriptive survey design was used and questionnaire was used in the collection of data. Statistical Package for Social Science (SPSS) version 20 was used to analyze data collected from the sample under study to perform variety of data analysis. The findings of the study led to the conclusions that level of mathematics anxiety of grade 10 students in both schools was high and there were moderate negative correlation ($r(192) = -.551, p < .001$) between mathematics anxiety and students achievement. The study found out that there was no significant mean difference between mathematics anxiety and mathematics achievement of male and female students. The study also found that mathematics anxiety and attitude towards mathematics were highly influential and strong predictors of mathematics achievement. Finally, the study recommended that to decrease the anxiety level of students and improve mathematics achievement teachers be aware of the effect of mathematics anxiety on students achievement and should provide the students with the information and skills necessary to manage and overcome their mathematics anxiety.

1. INTRODUCTION

The introduction part of the study includes background of the study, statement of the problem, research questions, objective of the study, scope of the study, significance of the study and definition of important terms.

1.1 Background of the Study

Worldwide, mathematics is one of the most important school subjects in the curriculum. Davies and Hersh, (2012) see mathematics as the important subject not only from point of view of getting academic qualification at school or college, but also is the subject that prepares the students for the future as well as irrespective of which work life they choose to be a part of. Mefor, (2014) summarized it all by saying that mathematics relates to everything in the universe from the smallest to the largest. Umameh, (2011) described that mathematics is the bedrock and an indispensable tool for scientific, technological and economic advancement of any nation. Umameh added that mathematics is intimately connected to daily life and every body's lifelong planning.

Similarly in Ethiopia, mathematics is one of the core or basic subject for all primary, secondary and preparatory school children. In addition to that mathematics is one of the compulsory subjects that must be passed a credit level by students before getting admission in to any institution or college. However, with all the importance attached to mathematics in Ethiopia's education system and its importance in daily life and economic advancement of any nation, mathematics anxiety is a problem for many people and mathematics is often viewed as difficult subject.

The main discomfort characteristics related to mathematics include dislike, worry, and fear with specific behavioral manifestation such as tension, frustration, distress, helpless, and mental disorganization (Ma and Xu, 2003). Mathematics Anxiety is a negative emotional reaction to mathematics that can be debilitating. It has been defined as "a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in ordinary life and academic situations. The severity of Mathematics Anxiety can range from a feeling of mild tension all the way to experiencing a strong fear of mathematics.

People with higher levels of mathematics anxiety tend to perform more poorly on assessments of mathematics skills whilst those with better performance in mathematics tend to report lower levels of mathematics anxiety Ashcraft & Moore (2009). Previous study investigated that mathematic anxiety as one of the effect of lowered mathematics achievement. On another hand, Furner (2003) mentioned that mathematics anxiety was driven by cognitive concerns about performance and emotional reaction to stress. Most of the students have problems with mathematics anxiety, with findings indicating that students with high mathematics anxiety perform worse in mathematics, and, as a result, they avoid mathematics. Poor mathematics performance is best explained as a result of mathematic anxiety.

In fact, mathematics anxiety is more than a dislike toward mathematics. Many people experience a genuine fear of mathematics and become nervous when engaging in mathematical tasks (Maloney et al., 2012; Vinson, 2001), avoid mathematics and mathematics-related professions, severely limiting their future career and earning opportunities.

Feelings of mathematics anxiety are widespread. For instance, an estimated 25% of 4-year college students and up to 80% of community college students suffer from a moderate to high degree of mathematics anxiety in the US (Beilock and Willingham, 2014). Increased mathematics anxiety is linked to decreased mathematics achievement (Lee, 2009). This decreased mathematics performance is not limited to academic situations but also related to large and detrimental consequences in people's daily lives such as reduced teaching self efficacy among teachers (Olango and Assefa, 2013; Swars et al., 2006).

Mathematics anxiety has been a research topic for several decades. There were several local studies conducted on mathematics anxiety of secondary school students and factors of mathematics anxiety. Eyob (2010) had conducted a research on mathematics anxiety of grade 9 and grade 10 students of three selected secondary schools in Dire Dawa and noted that mathematics anxiety prevalence among students of Dire Dawa secondary schools at a moderate level due to the fact that students already have a good mathematical background. Getachew (2015) had also conducted a research on anxiety, attitude towards mathematics and mathematics achievement of grade 10 at government and private schools in Kolfe Keranio subcity of Addis Ababa and concluded that mathematics achievement was highly correlated

with students' mathematics anxiety and there was no significant sex difference between male and female in both private and government school. Most of the local researches were conducted at schools where level of education of parents is assumed to be better and students with good mathematical background. Because for most children, parents are their first and probably most important educators; the level of education of parents may be the most important educational resource in the home. Hence, this study is a worthwhile work to assess the level and prevalence of mathematics anxiety and its effect on students academic achievement in Ameya Woreda.

1.2 Statement of the problem

Geist (2010) stated that mathematics anxiety and negative attitudes towards mathematics are serious obstacles for children in all levels of schooling. This negative attitude toward mathematics is creating a disparity between levels of mathematics achievement. Helping middle school students understand the effects of mathematics anxiety is critical. Furner and Gonzalez-Dehass (2011) explained that “mathematics anxiety is a real issue that can impact a young person's goals, many career-related decisions they may make in life and their overall future”. Our changing world is becoming more economically competitive and doors of opportunity are closing for students who struggle in mathematics. Occupations that require analytical thinking and mathematics skills become unattainable as fearful students rule out higher level mathematics courses.

The national movement of increasing the numbers of students entering science, technology, engineering, and mathematics (STEM) related career fields are critical. Ethiopia government applies 70/30 policy according to the students result and choices. Based on the policy, 70% of the students who scored the required passing point in grade 10 examination 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 those students who scored the passing point in grade 10 in Ameya woreda secondary schools have no interest to apply for natural science stream which indicates a gap between policy and practice. As mathematics teacher, we often find that in mathematics classrooms quite a few students are motivated to participate in classroom activities, fear to ask question, fear to give answer, unable to complete

their homework, achieve least in test score and the rest seem to be unwilling to get involved in learning tasks. Hence, it is essential for this study to identify the level and prevalence of mathematics anxiety among grade 10 students and the relation between mathematics anxiety and mathematics achievement so as mathematics anxiety might be one of the factor of the problems mentioned above in selected secondary schools of Ameya Woreda.

1.3 Research Questions

- At what level of magnitude mathematics anxiety prevail among grade 10 students of secondary schools in Ameya?
- What is the relation between mathematics anxiety, students' achievement and attitude towards mathematics, motivation and study skill of grade 10 students in Secondary Schools in Ameya?
- Is there any significant mean difference between anxiety level of grade 10 male and female students of secondary schools in Ameya?
- To what extent mathematics anxiety and student related factors predict students' achievement of grade 10 students of secondary schools in Ameya?
- What are the sources of mathematics anxiety of grade 10 students of secondary schools in Ameya?

1.4 Objectives of the study

1.4.1 General Objective

The general objective of this study was to examine the effect of mathematics anxiety of grade 10 students on their academic achievement of Secondary schools in Ameya Woreda.

1.4.2 Specific Objectives

The specific objectives of this study were:

- Analyze the level of mathematics anxiety among grade 10 students of secondary schools in Ameya.
- Examine how mathematics anxiety of students relates with mathematics achievement and student related factors such as sex, attitude, motivation and study skill of students.

- Identify if there is any significant mean difference between mathematics anxieties of grade 10 male and female students of secondary schools in Ameya.
- Identify to what extent mathematics anxiety and student related factors predict students' achievement of grade 10 students of secondary schools in Ameya?
- Identify source of mathematics anxiety of grade 10 students of secondary schools in Ameya.

1.5 Significance of the study

Investigating mathematics anxiety level among grade 10 students of secondary schools in Ameya might help in determining the percentage of students highly affected by mathematics anxiety so that appropriate action could be taken to minimize the anxiety level. Although there are many different reasons for the poor performance in mathematics, minimizing mathematics anxiety might improve mathematics performance and achievement. Overcoming mathematics anxiety is a recipe for success in helping students achieve and grow in mathematics. Having accurate information about anxiety can reduce confusion, fear and shame. Anxiety is a common and normal experience, and it can be managed successfully.

The study also provides information to future researchers, relevant decision and policy makers, curriculum designers about the level of mathematics anxiety and the relation between mathematics anxiety and students' achievement. It is also significant for the school principals, supervisors and mathematics teachers to help the students who have a greater mathematics anxiety. It is from this background that the researcher is interested to assess the prevalence of mathematics anxiety and its relation with students' achievement.

1.6 Scope of the study

Mathematics anxiety is prevalent among elementary, secondary or university students. But the great concern of this study is to assess the relation between mathematics anxiety and students' achievement. The study was delimited on analyzing the level and prevalence of mathematics anxiety, the relation between mathematics anxiety and students' academic achievement, the effect of student related factors such as attitude towards mathematics, motivation and study

skill of students on students' achievement among grade 10 students of selected secondary schools in Ameya Woreda.

1.7 Limitations of the Study

The respondents in this study were limited to only two selected secondary schools of grade 10 students in Ameya Woreda. Considering the fact that these students were chosen from two schools, the result of the study might not be representative of the entire population of grade 9 and grade 10 students of secondary schools in Ameya Woreda. The second limitation of this study was time constraint, uncooperativeness and misconception of respondents in filling the questionnaires and returning on time.

1.8 Operational Definition of key terms

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

Anxiety: fear, dislike, unable to perform mathematics operations

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

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

Mathematics anxiety: A feeling of tension, apprehension, or fear that interferes with mathematics performance

Mathematics Anxiety Questionnaire: the instrument used to assign a mathematics anxiety scale score.

Secondary School: Grade 9 and 10, the first cycle of Ethiopia secondary education

Student related factors: Sex, attitude towards mathematics and mathematics teacher, motivation and study skill of students.

2. REVIEW OF RELATED LITERATURE

2.1 Definition of Anxiety

Peter.s Mayer (2008) stated, “Anxiety is a mind-body reaction that occurs instantaneously, and its effects are felt physiologically, behaviorally, and psychologically all at the same time”. He then defined anxiety as a state of intense agitation, tension, or dread occurring from a perceived threat of danger. The American Psychological Association (2014) defined anxiety as “an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure.”

Anxiety is defined as “a painful or apprehensive uneasiness of mind usually over an impending or anticipated ill” (Merriam-Webster, 2012). Students experiencing academic anxiety feel apprehensive over academic tasks. Students can feel anxiety related to every academic task. Some may only feel anxiety related to test taking or other specific tasks. Anxiety is not always negative. Some students can be motivated by anxiety. Stress is how a person mentally and physically reacts to circumstances that are considered difficult or challenging (Beckner, 2004).

2.2 Mathematics Anxiety

Mathematics anxiety seems to be particularly related to self rating with regard to mathematics. People who think that they are bad at mathematics are more likely to be anxious. Most studies indicate a negative relationship between mathematics self-concept and mathematics anxiety (Jain and Dowson, 2009; Goetz et al., 2010; Hoffman, 2010).

While it may not be surprising that many people experience anxiety in high-pressure mathematics testing situations (e.g., the mathematics section of the SAT or the GRE), many people also experience anxiety even when engaging in everyday mathematics tasks like calculating a tip at a restaurant or deciding whether or not they received the proper change at the grocery store (e.g., Maloney & Beilock, 2012). In fact, for some people, their levels of mathematics anxiety are so high that they become nervous even simply reading aloud mathematical equations (Ashcraft & Moore, 2009).

2.3 Understanding Mathematics Anxiety

Understanding the mechanisms by which mathematics anxiety causes poor mathematics performance is critical in creating effective interventions aimed at reducing the negative impact of mathematics anxiety on mathematics achievement. It is also important to understand why mathematics anxiety arises in the first place. Although there is not yet an agreed-upon model of what causes mathematics anxiety per se, research within the last 10 years has led to many compelling findings which, taken together, are beginning to unearth a developmental trajectory for the mathematics anxiety–mathematics achievement relation.

