High School Students' Attitude Towards Learning Mathematics in Adama, Asella and Bishoftu Towns

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ACRONYMS

ASTU	Adama Science and Technology University
Deff	Design effect
Pps	Probability proportion to sample size
SPSS	Statistical Package for Social Sciences
SRS	Simple Random Sampling

ABSTRACT

Mathematics is a fundamental field of study that plays a pivotal role in the development of science, technology, business, and computer science. Due to this, mathematics has been considered as one of the most important core subject in the high school curriculum of Ethiopia. Thus, attitude of students towards leaning mathematics plays a crucial role in the teaching and learning processes of mathematics, moreover, it has a fundamental input for a sector aiming at promoting and controlling quality of education in high schools. The purpose of this study was to investigate the level of students' attitude towards leaning mathematics as well as some background factors associated with it among high school students in Adama, Bishoftu and Asella towns. A purposive stratified random sampling technique was used to select eligible respondents. Cross-sectional data were collected from 982 high school students about: 1) their attitude towards learning mathematics by using a five point Likert scale type of modified Fennema-Sherman mathematics attitudes scales questionnaire and 2) some background factors that might influence their attitude towards learning mathematics through structured questionnaire. The data were analyzed by using the chi-square test and the logistic regression model. The result of the analysis revealed that 59% of the respondent students had shown unfavorable attitude towards learning mathematics. The results in the chi-square statistic and logistic regression model indicated that there were strong association between students' attitude towards learning mathematics and gender/sex, performance, absenteeism, parents'/guardians' educational level, student's personal confidence, teacher's motivation, teaching methods and peers support. But students' attitude towards learning mathematics was not significantly associated with high school type, knowledge of usefulness of mathematics and educational value held by the family/community. Finally, the study forwarded some recommendations for education offices, teachers, families of students and other stake holders to improve high school students' attitude towards learning mathematics in the study area.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Problem

The mathematical knowledge has a very crucial instrument in our daily life (Baroody, 1987). The knowledge of mathematics is also a tool that can be applied in our community to overcome the problems we encountered in day to day activities (Bishop, 1996). Education of mathematics is also an vital means for indulgencing and applying the other sciences for knowledge development of the technology. Consequently, mathematics has been well thought-out as amongst the most important central part subject in school curriculum. Furthermore, as compared to other subjects, mathematics lessons are more likely to be taught in schools and colleges throughout the world (A. Orton et al., 2004). Nevertheless, in their study they also indicated that the students do not perform on the standard tests and evaluations to the anticipated level.

In the teaching and learning processes of mathematics students' attitude towards learning it plays a decisive role which in turn put some effects on their own achievement in the subject. Some of the factors that may influence students' attitude towards learning mathematics are (i) the teaching method in the classroom (ii) the support from the school structure (iii) the family and students' attitude towards school in general. Generally, the method by which mathematics is represented in the classroom and recognized by students sets to estrange several students from learning mathematics, even when teachers believe they are presenting it in reliable and context dependent manner (Barton, 2000; Furinghetti and Pekhonen, 2002). Therefore, some researchers concluded that a favorable students' attitude towards learning mathematics has a positive effect on their achievement in the subject (M.de Lourdes et al, 2012).

There are a number of researches regarding the students' attitudes and beliefs towards learning mathematics. For instance, Shoenfeld (1989), Mc Leod (1992) and Broun et al. (1988), confirmed that there is a positive association between students' attitudes and their performance in mathematics. Cobb (1986) has also shown that there is a relationship between students' beliefs and learning of mathematics. Schoenfeld (1989) verified that students' belief about Euclidean

Geometry is as result of the method of teaching mathematics. Some scholars also be in agreement that students' attitudes can be changed into more positive ones. To mention few, Regna and Dalla (1992) declared that when teachers are enthusiastic in their teaching and plan activities which are reachable to students, then students' attitudes can be enhanced. Similarly, Kifer and Robitaille (1989) and Philipou and Christou (2000) have established that students' attitude is influenced by their social surroundings, nevertheless, Dematte et al. (1999) have shown that students' beliefs about mathematics are predisposed by the educational system of their own country.

The efforts that may be done to improve students' attitude towards learning mathematics at the lower levels offer a base for the higher level studies or secondary school level in the subject. During 1960s investigations on students' attitude were presented attitude as a cause of students' difficulties in learning mathematics, predominantly in solving problems while recently, many of them studied the connected notions such as conceptions and beliefs of mathematics and its learning, motivation and self-regulation, self-concept, self-esteem and self-efficacy. The general analysis is that human beings are not merely cognitive individuals, but also social persons with beliefs, emotions and views that influence their development as learners. In fact, a person's behavior and preferences, when faced up with a task are determined more by her/his beliefs and personal hypotheses rather than by her/his knowledge of the specifics of the chore (M.Nicolaidou et al, 2003).

Attitudes are regarded by several researchers, as an important factor to be taken into account when attempting to understand and explain variability in student performance in mathematics (L.Mohammed and H.Waheed, 2011). A positive attitude towards mathematics reflects a positive emotional disposition in relation to the subject and, in a similar way, a negative attitude towards mathematics relates to a negative emotional disposition (M.de Lourdes et al, 2012). The emotional dispositions have an impact on an individual's behavior, as one is likely to achieve better in a subject that one enjoys, has confidence in or finds useful (B. Eshun, 2004). As a consequence, positive attitudes towards learning mathematics are desirable as long as they may influence one's willingness to learn and also the benefits one can derive from mathematics education.

In spite the fact that a number of the aforementioned studies have been done regarding students' attitude towards learning mathematics, ample researches on this issue among high school students were not well addressed in our country as well as in the study areas. Hence, this study aims to fill the knowledge gap in this regard.

1.2. Statement of the Problem

Students' attitude towards learning mathematics plays a fundamental role in the teaching and learning processes of the subject (Baroody, 1987). In the teaching and learning processes of mathematics students' attitude towards learning it plays a decisive role which in turn put some effects on their own achievement in the subject. Some of the factors that may influence students' attitude towards learning mathematics include the teaching method in the classroom, the support from the school structure and the family and students' attitude towards school in general.

According to Ma and Zu (2004), it is revealed that positive attitude towards learning mathematics directs students towards achievement in mathematics. Moreover, they arrived at the conclusion that any effort made to enhance students' attitude towards learning mathematics at lower level as well as at middle level causes for a success in mathematics at higher level and provides the foundation for higher studies in mathematics, engineering and other sciences. Therefore, we found that it is very important to investigate the level of high school students' attitude towards learning mathematics and its associated background factors in the study areas.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of this study is to assess students' attitude towards learning mathematics among high school students in Adama, Bishoftu and Asella towns and to investigate some background factors associated to it.

1.3.2. Specific Objectives

The specific objectives of this study are to:

1. Identify the level of students' attitude towards learning mathematics among high school students in the study areas.

2. Investigate whether there was a statistically significant difference between male and female students' attitude towards learning mathematics in the study areas.
3. Examine if there was a statistically significant difference in attitude towards learning mathematics between the government and private high schools in the study areas.
4. Explore the background factors that influence students' attitude towards learning mathematics in the study areas.

1.4. Research Questions

The study was guided by the following research questions:

1. Do high school students in the study area show a favorable or unfavorable attitude towards learning mathematics?
2. Is there a significant difference in attitude towards learning mathematics between high school male and female students in the study area?
3. Is there a significant difference in students' attitude towards learning mathematics between government and private high schools in the study area?
4. What are the socio-economic background factors that influence high school students' attitude towards learning mathematics the study area?

1.5. Significance of the Study

The significance of this study stemmed primarily from the priority given to mathematics by the ministry of education in lower, middle and higher education due to the fact that mathematics plays a great role in the development of science, technology, business and computer science that influences the socio-economic development of a society and civilization. But students' achievement in mathematics has been influenced by their attitudes towards learning mathematics. However, in the study area there was limited or no research conducted to investigate students' attitude towards learning mathematics at lower and middle level learning centers which is a base for future scientists and engineers. Therefore, by suggesting some recommendations for this problem, the present study tried to fill in the knowledge gap in this regard.

1.6. Conceptual Framework

Mathematics learning and capability to achieve good scores in mathematics examinations was not only attributed to some unique talent, great effort or good discipline from an individual, but also to favorable attitude and interest in mathematics (Kasimbu, 2004). Formation of such an attitude can depend on several factors to which the student got exposed while learning such as motivation he/she got from teachers or parents; readiness to learn; mathematical concepts and difficulty or organization of memory of what was learned.

Attitudes formed by students were categorized into cognitive, affective and behavioral components (Skinner, 1953). From these components of attitudes a conceptual framework model of attitudes formation towards learning process of mathematics among students in secondary schools was developed. Learning of mathematics involved all the three components responsible for attitude formation. However, other factors come into play depending on student's individual experience in his/her mathematics learning environment. The learning environment may comprise of appropriate teaching methods and sufficient learning resources or lack of it. It may include parental or teacher reinforcement or lack of it. Peer pressure and school experience may either reinforce a student to learn mathematics or may as well restrain effective learning of the subject. This depends on the peer group the learner was in. If the group was motivated to learn mathematics, then a group member may be motivated to learn mathematics also and vice versa. Student's day to day activities while in school may influence his interest in mathematics and in the long run develop favorable attitudes towards learning of mathematics. All these aspects are contributing to attitudes formation as shown in figure 1.

