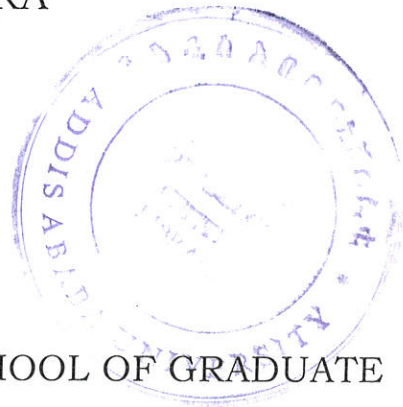


COMPARATIVE STUDY OF PRIVATE AND
GOVERNMENT SECONDARY SCHOOL STUDENTS'
ATTITUDES TOWARD MATHEMATICS AND THEIR
ACHIEVEMENT: THE CASE OF ADAMA CITY

BY
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ABSTRACT

The purpose of this study was to compare private and government school students' attitudes toward mathematics and their achievement in the first cycle secondary (Grades 9-10) schools in Adama city. One hundred ninety-seven subjects (99 males and 98 females) were randomly selected from one government and one private school in Adama city. An attitude scale and mathematics achievement tests were employed to gather the data. Analysis of t-test and Pearson correlation were employed on the data. The results indicate that there is a significant ($p < 0.05$) difference in attitudes toward mathematics between private and government first cycle secondary school students in favor of government, but there is no significant ($p > 0.05$) difference in attitudes toward mathematics between male and female students. Similarly, there is a significant ($p < 0.05$) difference in mathematics achievement between private and government first cycle secondary school students in favor of private school students, and also a significant ($p < 0.05$) difference was found in mathematics achievement between male and female students in favor of males. In the case of comparing students' attitudes and mathematics achievement, positive but very low correlation ($r = 0.14$) was observed in the first cycle secondary school. This, however, does not mean that there is statistically significant correlation between attitudes toward mathematics and mathematics achievement. That is why the government school students have positive attitudes, but lower achievement than that of private school students while private school students have negative attitudes, but higher achievement than that of government school students. It was thus concluded that government school students have better attitudes toward mathematics than the private school students, while private school students have better achievement in mathematics than those of the government school students.

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

With the rapid growth of science and technology a strong background in mathematics is very important. The knowledge of mathematics is essential in our daily life and in most human activities. To cope up with newly emerging technology and computerized world we need to have a strong background in mathematics. This idea is emphasized by Krutteskii (1976) as cited in Benbow and Arjmand (1990), that the development of sciences shows a tendency to become more mathematical, mathematical methods and mathematical style are penetrating every where.

Most people associate problem solving with Mathematics than other school subjects. Mathematics has a wider application in natural and social sciences. Adleke (1998) pointed out that mathematical techniques are consistently being developed to meet the changing requirements of Physics, Chemistry, Biology, and Behavioral sciences, Engineering, and computer science. Adleke (1998) added that no other subject forms a strong binding force among other branches of sciences as Mathematics.

Similarly, Jhonson (1984) as cited in Seleshi (1995) pointed out that as society becomes increasingly technical, mathematical ability will increasingly become a highly valuable skill. He also added that children must not be constrained in a career choice nor hindered from a full and rewarding participation in society by a failure to develop these skills.

Various studies (for example, Fennema, 1980).disclosed that mathematics is truly the critical filter that keeps females as well as some males from many desirable professions and vocations.This means that their inabilities in mathematical activities affect females and some males in the area of many desirable professions and vocations.

As mathematics involves both numbers and figures, it must be taught with great and careful effort. As Garden (1987) asserts, education system throughout the world places high importance on the teaching and learning of mathematics. Consequently, a high level of resource allocation is devoted to maintaining and improving efficiency and effectiveness in these activities. It is, therefore, not surprising that various studies conducted for more than fifty years have focused on mathematics and some factors related to mathematics achievement (Pattison and Grieve, 1984).