Mathematics anxiety, considered a fear or phobia, produces ‘a negative response specific to the learning, or doing, of mathematical activities that interferes with performance’ (Whyte, 2009,). Closer examination of mathematics anxiety reveals two general forms of anxiety: trait and state (Miller & Bischel, 2004). Trait anxiety describes the vulnerability to stress that an individual brings to a situation. State anxiety refers to the actual situational stress experienced that is specific to personally stressful or fearful circumstances. Research also notes that mathematics anxiety can affect individuals in varying ways, inducing a cognitive, affective, or physical reaction. For example, a cognitive reaction may involve negative self-talk, ‘blinking out’, and avoidance; an affective reaction may be characterized by distrust of ability, fear of looking stupid, and loss of self-esteem; and a physical reaction may be evidenced by perspiring, a boost in one’s heart rate, tenseness, or nausea (Freiberg, 2005). “If mathematics makes a student feel anxious, the learning and teaching of mathematics will be marked with negative emotions and bodily sensations” (Zambo & Zambo, 2006) and these may have a powerful and long-lasting effect on learning mathematics.

2.4 Prevalence of Mathematics Anxiety

Feelings of mathematics anxiety are widespread. In the United States, an estimated 25% of 4-year college students and up to 80% of community college students suffer from a moderate to high degree of math anxiety (Beilock & Willingham, 2014) and worldwide, increased mathematics anxiety is linked to decreased mathematics achievement (Lee, 2009). This decreased math performance is not limited to academic situations. Math anxiety is also related to poor drug calculations among nurses (McMullan, Jones, & Lea, 2012), reduced teaching

self-efficacy among teachers (Swars, Daane, & Giesen, 2006), and impaired financial planning (McKenna & Nickols, 1988). Meaning that, even outside of academics, mathematics anxiety can have large and detrimental consequences in people's daily lives.

2.5 Potential Origins of Mathematics Anxiety

Mathematics anxiety can have multiple origins and, as noted by Shields (2005), can be perpetuated in the home, society and the classroom.

2.5.1 The home

In the home, parents who themselves suffer mathematics anxiety can unintentionally transfer such anxiety to their children. In the context of doing mathematics, the emotions expressed by one will inevitably and reciprocally shape the other within parent-child interactions (Else-Quest, Hyde, & Hejmadi, 2008). For example, children who are reproached for their errors may develop a fear of taking risks and exploring new possibilities, and may start hating mathematics. Parental disappointment and despair are especially demoralizing due to the value placed on the high positive regard of parents by children, while parents giving mathematics low status or applying pressure to children may also contribute to the development of mathematics anxiety (Fraser & Honeyford, 2000).

Stolpa (2004) also identifies how parents may unintentionally raise mathematics anxiety in their children by providing them with an excuse to stop trying when they are frustrated or upset due to difficulties with a mathematical task. A response from parents, such as "Don't worry, I've never understood fractions" or "Never mind, mathematics was always tricky for me at school too", plants a seed that may grow into a strong belief for children that they are incapable of learning mathematics. High achievers are not immune to pressures from parents. Over-bearing parental pressure for success or concern about the difficulty of mathematics for their children may contribute to mathematics anxiety in high achievers.

2.5.2 Society

Social factors such as mathematical myths may also induce or reinforce mathematics anxiety for some students. For example, the myth that boys are better than girls in mathematics and

that only some people have a ‘mathematics mind’ can undermine positive self-efficacy beliefs. Too often, situations are encountered in which it is ‘cool’ to hate mathematics, with people readily stating, with some pride, ‘I’m not good at mathematics’, as though displaying a badge of honour or promoting membership to the I Hate Mathematics ‘Facebook’ group. As a subject mathematics is unique as embarrassment often does not result from failure. A study involving over 1000 undergraduate students in the United States affirms the view that failure at mathematics is socially acceptable – the participants were less embarrassed in relation to lack of mathematical skills compared with language skills (Latterell, 2005).

2.5.3 The classroom

Despite young children starting school having, for the most part, a well developed, informal competence in mathematics, it is apparent that the classroom is also a place where mathematics anxiety can develop and flourish. Research studies (Vinson, 2001) suggest that, in combination with the parental and societal factors, mathematics anxiety may have its roots in teaching and teachers, with mathematics anxious teachers resulting in mathematics anxious students at times. Teaching by mathematics anxious teachers is characterized by an over-reliance on traditional instructional activities such as: drills, flash cards, and work sheets; assigning the same work for everyone; teaching to the textbook; insisting on only one correct way to complete a problem; concentrating more on basic skills rather than concepts; and, whole class instruction (Gurganus, 2007). Despite New Zealand’s systemic attempts to reform primary mathematics programmes (Higgins & Parson, 2009), we have ‘a long tail of underachievement in mathematics’ (Neill, Fisher, & Dingle, 2010, p. 1) and traditional ways of learning mathematics continue to be present within our schools (Young Loveridge, Taylor, Sharma, & Hāwera, 2006). While traditional instruction may contribute to math anxiety, so too does the culture of the classroom.

Classroom culture can be defined as the behaviors and norms that guide classroom interactions. Experiences of learning mathematics in structured, rigid classrooms include little opportunity for debate or discussion, focus on searching for the one right answer, offer limited encouragement to reflect on thinking, expect quick answers, and emphasise timed tests (Shields, 2005). In such classrooms, it is likely both overt and covert teacher behaviours are implicated in fostering students’ mathematics anxiety (Breen, 2003). These behaviours

include: unrealistic expectations of students; gender bias; giving poor explanations; hostility, anger or intimidation; embarrassing students in front of peers if a concept is not understood; and, an insensitive or uncaring attitude (Shields, 2005). With the advent of National Standards, New Zealand teachers are encouraged to integrate a range of assessment practices that support students' learning. However, we know from the research that implementing effective assessment for learning practices is challenging. Watson's (2000) study of informal assessment practices in classrooms, found that teachers were more prone to ask students to report mathematics already done. Limited attendance to, and probing of children's thinking means judgments are more likely to be based on written work.

Unfortunately, written tests, in particular, are often the primary source for students' anxiety (Shields, 2005). Other types of assessment that might also contribute to mathematics anxiety are timed assessments or activities within competitive environments. Students who do not perform well on these types of assessment are often left feeling embarrassed and with the belief they cannot do mathematics. While the classroom and the experiences provided can contribute to mathematics anxiety, so too can a 'dropped stitch'. These stitches can be described as a gap in a student's prior mathematics learning that prevents more advanced concept learning (Farrell, 2006) and can arise when students miss learning access to particular concepts due to shifting schools, illness, or other personal reasons (Freiberg, 2005).

2.6 Factors that contribute for Mathematics Anxiety:

2.6.1 Genetics

One potential factor that has been investigated is genetics. Wang et al. (2014) carried out behavioral genetic studies of mathematics anxiety in a sample of 514 twelve- year-old twin pairs. They were given the Elementary Students version of the MARS as a measure of mathematics anxiety; the Spence Children's Anxiety Scale as a measure of test anxiety; a mathematical problem solving subtest of the Woodcock- Johnson III Tests of Achievement; and a reading comprehension test from the Woodcock Reading Mastery Test. Mathematics anxiety correlated significantly with general anxiety, and also correlated negatively with both mathematical problem solving and reading comprehension, while general anxiety did not correlate significantly with either academic measure.

Univariate and multivariate behavioral genetic modeling indicated that genetic factors accounted for about 40% of the variance in mathematics anxiety, with most of the rest being explained by non-shared environmental factors. It is unlikely that there are genetic factors specific to mathematics anxiety. Rather, the multivariate analyses suggested that mathematics anxiety was influenced by the genetic and environmental risk factors involved in general anxiety, and the genetic factors involved in mathematical problem solving. Thus, mathematics anxiety may result from a combination of negative experiences with mathematics, and predisposing genetic risk factors associated with both mathematical cognition and general anxiety.

2.6.2 Gender and Mathematics Anxiety

One of the factors that have received most study with regard to mathematics anxiety is that of gender. Much recent research indicates that males and females, in countries that provide equal education for both genders, show little or no difference in actual mathematical performance (Spelke, 2005). However, they do indicate that females tend to rate themselves lower and to express more anxiety about mathematics (Else-Quest et al., 2010; Devine et al., 2012), though such differences are not huge (Hyde, 2005). Most studies suggest such gender differences only develop at adolescence, and that primary school children do not exhibit gender differences in mathematics anxiety (Dowker et al., 2012; Wu et al., 2012; Harari et al., 2013) though even in the younger age group boys often rate themselves higher in mathematics than girls do (Dowker et al., 2012). This increased anxiety may come from several sources, including exposure to gender stereotypes, and the influence and social transmission of anxiety by female teachers who are themselves anxious about mathematics (Beilock et al., 2010). It may also be related to more general differences in anxiety between males and females.

Many studies indicate that females tend to show higher levels of trait anxiety and the closely related trait of Neuroticism than males (Costa et al., 2001; Chapman et al., 2007) and show higher prevalence of clinical anxiety disorders (McLean et al., 2011). They have been found to show greater anxiety than males even in subjects where their actual performance tends to be higher than that of males, such as foreign language learning (Park and French, 2013). Also, males tend to show more confidence and rate themselves higher in a number of domains than females do (Beyer, 1990; Beyer and Bowden, 1997; Jakobsson et al., 2013). Thus, it is not

surprising that this should also apply to mathematics, and, given the associations between anxiety and self-rating, that it might contribute to gender differences in mathematics anxiety.

However, there is some evidence that gender differences in mathematics anxiety cannot be reduced to gender differences in general academic self-confidence or in test anxiety. Devine et al. (2012) found that mathematics anxiety has an effect on mathematics performance, even after controlling for general test anxiety, in girls but not in boys. They asked 433 British secondary school children in school years 7, 8, and 10 (11-to 15-year-olds) to complete mental mathematics tests and Mathematics Anxiety and Test Anxiety questionnaires. Boys and girls did not differ in mathematics performance; but girls had both higher mathematics anxiety and higher test anxiety. Both girls and boys showed a positive correlation between mathematics anxiety and test anxiety and a negative correlation between mathematics anxiety and mathematics performance. Both boys and girls showed a negative correlation between mathematics anxiety and mathematics performance. However, regression analyses showed that for boys, this relationship disappeared after controlling for general test anxiety. Only girls continued to show an independent relationship between mathematics anxiety and mathematics performance.

By contrast, Hembree (1990) suggested that math anxiety is more negatively related to achievement in males than in females, and some other studies suggested that there are no gender differences in the relationship between mathematics anxiety and performance (Wu et al., 2012). However, most such studies have not controlled for general test anxiety. Gender effects on the relationship between mathematics anxiety and performance may also depend on whether one is examining the cognitive or affective component of mathematics anxiety, and on what aspects of mathematics are involved. Indeed, Miller and Bichsel (2004) found that mathematics anxiety was more related to basic mathematics scores in males, but to applied mathematics scores in females. More research is needed as to what influences gender differences in both mathematics anxiety itself, and in its influence on performance. It is unlikely that such gender differences are the result of gender differences in working memory, as on the whole, studies show relatively few gender differences in working memory (Robert and Savoie, 2006) though some studies suggest that males may be better at visuo-spatial working memory and females at verbal working memory (Robert and Savoie, 2006).

Intriguingly, Ganley and Vasilyeva (2014) carried out a mediation analysis that suggested that mathematics anxiety seemed to affect visuo-spatial working memory more in female than male college students, and that this led to a greater decrement in mathematics performance.

However, since other studies suggest that mathematics anxiety affects verbal more than visuo-spatial working memory (De Caro et al., 2010), there is still much room for further research here. One possible explanation for greater mathematics anxiety in females than males is stereotype threat. Stereotype threat occurs in situations where people feel at risk of confirming a negative stereotype about a group to which they belong. In the domain of mathematics anxiety, this usually refers to females being reminded of the stereotype that males are better at mathematics than females, though it can also occur with regard to other stereotypes. For example, Aronson et al. (1999) found that white American men performed less well in mathematics when they were told that Asians tend to perform better in mathematics than white people, than when they were not exposed to this stereotype.

Most of the studies of the effects of stereotype threat on mathematics anxiety are somewhat indirect: they indicate that mathematics performance is worse when people are exposed to stereotype threat, but do not usually include direct measures of mathematics anxiety. While one likely explanation for the effects of stereotype threat is that it increases mathematics anxiety, there are other possibilities: e.g., those participants choose to conform to social expectations. This caution must be borne in mind when considering the evidence about the effects of stereotype threat on performance.