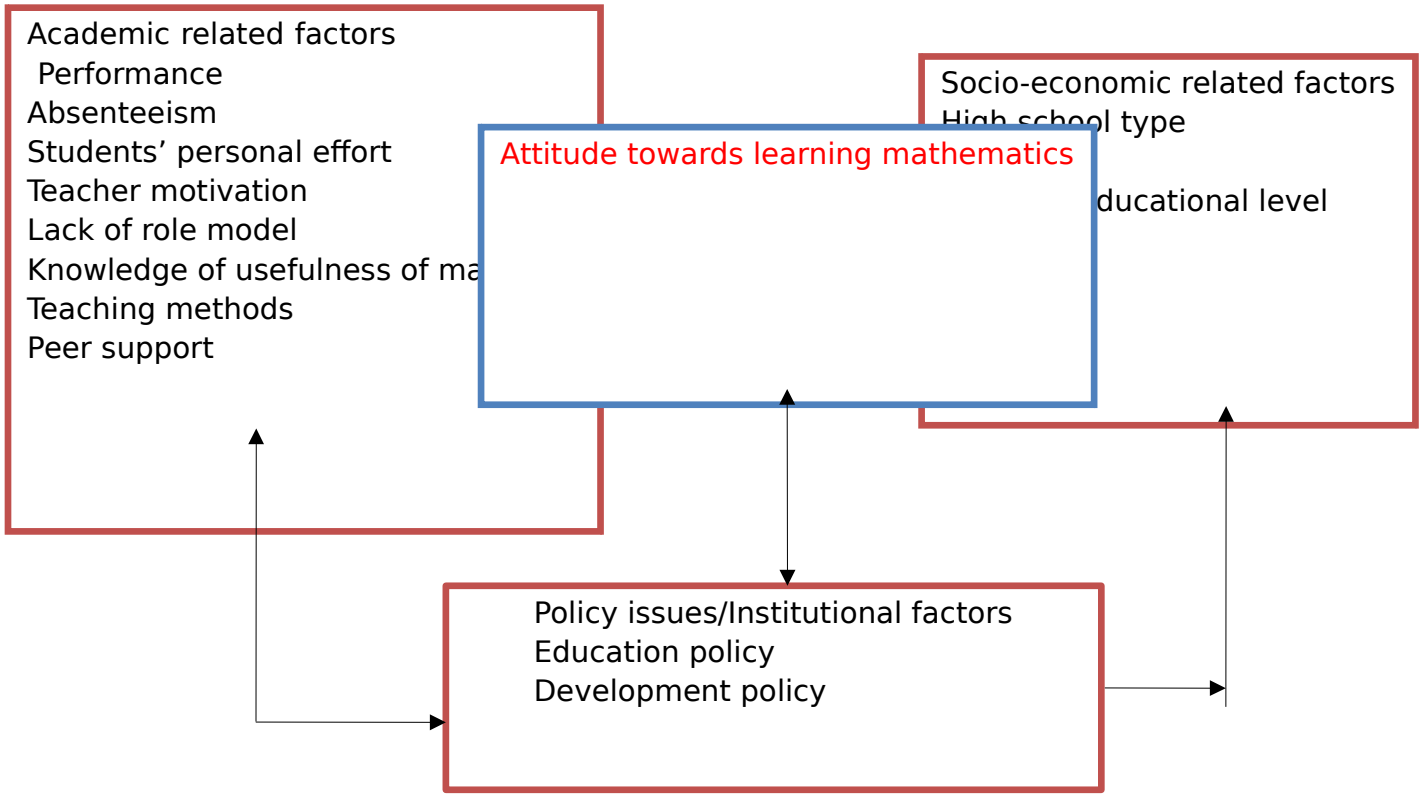

Fig.1: Conceptual framework illustrating socio-economic and academic related factors on attitude towards learning

1.7. Limitation of the Study

- Students' performance was measured by the mark given by class room teacher, which might vary under different circumstances (different teacher, school, class room). Each teacher has his/her own way of testing and marking, therefore it may be true that under different circumstances some students my do better or more poorly. Some high school students' mathematics mark was highly inflated.
- Only high schools in Adama and nearby towns were considered, so that the results could not be generalized to the whole country.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Operational Definitions of Key Terms

Attitude is students' feeling, opinion, perception, standpoint, towards learning mathematics. It is a favorable or unfavorable degree of affect associated with learning mathematics. In this study, students' attitude towards learning mathematics was measured using 10 items which was rated on a Likert scale (Mogey N., 2007). For items supposed to be incorrect (items 202, 204, 205, 207 and 209) a score of 5, 4, 3, 2, and 1 was given to strongly disagree, disagree, neither agree nor disagree, agree and strongly agree responses respectively. For items supposed to be correct (items 201, 203, 206, 208 and 210) a score of 1, 2, 3, 4, and 5 was given to strongly disagree, disagree, neither agree nor disagree, agree and strongly agree responses respectively. Based on this, the total summation of responses to attitude measuring items would yield a maximum of 50 and a minimum of 10 scores.

- A student was considered as having favorable attitude towards learning mathematics if the total sum of his responses to attitude measuring items was above 30.
- A student was considered as having unfavorable attitude towards learning mathematics if the total sum of his responses to attitude measuring items was 30 or less.

High school is school which educates 9^{th} and 10^{th} grade students according to Ethiopian educational system.

Performance: Accomplishment in a particular subject area of a course, usually by reasons of skill, hard work or interest and attitudes.

Learning: Gain skill. Relatively, persistent change in an individual's potential behavior due to experience. The experience a student gets when he/she is exposed to mathematics activity or any other activity aimed at causing a change in an individual's behavior.

Mathematics confidence: a student's perception of their ability to attain good results and their assurance that they can handle difficulties in mathematics.

2.2. Attitudes towards Learning Mathematics

Mobilizing a set of different definitions concerning attitudes presented since 1935. Eshun (2005) defines an attitude towards mathematics as "a disposition towards an aspect of Mathematics that has been acquired by an individual through his or her beliefs and experiences but which could be changed." When emphasizing the importance of individual experiences, the contexts where students interact with others and with mathematics become important focal points.

Oppenheim (1966) defines attitude as a state of readiness, a tendency to act or react in a certain manner when confronted with certain stimuli. More specifically to learning, Wasiche (2006) defines attitude as a feeling towards something or somebody which is sometimes reflected in a person's behavior. Attitudes formed by an individual mostly depends on his/her experience in the learning environment. Attitudes are further enhanced by interpersonal interaction. Heider (1946) and Njue (2005) explain that attitude is either positive or negative depending on whether a person likes or dislikes something or someone.

Attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Eagly and Chaiken, 1993). It is a predisposition or a tendency to respond positively or negatively towards a certain idea, object, person, or situation or an attitude object. Attitude influences an individual's choice of action, and responses to challenges, incentives, and rewards (Business Dictionary). Arul (1995) quotes all port's definition of attitude as a mental and neural state of readiness organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related.

Implicit in the various definitions is that attitude is a psychological orientation developed as a result of one's experiences, which influences how a person views situations, objects or people, and how he/she appropriately responds to them. The response may be positive or negative; favorable or unfavorable; neutral or ambivalent.

Measuring attitude

Attitudes are descriptions of how people typically feel about or react to other people, places, things or ideas. When looking at attitudes, they are usually referred to as positive or negative, since these terms do not necessarily imply value judgements about the attitude itself, as good/bad or appropriate/inappropriate might (Kubiszyn and Borich, 1996).

The Fennema-Sherman Mathematics Attitudes Scales are among the instruments used for measuring students' attitudes toward mathematics. The nine domain-specific Fennema-Sherman attitude scales are

1) **Confidence in Learning Mathematics Scale (C)**: This scale is "intended to measure confidence in one's ability to learn and to perform well on mathematical tasks. The dimension ranges from distinct lack of confidence to definite confidence. The scale is not intended to measure anxiety and/or mental confusion, interest, enjoyment or zest in problem solving."
2) **Attitude Towards Success in Mathematics Scale (AS):** This scale is "designed to measure the degree to which students anticipate positive or negative consequences as a result of success in mathematics. They evidence this fear by anticipating negative consequences of success as well as by lack of acceptance or responsibility for the success, e.g., 'It was just luck.'
3) **Teacher Scale (T):** This scale is "designed to measure students' perceptions of their teachers' attitudes toward them as learners of mathematics. It includes the teachers' interest, encouragement and confidence in the student's ability."
4) **Mathematics as a Male Domain Scale (MD):** This scale is "intended to measure the degree to which students see mathematics as a male, neutral, or female domain in the following ways: a) the relative ability of the sexes to perform in mathematics; b) the masculinity/femininity of those who achieve well in mathematics; and c) the appropriateness of this line of study for the two sexes."
5) **Usefulness of Mathematics Scale (U):** This scale is "designed to measure students' beliefs about the usefulness of mathematics currently and in relationship to their future education, vocation, or other activities."
6) **Mathematics Anxiety Scale (A):** This scale is "intended to measure feelings of anxiety, dread, nervousness and associated bodily symptoms related to doing mathematics. The dimension ranges from feeling at ease to those of distinct anxiety. The scale is not intended to measure confidence in or enjoyment of mathematics."

7) **Effectance Motivation in Mathematics Scale (E):** This scale is "intended to measure effectance as applied to mathematics. The dimension ranges from lack of involvement in mathematics to active involvement and seeking of challenge. The scale is not intended to measure interest or enjoyment of mathematics."
8) **Mother Scale (M):** This scale is "designed to measure students' perception of their mother's interest, encouragement, and confidence in the student's ability. It also includes the student's perception of their mother's example as an individual interested, confident, and aware of the importance of mathematics."
9) **Father Scale (F):** This scale is "designed to measure students' perception of their father's interest, encouragement, and confidence in the student's ability. It also includes the student's perception of their father's example as an individual interested, confident, and aware of the importance of mathematics."(Fennema and Sherman, 1976)

Attitude scales toward learning depends on cultural milieu and age of the learner (Schmidt et al.,1996). So, Fennema and Sherman attitude scales have been modified and used extensively in many studies (e.g., Ellerton, and Konki, 2001; Tapia and Marsh, 2004), Ma and Kishor (1997), Sriraman (2008), and Wong (2012)).