It is probably self-evident that the major reason for mathematics to get so much attention in research is its importance to future careers (Mills, et al., 1993). In explicit terms, that is to say as society becomes increasingly more technical, mathematical ability will increasingly become a highly valuable skill.

In spite of the above, stated importance of mathematics, it is unfortunate that many students have misconceptions about mathematics and dislike mathematical activities; many seem to fear, even hate, mathematics (Neale, 1969). Generally, mathematics appears to be unpopular as a school subject as students ascend the academic ladder (Aiken, 1970). The late elementary and junior high grades are viewed as being

particularly important to the development of attitudes toward mathematics (Callahan, 1971).

The importance of attitudes in mathematics achievement appears to be well recognized. As Aiken (1976) indicated, students' attitudes are directly related to both actual and aspired marks in mathematics courses, but somewhat inversely related to grade level. Some investigators in the area seem to recognize the relationship between mathematics achievement and attitude and their reciprocal influence (Neale, et al., 1970; Tsia and Walberg, 1983). In this regard, Tocci and Engelhard (1991) pointed out that the relationship between attitude and achievement in mathematics is certainly the consequence of a reciprocal influence, in that attitude affects achievement and achievement in turn affects attitude. It has been further suggested that the relationship between mathematics achievement and attitude is significantly stronger for boys as compared with girls (Hilton and Berglund, 1974; Schofield, 1982).

Some research findings that are dealt with gender differences in mathematics achievement show male superiority; and this is more pronounced between the upper elementary school years and the last year of high school (Benbow and Stanley, 1980, 1983). Marshal (1984) showed that there is no significant gender difference in achievement. On the other hand, though some studies have failed to find significant gender differences, some investigators (E.g., Hilton and Bergland, 1974, Aiken, 1976) have concluded that differences in both attitude and achievement in mathematics are frequently found between boys and girls in favor of boys at the junior high school level and beyond.

According to *GSEQANEA (2006) there is a striking differences in Ethiopian General Secondary Education Certificate Mathematics examination results of the year 2006 between private and government schools in Adama City. From the raw data 90% of the students scored grade 'C' and above in private schools, while 52% of the students scored grade 'C' and above in government school. There is also difference in mathematics scores between male and female students in favor of boys in government schools while this difference is smaller in private schools.

The gender differences in mathematics achievement were found in different countries (Badger, 1981). But the exploration of these differences in relation to pupils' attitudes and type of schools in Ethiopia has been limited. It is this limitation of local studies is the important issue, which may have implication on our mathematics education, which has initiated the investigator to see comparatively the private and government secondary school students' attitudes toward mathematics and their achievement.

1.2 Statement of the Problem

Different studies made so far show the gender difference in mathematics achievement in different educational (grade) levels. And also some studies have been made on the area of the relationship between mathematics achievement and attitude towards mathematics among boys and girls across different grade levels. How ever, the main purpose

* Data taken from the office of General Secondary Education Quality Assurance and National Examination Agency.

of this study is to compare the private and government secondary school students' attitude towards mathematics and their achievement. Based on this purpose of the study, an attempt is made to answer the following research questions.

1. Is there a difference in attitudes toward mathematics between private and government first cycle secondary school students?
2. Is there a difference in attitudes toward mathematics between males and females students in the first cycle secondary schools?
3. Is there a difference in mathematics achievement between private and government first cycle secondary school students?
4. Is there a difference in mathematics achievement between male and female students in the first cycle secondary school?
5. Is there a significant relationship between students' attitude and mathematics achievement in the first cycle secondary school?

1.3 Objectives of the Study

The general objective of the study is to compare the private and government school students' attitudes toward mathematics and their achievement in the first cycle secondary (grade 9-10) schools. To this end, the study has the following specific objectives:

1. To find out if there is any significant difference in attitude towards mathematics between private and government first cycle secondary school students.

2. To examine if there is any significant difference in mathematics achievement between the private and government first cycle secondary school students.
3. To investigate if there is a relationship between students attitude and their mathematics achievement in the first cycle secondary school students.
4. To investigate if there is a difference between male and female students' achievement in mathematics in grade 9-10
5. To check if there is a gender difference in attitudes toward mathematics.