Schmader (2002) and Beilock et al. (2007) found that women performed less well on an arithmetic task if they were told that the researchers were studying why women do more poorly than men. Beilock et al. (2007) noted that, as is often found in studies of mathematics anxiety, the effect only occurred for problems that required the significant use of working memory resources. Johns et al. (2005) gave participants a mathematics test under three conditions: one without any reference to gender stereotypes; one where they were told that the researchers were studying reasons why women performed less well in mathematics; and one where they were exposed to the same

Gender stereotype, but also taught explicitly about the nature of stereotype threat in this context, and how it could increase women's anxiety when doing mathematics. Females performed less well than men in the condition where the gender stereotype was presented without explanation, but there were no gender differences either in the condition where no gender stereotype was presented *or* in the condition where they were taught explicitly about the stereotype threat.

However, the effect of stereotype threat is not always found, especially in children. Ganley et al. (2013) carried out three studies with a total sample of 931 school children ranging from fourth to twelfth grade, and using several different methods from the implicit to the highly explicit to induce stereotype threat. There was no evidence of any effect of stereotype threat on girls' performance in any of these studies. It may be that stereotype threat only exerts an influence in very specific circumstances, or on the other hand that it always occurs and exerts an influence under all circumstances, so that the experimental manipulations exerted no additional effect. It may also be that the importance of stereotype threat has been overestimated at least with regard to children; or that the effects were greater in the past than now, due to changes in social attitudes.

Moreover, it may be that gender stereotypes are affecting not so much mathematics anxiety itself as self-perceptions of mathematics anxiety. Goetz and colleagues gave secondary school pupils questionnaires about mathematics anxiety as a trait, and also about their anxiety as a state during a mathematics class (Goetz et al., 2013; Beige et al., 2015). Both boys and girls tended to report higher trait anxiety than state anxiety, but girls did so to a much greater extent. Girls reported higher trait anxiety than boys in both studies, but higher state anxiety only in one of the studies. One possible conclusion that girls do not in fact experience so much more mathematics anxiety than boys, but that due to gender stereotypes they *expect* to experience more mathematics anxiety and this in itself may discourage them from pursuing mathematics activities and courses.

2.6.3 Age

On the whole, mathematics anxiety appears to increase with age during childhood. Most studies suggest that severe mathematics anxiety is uncommon in young children, though some

researchers have found significant mathematics anxiety even among early primary school children (Wu et al., 2012). This apparent increase in mathematics anxiety with age is consistent with findings that show that other attitudes to mathematics change with age. Unfortunately, they tend to deteriorate as children get older (Dowker, 2005; Mata et al., 2012).

There are a number of reasons why mathematics anxiety might increase with age: some relating more to the “anxiety” and some more to the “mathematics.” One reason is that general anxiety appears to increase with age during childhood and adolescence could also reflect increases in tendency to general anxiety. For example, it is generally found that the onset of clinical anxiety disorders peaks in early adolescence (Kiessler et al., 2005) though it is possible that such disorders in younger children are under-diagnosed due to lack of clear and appropriate diagnostic methods (Egger and Angold, 2006). It may be that a factor such as increasing intolerance of uncertainty or increasing awareness of social comparison is leading to both increased general anxiety and to increased mathematics anxiety in particular.

Reasons more specifically relating to mathematics may include exposure to other people’s negative attitudes to mathematics; to social stereotypes, for example about the general difficulty of mathematics or about supposed gender differences in mathematics; to experiences of failure or the threat of it; and/or to changes in the content of mathematics itself. Arithmetic with larger numbers that make greater demands on working memory, and more abstract non-numerical aspects of mathematics, may arouse more anxiety than the possibly more accessible aspects of mathematics encountered by younger children.

Moreover, the relationships between attitudes and performance may change with age. A meta-analysis by Ma and Kishor (1997) indicated that the relationship between attitudes and performance increases with age. Some studies suggest that among young children, performance is not significantly related to anxiety (Krinzinger et al., 2009; Dowker et al., 2012; Haase et al., 2012), but is more related to liking for mathematics and especially to self-rating. However, different studies give conflicting results; and some studies do show a significant relationship between anxiety and performance in young children (Dossey et al., 1988; Newstead, 1998; Wu et al., 2012; Ramirez et al., 2013; Vukovic et al., 2013).

There are at least three possible explanations for the conflicting findings. One is that the results may vary according to the aspect of mathematics anxiety that is being studied. Mathematics Anxiety Rating Scale (MARS) have tended to show such a relationship even in young children (Wu et al., 2012; Vukovic et al., 2013), and this could reflect the fact that such measures tend to focus on the affective dimension of mathematics anxiety. Those that have used the Mathematics Anxiety Questionnaire (MAQ) developed by Thomas and Dowker (2000) have tended not to show such a relationship in younger children (Krinzinger et al., 2007, 2009; Dowker et al., 2012; Haase et al., 2012; Wood et al., 2012), which could reflect the fact that this measure places more emphasis on the cognitive (“worry”) aspect of mathematics. The few studies that have included both dimensions of mathematics anxiety have suggested that performance in young children is related to the affective but not to the cognitive dimension (Harari et al., 2013), whereas studies of older children and adults suggest that performance is related to both, but is more strongly related to the affective dimension. More research is needed on how the relationship changes with age between performance and different components of mathematics anxiety.

A second explanation is that mathematics anxiety becomes more closely related to mathematics performance because of changes in working memory. Working memory of course increases with age in childhood (Henry, 2012), which could affect the relationship between anxiety and performance. One study does suggest that the relationship between anxiety and performance is greater in children with higher than lower levels of working memory. Vukovic et al. (2013) carried out a longitudinal study of 113 children, who were followed up from second to third grade. Mathematics anxiety was measured by items from the MARS-Elementary and from MAQ. Mathematics anxiety was negatively related to performance in calculation but not geometry. It was also negatively correlated with pupils’ improvement from second to third grade, but only for children with higher levels of working memory. This is at first sight surprising given that working memory is generally positively correlated with mathematical performance, and especially in view of the theory that mathematics anxiety impedes performance by overloading working memory. We would suggest that a likely explanation is that among younger elementary school children, only those with high levels of working memory are already using mathematical strategies that depend significantly on working memory, and that therefore these may be the children whose progress

is most impeded by mathematics anxiety. This could be one explanation for mathematics anxiety being more correlated with performance more in older than in younger children.

A third possible explanation is cultural. The studies that do show a relationship between mathematics anxiety and achievement among young children tend to be from the USA, though this could of course be a coincidence, and there are at present no obvious reasons why the relationship should be stronger in the USA than elsewhere. Nevertheless, there is evidence more generally for cultural influences on mathematics anxiety.

2.6.4 Culture, Nationality, and Mathematics Anxiety

Some aspects of attitudes to mathematics seem to be common to many countries and cultures: e.g., the tendency for young children to like mathematics, and for attitudes to deteriorate with age (Dowker, 2005). However, different countries differ not only in actual mathematics performance, but also in liking mathematics; in whether mathematics is attributed more to ability or effort; and how much importance is attributed to mathematics (Stevenson et al., 1990; Askew et al., 2010). Some of these differences could affect mathematics anxiety, though the direction is not completely predictable. Children in high-achieving countries could be low in mathematics anxiety because they are doing well (and/or may do well because they are not impeded by mathematics anxiety).

On the other hand, they could be high in mathematics anxiety, because such countries often attach high importance to mathematics and to academic achievement in general, making failure more threatening; and because such children are likely to be comparing themselves with high-achieving peers, rather than with lower-achieving children in other countries. Lee (2009) investigated mathematics anxiety scores in a variety of countries and found that the relationship between a country's overall mathematics achievement level, and the average level of mathematics anxiety among children in that country, was not consistent. Children in high-achieving Asian countries, such as Korea and Japan, tended to demonstrate high mathematics anxiety; while those in high-achieving Western European countries, such as Finland, the Netherlands, Liechtenstein, and Switzerland tended to demonstrate low mathematics anxiety. At present, the reason for these differences is not clear. They may be related to the fact that pressure to do well in examinations is probably significantly greater in Asian countries (Tan

and Yates, 2011). They could also be related to some as yet undetermined specific aspects of the educational systems or curricula.

Another possible reason could involve cultural or ethnic differences either in willingness to admit to mathematics anxiety, or in the nature of the relationship between mathematics anxiety and mathematics performance. Several studies have suggested that ethnic minority students express more positive attitudes to mathematics than white pupils both in the USA ((Lubienski, 2002) and in the UK (National Audit Office, 2008), which did not conform to actual differences in performance. However, the meta-analysis of Ma (1999) showed no ethnic differences with regard to the relationship between anxiety and performance.

There is overwhelming evidence that both the socio-economic status of individuals and the economic position of countries have a very large influence on mathematical participation and achievement (e.g., Chiu and Xihua, 2008), However, there has been little research specifically on the influence of socio-economic status on mathematics anxiety or attitudes to mathematics; and the research that has been done does not suggest a very strong SES effect on these variables (Jadjewski, 2011)

2.8 The Relationship Mathematics Anxiety and Mathematics Achievement

Mathematics anxiety is not simply a proxy for low mathematics ability meaning that when people have poor mathematics skills they feel anxious about them (Ashcraft & Kirk, 2001). Rather, when mathematics-anxious individuals are faced with a mathematics task, they experience worries often about performing poorly on the mathematics task—and these worries tie up valuable thinking and reasoning resources needed for the task at hand. Specifically, these worries tie up working memory resources (Ashcraft & Kirk, 2001), our “mental scratchpad” that allows us to “work” with whatever information is held in consciousness (Beilock, 2010). Working memory is a limited capacity system that integrates, computes, stores, and manipulates the information to which a person is attending. Because higher-mathematics-anxious people are essentially doing two things at once when they do mathematics (i.e., attending to their worries and doing the math), their math performance suffers.

In this respect, mathematics anxiety itself actually causes people to perform worse in mathematics than their abilities warrant. Neuroscientific data, in which functional magnetic resonance imaging was used to examine differences in brain activation between higher- and lower-math-anxious children while they performed mathematics questions, provide initial support for the idea that mathematics anxiety disrupts working memory resources important for success on the mathematics task at hand (Young, Wu, & Menon, 2012). When engaging in mathematics, not only do higher-mathematics-anxious students show more activation in brain regions that are associated with processing negative emotions, they also show less activation in brain regions associated with working memory (i.e., the dorsolateral prefrontal cortex and the posterior parietal lobe) and optimal mathematics performance. It is important to note that disruption of working memory processes is not the only link between math anxiety and poor math performance.

Mathematics anxiety also causes students to avoid mathematics, mathematics classes, and mathematics-related careers and this avoidance undoubtedly impairs math achievement. After all, it is difficult for someone to hone their mathematics skills if they avoid engaging in mathematical processing. As such, students can enter into a vicious cycle in which their anxiety causes them to perform worse in mathematics, and, as a result, they avoid mathematics and opportunities to improve their skills. Understanding the mechanisms by which mathematics anxiety causes poor mathematics performance is critical in creating effective interventions aimed at reducing the negative impact of mathematics anxiety on math achievement. It is also important to understand why mathematics anxiety arises in the first place. Although there is not yet an agreed-upon model of what causes mathematics anxiety per se, research within the last 10 years has led to many compelling findings which, taken together, are beginning to unearth a developmental trajectory for the mathematics anxiety–mathematics achievement relation.

2.9 Reduction and Prevention of Mathematics Anxiety

Research has already told us a lot about the nature of emotions and attitudes toward mathematics. So far, it tells us less about how such attitudes can be modified, and how mathematics anxiety may be treated, or, ideally, prevented. It is likely that early interventions for children with mathematical difficulties may go some way toward preventing a vicious

spiral, where mathematical difficulties cause anxiety, which causes further difficulties with mathematics. Parents and teachers could attempt to model positive attitudes to mathematics and avoid expressing negative ones to children. This may, however, be difficult if the parents or teachers are themselves highly anxious about mathematics. There could be greater media promotion of mathematics as interesting and important.