2.3. Gender and Attitude towards Mathematics

There are noticeable differences in the beliefs held by boys and girls. Research has consistently shown that girls have lower math self-concept than boys (Skaalvik, 2004). Results concerning gender differences in attitudes are less consistent than those in self-concept. Some studies have reported significant differences when we compare girls and boys attitudes towards mathematics (Eshun, Asante,2012, Kishur,1997), A meta-analysis conducted by Etsey and Snetzler(1998) concluded that gender differences in student attitudes towards mathematics do exist but are small. The results indicate that males show more positive attitude. However in elementary school studies the effect size was about 0.20 in favor of females and for grades 9 to 12 the effect size was similar, 0.23, but in favor of males. Also Hyde et al. (1990) in their meta-analysis confirm small gender effects, which increase among older students (high school and college), with females holding more negative attitudes. Although these meta-analyses were developed in the 1990s, there is recent research which confirms these results (Asante, 2012, Sanchez, 2004) and attempts to provide a justification for it. Asante (2012) states that, when

compared with boys, “girls lacked confidence, had debilitating causal attribution patterns, perceived mathematics as a male domain, and were anxious about mathematics” (Asante, 2012).

The research carried out by this author in Ghana, showed that boys had more positive attitudes towards mathematics than girls. According to Asante (2012) school environment, developmental changes in gender identity, and teacher and parent attitudes and beliefs towards mathematics are factors that may contribute to the differences identified between boys and girls in their attitudes towards mathematics.

Nonetheless there are researches which conclude that gender does not affect attitudes towards mathematics (Kogce, 2009, Mohammed, 2011, Philippou, 2003, Georgiou, 2007). The meta-analysis conducted by Ma and Kishor (1997), when studying the effects of gender, concludes that this variable did not have a significant effect on the relationships between attitudes and performance in mathematics because separate analysis by gender demonstrated similar significant effect sizes. Georgiou (2007) showed that there was no difference either in math achievement or in mathematics attitudes between boys and girls. However, high achieving boys and girls, despite both considering mathematics as an attractive subject, differed in the explanations they gave for their performance. Since the ability attributions of boys were higher, they believed that their grades were due to their intelligence more consistently than girls did.

2.4. Performance in Mathematics and Attitude

Twoli (1986) asserts in his work that there is a relationship between achieved grades in earlier examinations at same level and attitudes formed by students towards learning sciences and mathematics. Repeated low academic achievement might lead to negative attitudes towards the subject which in turn may influence how a student will learn the subject in the subsequent years of education.

Ma and Xu (2005) conducted a study to determine the casual ordering between attitude towards mathematics and achievement in mathematics of secondary school students. Their results showed that the achievement demonstrated casual predominance over attitude across the entire secondary school. Mato and De La Torre (2010) in a study with secondary school students also showed that those with better academic performance have more positive attitudes regarding mathematics than those with poorer academic performance.

Georgiou (2007) showed that high achievement could serve to predict a positive attitude towards mathematics, but such an attitude could not predict stronger achievement. However, these authors emphasize the role of teachers and schools in changing attitudes stating that, mathematics achievement could be improved by, for example, better teaching methods, more motivated teachers or better course books, which has as its corollary the improvement of attitudes towards mathematics.

Good achievers develop more positive attitudes than lower achievers as well as when students succeed at a mathematics task, it increases their sense of competence (F. Peixoto and L. S. Almeida, 2010), which promotes more positive attitudes towards mathematics.

2.5. Personal Confidence and Attitude toward Mathematics

Students' confidence is another ingredient for education of mathematics. Having a positive attitude towards mathematics means generally enjoying working with mathematics and having confidence in one's own ability to do it but it does not mean that a student will display this positive attitude towards the whole area of mathematics all the time (Robson, 1996). Ryan et al, 1997, showed that students who perceived themselves as cognitively competent were less likely to avoid seeking help, whereas, students who were unsure of themselves were more likely to feel threatened when asking their peers for help and more likely to avoid seeking help.

2.6. Teacher's Motivation and Students Attitude toward Mathematics

Cockcroft (1982) noted aptly that there is no area in knowledge, where a teacher has more influence over the attitudes as well as the understanding of his/her pupils than he/she does in mathematics. During his/her professional life, a teacher of mathematics may influence for good or bad the attitudes towards mathematics of several students and decisively affect many of their career choices. Without a doubt, the teacher maintained a potent force in the classroom. It was found that a teacher's enthusiasm toward the subject matter had a greater impact on student attitude than instructional variables. A teacher who showed excitement toward mathematics, for

example, tended to produce similar enthusiasm in his or her students. Furthermore, a teacher who disliked and feared mathematics also passed on a lasting negative attitude to students (Burton, 1999).

A qualitative research on effect of teachers attitude on students performance by Ferrant (1968), asserted that, *"Today the relationship between teachers and pupils is often up-side down; pupils come because they must and teachers teach because they are paid to. Teachers mourn that their profession is not respected and complain that they are inadequately paid for the duties they are required to do. They look over their shoulders at others professions and conditions of services for a better life'* . This assertion exhibited lack of motivation on the part of both teachers and Students. Lockheed (1991) cited in Etsey (2005), revealed that lack of motivation and professional commitment produce poor attendance and unprofessional attributes towards students which in turn affect the attitude of students towards mathematics (Cockcroft, 1982, Burton, 1999) .

2.7. Peer Supports and Students' Attitude towards Mathematics

Researche by Fraser and Kahle (2007, reached on the conclusion that teacher and peer supports are significant predicators of attitudes towards mathematics. Males are more inclined towards mathematics than females on being the male dominated domain. It is found that at secondary school level most of the girls don't actively participate in mathematics classes due to their poor perceptions about mathematics. The poor perception comes from the fact that girls are negatively influenced by their sex-role stereotypes (Boswell, 1979; Fennema and Sherman, 1977; Sherman, 1882; Leder, 1982 and Ethington, 1992).

2.8. Teaching Methods and Students' Attitude toward Mathematics

Fennema and Sherman (1995) found that students of teachers who were well organized, achievement oriented and enthusiastic tended to have more positive attitude towards mathematics and science. According to Papanastasiou (2008), teaching methods has direct effect on achievements in mathematics and also on the students' attitudes toward mathematics, on class climates, on students' mathematics self-perception, and etc. In other words, if it is delivered properly, the students can have a better learning environment. In addition, students whom are

benefited more from high quality instruction are self regulated, have strong mathematics backgrounds and had low levels of frustration (Jones & Byrnes, 2006). On the other hand, Yilmaz et al. (2010), by using semi structured interview have found that some other factors affecting students' attitudes towards mathematics are usage of different teaching materials, teachers' classroom management skills, teachers' content knowledge and personality, teaching topics with real life enriched examples, and students' opinion about mathematic courses.

Another research finding suggested teachers and students often have very different perceptions of how a mathematics class should be conducted (Diamond, 2001). Teachers often followed a textbook to fill the allotted time for mathematical computation via pencil and paper practice alone. This process tended to leave little opportunity for creative problem solving and mathematical interpretation. The mathematics taught in many schools, therefore, appeared to students as only a creation of teachers and textbook writers as opposed to essential life skills. Unfortunately, students who objected to the format or goal of mathematics class could either argue convincingly for a different approach or simply trust the teacher and wait for results (Diamond, 2001).

CHAPTER THREE

DATA AND METHODOLOGY

3.1. Study Design

A cross-sectional study was conducted between the months of September and June of 2015/16 to assess attitude towards learning mathematics among high schools students in Adama, Bishoftu and Asella towns.

3.2. Source Population

The source population of this study was all high school students in Adama, Bishoftu and Asella towns.

3.3. Sample Size Determination

Sample size calculation was made based on the following assumptions. Proportion of students showing favorable attitude towards learning mathematics was assumed to be 50% because there was no previous study conducted in the study area. The margin of error assumed to be 5% and confidence interval (CI) taken to be 95%. Based on these; the sample size was calculated using the formula:

$$n=\frac{(Z_{\alpha/2})2\,p(1-p)}{d^2}$$

Where: n = sample size, $Z_{\alpha/2}$ ¿ critical value = 1.96 for 95% CI

p = proportion of students having favorable attitude = 50%

d = precision (marginal error) = 0.05

Hence, $n=\frac{(1.96)2(0.5)(1-0.5)}{(0.05)^2}$ = 385 (which was the minimum sample size)

Since the sampling technique used was systematic multi-stage sampling, the sample size was modified to account for the design effect (Deff). This was in order to account for the loss of effectiveness in variation for not using simple random sampling. The design effect is the ratio of actual variance, under the sampling method actually used, to the variance computed under the assumption of simple random sampling. Deff = 2.4 (Deff is usually between 1 and 3) (Ariawan,

2005). n (adjusted) = n (minimum)*Deff. So, n = 385*2.5 = 963. The sample size was further increased by 2% for non response errors. Hence, actual sample size n = 963 +963*0.02 = 982

3.4. Data Collection Instruments

To collect information about students' socio-economic and academic background factors that might influence the students' attitude towards learning mathematics, structured questionnaire was employed. To collect information regarding students' attitude towards learning mathematics, the instrument used was a modified Fennema-Sherman mathematics attitudes scales. These modified Fennema-Sherman mathematics attitudes scales were classified into five domain-specific scales such as 1) confidence in learning mathematics scale (C), 2) attitude towards success in mathematics scale (AS), 3)usefulness of mathematics scale (U), 4)mathematics anxiety scale (A) and 5) effectance motivation in mathematics scale (E). Under each domain there were 2 questions of Likert scales so that the students gave their response to the total 10 questions from strongly agreed to strongly disagreed (see appendix i).

3.5. Data Collection Procedure

A stratified three-stage random sampling technique was used to conduct this study where strata-one consisted government schools and strata-two consisted private schools. Firstly, Adama, Bishoftu and Asella towns were selected. Secondly, 3 from 6 government high schools in Adama, 1 from each 2 government high schools in Bushoftu, and 2 government high schools Asela towns were randomly selected. With similar fashion, 4 from 9 private high schools in Adama, 1 from 3 private high schools in Bushoftu and 1 from 2 private high schools in Asella towns were randomly selected. Finally, 2 sections from each high school, a total of 22 sections were randomly selected. From government high schools, 10x49=490 students and from private, 12x41=492 students so that a total of n=982 students were selected.