However, much more research is needed on the effectiveness of different strategies for improving attitudes to mathematics. In such research, it must be taken into account, both that mathematics has many components and that different strategies might be effective with different components; and that improving attitudes to mathematics means not only reducing anxiety and other negative emotions toward mathematics, but increasing positive emotions toward mathematics. Treatments of already-established mathematics anxiety may involve both mathematics interventions as such, and treatments for anxiety such as systematic desensitization and cognitive behavior therapy. So far, no miracle cure seems to be in sight. However, there are new methods, based on recent research findings that appear to be promising.

In particular, researchers have recently attempted to use findings about the cognitive aspects of mathematics anxiety and about cognitive treatments of anxiety more generally, to develop techniques involving reappraisal of the anxiety-provoking situation. A few recent studies suggest that instructing people to reappraise the nature and consequences of mathematics anxiety may reduce the negative effects, breaking a vicious circle, whereby people feel that their anxiety will worsen their performance or is a signal of inability to carry out the tasks. Johns et al. (2008) and Jamieson et al. (2010) found that informing people that arousal could actually improve performance led to better mathematics performance than in a control condition. Beilock and colleagues have developed a promising intervention for mathematics anxiety that amounts to “writing out” the negative affect and worry (Ramirez and Beilock, 2011; Park et al., 2014). The researchers drew on previous findings that writing about traumatic and highly emotional events lowered ruminating behavior in individuals with clinical depression. A possible mechanism for this could be that writing enables a form of reappraisal that interrogates the need to worry in the first place. This in turn frees working memory resources consumed by worrying, which can be deployed toward task performance.

Ramirez and Beilock (2011) tested this proposition both in a laboratory environment and also in a high-stakes field experiment (i.e., an exam).

Both the laboratory and field experiments showed that writing about one's worries before academic performance significantly improved performance compared to a control condition (e.g., writing about untested exam material). An exam can be stressful for anyone taking it. Most interesting, therefore, was the finding that 10 min of expressive writing before an exam was only beneficial for individuals with high test anxiety, compared to control writing. Individuals with low test anxiety did not experience any particular benefits from expressive writing. The authors attribute this to the extent to which individuals with high and low test anxiety differ in worrying about exams. Individuals with lower test anxiety, who presumably worry less, would therefore write about fewer worries during an expressive writing exercise.

In other words, there is simply less worry that needs to be "written out" for individuals with low test anxiety, in contrast to individuals with high mathematics anxiety. The potential of this kind of intervention to facilitate a level playing field during examinations is potentially large. Indeed, students in the expressive condition outperformed those in the control condition by 6%. In letter grades, the expressive condition students earned a B+ on average, while those in the control condition earned a B-. Could this kind of intervention be useful for mathematics anxiety? The same group of authors has suggested that this may be the case. In a recent paper, Park et al. (2014) explored the influence of expressive writing on the link between mathematics anxiety and mathematics performance. Parallel to the Ramirez and Beilock (2011) results, Park et al. (2014) found that expressive writing ameliorated performance on tasks of modular arithmetic (specially developed working memory-intensive mathematics problems) in high mathematics anxiety individuals compared to a control writing task.

From the literature, it appears that there are three primary causes of mathematics anxiety. These are beliefs, learning environment, and an anticipatory response. It is likely that these three variables are intertwined and strengthen one another. Beliefs might include negative stereotypes about your own gender or race. Cognitive restructuring of beliefs could be a partial solution to that malady. Understanding based approaches, such as discourse, seem to have a positive effect on how a student's learning environment affects his or her anxiety. Much more study needs to be done in mathematics anxiety. Its effect on students can be

palpable. Mathematics anxiety can have multiple origins and, as noted by Shields (2005), can be perpetuated in the home, society and the classroom. Stolpa (2004) also identifies how parents may unintentionally raise mathematics anxiety in their children by providing them with an excuse to stop trying when they are frustrated or upset due to difficulties with a mathematical task. Social factors such as mathematical myths may also induce or reinforce mathematics anxiety for some students. More research is needed as to what influences gender differences in both mathematics anxiety itself, and in its influence on performance. Mathematics anxiety also causes students to avoid mathematics, mathematics classes, and mathematics-related careers and this avoidance undoubtedly impairs math achievement.

3. RESEARCH DESIGN AND METHODOLOGY

This chapter describes location of the study, construction and development of data gathering instrument on different variables, methods adopted for the selection of samples, collection of data, scoring and analysis.

3.1 Location of the study

The study was undertaken at Ameya Woreda. Ameya Woreda is located at 143km West of Addis Ababa and it is one of the 12 Woreda's in the South West Shoa Zone. The administrative center of the Woreda is Gindo town which is 29km from Woliso town in the west. In the Woreda there is no private school and there are three Secondary Schools and one preparatory government school. One secondary school and preparatory school are located at the Woreda town. One secondary school is located at 23km north of Woreda town and the other secondary school is located at 19km south west of Gindo town.

3.2 Research Design

The design of the study was a case study in selected secondary schools of Ameya Woreda and survey method was employed in this study. The purpose of this study was well suited for descriptive survey method. There are 3 secondary government schools in Ameya Woreda and there is no private secondary school. The researcher selected two secondary schools located at different positions purposively because the present researcher has been working there in the woreda town and so he could get better cooperation and obtain necessary information from Gindo Secondary School than other areas and the availability of transportation to reach Kota secondary school. The two selected secondary schools are GSS and KSS.

This research attempted to study the level and prevalence of mathematics anxiety and its relation with students' achievement with a group of variables such as gender, attitude towards mathematics, motivation and study skill, parent's educational level and achievement level in mathematics.

3.3 Sources of the Data

In order to obtain required information in line with the research questions, different sources of information were considered. Grade 10 students of the selected two secondary schools were the main sources of information. In addition, record offices of the selected schools were other source of information.

3.4 Population and Sampling Techniques

From the three Secondary schools and one preparatory school in the Woreda, the researcher selected two secondary schools located at different positions purposely. These schools are Gindo Secondary School (GSS) which is located in the woreda town and Kota Secondary School (KSS) which is located at 19km South West of Gindo town. Once the list of the total population obtained from sample schools, the researcher arranged in alphabetical order and collected each student 2010 grade 9 average mathematics score from the record offices of the two selected schools. Then, male and female students of each school were arranged separately in ascending order of mathematics achievement score and the required sample with respect to their achievement were selected from population list being represented divided by the sample size required in a systematic sampling method where every n^{th} case after a random start is selected. (Cohen, L., Manion, L., and Morrison, R.B. 2007)

$$f = \frac{N}{sn}$$

f = frequency interval

N = the total number of population

sn = the required number in the sample

From the total population 412 male and 340 female, 105 male and 87 female were selected.

In this case $N = 752$, $sn = 192$ $f = \frac{752}{192} = 3.9166$ which is approximately equal to 4 and the 4th case after random start were selected from the list of the total population of sampled school.

The distribution of the population and sample students in the two selected schools is described as follows:

Table 1: Number of students in the two selected secondary schools

School	Number of students		
	10 th Grade students		
	Male	Female	Total
GSS	309	270	579
KSS	103	70	173
Total	412	340	752

Table 2: Number of sample students in the two selected schools

School	Number of students		
	10 th Grade students		
	Male	Female	Total
GSS	78	69	147
KSS	27	18	45
Total	105	87	192

3.5 Data Gathering Instruments

Two instruments of data collection were used in order to collect the quantitative data from the subject. These were: Questionnaire and Document Analysis.

3.5.1 Questionnaire

Questionnaire was used as a major instrument to collect information. Questionnaire is an appropriate instrument to collect information about conditions and factors from relatively

large sample studies. Questionnaires were prepared and distributed to the selected participants after it was translated in to Afan Oromo language (Appendix III). Two questionnaires were prepared and distributed to the selected participants. The questionnaires used to collect were the “Mathematical Anxiety Rating Scale” adopted from Mahmood, S., & Khatoon, T. (2011) and (Ellen Freedman, 1997) (Appendix I) and a “Personal Information Form”, developed by the researcher to obtain demographic information about students. (Appendix II)

The Mathematics Anxiety Rating Scale (MARS) developed by Mahmood, S., & Khatoon, T. (2011) and Ellen Freedman (1997) was used extensively to measure mathematics anxiety. The researcher selected and organized 15-items that are related to daily life statements and are solutions to mathematical problems involving academic conditions that contain the complexity of numbers or mathematical problems that may cause anxiety. The items were constructed using a Likert-Scale format with the following anchors: 1=strongly disagree, 2=Disagree, 3=undecided, 4=Agree, 5=strongly agree. Mahmood, S., & Khatoon, T. (2011) reported reliability coefficient of the instrument as 0.91. The total anxiety score was the sum of all the ratings. Possible scores range from 15 to 75. This is a component of mathematics anxiety score and indicates the degree of mathematics anxiety.

Personal Information Form: This form was developed by the researcher to obtain the following information: sex, age, attitude towards mathematics, attitude towards mathematics teacher, whether participants liked mathematics class or not, whether they liked their mathematics teacher, motivation and study skill of students and parents educational

3.5.2 Document Analysis

The document analysis was used in order to achieve the objective of the study which is analyzing the correlation between mathematics anxiety and achievement level of the students. In order to distinguish the achievement level in mathematics of the respondents, their two semester average examination scores in mathematics are collected from the record offices of the two selected school and the summary is given in Appendix V.

3.6 Procedures of Data Collection

After review of the related literature the researcher prepared data gathering instrument of 5-point Likert type with English (Appendix I). The statements or items were translated from English into Afan Oromo in order to make them comprehensible to all students. Once the researcher has finished designing questionnaire the prepared instruments and questions evaluated and approved by advisor and co-advisor. Then, it is important to test the survey questions before using it to collect data. The researcher selected 30 students (15 male and 15 female students) randomly from the target group to pretest the questionnaire. Pretesting and piloting can help to identify questions that do not make sense to participants. The purpose of piloting is to make sure that everyone in the sample understands the questions in the same way. The next step was that the researcher selected 11 grade 10 and grade 9 mathematics teachers from sample schools that helped him to collect data purposefully and gave orientation for the teachers about the purpose of the study and how to collect the required information from sample under the study. Then mathematics anxiety questionnaire was administered depending on the free time of students and teachers with the help of school administrative and mathematics teachers. After the students completed the survey, the researcher collected the questionnaire and organized the points on each sheet.

3.7 Methods of Data Analysis

The data collected through questionnaire were analyzed and calculated using Statistical Package for Social Science (SPSS) version 20 in line with the basic questions raised in chapter one. Different statistical tools were used for data analysis. In order to fulfill the objective of the study, correlation analysis and descriptive statistics such as percentage, mean and standard deviation were used. Means were compared using independent t-test, ANOVA, and regression analysis to determine if the relation between them were meaningful or not.

4. RESULTS AND DISCUSSION

The purpose of this part is to present the analysis of data. This study assessed the anxiety level of grade 10 students about mathematics in two selected Ameya Woreda secondary schools. The presentation of data analysis is organized according to the four research questions.

4.1 Analysis and Results of Level and Prevalence of Mathematics Anxiety

The first research question was “At what level of magnitude mathematics anxiety prevail among grade 10 students of secondary schools in Ameya? The analysis of this research question discussed as follows: 192 students have filled and returned the questionnaire forms, 105 are male and 87 are female. Table 3 shows ranges of mathematics anxiety score for each mathematics anxiety level. The table also shows the summary of each mathematics anxiety level occurrence of the respondents which indicate the prevalence of mathematics anxiety in 192 of the respondents of grade 10 in the two selected schools.

Table 3: Mathematics anxiety level of the respondents:

Statements	Anxiety Level									
	No anxiety (1)		Low anxiety (2)		Undecided (3)		High anxiety (4)		Sever anxiety (5)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Q₁	41	21.35	34	17.70	20	10.41	61	31.77	36	18.75
Q₂	43	22.39	38	19.79	34	17.70	51	26.56	26	13.54
Q₃	35	18.23	22	11.46	24	12.5	59	30.73	52	27.08
Q₄	47	24.48	30	15.63	27	14.06	42	21.88	46	23.96
Q₅	12	6.25	28	14.58	22	11.46	66	34.38	64	33.33
Q₆	54	28.13	37	19.27	32	16.67	39	20.31	30	15.63
Q₇	29	15.10	27	14.60	24	12.5	47	24.48	65	33.85
Q₈	36	18.75	33	17.19	31	16.15	47	19.27	45	23.44
Q₉	46	23.96	24	12.5	34	17.70	39	20.31	49	25.52
Q₁₀	33	17.19	31	16.15	27	14.06	48	25.52	52	27.08
Q₁₁	62	32.29	27	14.06	35	18.23	35	18.23	33	17.19
Q₁₂	62	32.29	31	16.15	32	16.67	33	17.19	35	18.23
Q₁₃	28	14.58	22	11.46	25	13.02	49	25.52	68	35.42
Q₁₄	59	30.73	38	19.79	27	14.06	38	19.79	30	15.63
Q₁₅	32	16.67	33	16.67	27	14.06	52	27.08	49	25.52
Sum		322.39		237		219.25		363.02		354.17
Average		21.49		15.8		14.62		24.20		23.61

Q_i : the i^{th} mathematics anxiety question where $i = 1, 2, \dots, 15$ (Appendix III A)

Freq. = frequency

As can be seen from Table 3 according to the anxiety level category, the prevalence of mathematics anxiety among grade 10 students of secondary schools in Ameya Woreda was at high and sever anxiety level. 24.20% of sampled students' mathematics anxiety level was at high anxiety level and 23.61% of the sampled students mathematics anxiety level was at sever anxiety level (Table 3). This implies that most of the students do really fear mathematics and mathematics anxieties was prevalent at high and sever anxiety level among grade 10 students of Ameya Woreda Secondary schools. This might be due to negative attitude towards mathematics, poor study skill, low motivation, not good mathematical background of the sampled students, hence less confidence in the subject.

4.2 The Relation between Mathematics Anxiety and Students Achievement

The second question was, "What is the relation between mathematics anxiety and students' achievement? To investigate if there was a statistically significant relation between mathematics anxiety and students' achievement in mathematics, a correlation analysis of the sum of the anxiety score and the students' mathematics achievement obtained from the record office was computed (Appendix V)

Table 4: Pearson Statistic Association between Mathematics Anxiety and Mathematics Achievement (N= 192)

		Correlations	
		Math achievement	Math anxiety
Math achievement	Pearson correlation Sig. (2-tailed)	1	-.551
Math anxiety	Pearson correlation Sig. (2-tailed)	-.551	1

As can be seen from table 4 mathematics anxiety was highly but negatively correlated with students' mathematics achievement, ($r(192) = -.551, p < .001$). This negative correlation shows that as mathematics anxiety of students increases their mathematics achievement decreases and vice-versa.

4.3 Mathematics Anxiety Level in Sex

For the third research question “Is there any significant mean difference between anxiety level of grade 10 male and female students of secondary schools in Ameya?”, the distribution of magnitude of mathematics anxiety the respondents according to their sex was summarized as follows:

Table 5: Distribution of mathematics anxiety level according to sex

Anxiety level	Sex of students			
	Male		Female	
	frequency	%	frequency	%
No anxiety (1)	336	21.33	283	21.68
Low anxiety (2)	292	18.53	163	12.49
Undecided (3)	235	14.92	184	14.09
High anxiety (4)	396	25.14	311	23.83
Sever anxiety (5)	316	20.06	364	27.89`

1 = Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree

From Table 5, one can compare the magnitude of anxiety in different sex of the students. As can be seen on Table larger percent of female students are at sever anxiety level (27.89%), compared to male students (20.06%) and larger percent of male students are at high anxiety level (25.14%) compared to female students (23.83%). Generally high level of mathematics anxiety was observed in females in terms of percentages which have a negative effect on their mathematics achievement. To assess whether male and female students differ significantly in regard to their mathematics achievement and mathematics anxiety scores, an independent sample *t*-test was used.

Table 6: Comparison of Male and Female Students on Mathematics Achievement and Mathematics Anxiety (n=105 males and 87 females)

Variable	N	M	Sd	F	Df	T	P
Math Achievement				.493	190	-0.079	.937
Males	105	63.47	9.98				
Females	87	63.58	9.42				
Math Anxiety				2.378	190	-1.541	.125
Males	105	45.71	13.14				
Females	87	48.54	12.02				

Table 6 shows that the mean achievement score of male and female students did not differ, $t(190) = -0.079$, $p = >0.05$ and the mean anxiety score of male and female students also did not differ $t(190) = -1.541$, $p = >0.05$ which shows that males and females had no statistical significance mean difference on mathematics achievement and mathematics anxiety

4.4 The Relation between Students' Achievement and Student related factors

The fourth research question was 'To what extent mathematics anxiety and student related factors predict students' achievement of grade 10 students of secondary schools in Ameya? The relation and effect of student related factors such as mathematics anxiety, attitude towards mathematics, attitude towards mathematics teacher and motivation and study skill of the respondents was assessed as follows:

4.4.1 Mathematics Achievement of the respondents

Table 7: Frequency and Descriptive table of Mathematics Achievement Scores obtained from the record office of the two secondary schools is as follows (N = 192)

Mathematics Achievement	Frequency	Percent	Cumulative Percent
Below 50	9	4.69	4.69
50 – 59.5	61	31.77	36.46
60 – 69.5	86	44.79	81.25
70 – 79.5	25	13.03	94.28
80 – 89.5	6	3.12	97.40
90 – 100	5	2.60	
Total	192	100	

As can be seen from Table 7 the mathematics score of 86 students is satisfactory and the mathematics score of 61 students is fair and only 11 students scored above 80 which refers mathematics achievement scores of students is not sufficient which needs to be improved.

4.4.2 Attitude towards mathematics of the respondents

The attitude towards mathematics survey consists of 26 statements (Appendix IV-D), 14 are positive and 12 are negative. The following values were assigned to the response options for analysis of data: 1=strongly disagree, 2=Disagree, 3=undecided, 4=Agree, 5=strongly agree. Survey statements number 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 and 26 on the attitude towards mathematics survey are positive items and the statements number 1, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23 and 25 on the attitude towards mathematics anxiety are negative items and the response options are the same but the values for the responses must be reversed when scored. For each student, participating in the survey, the responses were totaled giving a measure of attitude toward mathematics.

After the total attitude scored, it is categorized as bad(1 or 2), neutral (3) or good attitude (4 or 5). The ranges of these categories and the distribution of the respondents based on the categories is summarized as follows:

Table 8: Attitude towards mathematics of the respondents

	Bad Attitude (1 or 2)				Neutral Attitude (3)				Good Attitude (4 or 5)			
	M	F	Total	%	M	F	Total	%	M	F	Total	%
Q₁	42	44	86	44.79	28	12	40	20.83	35	31	66	34.375
Q₂	21	14	35	18.23	4	6	10	5.21	80	67	147	76.56
Q₃	27	18	45	23.44	14	5	19	9.89	64	64	128	66.67
Q₄	28	19	47	24.48	21	13	34	17.71	56	55	111	57.81
Q₅	31	27	58	30.21	8	13	21	10.94	66	47	113	58.85
Q₆	25	14	39	20.31	15	8	23	11.98	65	65	130	67.71
Q₇	33	37	70	36.46	15	5	20	10.41	57	45	102	53.13
Q₈	17	17	34	17.71	11	5	16	8.33	77	65	142	73.96
Q₉	56	34	90	46.88	13	15	28	14.58	36	38	74	38.54
Q₁₀	30	23	53	27.60	20	16	36	18.75	55	48	103	53.65
Q₁₁	33	31	64	33.33	10	15	25	13.02	62	41	103	53.65
Q₁₂	24	20	44	22.92	14	6	20	10.41	67	61	128	66.67
Q₁₃	41	33	74	38.54	17	18	35	18.23	47	36	83	43.23
Q₁₄	25	18	43	22.40	19	16	35	18.23	61	53	114	59.37
Q₁₅	39	30	69	35.94	14	11	25	13.02	52	46	98	51.04
Q₁₆	20	12	32	16.67	4	6	10	5.21	81	69	150	78.12

Q₁₇	58	44	102	53.12	17	11	28	14.58	30	32	62	32.30
Q₁₈	26	19	45	23.44	18	13	31	16.15	61	55	116	60.41
Q₁₉	32	32	64	33.33	15	9	24	12.50	58	46	104	54.17
Q₂₀	18	13	31	16.15	5	7	12	6.25	82	67	149	77.60
Q₂₁	54	55	109	56.77	14	13	27	14.06	37	19	56	29.17
Q₂₂	16	12	28	14.58	6	5	11	5.73	83	70	153	79.69
Q₂₃	40	37	77	40.10	17	17	34	17.70	48	33	81	42.20
Q₂₄	28	25	53	27.60	17	19	36	18.75	60	43	103	53.65
Q₂₅	40	45	85	44.27	15	11	26	13.54	50	31	81	42.19
Q₂₆	21	10	31	16.15	10	11	21	10.94	74	66	140	72.91
Sum				785.42				336.95				1477.625
Aver				30.21				12.96				56.83

Q_i : The i^{th} attitude towards mathematics question where $i = 1, 2, 3, \dots, 26$ (Appendix II- E)

As shown on Table 8 the attitude towards mathematics of 30.21% of the respondents were bad, the attitude towards mathematics of 12.96% of the respondents were neutral and attitude towards mathematics of 56.83% of the respondents were good.

4.4.3 Attitude towards mathematics teacher of the respondents

Attitude towards mathematics teacher consists of 8 statements (Appendix IV-E), using Likert scale. The following values were assigned to the response options for analysis of data: 1=strongly disagree=5, 2=Disagree, 3=undecided, 4=Agree, 5=strongly agree. Survey statements number 2,3,4,6,7 on the attitude towards mathematics teacher are positive items and the statements number 1, 5 and 8 on the attitude towards mathematics teacher are negative items and the response options are the same but the values for the responses must be reversed

when scored. For each student, participating in the survey, the responses were totaled giving a measure of attitude toward mathematics teacher.

Table 9: Attitude towards mathematics teachers of the respondents

Statements	Bad (1 or 2)		Neutral (3)		Good (4 or 5)	
	Freq,	%	Freq.	%	Freq.	%
Q ₁	64	33.33	20	10.42	108	86.25
Q ₂	26	13.54	12	6.25	154	80.21
Q ₃	28	14.58	9	4.69	155	80.73
Q ₄	33	17.19	27	14.06	132	68.75
Q ₅	60	31.25	36	18.75	96	50
Q ₆	39	20.31	22	11.46	131	68.23
Q ₇	35	18.23	11	5.73	146	76.04
Q ₈	46	23.96	26	13.54	120	62.5
Sum	331	172.39	163	84.9	1042	572.71
Aver.	41.37	21.55	20.37	10.61	130.25	71.59

Q_i : The ith attitude towards mathematics teacher question where i = 1, 2, 3, . . . , 8 (Appendix II- F)

As shown in the Table the attitude towards mathematics teacher of 21.55% of the respondents were bad, the attitude towards mathematics teacher of 10.61% of the respondents were neutral and attitude towards mathematics teacher of 71.59% of the respondents were good.

4.4.4 Motivation and Study skill of the respondents

The motivation and study skill of students survey consists of 15 statements (Appendix IV-F), using Likert scale. The following values were assigned to the response option for analysis of the data: For Likert scale rarely=1; sometimes=2; always=3. For each student, participating in the survey, the responses are totaled giving a measure of motivation and study skill of students. The possible minimum and maximum scores are 15 and 45 respectively. The respondent's motivation score described is presented in Appendix V. After total motivation scored, it is categorized as strong (3), medium (2) or weak motivation and study skill(1). The range of these categories and the distribution of the respondents in the categories are summarized in

Table 10: Motivation and Study Skill of the respondents

Statements	Low Motivation and study skill (1)		Medium motivation and study skill(2)		Good motivation and study skill (3)	
	Freq.	%	Freq.	%	Freq.	%
	Q ₁	58	30.21	90	46.88	44
Q ₂	40	20.83	87	45.31	65	33.85
Q ₃	53	27.60	85	44.27	54	28.13
Q ₄	63	32.81	79	41.15	50	26.04
Q ₅	38	19.79	96	50	58	30.21
Q ₆	35	18.23	120	62.5	37	19.27
Q ₇	70	36.46	86	44.79	36	18.75
Q ₈	48	25	92	47.92	52	27.08
Q ₉	28	14.58	60	31.25	104	54.17
Q ₁₀	15	7.81	45	23.44	132	68.75
Q ₁₁	29	15.10	75	39.06	88	45.83
Q ₁₂	46	23.96	104	54.17	42	21.88
Q ₁₃	42	21.88	94	48.96	56	29.17
Q ₁₄	32	16.67	85	44.27	75	39.06
Q ₁₅	35	18.29	56	29.17	101	52.60
Sum	632	329.22	1254	653.14	994	517.71
Aver.	42.13	21.948	83.6	43.54	66.27	34.514

Q_i: The ith motivation and study skill question where i = 1, 2, 3, . . . , 15 (Appendix II- E)

Freq. = frequency

As can be seen from the Table 21.96% of the respondents' motivation and study skill was weak, 43.54% of the respondents' motivation and study skill was medium and 34.514% of the respondents' motivation and study skill was good.