3.6. Data Quality Management

The quality of the data was ensured through properly recruited and trained data collectors as well as through pre-test (pilot survey) of questionnaires. Data collectors was closely supervised and feedbacks on corrections were made frequently, each filled out or completed questionnaires were checked daily and information was exchanged with the data collectors and mistakes was corrected at every time of data collection. After the completion of data collection, the filled questionnaires were taken from the enumerators for further checking. The data were entered in to a computer and checked for consistency and completeness. The data clearing was done regarding missing and mismatching data through running simple frequency distribution, cross tabulation, sorting and other appropriate techniques by using SPSS software version 20.0.

3.7. Method of Data Analysis

In this study the collected data were analyzed quantitatively by using SPSS 20.0.0/the statistical package for social science/ at two levels: bivariate and multivariate. The analytical tools employed in this study were logistic regression model and a chi-square test. A logistic regression model was used to measure the relationship between a binary response dependent variable attitude and one or more explanatory variable(s). The chi-square test was also used to test the association between students' attitude towards learning mathematics and these explanatory variables.

In the bivariate analysis, cross tabulations were performed for analysis of a dependent variable and independent variables. The Pearson chi-square was used as a measure of association at 5% confidence level. Bivariate analysis was carried out to establish any statistical significance of the relationship between the dependent and independent variables. The Pearson chi-square was used to show the level of association by a p-value fixed at 0.05.

The multivariate analysis was performed to assess the factors that were associated with students' attitude towards learning mathematics. A multivariate analysis was employed to assess the net effect of each determinant factor by controlling for all other factors for the binary dependent variable. The degree of association between the dependent variable and the independent variables

was tested by using logistic regression model. The general model of the logistic regression equation used in the analysis was of the form:

$$\ln\left[\frac{p}{1-p}\right]=\beta_0+\beta_1 X_1+\beta_2 X_2+\ldots+\beta_k X_k$$

where x_i's were set of independent variables: gender/sex, high school type, performance, absenteeism, parents/guardians educational level, knowledge of usefulness of mathematics, student's personal confidence, teacher's motivation, educational value held by the family/community, presence of the role models, type of teaching methods and peers support.

β_0 was a constant while β_i's were regression coefficients. P was the probability of having a favorable attitude while $(1-p)$ was the probability of having unfavorable attitude towards learning mathematics.

ln[p (event) ¿$1-p$ (event)] = the odds or the chance of having a favorable attitude towards learning mathematics in the logistic regression. β_i was the factor by which the odds change when the i^{th} independent variable increased by 1 unit. If β_i was positive, then Exp(β_i) would be greater than 1 which implies the odds were increasing. If β_i was negative, then Exp(β_i) would be less than 1 by indicating that the odds were decreasing. When β_i was zero, then Exp(β_i) equal to 1 by indicating that the odds would be the same within the categories of the i^{th} independent variable (Nicola et al., 2006).

In logistic regression, Exp(β) was the estimated multiplicative change in the odds for a unit increase in the predictor, controlling for the effect of others. The value of the relative odd ratio can be further expressed as a percentage change of the odds [Exp(β)-1*100]. Logistic regression was particularly relevant here because of the dichotomous nature of the response to the dependent variable which was showing a favorable or unfavorable attitude towards learning mathematics. The value label of the variable was '1' if a sampled student has a favorable attitude and '0' otherwise.

CHAPTER FOUR

RESULTS

This chapter describes the attitude of high school students towards learning Mathematics in Adama, Asella and Bishoftu and some socio-economic factors as well as student and teacher related characteristics that influence the attitude of these students by using frequency distributions and graphs. Furthermore, both the bivariate and multivariate results were presented by considering objectives of the study.

4.1. Attitude of Students towards Learning Mathematics

The students selected for the study were asked about their opinions towards learning mathematics by using a modified Fennema-Sherman mathematics attitude scale which contains 10 items. The responses were put under five categories of a five-point Likert-scale which included strongly agree (SA), agree (A), undecided (U), disagree (D) and strongly disagree (SD) as presented in table 1. This helped in detecting the kind of attitudes they had formed towards the subject.

According to the results presented in table 1 below, 49.4% of students indicated that they agree and 27.5% of them strongly agree to the item mathematics makes me uncomfortable. It is also therefore not surprising that 48.1% of students responded agree and 25.3% of them strongly

agree that mathematics has been their worst subject. Majority (46.8%) of the students responded disagree to the item I think I can handle more difficult problems in mathematics while only 7.6% responded agree to the item. Moreover, 44.6% of the respondents also indicated that they disagree to the item mathematics was enjoyable and stimulating to me. Majority of respondents (45.6%) see that they will need mathematics for their future work and 40.8% of them responded disagree to the item I study mathematics only to pass the examination.

The analysis of the responses of the sample students to these 10 items of 5 points Likert-scale type also indicated that 59% of the respondent students had unfavorable attitude towards learning mathematics while the rest 41% of them had a favorable attitude towards learning the subject.

Table 1: Distribution (%) of student's responses to attitude measuring items towards learning Mathematics ($n=982$)

Responses (%)					
Opinions/feelings of students	Strongly agree (SA)	Agree (A)	Undecided (U)	Disagree (A)	Strongly disagree (SD)
Mathematics is enjoyable and stimulating to me	7.2	13.8	10.3	44.6	24.1
The challenge of mathematics problems does not appeal to me	25.2	38.3	11.4	16.7	8.4
I think I can handle more difficult problems in math	4.4	7.6	12.3	46.8	28.9
Mathematics has been my worst subject	25.3	48.1	9.1	12.1	5.4
Mathematics makes me uncomfortable	27.5	49.4	5.2	11.7	6.2
I usually have been at ease during mathematics tests	3.6	7.2	14.7	48.6	25.9
People would think I was some kind of a grind if I get good results in math	18.7	10.5	43.1	17.3	10.4
It would make me happy to be recognized as an excellent student in math	10.2	11.5	36.4	23.5	18.4
I study mathematics only to pass the examination	13.8	23.7	13.9	26.3	22.3

I will need mathematics for my future work	9.9	30.6	37.7	13.2	8.6

4.2. Results of the Bivariate Analysis

Cross tabulations were performed in order to test the association or relationship between the dependent variable (attitude) and independent variables. In this study the independent variables include gender, high school type, performance, absenteeism, parents/guardians educational level, knowledge of usefulness of Mathematics, student's personal confidence, teacher's motivation, and educational value held by the family/community, type of teaching methods and peers support.

The Pearson Chi-square statistic was used as a measure of association at 5% level of significance. The higher value of Pearson Chi-square at small value of p ($p < 0.05$) shows the presence of casual association between the dependent and its predictors. The results were given in table 2.

Variables	Attitude towards learning mathematics		df	$\chi 2$	P
Gender	Favorable attitude (%)	Unfavorable attitude (%)	1	102.35	
Males	60.3	39.7			
Females	22.5	77.5			
Type of high school	Favorable attitude (%)	Unfavorable attitude (%)	4	220.58	
Government	40.0	60.0			
Private	42.1	57.9			
Parent/guardian education	Favorable attitude (%)	Unfavorable attitude (%)	3	115.79	
Illiterate	34.9	65.1			
Primary	36.0	64.0			
Secondary	47.1	52.9			
Diploma and above	55.0	45			
Performance	Favorable attitude (%)	Unfavorable attitude (%)	1	109.43	
High	79.6	20.4			
Moderate	26.7	73.3			
Low	18.6	81.4			
Absenteeism	Favorable attitude (%)	Unfavorable attitude (%)	1	196.5	

Almost non-absent	46.8	53.2			
Absent sometimes	33.8	66.2			
Knowledge of usefulness of Math	Favorable attitude (%)	Unfavorable attitude (%)	1	137.16	
Yes	46.1	53.9			
No	27.0	73.0			
Student's personal effort	Favorable attitude (%)	Unfavorable attitude (%)	1	184.62	
Very much	61.5	38.5			
Moderate	34.3	65.7			
Very little	19.0	81.0			
Teacher's motivation	Favorable attitude (%)	Unfavorable attitude (%)	2	220.05	
Very much	71.4	28.6			
Moderately	30.5	69.5			
Very little	26.7	73.3			
Educational value held by the family	Favorable attitude (%)	Unfavorable attitude (%)	4	10.57	
High	43.6	56.4			
Moderate	41.8	58.2			
Low	38.0	62.0			
Teaching methods	Favorable attitude (%)	Unfavorable attitude (%)	2	294.12	
Lecture	31.1	68.9			
Small group discussion	46.4	53.6			
Questioning and answering	44.0	56.0			
Teacher assisting individual students	47.7	52.3			
Plasma	30.0	70.0			
Peer support	Favorable attitude (%)	Unfavorable attitude (%)	1	112.5	
Yes	46.5	53.5			
No	30.7	69.3			

Table 2: Relationship between attitude towards learning Mathematics and the independent variables (%)

Gender/sex and attitude of students towards learning Mathematics

As it was shown in the Chi-square statistic in table 2, there was a significant association between sex of the students and their attitude towards learning mathematics at Pearson $\chi 2 = 102.35$ and $p = 0.000$. The proportion of male who had shown a favorable attitude towards learning mathematics (60.3%) was much higher than that of their female counter parts (22.5%) as shown in fig.2.