4.4.5 Parent's Education Level of the respondents

Parents' educational level survey consists of 2 items (Appendix IV-H) about respondent's father and mother educational level. The following values were assigned to the response options for analysis of the data: Illiterate = 1; Primary level = 2; Secondary level = 3; Diploma graduate = 4; and Degree and above = 5. The distribution of the respondents according to their father educational level is summarized under the five educational levels as follows.

Table 11 Father's educational level of the respondents

Father's Educational level	Frequency	Percent	Cumulative frequency
No formal education	69	35.9	35.9
Primary level	76	39.6	75.5
Secondary level	28	14.6	90.1
Diploma graduate	10	5.2	95.3
Bachelor degree & above	9	4.7	100
Total	192	100	

The distribution of the respondents according to their mother's educational level is summarized under the five educational levels as follows:

Table 12: Mother's educational level of the respondents

Mother's Educational level	Frequency	Percent	Cumulative frequency
No formal education	107	55.7	55.7
Primary level	68	35.4	91.1
Secondary level	13	6.8	97.9
Diploma graduate	2	1.0	99.9
Bachelor degree & above	2	1.0	100
Total	192	100	

4.4.6 Correlation Analysis of the Variables

Person product moment correlations among study variables were computed as you can see in Table 13 below to assess the relation among study variables

Table 13: Person product moment correlations among study variables of the respondents

Variable	SEX	MACH	MA	ATM	ATMT	MOSS
SEX	1					
MACH	.06	1				
MA	.111	-.551**	1			
ATM	.038	.441**	-.261**	1		
ATMT	.165*	.283**	-.128	.541**	1	
MOSS	.041	.295**	-.215**	.359**	.290**	1

(**MACH**: Mathematics Achievement; **MA**: Mathematics Anxiety; **ATM**: Attitude towards Mathematics; **ATMT**: Attitude towards Mathematics Teacher; **MOSS**: Motivation and Study Skill) of the respondents

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

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

Table 13 describe the inter correlation between the variables treated under the study. As revealed, there were inter- correlation between the independent and the dependent variable. Mathematics achievement has shown better statistically significant positive relation with attitude towards mathematics ($r=.441$). It indicates that as the students' positive attitude towards mathematics increases, their mathematics achievement increases. But attitude towards mathematics has negative correlation with mathematics anxiety ($r = -.261$). This indicates that as the students attitude towards mathematics decrease, their level of math anxiety increase and vice-versa. In addition to this mathematics achievement also has negative relation with mathematics anxiety ($r =-.551$). This also indicate that the students level of mathematics anxiety increase, their mathematics achievement decrease and vice-verse. Similarly, there were negative relation between mathematics anxiety and motivation and study skill of students ($r = -.215$) which indicate as motivation and study skill of students increase mathematics anxiety decrease. However, the relation of sex with others study variables was failed to reach the significant level.

4.4.7 The Effect of Student related factors on students academic achievement

The contribution of the independent variables to the prediction of mathematics achievement score can be seen in table 14 below.

Table 14: The results of the regression analysis on mathematics achievement

Sources of variation	Df	R	Sum of squares	Mean square	F	R ²	Adjusted R ²	P
Regression	9	.646	7521.078	835.675	14.495	.418	.389	.000*
Residuals	182		10492.557	57.651				
Total	191							

* $P < 0.01$ (Dependent variable: Students achievement; Predictors: (constants) variables of sex, attitude towards mathematics, mathematics anxiety, attitude towards mathematics teacher, motivation and study skill, fathers' education level and mothers' education level)

As can be seen in Table 14, the predictor variables of sex, attitude towards mathematics, mathematics anxiety, attitude towards mathematics teacher, motivation and study skill, fathers' education level and mothers' education level all together contributed for the variation of students' mathematics scores by 41.8%. It implies that 41.8% 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 .389. It indicated that there were overall relationships between the predictors and the outcome variables. This proportion of variance was statistically significant ($F(9,182)=14.495, p < .01$)

4.4.8 Regression analysis on Mathematics Achievement in General

Table 15: Summary of multiple regression analysis on mathematics achievement among the predictors and outcome variables can be seen in table below.

Variable	Regression coefficient (b)	Standard Error	Beta coefficient (β)	T	P
Constant	63.096	9.024		6.992	.000
Math Anxiety	-.359	.046	-.469	-7.779	.000*
Attitude towards mathematics	.158	.046	.250	3.437	.001*
Motivation and study skill	.128	.134	.061	.955	.341
Liking/ Disliking mathematics teacher	-4.906	5.482	-.051	-.895	.372
Attitude towards mathematics teacher	.092	.106	.060	.865	.388
Mother's Education level	.769	.873	.060	.881	.379
Sex (Male or Female)	.629	1.130	.032	.557	.578
Liking / Disliking mathematics class	-1.194	2.344	-.030	-.510	.611
Fathers' Education level	.165	.614	.018	.269	.789

Dependent Variable: Students achievement *P<.05

As can be seen in Table 15, 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 mathematics anxiety and mathematics achievement scores ($t(192) = -7.779, p < .05$); attitude towards mathematics and mathematics achievement scores ($t(192) = 3.437, p < .05$).

On the other hand, there was little statistically significant relation between the other variables and mathematics achievement scores. In general, mathematics anxiety and attitude towards mathematics had highly dominant and very much influential of students' mathematics achievement among other variables. The findings in this study show that past trends are continuing without any change. As stated by Ashcraft and Kirk (2001), Individuals with high mathematics anxiety take fewer mathematics courses, earn lower grades in the classes they do take and demonstrate lower mathematics achievement and aptitude than their counterparts with low mathematics anxiety.

4.5 Source of Mathematics anxiety of the respondents

For the fifth question "What are the sources of mathematics anxiety of grade 10 students of secondary schools in Ameya?"; the sampled students were asked the question "Who do you think is first source that made you to fear mathematics? (Appendix II-G) and the respondents replied as described in Table 16 below.

Table 16: Source of mathematics anxiety of the respondent

Source of mathematics anxiety	Number of respondents		
	Count	Percent	Cumulative percent
My family	9	4.7	4.7
My friend	14	7.3	12.00
My mathematics teacher	11	5.7	17.7
I , Myself	125	65.1	82.8
I don't know	33	17.2	100
Total	192	100	

As shown in Table 16, 65.1% of the respondents replied that first source of mathematics anxiety was himself or herself and 17.2% of the respondents said that they don't know the first source of their mathematics anxiety. As noted by Shields (2005) the response of students showed that the possible origins of mathematics anxiety can be the home, society and classroom and most of the factors of mathematics anxiety are student related such as negative attitude towards mathematics, poor motivation and study skill of students.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The purpose of this study was to examine the effect of mathematics anxiety of grade 10 students on their academic achievement, to assess the level of mathematics anxiety, to examine how mathematics anxiety of students relates with mathematics achievement and to identify the difference between the levels of mathematics anxiety male and female students particularly in secondary schools grade 10 students in Ameya.

Therefore, at the very beginning, the study was designed to answer the following basic questions:

- At what level of magnitude mathematics anxiety prevail among grade 10 students of secondary schools in Ameya?
- What is the relation between mathematics anxiety, students' achievement and attitude towards mathematics, motivation and study skill of grade 10 students in Secondary Schools in Ameya?
- Is there any significant mean difference between anxiety level of grade 10 male and female students of secondary schools in Ameya?
- To what extent mathematics anxiety and student related factors predict students' achievement of grade 10 students of secondary schools in Ameya?
- What are the sources of mathematics anxiety of grade 10 students of secondary schools in Ameya?

The main study is comprised of 192 grade 10 secondary school students. There were 105 male and 87 female participants selected from the population of 412 male and 340 female students of 2 government schools. The descriptive survey design was used and questionnaire was used in the collection of data. Statistical Package for Social Science (SPSS) version 20 was used to analyze data collected from the sample under study to perform variety of data analysis.

This study investigated the prevalence and level of mathematics anxiety and the relation between mathematics anxiety and students achievement among grade 10 students in South West Shoa Zone of Ameya Woreda secondary schools and observed that mathematics anxiety is prevalent at high level and it is negatively correlated with students' achievement.

The instruments, mathematics anxiety scale developed by (Mahmood & Khatoon, 2011) were 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 $n=30$. 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 no significant mean difference between male and female students' mathematics anxiety and mathematics achievement.

Person Product Moment correlation was used to examine inter-correlations between sex, attitude towards mathematics, mathematics anxiety, mathematics achievement and motivation and study skill of students. These relations implied that those independent variables had significant correlation with each other and dependent variables as well. To determine the effect of mathematics anxiety on students achievement and overall relationship of independent variables and mathematics achievement multiple regressions was used.

5.2. Conclusions

The findings of the study led to the conclusion that level of mathematics anxiety of grade 10 students in both schools was high and there were moderate negative correlation between mathematics anxiety and students achievement. The study also found out that there were no statistically significant mean difference between male and female students in mathematics anxiety and mathematics achievement.

Mathematics anxiety, attitude towards mathematics and motivation and study skill of students jointly explained students' mathematics achievement. The finding in this study showed that the major sources of mathematics were student related factors, the home, classroom and society. In general, mathematics anxiety and attitude towards mathematics are strong predictors and very much influential for students' mathematics achievement among other variables which reveals that students with high anxiety and high negative attitude towards mathematics achieve least in mathematics score compared with students with low anxiety.

5.3. Recommendations

In order to lessen the anxiety level of students and improve mathematics achievement school administrators, teachers, education planners, parents and students should work together cooperatively. Teachers be aware of the effect of mathematics anxiety on students achievement and should provide the students with the information and skills necessary to manage and overcome their mathematics anxiety. They should make an effort to lessen anxiety on these students. Teachers should develop strategies that motivate students and improve study skill of students with the support of school administrator, education planners and parents.

To overcome the problem of mathematics anxiety, Students should learn the causes of mathematics anxiety, utilize anxiety management skills, practice positive self-talk, recognize mathematics anxiety producing situations, acquire a solid mathematics base and develop a positive attitude towards mathematics with the support of their teachers, school administrators, and parents. Without excellent grades in mathematics, students will not be selected for science classes; hence the basic platform to join certain courses like medical, accounting, engineering and other science and technological courses will be jeopardized.

It is crucial to alleviate mathematics anxiety not only at secondary school level but at all levels. Alleviating mathematics anxiety should begin at the elementary level because at such stage the students might have acquired a fair amount of mathematics anxiety. By the time students started secondary education, the acquisition of mathematics anxiety from elementary level might inhibit or debilitate the ability to solve mathematical problem and exert negative influence on their attitude towards mathematics at the secondary level.

This study was by no means exhaustive and there is still much more research that can and should be done on the topic of mathematics anxiety and its effect on students' achievement. This study has demonstrated that teachers need to be aware of the impact that mathematics anxiety can have on their students' mathematics achievement. There needs to be more literature to aid teachers in helping their students overcome mathematics anxiety. Also, it would be useful for teachers to know more about how mathematics anxiety first appears in a child and how it grows into a larger problem.

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7. APPENDICES

HARAMAYA UNIVERSITY

POSTGRADUATE PROGRAM DIRECTORATE

College of Natural and Computational Sciences Department of Mathematics

Appendix I

The Questionnaire in English Language on Respondents' Mathematics anxiety

This questionnaire is aimed at addressing the necessary information needed for this specific study. I am interested to assure you that the information you provide will be kept furtively or will not be shared to anyone. Therefore, the researcher asked you to cooperate in giving your response towards the stated question. Your response contribute much to the success of the research to be under taken, Hence you are kindly requested to fill the questionnaire accurately. Thank you in advance for your cooperation!

Mathematics Anxiety Rating Scale

Direction: Direction: As you read the sentence, you will know whether you agree or disagree. If you strongly agree, circle 5, if you agree but not so strongly very much, circle 4, if you are not sure about a question or you cannot answer it, circle 3, if you strongly disagree circle 1 , if you disagree but not so strongly circle 2.

- | | |
|--|-----------|
| 1. I become physically agitated when I have to go to mathematics class. | 1 2 3 4 5 |
| 2. I am fearful about be asked go to the board in a mathematics class | 1 2 3 4 5 |
| 3. I am afraid to ask questions in mathematics class. | 1 2 3 4 5 |
| 4. I am always worried about being called on in mathematics class. | 1 2 3 4 5 |
| 5. I understand mathematics now, but I worry that it's going to get really difficult soon. | 1 2 3 4 5 |
| 6. I tend to lose my concentration in mathematics class. | 1 2 3 4 5 |
| 7. I fear mathematics tests more than any other kind. | 1 2 3 4 5 |
| 8. I'm afraid I won't be able to keep up with the rest of the class. | 1 2 3 4 5 |

9. I don't know how to study for mathematics tests. 1 2 3 4 5
10. It's clear to me in mathematics class, but when I go home it's like I was never there. 1 2 3 4 5
11. I tend to zone out in mathematics class 1 2 3 4 5
12. My mind goes blank during mathematics test 1 2 3 4 5
13. I am afraid to give an incorrect answer during my mathematics class 1 2 3 4 5
14. I get nervous when I have to use mathematics outside of school 1 2 3 4 5
15. I worry that I won't be able complete every assignment in mathematics course. 1 2 3 4 5

APPENDIX II

The Questionnaire in English Language on respondent's personal information

Personal Information form

A. Demographic Characteristics

Name: _____ Sex: _____

Age _____ Grade _____

B. Liking and Disliking of Mathematics teacher

Do you like your mathematics teacher? 1. Yes 2. No

C. Liking and Disliking of mathematics class

Do you like your mathematics class? 1. Yes 2. No

D. Attitude towards Mathematics

Direction: Direction: As you read the sentence, you will know whether you agree or disagree. If you strongly agree, circle 5, if you agree but not so strongly very much, circle 4, if you are not sure about a question or you cannot answer it, circle 3, if you strongly disagree circle 1, if you disagree but not so strongly circle 2

- | | |
|--|-----------|
| 1. I don't do very well in mathematics. | 1 2 3 4 5 |
| 2. Mathematics is helpful in understanding today's world. | 1 2 3 4 5 |
| 3. I feel at ease in a mathematics class. | 1 2 3 4 5 |
| 4. Mathematics is something which I enjoy very much. | 1 2 3 4 5 |
| 5. There is little need for mathematics in most jobs | 1 2 3 4 5 |
| 6. Working mathematics problems is fun. | 1 2 3 4 5 |
| 7. When I hear the word mathematics, I have a feeling of dislike. | 1 2 3 4 5 |
| 8. Mathematics is useful for the problems of everyday life. | 1 2 3 4 5 |
| 9. I would like to spend less time in school doing mathematics. | 1 2 3 4 5 |
| 10. I usually understand what we are talking about in mathematics class. | 1 2 3 4 5 |

- | | |
|--|-----------|
| 11. I don't like anything about mathematics | 1 2 3 4 5 |
| 12. I have a real desire to learn mathematics. | 1 2 3 4 5 |
| 13. No matter how hard I try, I cannot understand mathematics. | 1 2 3 4 5 |
| 14. I am good at working mathematics problems. | 1 2 3 4 5 |
| 15. I feel tense when someone talks to me about mathematics. | 1 2 3 4 5 |
| 16. Mathematics is of great importance to a country's development. | 1 2 3 4 5 |
| 17. I often think, "I can't do it," when a mathematics problem seems hard. | 1 2 3 4 5 |
| 18. Sometimes I read ahead in our mathematics book. | 1 2 3 4 5 |
| 19. Most of the ideas in mathematics aren't very useful | 1 2 3 4 5 |
| 20. Mathematics is helpful in understanding today's world. | 1 2 3 4 5 |
| 21. If I don't see how to work a mathematics problem right away,
I never get it | 1 2 3 4 5 |
| 22. It is important to know mathematics in order to get a good job. | 1 2 3 4 5 |
| 23. Working with numbers upsets me. | 1 2 3 4 5 |
| 24. I enjoy talking to other people about mathematics. | 1 2 3 4 5 |
| 25. It makes me nervous to even think about doing mathematics. | 1 2 3 4 5 |
| 26. I like the easy mathematics problems the best. | 1 2 3 4 5 |

E. Attitude towards Mathematics teacher

Direction: As you read the sentence, you will know whether you agree or disagree. If you strongly agree, circle 5, if you agree but not so strongly very much, circle 4, if you are not sure about a question or you cannot answer it, circle 3, if you strongly disagree circle 1, if you disagree but not so strongly circle 2

- | | |
|--|-----------|
| 1. My mathematics teacher shows little interest in the students. | 1 2 3 4 5 |
| 2. My mathematics teacher makes mathematics interesting. | 1 2 3 4 5 |

3. My mathematics teacher presents material in a clear way. 1 2 3 4 5
4. My mathematics teacher knows when we are having trouble with our work 1 2 3 4 5
5. My mathematics teacher doesn't seem to enjoy teaching mathematics. 1 2 3 4 5
6. My mathematics teacher is willing to give us individual help. 1 2 3 4 5
7. My mathematics teacher knows a lot about mathematics 1 2 3 4 5
8. My mathematics teacher doesn't like students to ask questions. 1 2 3 4 5

F. Motivation and Study Skill

Direction: Choose the best one

1. Do you study math every day ? 1. Rarely 2. Sometimes 3. Always
2. Do you try to start working on your math homework immediately after math class?
1. Rarely 2. Sometimes 3. Always
3. Do you have a specific time (schedule) to study math?
1. Rarely 2. Sometimes 3. Always
4. Do you have a specific place to study math ? 1. Rarely 2. Sometimes 3. Always
5. Do you work on your math homework in the library where you can get help?
1. Rarely 2. Sometimes 3. Always
6. Do you accept help from others? 1. Rarely 2. Sometimes 3. Always
7. Do you study math at least 8 to 10 hours a week? 1. Rarely 2. Sometimes 3. Always
8. Do you read your textbook before you come to class? 1. Rarely 2. Sometimes
3. Always
9. Do you enjoy working in group to solve difficult problems?
1. Rarely 2. Sometimes 3. Always
10. Do you take notes in math class? 1. Rarely 2. Sometimes 3. Always
11. Are careful to copy all the steps of math problems in your notes?
1. Rarely 2. Sometimes 3. Always

12. Do you ask questions when you are confused? 1. Rarely 2. Sometimes 3. Always

13. Do you go to the instructor or study partner when you are confused?

1. Rarely 2. Sometimes 3. Always

14. Do you review your notes and text before beginning homework?

1. Rarely 2. Sometimes 3. Always

15. Do you work problems until you understand them, not just until you get the right answer for homework? 1. Rarely 2. Sometimes 3. Always

G. Source of Mathematics Anxiety

Direction: Choose the correct answer

1. Who do you think is the first source that made to fear mathematics?
 1. My family
 2. My friend
 3. My mathematics teacher
 4. I, my self
 5. I don't know

H. Parents Educational Level

Direction: Choose the correct Answer

1. Your father's educational level

1. No formal education
2. Primary level
3. Secondary level
4. Diploma graduate
5. Degree and above graduate

2. Your mothers educational level

1. No formal education
2. Primary level
3. Secondary level
4. Diploma graduate
5. Degree and above graduate

APPENDIX III

The Questionnaire in Afan Oromo Language on Respondents' Mathematics anxiety

Gaafannoo Barataaf

Kabajamaa barataa/ttuu.: hunda dura gaafannoo kana guutuu keetiif galata qabda. Gaafannoon kun odeeffannoo qorannoo dhiibbaa sodaan barnoota herregaa qabxii barattoota kutaa 10ffaa manneen barnoota sadarkaa 2^{ffaa} annaa Ammayyaa irratti qabu. Kanaafuu odeeffannoon ati gaafannoo kana irratti kennitu dhugummaa bu'aa qorannoo kanaaf baay'ee murteessaa dha. Waan ta'eef, himoota gaafannoof dhiyaatan of eeggannoon dubbiftee erga hubattee booda deebii kee filannoo kennaman keessaa kan yaada kee ibsuu danda'u akka kennitu gaafachaa, gaafannoo kana irratti odeeffannoo kennamu icciitiin kan qabamu fi qaama lammaffaa ykn nama biroo kamiifiyyuu kan hin ibsamne ta'uu isaa siif mirkaneessuu barbaada. Kanaafuu gaafannoowwan armaan gaditti dhiyaatan haala gaariin akka deebiftu kabajaan gaafadha.

Madaala Sodaan Barnoota Herregaa ittiin safaramu

- A. Qajeelfama: Gaaffiiwwan kanaan gaditti dhiyaatan yeroo dubbiftu yaada gaafichaa irratti baay'istee walii galta / strongly agree /yoo ta'e lakkoofsa 5tti mari, yaada isaatiin walii galta garuu baay'istee miti / agree / yoo ta'e lakkoofsa 4tti mari; hin murteessine / undecided yoo ta'e lakkoofsa 3tti mari; yaada isaatiin walii hin galta / disagree / yoo ta'e lakkoofsa 2tti mari; baay'istee walii hin galta /strongly disagree / yoo ta'e immoo lakkoofsa 2tti mari
- | | |
|--|-----------|
| 1. Yeroon gara daree barnoota herregaatti deemu nan siqiqa | 1 2 3 4 5 |
| 2. Wayitii barnoota herregaa gara gabateeb gurraachaatti deemuun natti hin tolu | 1 2 3 4 5 |
| 3. Yeroo wayitii barnoota herregaa gaaffii gaafachuu nan leeyya'a (sodaadha) | 1 2 3 4 5 |
| 4. Yeroo wayitii barnoota herregaa maqaan kiyya ni waamama jedheen dhiphadha | 1 2 3 4 5 |
| 5. Yeroof barnootichi naaf gala; garuu xiqqoo turee natti cima jedheen Dhiphadha | 1 2 3 4 5 |
| 6. Yeroo barnoota herregaa yaadni koo ni bittinnaa'a | 1 2 3 4 5 |
| 7. Kanneen biro caalaa qormaata barnoota herregaan sodaadha. | 1 2 3 4 5 |
| 8. Akka hiriyoota koo birootti hojjechuu hin danda'u jedheen sodaadha | 1 2 3 4 5 |
| 9. Qormaata barnoota herregaaf akkamitti akkan qophaa'u /qo'adhu/ hin | |

- beeku 1 2 3 4 5
10. Yeroon baradhu naaf gala. Gara manaa yoon deemu garuu gonkumaa akka waan daree hin turreetti natti dhagahama. 1 2 3 4 5
11. Wayitii barnoota herregaa yaadni kiyya gara biraa deema 1 2 3 4 5
12. Wayitii barnoota herregaa sammun kiyya duwwaa ta'a 1 2 3 4 5
13. Wayitii barnoota herregaa gaaffii doggoggoraan deebisa jedheen sodaadha 1 2 3 4 5
14. Mana barumsaan alatti herregatti fayyadamuun na jeeqa 1 2 3 4 5
15. Gaaffiwwan herregaa hojjechuu hin danda'u jedheen yaadda'a 1 2 3 4 5

Galatoomi!