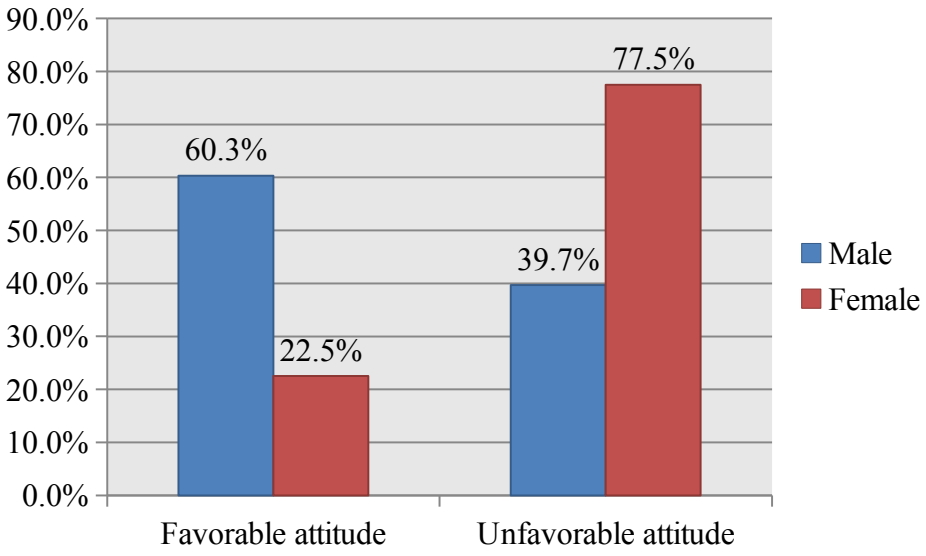

Fig.2: Distribution (%) of students' attitude by gender

Type of high school and attitude of students towards learning Mathematics

For the purpose of this study the researchers grouped the high schools under study into two as government and private school. But according to the results of the chi-square statistic of this study, there was no significant association between high school type and student's attitude towards learning mathematics ($\chi 2 = 220.58,\ p=0.482$) as presented in table 2. The proportion of students from government high schools who had shown positive attitude toward learning mathematics (40%) and that from private high schools (42.1%) which is not statistically significant at 5% confidence interval.

Parents'/guardians' education and attitude of students towards learning Mathematics

The Chi-square statistic of this study had shown that, parents'/guardians' educational level had strong association with their children's attitude towards learning mathematics with $\chi 2 = 115.79$ and $p = 0.000$. The survey result depicted that the proportion of favorable attitude towards

learning mathematics was high among those students whose parents/guardians attained diploma and above level of education (55.0%) and low among the students from illiterate families (34.9%). According to this finding, the proportion of favorable attitude towards learning mathematics among the students whose parents completed primary level of education was (36.0%) and that of students from families with secondary level of education was (47.1%) as it indicated in fig.3.

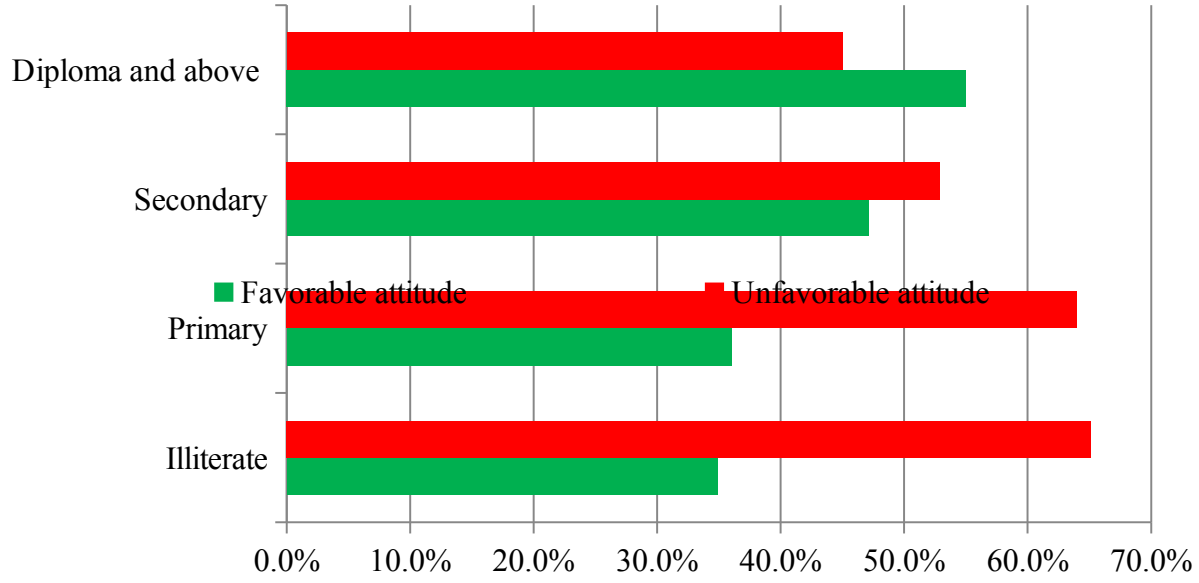

Fig.3: Distribution (%) of student attitude by parents'/guardians' educational level

Performance and attitude of students towards learning Mathematics

For the purpose of this study the researchers tried to measure performance of students in terms of their first semester mathematics exam score. Thus, students with scores of higher than 8 ^{5} %, $(65-85)$ % and below ^{65} % were categorized as high, moderate and low performance, respectively. There was also a strong statistically significant association between performance in mathematics and their attitude towards learning mathematics according to the result in table 2 above with Pearson $\chi 2 = 109.43$ and $p = 0.000$. According to the finding of this survey, $^{79.6}$ % of the students who had high performance, $^{26.7}$ % of them with moderate performance and

only 18.6 of them having low performance were showing a favorable attitude towards learning mathematics.

Absent from school and attitude of students towards learning Mathematics

According to the results of cross tabulation in table 2 above, there was a strong association between students' attitude towards learning mathematics and their class attendance/absenteeism with Pearson $\chi 2$ = 196.50 and $p=0.000$. Thus, 46.8 % of the students who were almost non-absent from school have shown a favorable attitude towards learning mathematics while 33.8 % of students categorized themselves who were sometimes absent from school had shown a favorable attitude towards learning mathematics.

Knowledge of usefulness of Mathematics and attitude of students towards learning Mathematics

The Chi-square statistic in table 2 above indicated that, students' knowledge of the usefulness of mathematics has strong association with their attitude towards learning mathematics with $\chi 2$ ¿137.16 and $p=0.000$. The survey result revealed that the proportion of students' who had some knowledge of the usefulness of mathematics was (46.1%) to have a positive attitude towards learning mathematics, whereas it was only 27.0 for students who had no any knowledge about the usefulness of mathematics to have such attitude.

Student personal effort and attitude of students towards learning Mathematics

According to the results of this study as presented in table 2 above, there was statistically significant association between student's personal effort in doing mathematical activities and student's attitude towards learning mathematics ($\chi 2$ = 184.62 and $p = 0.000$). Thus, among those students who have made very much effort in doing mathematical activities 61.5 % of them had shown a favorable attitude towards learning mathematics while 34.3 % and only

19.0 among those students who had made a moderate effort and a very little effort, respectively have shown a favorable attitude towards learning mathematics.

Teacher motivation and attitude of students towards learning Mathematics

Teacher motivation has shown a significant influence on student's attitude towards learning mathematics according to the results in table 2 above with Pearson $\chi 2 = 220.05$ and $p=0.004$. Accordingly, students' whose mathematics teacher's had high motivation during teaching in the class room as well as encouraging and assisting them out of the class room was the highest proportion (71.4) in showing a favorable attitude towards learning mathematics. 30.5 of students who perceived their teacher as moderately motivated have shown favorable attitude towards learning mathematics where as only 26.7 of students whose teacher's motivation was very little had positive attitude towards learning mathematics.

Educational value held by the family/community and attitude of students towards learning Mathematics

According to the results in the chi-square statistic of this study, there was no significant association between educational value held by the family/community and their student's attitude towards learning mathematics ($\chi 2 = 10.57$, $p=0.087$) as presented in table 2 above.

Teaching methods and attitude of students towards learning Mathematics

For the purpose of this study the researchers considered only some teaching methods such as lecture, small group discussion, questioning and answering, teacher assisting individual students and Plasma. According to the findings in table 2 above, there was statistically significant association between teaching method and student's attitude towards learning mathematics ($\chi 2 =$ 294.12 and $p = 0.000$). Thus, the highest proportion (47.7) of students with a favorable

attitude towards learning mathematics was among those who preferred to learn mathematics in the class room by teacher assisting individual support while the least proportion (30.0) of students among those who preferred to learn the subject by using plasma, and 31.1% of students among those fevered the lecture methods had shown favorable attitude towards learning mathematics. 46.4 and 44.0 of the students with a favorable attitude towards learning mathematics was those who preferred to learn mathematics in the class room by small group discussion and questioning and answering, respectively.

Peer support and attitude of students towards learning Mathematics

According to the results of this study as presented in table 2 above, there was statistically significant association between students attitude towards learning mathematics and the educational support that they got from their peer friends ($\chi 2 = 112.5$ and $p = 0.000$). Thus, 46.5 of students who were doing a lot of mathematics exercises together with their peer friends or studying mathematics together had shown a favorable attitude towards learning mathematics while it was only 30.7 among students who was doing mathematics exercises alone or studying mathematics alone to have a positive attitude towards learning mathematics.

4.3. Results of the Logistic Regression Model

In this sub-section results of testing multicollinearty effect and model goodness of fit were presented. Moreover, results of the logistic regression model were also presented.

Testing Multicollinearity Effect and Model Goodness of Fit

Multicollinearity is an interaction of explanatory/independent variables with each other. There are different ways of testing the interaction between independent variables. But in this study, coefficient of contingency table was used where the values of the coefficients should be somewhere between +1 and -1. If the independent variables are completely associated with each other it is called perfect positive association and the corresponding coefficient will be +1. If the

variables are completely disassociated to each other it is called perfect negative association and the value for the coefficient will be -1. If the variables are completely independent of each other, their coefficient of association will be 0. In this study, multicollinearty test showed weak association between the explanatory variables with a maximum value of 0.198, so that the Multicollinearity was not the problem of this study as it was presented in appendix ii.

Regarding goodness of fit of the model, there are also various methods to assess the extent to which the model robustly fits the data. One method is Hosmer and Lemeshow Test. It indicates the goodness of fit of the model and tests the hypothesis that there is no difference between observed and model predicted values. If the test is greater than 0.05 we accept the null hypothesis and conclude that the model well fits the data (Hosmer and Lemeshow, 2000). In this study the test was 0.799. Therefore, the model has fitted the data well (see appendix iii).
In order to assess the relationship between student attitude towards learning Mathematics and the predictor variables: sex, type of high school, performance, parent/guardian educational level, absenteeism, knowledge of usefulness of mathematics, students personal confidence, teacher motivation, educational value held by the family/community, presence of role models, teaching methods and peer support, a logistic regression model was fitted.

During the analysis, the data were coded and a reference category was defined for each variable. Results are shown in table 3 below. The values reported in table 3 were the logistic regression coefficients (β) and the associated relative odds, Exp(β), of attitude towards learning mathematics. Similarly, as indicated under the methodology section, Exp(β) represents the relative odds of attitude towards learning mathematics with each covariate relative to the odds for the reference category. The relative odds for the reference category is unity [Exp(0) = 1], hence, the Exp(β) = 1 for any of the other categories indicates that the variable category in question has the same effect as the reference category on attitude towards learning mathematics. A value of Exp(β) higher than unity indicates greater odds of attitude than the reference category, while values less than unity indicate a lower relative odds of attitude.

Table 3: Parameters of logistic regression model on attitude towards learning Mathematics and the predictor variables

Variables	Regression coefficients (β)	S.E.	P-value
Sex(reference = Male)			
Female	-1 .13	0.57	0.012*
Type of high school(reference = Government)			
Private	0.623	0.715	0.224
Parent education(reference = Primary)			
Illiterate	-2.481	0.823	0.056
Secondary	0.394	0.654	0.000**
Diploma and above	0.511	0.587	0.001*
Performance(reference = Moderately)			
High	1.992	0.468	0.000**
Low	-1.176	0.47	0.000**
Absenteeism(reference = Almost non-absent)			
Sometimes absent	-2.150	0.446	0.000**
Knowledge of usefulness of Math(reference = No)			
Yes	0.725	0.728	0.001
Student effort(reference = Moderately)			
Very much	1.229	0.635	0.010*
Very little	-1.130	0.703	0.022*
Teacher motivation (reference = Moderately)			
Very much	1.196	0.754	0.000**
Very little	-1.023	0.687	0.000**
Educational value held by family/community(reference = Moderate)			
High	-1.012	0.512	0.147
Low	-1.356	0.398	0.221
Presence of role models(reference = Yes)			
No	-1.345	0.575	0.000
Teaching methods(reference = Small group discussion)			
Lecture	-0.507	0.657	0.000
Teacher assisting individual student	0.017	0.549	0.060
Questioning and answering	-1.587	0.741	0.001
Plasma	-0.294	0.524	0.000
Peer support(reference = Yes)			
No	-0.753	0.624	0.000**
-2Likelihood	**4.654**		
Model χ^2			
Number of cases			

Note: Statistically significant at: * P < 0.05; **P < 0.01; ***P < 0.001

Gender/sex and attitude of students towards learning Mathematics

According to the result of the multivariate analysis as indicated in table 3 above, sex of the students was associated with the odds of having a favorable attitude towards learning mathematics. Hence, the odds/probability of showing a favorable attitude towards learning mathematics for female students were $67.7\,[(1-0.323)*100]$ lower than their male counter parts (the reference category) at p -value $¿0.05$ ($p=0.012$).

Type of schools and attitude of students towards learning Mathematics

According to the result of this study as presented in table 3 above, type of high school did not significantly influence student's attitude towards learning mathematics which has confirmed the results in the Chi-square statistic.

Parents'/guardians' education and attitude of students towards learning Mathematics

For the purpose of this study, the researchers categorized parents'/guardians' educational level into four categories. Those parents'/guardians' who have no any formal education as illiterate, those who completed grades 1-8 as primary, those who completed grades 9-12 as secondary and those who earned diploma, Bachelor degree, Masters degree etc. as diploma and above. According to the results of the multivariate analysis, parents'/guardians' educational level had shown an effect on student's attitude towards learning mathematics as it was presented in table 3. The probability of having a favorable attitude towards learning mathematics was 1.667 times higher ($p=0.000¿$ for students from families/guardians with diploma and above level of education as compared to those students from families/guardians of primary level of education (reference category). Moreover, the probability of having a favorable attitude towards learning mathematics for the students from families/guardians who completed secondary level of education was also 1.483 times higher than that of students from families/guardians with primary level of education (reference category). However, the probability of having a favorable attitude towards learning mathematics for students from illiterate families/guardians was 8.4

lower than that of students from families/guardians with primary level of education (reference category) even though the difference was not statistically significant ($p=0.056$¿.

Performance and attitude of students towards learning Mathematics

As it was presented in table 3 above, students' mathematics performance has shown an influence on their attitude towards learning mathematics. The result of the multivariate analysis revealed that the probability of showing a favorable attitude towards learning mathematics for high performing students was 2.98 times higher than that of students with moderate performance (reference category). But the probability of showing a favorable attitude towards learning mathematics for low performing students was 30.9 lower than that of the reference category.

Absent from school and attitude of students towards learning Mathematics

As presented in table 3 above, student's absenteeism from school has an influence on student's attitude towards learning mathematics. Thus, the chance of having a favorable attitude towards learning mathematics for almost non-absent students was 11.6% lower than that of students who were sometimes absent from school.

Knowledge of usefulness of Mathematics and attitude of students towards learning Mathematics

According to the result of the multivariate analysis of this study as presented in table 3 above, knowledge of usefulness of mathematics has shown an effect on student's attitude towards learning mathematics. Thus, for students having some usefulness of mathematics, the chance of having a favorable attitude towards learning mathematics was 2.065 times higher that of students who had no knowledge about the usefulness of mathematics.

Students personal effort and attitude towards learning Mathematics

As it was presented in table 3 above, students' personal effort has shown an influence on their attitude towards learning mathematics. The result of the multivariate analysis indicated that the probability of showing a favorable attitude towards learning mathematics for students who made

a very much effort in doing and studying mathematics was 3 .418 times higher than that of students who made a moderate effort (reference category). But the probability of showing a favorable attitude towards learning mathematics for students who made a very little effort was 32.3 lower than that of the reference category.

Teachers motivation and attitude of students towards learning Mathematics

According to the result of the multivariate analysis presented in table 3 above, teacher's motivation has an effect on student's attitude towards learning mathematics. Hence, the probability of showing a favorable attitude towards learning mathematics for students whose teacher made a very much effort in class room teaching as well as assisting students outside the class room was 3 .307 times higher than that of students whose teacher made a moderate effort (reference category). Unfortunately, the probability of showing a favorable attitude towards learning mathematics for students whose teacher made a very little effort was 36. lower than that of the reference category.

Educational value held by the family/community and attitude of students towards learning Mathematics

As it was presented in table 3 above, educational value held by the family/community did not significantly influence student's attitude towards learning mathematics which has confirmed the results in the Chi-square statistic.

Teaching methods and attitude of students towards learning Mathematics

According to the results of the multivariate analysis, teaching method had shown a statistically significant influence on student's attitude towards learning mathematics as it was presented in table 3. The probability of having a favorable attitude towards learning mathematics was 60.23 lower for students who preferred to learn mathematics in the class room by lecture method as compared to those students preferring learning by small group discussion (reference category). Moreover, the probability of having a favorable attitude towards learning mathematics

for the students who preferred learning by questioning & answering and by using plasma was 20.5% and 74.5% respectively lower than that of the reference category. However, the chance of showing a favorable attitude towards learning mathematics for those students preferring to learn by teacher assisting individual student was 1.017 times higher than the reference category but the difference was not statistically significant ($p=0.060¿$.

Peer support and attitude of students towards learning Mathematics

The result of the multivariate analysis of this study as presented in table 3 above revealed that peer support has shown an effect on student's attitude towards learning mathematics. Accordingly, the chance of having a favorable attitude towards learning mathematics for students who had not get an academic support from their peer friends was $^{47.1}$ lower than that of students who had got peer support (reference category).

CHAPTER FIVE

DISCUSSIONS OF THE FINDINGS

The study was aimed to assess the level of attitude towards learning mathematics among high school students in Adama, Bishoftu and Asella towns as well as to identify some socio-economic factors influencing their attitude.

5.1. Student's Attitude towards Mathematics and its Related Challenges

The major feelings/opinions towards learning mathematics in the study area were a general feeling of extreme anxiety and fear. This was evident that 49.4 of students responded agreed to the item mathematics makes me uncomfortable and 48.6 of them responded disagreed to the item I usually have been at ease during mathematics tests. This in turn prompted lack of confidence among the students as confirmed by approximately (48) of students responded agreed to the item mathematics has been my worst subject and about 47% of them responded disagreed to the item I think I can handle more difficult problems in mathematics.

It was noted that a large proportion (44.6%) of the student respondents still do not believed that mathematics is enjoyable and stimulating to them and 33.8% of them believe that the challenge of mathematics problems does not appeal to them. However, majority of student respondents believe that mathematics was a useful subject in life as (45.6%) of them agreed that they will need mathematics for their future work and 40.8% of them disagreed that they study mathematics only to pass the examination. Consequently, majority of the students were

enthusiastic to have excellent score in mathematics subject because 41.5% of the students responded agreed to the item it would make me happy to be recognized as an excellent student in mathematics.