APPENDIX IV

Odeeffannoo Dhuunfaa

A. Odeeffannoo Waa'ee barataa

Maqaa _____ Saala _____

Umurii _____

Sadarkaa barnootaa : Kutaa _____

Qabxii barnoota herregaa kutaa 8ffaa _____ Kutaa 9ffaa _____

B. Barsiisaa barnootaa herregaa kee ni jaallataa? 1. Eyyee 2. Lakki

C. Wayitii barnoota herregaa kee ni jaallataa? 1. Eyyee 2. Lakki

D. Ilaalcha barnoota herregaa irratti

Qajeelfama: Gaaffiiwwan armaan gadii dubbisuun haala “Qajeelfama A” irratti ibsameen deebisi

- | | |
|--|-----------|
| 1. Herrega sirriitti hin hojjedhu | 1 2 3 4 5 |
| 2. Herregni yeroo ammaa kana baay'ee barbaachisaa dha | 1 2 3 4 5 |
| 3. Yeroo wayitii barnoota herregaa natti tola | 1 2 3 4 5 |
| 4. Waan ani jaaladhu keessaa tokko herrega | 1 2 3 4 5 |
| 5. Dalagaawwan hedduu keessatti herregni amma kana barbaachisaa miti | 1 2 3 4 5 |
| 6. Gilgaala herregaa hojjechuun nama gammachiisa | 1 2 3 4 5 |
| 7. Jecha herrega jedhu yoon dhagahu natti hin tolu | 1 2 3 4 5 |
| 8. Jireenya guyya guyyaa keessat herregni fayidaa qaba jedhee yaada | 1 2 3 4 5 |
| 9. Herrega hojjechuu irratti yeroo xiqqoon fayyadamuu fedha | 1 2 3 4 5 |
| 10. Yeroo barnoota herregaa waanti dubbatamu hundi naaf gala | 1 2 3 4 5 |
| 11. Herrega waan jedhamu hin jaaladhu | 1 2 3 4 5 |
| 12. Herrega barachuuf fedhii olaanaan qaba | 1 2 3 4 5 |
| 13. Amma fedhe yoon yaale herregni naaf hin galu | 1 2 3 4 5 |
| 14. Gaaffiiwwan herregaa hojjechuu irratti ani fooyyee dha | 1 2 3 4 5 |
| 15. Waa'een herregaa yoo haasa'amu natti hin tolu | 1 2 3 4 5 |
| 16. Guddina biyya tokkoof herregni fayidaa olaanaa qaba | 1 2 3 4 5 |
| 17. Gaaffii herregaa tokko yoon arge yeroo mara ni cima jedheen
yaada | 1 2 3 4 5 |
| 18. Yeroo tokko tokko kitaaba herregaa durseen dubbisee daree dhufa | 1 2 3 4 5 |

- | | |
|---|-----------|
| 19. Yaadoleen hedduun herrega keessatti argaman barbaachisoo miti | 1 2 3 4 5 |
| 20. Addunyaa amma keessa jiraannuuf herregni bar baachisaa dha | 1 2 3 4 5 |
| 21. Gaaffin herregaa akkamitti akka hojjetamu yoon arguu baadhe
gonkumaa hojjechuu hin danda'u | 1 2 3 4 5 |
| 22. Dalagaa gaarii ta'e argachuuf herregni murteessaa dha | 1 2 3 4 5 |
| 23. Herrega hojjechuun na nuffisiisa | 1 2 3 4 5 |
| 24. Waa'ee herregaa nama birootti himuun natti tola | 1 2 3 4 5 |
| 25. Herrega hojjechuu yeroon yaadu nan jeeqama. | 1 2 3 4 5 |
| 26. Gaaffiiwwan herregaa sassalmaa ta'an nan jaaladha | 1 2 3 4 5 |

E. Ilaalcha Barsiisaa Barnoota herregaaf qabu

Qajeelfama: Gaaffiiwwan armaan gadii dubbisuun haala “Qajeelfama A” irratti ibsameen deebisi

- | | |
|---|-----------|
| 1. Barsiisaan keenya herregaa barattootaaf fedhii amma kana hin qabu | 1 2 3 4 5 |
| 2. Barsiisaan keenya barnootni herregaa haala nama gammachiisuun
dhiyeessa | 1 2 3 4 5 |
| 3. Barsiisaan keenya barnoota herregaa haala ifa ta'een dhiyeessa | 1 2 3 4 5 |
| 4. Barsiisaan keenya yeroo barnootichi nutti cime ni hubata | 1 2 3 4 5 |
| 5. Barsiisaan keenya herrega barsiisuu waan itti gammadu hin fakkaatu | 1 2 3 4 5 |
| 6. Barsiisaan keenya barnoota herregaa deeggarsa dhuunfaan nu
barbaachisu nuuf gochuuf fedhii qaba | 1 2 3 4 5 |
| 7. Barsiisaan herregaa kiyya waa'ee barnoota herregaa sirriitti beeka | 1 2 3 4 5 |
| 8. Barsiisaan barnoota herregaa kiyya barataan akka gaaffii isa gaafatu
hin fedhu | 1 2 3 4 5 |

F. Kaka'umsa fi ogummaa barachuu

Qajeelfama: yaada irratti waliigaltan filachuun itti marsi.

1. Herrega guyya guyyaan ni qo'attaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
2. Hojii manaa siif kennamu wayitii barnoota herregaan booda dafttee battaluma sana ni hojjettaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
3. Sagantaa dhaabbataa herrega itti qo'attu ni qabdaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
4. Bakka murtaa;aa herrega itti qo'attu ni qabdaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
5. Hojii manaa herregaa yoo sitti cime bakka deeggarsa itti argachuu dandeessutti ni hojjettaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
6. Deeggarsa namoota biro irraa ni fudhattaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara

7. Torbaanitti yoo xiqqaate sa'aatii 8:00 hanga 10:00 herrega ni qo'attaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
8. Gara daree barnootaatti osoo hin dhufiin dura kitaaba barnoota keetii ni dubbiftaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
9. Gaaffiiwwan ulfaataa furuuf ykn hojjechuuf gareen hojjechuu ni filattaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
10. Waayitii barnoota herregaa yaadannoo ni qabattaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
11. Gaaffiilee barnoota herregaa furuuf tarkaanfilee barbaachisoo ta'an of eeggannoon ni hordoftaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
12. Yeroo si rakkise gaaffii ni gaafattaa ? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
13. Yeroo gaaffiin herregaa sitti ulfaate gara barsiisaa keetii ykn hiriyaawaliin qo'attuu deemtee ni gaafattaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
14. Gilgaala ykn hojmanee osoo hojjechuu hin eegaliin dura waan dareetti baratte keessa deebitee ni dubbiftaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara
15. Gilgaala siif kenname deebii isaa argachuuf qofa osoo hin taane amma siif galutti ni hojjettaa? 1. Yeroo muraasa 2. Darbee darbee 3. Yeroo mara

G. Madda Sodaa Barnoota Herregaa

Qajeelfama: Deebii sirrii ta'etti mari

1. **Yeroo jalqabaaf soodaan barnoota herregaa akka sitti uumamu kan taasisse eenyu?**
 1. **Maatii kiyya (Haadha ykn Abbaa)**
 2. **Hiriyaawaliin kiyya (Hawaasa naannoo)**
 3. **Barsiisaa Herregaa kiyya**
 4. **Anuma (Mataa kiyya)**
 5. **Hin beeku**

H. Odeeffannoo Sadarkaa Barumsa Maatii

Qajeelfama: Gaaffiiwwan armaan gadiitiif deebii qajeelaa ta'etti mari .

1. Sadarkaa Barumsaa abbaa
 1. Kan hin baranne
 2. Sadarkaa 1ffaa
 3. Sadarkaa 2ffaa
 4. Dippiloomaa
 5. Digrii fi isaa ol
2. Sadarkaa barumsa haadhaa
 1. Kan hin baranne
 2. Sadarkaa 1ffaa
 3. Sadarkaa 2ffaa

4. Dippiloomaa
5. Digrii fi isaa oli

APPENDIX V

ACHIEVEMENT SCORE, ANXIETY SCORE, ATTITUDE SCORE, ATTITUDE TOWARDS MATHEMATICS TEACHER SCORE, MOTIVATION AND STUDY SKILL SCORE OF RESPONDENTS

ACHIEVEMENT SCORE	ANXIETY SCORE	ATM SCORE	ATMT SCORE	MOSS SCORE
61	38	78	38	29
85	35	85	36	34
57.5	43	90	27	34
56	62	78	32	26
74	27	115	37	31
56.5	39	102	38	36
59	44	96	32	29
64	35	70	36	28
57	37	39	26	39
58	68	80	36	37
67.5	63	66	18	25
69.5	34	61	29	19
68.5	35	82	21	26
63	49	89	33	27
56.5	66	76	20	27
58.5	48	112	32	31
64	41	101	36	35
63.5	55	88	29	35

53.5	45	98	36	35
65	46	86	24	39
64	53	79	40	34
67.5	45	88	23	27
63	56	83	32	31
71.5	55	108	39	35
88.5	23	105	37	40
65.5	56	108	35	35
64.5	49	89	28	32
56.5	55	96	36	34
57.5	71	89	33	29
55	64	100	24	41
60	50	83	19	35
75	34	122	40	37
69	59	110	38	26
54	50	73	27	31
76.5	27	115	38	37
96.5	19	127	39	39
69.5	58	82	32	33
70	49	112	38	40
66.5	65	84	30	36
51.5	54	64	30	31
43	54	70	20	25
63	54	99	28	32

56	54	102	39	36
67	47	95	37	28
65.5	29	88	24	28
68	48	94	32	35
57	47	99	24	27
67.5	56	98	30	29
64.5	48	105	40	39
71	42	79	28	33
66	37	84	31	22
65	40	76	27	32
56	51	82	25	34
59.5	30	111	37	36
68	56	92	39	35
57.5	63	103	40	31
62.5	65	76	36	34
61.5	50	85	29	32
62	62	78	26	26
58	59	83	36	35
72	24	105	37	34
61.5	43	109	30	37
53.5	62	72	36	29
60.5	37	109	34	42
72.38	45	98	34	35
60.5	46	92	40	31

63.5	65	92	34	31
49	61	90	23	27
78	61	95	30	30
70.5	38	63	20	33
59	60	95	37	28
53	55	91	32	32
61.5	56	85	40	36
97.5	15	123	36	37
48	66	78	32	23
59.5	54	107	35	39
78.5	40	98	32	34
52	50	58	25	27
64	48	106	40	35
73.5	45	75	30	37
62.5	51	92	34	25
57	51	91	33	29
52.5	56	76	12	30
57	37	107	33	31
65.5	43	93	40	29
62	54	76	24	27
49.5	66	90	30	30
65	49	85	27	30
64	65	90	31	29
54.5	53	82	20	33

61	26	119	24	27
52.5	63	82	28	35
60	57	104	36	38
65	29	83	37	38
63.5	45	91	21	30
77.5	26	122	35	35
58	41	82	17	28
62.5	36	86	36	39
69.5	48	93	26	40
69	39	82	24	29
46	49	60	10	28
72	33	92	31	30
70	37	116	37	34
65.5	54	101	28	24
65	49	90	32	34
49.5	55	71	31	25
57	52	73	31	29
60	46	87	29	35
54	56	81	32	32
70.5	44	83	23	32
59	34	82	31	26
47.5	57	62	21	29
67.5	64	105	37	30
60	51	86	24	28

68	22	115	40	37
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68.5	32	105	40	31
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61	39	86	20	37
86	33	111	36	27
65	61	87	33	33
74.5	29	97	24	33
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62	55	89	34	27
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71	54	91	31	33
61.5	60	102	37	38
68	36	64	39	40
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94.5	25	114	34	33
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69.5	47	83	25	28

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75.5	19	129	38	42
63	46	104	30	30
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82	27	115	35	34
68.5	33	80	26	27
66.5	27	71	20	40
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79	37	65	18	32
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57.5	56	86	28	35
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69	40	82	17	31
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85	43	104	40	26
91	30	113	36	40
71	49	93	24	29
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61.5	67	77	27	33
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68	18	64	17	37
73	29	116	39	37
63.5	56	92	23	34
68.5	45	92	35	32
68	48	98	31	29
47	50	89	29	28
83	34	107	35	36
54.5	60	86	27	26
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59	47	99	29	35
50.5	54	78	25	21
51	37	95	30	30
68	43	71	29	26

70.5	37	109	32	32
56	64	78	36	23
50.5	45	96	38	28
64.5	36	79	33	36
46.5	60	85	28	29