5.2. Factors Influencing Student's Attitude towards Learning Mathematics

Gender/sex: ***female students had shown unfavorable attitude towards learning mathematics***

The chi-square test and the logistic regression results had shown that the gender/sex of an individual student was strongly associated with their attitude towards learning mathematics. Hence, the probability of having a favorable attitude towards learning mathematics for female students was lower than that of male students. This might be due to our socio-cultural customs; most of the girls at high school age living with their parents were expected to carry out additional activities to support their family. This shares their study time and makes them unscheduled. This erratum forces the girls study mathematics only to pass the exam and dependent on boys in mathematical activities. As a result girls are less confident, are more anxiety, and are negatively influenced by their sex-stereotype, supporting the results in the literature (Eshun, Sanchez, 2004, Asante, 2012, Kishur, 1997), which leads girls to develop unfavorable attitude towards learning and studying of mathematics than their boys counter parts.

Type of high school completed: ***The type of high school in which students were learning did not influence their attitude towards learning mathematics***

Even though, the attitude of students toward learning mathematics was not significantly different between students from government as well as private high schools, private high schools had shown more positive attitude than government high schools. This difference might be due to the number of students per section, which might influence the learning environment.

Performance: ***The better the performance of student in mathematics the better their attitude towards learning mathematics.***

The chi-square test and the logistic regression results had shown that student's academic performance in mathematics was strongly associated with their attitude towards learning mathematics. The result of the multivariate analysis revealed that the probability of showing a favorable attitude towards learning mathematics for high performing students was $^{2.98}$ times higher than that of students with moderate performance. But the probability of showing a favorable attitude towards learning mathematics for low performing students was $^{30.9}$ lower than that of moderate performance category. The differences in the pattern of good and low achievers seems to support the hypothesis of differences in the way the challenges set by math learning are experienced by students belonging to different achievement groups (Maria.et.al. 2012). For good achievers mathematical tasks are likely faced as real challenges which could increase intrinsic motivation, raising the sense of competence when the tasks are solved, and leading to the development of positive attitudes towards math. Conversely, for low achievers math tasks are likely experienced as unsurpassable obstacles that will be won infrequently, producing low self-belief in competence and negative attitudes towards mathematics. Perhaps, the negative attitudes developed due to low academic performance are relatively permanent.

Absenteeism: ***Students attending their class regularly had a favorable attitude towards learning mathematics***

It was expected that the relationship between attitude and student class attendance is positive because regularity shows the effort and seriousness of student about his or her education. This relation is proved in our analysis since the probability of showing a favorable attitude towards learning mathematics for students who were almost non-absent was lower than those students who were sometimes absent from school. This reflects that regularity in school, did contribute in high school student's attitude towards learning mathematics.

Parent/guardian education: ***Students from families closest to the academic culture had a favorable attitude towards learning mathematics***

College diploma and University degree of parents /guardians had guaranteed for a favorable attitude of their children towards learning mathematics in high school under the study area. Thus,

the chance of having a favorable attitude towards learning mathematics for students whose parents /guardians completed primary level of education was lower than that of students whose parents /guardians completed secondary level of education as well as diploma and above level of education. But for students from illiterate parents /guardians, the probability was lower than that of students from parents /guardians with primary level of education. This might be obviously due to the fact that educated parents/guardians provide their children both the necessary information and materials that support their education while bringing up them. These parents also provide higher levels of psychological support for their children through environments that encourage the development of skills necessary for academic success since the higher the educational attainment for parents, the greater their aspirations for children. In this case such students might get enough information about the usefulness of mathematics in their future education and are relatively confident in performing mathematical activities.

Knowledge of usefulness of Mathematics: ***Students' knowledge about usefulness of mathematics influences their attitude towards mathematics positively***

Our research result confirmed that awareness about the usefulness of mathematics has a potential in influencing students attitude towards learning mathematics. For students having some knowledge about the usefulness of mathematics, the chance of having a favorable attitude towards learning mathematics was 2.065 times higher that of students who had no knowledge about the usefulness of mathematics.

Only a limited number of teachers demonstrated usefulness of mathematics by telling the students about the importance of the subject or even tell the students the importance of mathematics especially in relation to other subjects and day to day life, meaning that students learnt the lesson as routine to pass examinations.

The importance of mathematics is for students to regard mathematics as a subject not only crucial to pass the examination but a practical tool for day to day use. The data on whether students will aware of the usefulness of mathematics a lot in life, to some extent, indicate that some students cannot see the functional aspect of mathematics in their later life despite students viewing mathematics as a subject being abstract and not applicable to real-life situation.

Student's personal confidence: ***Student's confidence in doing, studying and learning mathematics enhances their attitude towards it***

Our research result confirmed that there was a positive correlation between student's personal confidence in doing mathematical activities and his/her attitude towards learning and studying of mathematics. Thus, students who made a very much effort in doing and studying mathematics were $3^{.418}$ times higher than that of students who made a moderate effort, but the probability of showing a favorable attitude towards learning mathematics for students who made a very little effort was 32.3 lower than that of students who made moderate effort. This might be the consequence of students who perceived themselves as cognitively competent were less likely to avoid seeking help, whereas, students who were unsure of themselves were more likely to feel threatened when asking their peers and teachers for help and more likely to avoid seeking help. Students with high confidence in mathematics do not attribute their need for help to lack of ability and thus are more likely to seek help when they need it. More confident students can get support of both teachers and their peers whenever they need it. Thus, the difficulty of mathematics problems does not appeal to them and mathematics is enjoyable and stimulating to them. Less confident students are mostly likely fear of making mistakes so that they would not apply their potential in mathematical activities.

Teacher's motivation: ***A highly motivated mathematics teacher in teaching and assisting students in turn motivated his students so that they had a favorable attitude towards the subject***

The person's chi-square and logistic regression model confirmed that mathematics teacher's motivation in teaching and assisting his/her students and students' attitude towards the subject had direct correlations. This result might be a result of motivated teachers had a potential to comprise the quality of teaching since they may have time plan for their lessons, regularly attend classes, not come to class lately and successful in marking students work. Consequently, teachers with these characteristics may demonstrate usefulness of mathematics by telling the students about the importance of the subject especially in relation to other subjects and day to day life, meaning that students learn the lesson not as routine to pass examinations as discussed in the literature (Diamond, 2001). This might results in enhancing favorable attitudes towards learning and performance of the subject making the students to term it as ease.

Type of teaching methods: ***Students preferring to learn mathematics in the class room through teacher assisting individual students had a favorable attitude towards learning the subject***

It was confirmed in our study that the way mathematics is thought in class had an influence on students' attitude towards learning of mathematics. The probability of having a favorable attitude towards learning mathematics was $^{60.23}$ lower for students who preferred to learn mathematics in the class room by lecture methods or by using plasma as compared to those students preferring learning by teacher assisting individual students. Moreover, the probability of having a favorable attitude towards learning mathematics for the students who preferred learning by questioning & answering was lower than students preferring learning by teacher assisting individual students as well as students preferring by small group discussion. However, students preferring to learn the subject by teacher assisting individual students had shown more chance of favorable attitude towards learning mathematics than those students preferring to learn by small group discussion and question and answering even though the difference was not statistically significant.

Some students" dissatisfaction on how some mathematics teachers taught the subject was related to the fact that some difficult topics were not thoroughly covered to involve applications which were to be acquired by students for future use either in daily activities or in their careers. Also learning experiences provided in the classrooms should include such activities which provide opportunities for students to participate, bring out analogy, to draw inferences, arrive at generalizations. Students worked in groups as well as being given individual attention by their teachers to enable them to clearly understand the concepts which enabled them to have a favorable attitude towards learning mathematics.

Peers support: ***Student's attitude towards learning mathematics was influenced by academic support from peer friends***

The parson's chi-square and logistic regression model revealed that students attitude towards learning mathematics and students' academic support from their peer friends had a positive correlation. It was clear that influence of the siblings and peers on the students was not confined to imparting of subject knowledge alone, but goes further to play a part in the total development of the student's attitudes towards learning and performance of mathematics.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In this chapter the researchers tries to give a summary of the study, conclusions and recommendations, which can be made to help in improving student's attitude towards learning mathematics and therefore mitigate the negative impacts of such attitudes on learning of mathematics among high school students in the study area.

6.1. Summary and Conclusions

This study has sought to assess the level of student's attitude towards learning mathematics in Adama, Bishoftu and Asella towns. The relationship between attitude towards learning mathematics and predictor variables had also analyzed by using the chi-square test and logistic regression model.

According to the findings of this study, more than half (59%) of the students had unfavorable attitude towards mathematics. The results in the bivariate and multivariate analysis revealed that there was strong association between the dependent variable student's attitude towards learning mathematics and a number of predictor variables such as sex, performance, parents'/guardians' educational level, knowledge of usefulness of mathematics, students personal confidence, teachers motivation, teaching methods and peer supports. But the dependent variable (attitude) had no significant relationship with type of high school at which the students were learning, absenteeism, presence of role model and educational value held by the family/community.

The result of the logistic regression had indicated that female students had shown less favorable attitude towards learning mathematics as compared to their male counterparts. Thus, the chance

of having a favorable attitude towards learning mathematics for female students was 67.7 lower than that of male students.

In most of the studies done on academic performance of students, it is not surprising that socio-economic status is one of the major factors studied while predicting academic performance. Educational level is one of the influential parameter to determine ones socio-economic status in the community as well as in the entire nation. Hansen and Mastekaasa (2003), argue that one could expect students from families who are closest to the academic culture to have greatest success. It is believed that low social economic status of parents negatively affects learning condition of their children because low social economic status prevents access to vital resources and creates additional stress at home which in turn negatively affects learning attitude and achievement in school. According to the findings of this study, students from parents who were closest to the academic culture had shown a favorable attitude towards learning mathematics. College diploma and University degree of parents /guardians had guaranteed for having a favorable attitude of their children in learning mathematics in high schools under study. Thus, the probability of having a favorable attitude towards learning mathematics was 1.667 times higher ($p=0.000¿$ for students from families/guardians with diploma and above level of education as compared to those students from families/guardians of primary level of education. Moreover, the probability of having a favorable attitude towards learning mathematics for the students from families/guardians who completed secondary level of education was also 1.483 times higher than that of students from families/guardians with primary level of education. This might be obviously due to the fact that educated parents/guardians provide their children both the necessary information and materials that support their education while bringing up them. These parents also provide higher levels of psychological support for their children through environments that encourage the development of a favorable attitude towards leaning mathematics or other subjects since the higher the educational attainment for parents, the greater their aspirations for their children. Alternatively, as ones parent's/guardian's educational level increases, the income of the whole family also relatively increases in the context of Ethiopia. Hence, students from families' of lower educational level being from low income family may work in the town to earn additional money which consumes their study time or even their school

time that in turn negatively affects their attitude towards education generally and towards mathematics particularly.

In our analysis, we found that student's attitude towards learning mathematics was associated with their performance in the subject. The result of the multivariate analysis revealed that the probability of showing a favorable attitude towards learning mathematics for high performing students was $^{2.98}$ times higher than that of students with moderate performance. But the probability of showing a favorable attitude towards learning mathematics for low performing students was $^{30.9}$ lower than that of moderately performing students. This result may be justified as, for good achievers mathematical tasks are likely faced as real challenges which could increase intrinsic motivation, raising the sense of competence when the tasks are solved, and leading to the development of positive attitudes towards math. Conversely, for low achievers math tasks are likely experienced as unsurpassable obstacles that will be won infrequently, producing low self-belief in competence and negative attitudes towards mathematics.

It was confirmed in our study that the way mathematics is thought in class had an influence on students' attitude towards learning of mathematics. The probability of having a favorable attitude towards learning mathematics was $^{60.23}$ lower for students who preferred to learn mathematics in the class room by lecture method as compared to those students preferring learning by small group discussion. Moreover, the probability of having a favorable attitude towards learning mathematics for the students who preferred learning by questioning & answering and by using plasma was 20.5% and 74.5% respectively lower than that of those students preferring learning by small group discussion. However, students preferring to learn the subject by teacher assisting individual students had shown more chance of favorable attitude towards learning mathematics than those students preferring to learn by small group discussion even though the difference was not statistically significant. Learning experiences provided in the classrooms should include activities which provide opportunities for students to participate, bring out analogy, to draw inferences, arrive at generalizations. Students worked in groups as well as being given individual attention by their teachers to enable them to clearly understand the concepts which enable them to have a favorable attitude towards learning mathematics.

Our research result confirmed that awareness about the usefulness of mathematics has a potential in influencing students attitude towards learning mathematics. For students having some knowledge about the usefulness of mathematics, the chance of having a favorable attitude towards learning mathematics was 2.065 times higher that of students who had no knowledge about the usefulness of mathematics. Only a limited number of teachers demonstrated usefulness of mathematics by telling the students about the importance of the subject or even tell the students the importance of mathematics especially in relation to other subjects and day to day life, meaning that students learnt the lesson as routine to pass examinations. The importance of mathematics is for students to regard mathematics as a subject not only crucial to pass the examination but a practical tool for day to day use. The data on whether students will aware of the usefulness of mathematics a lot in life, to some extent, indicate that some students cannot see the functional aspect of mathematics in their later life despite students viewing mathematics as a subject being abstract and not applicable to real-life situation.

6.2. Recommendations

Depending on the study findings and the conclusions made, the researchers derived the following recommendations.

1. Parents, school management body, teachers and other stake holders working on educational development should provide learning environments in which male and female students' have equal opportunities in learning, participating and studying of mathematics.
2. Teachers, peers and siblings of the students should encourage both female and male learners to equally embrace mathematics.
3. Mathematics teachers should wisely utilize appropriate teaching methodology to enhance positive attitudes and neutralize any negative attitudes towards learning mathematics. This will need rewriting mathematics syllabus to include attitude change, precise reason for learning then go ahead and let students learn and expect to perform well in the study so that students could realize mathematics applications in their future careers. Though it could be difficult to relate some areas of mathematics to real life situations, many topics in the subject could be taught by identifying certain areas which could be illustrated involving application aspects. In addition, school teachers must be aware that there are certain aspects of students' learning in mathematics that need to be improved. In particular, students should be given more opportunities to work on non-routine and

challenging mathematics problems so as to maximize their thinking skills and value the intrinsic essence of mathematics this will require teachers going the extra mile in leading students in that path of learning. The subject should not be limited to theoretical teaching and focused on passing examinations only. In this sense, mathematics should be demonstrated in a more practical way, by which students can spontaneously associate mathematics knowledge with their everyday life. By doing so, the engagement and exposure will result in students‟ better perspective of mathematics and their mathematics learning, which in turn help students to develop more positive attitudes toward the subject and therefore further promote their learning ability and consequently perform better in mathematics examinations.

4. The management body of high schools in the study area could also devise means of paying special attention to those students coming from parents of low academic backgrounds. Moreover, the school management could improve the student support system such that his/her families' educational and economic backgrounds could not hinder students from using their potential in learning and studying of mathematics and other sciences.
5. Recommendations for future research
    - This study was carried out in only three nearby towns. Similar studies could be carried out in other parts of the country to gather adequate information on the subject to be able to generalize.
    - Marks given by class room teachers were used to measure students' academic performance. Such measurement was varying under different circumstances so that standardized exams could be given to illegible groups in order to minimize such variations.

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APPENDICES

APPENDEX I: QUESTIONNAIRE

Dear Student,

The investigators of this research project are lecturers from Adama Science and Technology University. This questionnaire prepared primarily to collect information on the socio-economic factors associated with attitude of high school students in learning and studying mathematics in Adama, Asella and Bishoftu towns. The investigators of the research would like to inform you that the responses given to all questions by you are confidential. Therefore, you are kindly requested to be cooperative enough to give your responses to the following questions**.**

Will you participate in the study? Yes ☐ No ☐

If your answer is "Yes", continue responding to the questions in part I, part II and Part III.

Part I: Questions related to the study area

1. Name of your town _____
2. Name of your high school _____
3. Type of your school (Private/Government) _____
4. Your Grade (10^{th}/9^{th}) _____

Date of interview_____/_____/_____

For office use only

Code number of the questionnaire _____

First semester mathematics mark/score (to be taken from student card record)_____

Part I: Questions related to socio-economic and academic information of the respondents

Instruction: Please read the questions below and kindly give the appropriate response by either encircling the number of your choice or by giving the required information in the spaces provided.

101. What is your sex? 1.Male 2.Female
102. Your Mathematics mark/score of the 1st semester = _____%
103. How do you evaluate your absent from school in this academic year?
    1. Almost non-absent 2. absent some times
104. In your family, (any household member) the maximum educational level is

    1. Illiterate 2.Elementary(1-8) 3. High school(9-10) 4. Diploma and above

105. Do you know that Mathematics is useful in your life or in your future education?
    1.Yes 2.No
106. If your answer for question 4 above is No, skip to question 6, if Yes, mention at least two usefulness of mathematics.

    _____

    _____

    _____
107. How do you make an effort to learn Mathematics in class attentively as well as to practice the exercises in the text book or from other references at your home or out of your school time?
    1.Very much 2. Moderately 3. Very little
108. How does your teacher motivated/encouraged you to learn and study Mathematics subject?
    1.Very much 2. Moderately 3. Very little
109. The educational value held by your family/community is
    1. High 2. Moderate 3. Low
110. Do you have any role model in your family or community to like Mathematics? 1. Yes 2. No
111. Did you get any support from your peer friends so that you did a lot of mathematics exercises together or studying mathematics together? 1.Yes 2.No
112. From the following teaching methods, which one do you like more to learn Mathematics and understand well in the class?
    1. Lecture 2. Small group discussion 3. Questioning and answering
    4. Teacher assisting individual students 5. Plasma

Part II: Questions related to attitude of students towards mathematics

Instruction: This section has statements that you are to decide carefully whether you **Strongly Agree (SA), Agree (A), Unsure (U), Disagree (D), or Strongly Disagree (SD).** Please respond to the items below as honestly as possible by putting a tick [√] mark against each statement depending on your feeling.

Code	Survey items	Rating Scales (%)				
		SA	A	U	DA	SD
201	Mathematics is enjoyable and stimulating to me					
202	The challenge of mathematics problems does not appeal to me					
203	I think I can handle more difficult problems in math					
204	Mathematics has been my worst subject					
205	Mathematics makes me uncomfortable					
206	I usually have been at ease during mathematics tests					
207	People would think I was some kind of a grind if I get good results in math					
208	It would make me happy to be recognized as an excellent student in math					
209	I study mathematics only to pass the examination					
210	I will need mathematics for my future work					

Variables	Sex	High school type	Parent education	Performance	Absenteeism	Knowledge of usefulness of math	Student effort	Teacher motivation	Educational value held by family	Presence of role model	Teaching methods	Peer support
Sex	1											
High school type	-0.117	1										
Parent education	-0.133	0.152	1									
Performance	0.121	0.021	-0.023	1								
Absenteeism	-0.175	0.028	0.030	0.114	1							
Knowledge of usefulness of math	0.124	-0.167	0.031	-0.118	0.056	1						
Student effort	-0.187	0.122	0.158	0.074	0.014	0.067	1					
Teacher motivation	-0.029	0.065	-0.087	-0.097	0.011	0.025	0.005	1				
Educational value held by family	-0.094	-0.064	-0.027	-0.087	-0.045	-0.069	0.055	-0.128	1			
Presence of role model	0.007	-0.069	-0.032	-0.028	-0.017	0.057	-0.041	-0.162	0.085	1		
Teaching methods	0.063	0.002	-0.054	0.128	0.080	0.067	0.092	0.198	-0.084	0.024	1	
Peer support	-0.141	0.115	0.012	0.086	0.145	0.086	-0.019	0.047	0.024	0.082	0.019	1

APPENDEX II: COEFFICIENT OF CONTIGENCY TABLE

APPENDEX III: HOSMER AND LEMESHOW TEST FOR MODEL GOODNESS OF FIT

Step	Chi-square	df	Sig.
1	2.981	7	0.799