1.4 Significance of the Study

This study is significant to identify in which type of school students develop positive attitude toward mathematics. It is also important to explore in which type of school students achieve better results in mathematics. If there is any significant difference in the area of attitude and achievement, this study indicates the concerned bodies to make an investigation on why such differences existed and make the necessary adjustment.

This study is particularly significant to schools, teachers, students and parents. From the findings of this study schools understand the problems of their students, either in the area of attitude or achievement. Then the school bodies would be able to create conducive atmosphere for the students in developing positive attitudes as well as in acquiring better achievement. Teachers and parents will be aware of the type of attitudes the students have and their level of achievement there by make

their own contribution in assisting the students. This study also helps students to understand the level of achievement as well as the type of attitudes as compared to other school students so that they will be able to seek solutions for the difference, if it exists.

Furthermore, the findings of the study and their implications are expected to serve as a springboard for further study in any other subject areas.

1.5 Delimitation of the Study

The problems could be observed at different educational levels, but this study is delimited to the first cycle secondary schools. Even though, it could be investigated in different large cities in the country, this study is delimited to Adama City Secondary Schools. It might have been also possible to assess the problem in different subject areas but this study focuses only on mathematics subject. It could have been important if reasons or the conditions for the development of positive attitudes and achieving better results in mathematics subject were assessed. However, this study does not include these issues.

1.6 Limitation of the Study

This study is limited in scope and depth from what was expected due to time and personal constraints. Shortage of time and health problems were serious problems encountered during the study. Particularly the health problem that the investigator faced compelled him to limit the

sample schools as well as the sample size. In spite of these, the investigator has attempted to make the study as complete as possible.

1.7 Operational Definitions of Terms

According to their usage in this study the following terms are defined in the manner stated below:

Mathematics Achievement- refers to students' mathematics performance as shown by their scores on a test prepared and administered by the investigator.

Achievement Tests- mathematics tests prepared for this study based on the syllabuses and textbooks of mathematics of grades 9-10.

Attitude toward Mathematics – refers to a tendency of students to respond positively; that is favorably or negatively ; that is , unfavorably , to mathematical activities(statements) as collected by a Likert-type scale adapted by the investigator.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

Identifying factors in developing attitude towards learning, and the relationship between mathematics achievement and attitude among males and females students across different grade levels, have been an issue of great concern for various investigators. This part of the study, thus, reviews the contentions of different authorities in the area. To this effect, the following four major themes have been dealt with: related factors in developing attitude towards learning, the relationship between mathematics achievement and attitude towards mathematics, students' attitude towards learning, and gender and academic performance.

2.1 Related Factors in Developing Attitudes toward Learning

2.1.1 Planning a School Organization

To function well, the life of a school organization must be well organized, providing for the best performance both on the part of the teacher and of the pupils (Robinson, 1980). This means that a well organized school administration is a system which has qualified and experienced administrative bodies and teachers, which equipped with the necessary instructional materials so that learning becomes more interesting. Robinson also explained that a well coordinated and systematically designed schedule for the school day, week and years is paramount importance in achieving a good working conditions, providing efficient results in every sphere of life.

Since planning and programming are continuous processes there is always a tendency to change when there are certain shortcomings and limitations. This is mostly done in order to make the teaching learning process more viable and up to date which in turn can develop positive attitudes of students towards learning. Different age groups in a society have got different interests. Plans and programs should be prepared to satisfy the needs and interests of those particular groups. By the same token educational plans and programs should be designed and changed taking the learners' needs and wants into consideration. Furthermore, a given plan or program should keep the interest and need of that given society. (Ibid)

According to Coombs (1970:14) educational planning is the application or national systematic analysis to the process of educational development with aim of making education more effective and efficient in responding to the needs of its students and society. Further more, Coombs also explained that in planning a school organization, it should be planned so that the school organizations satisfy the needs of the students. This leads to the development of positive attitude towards learning.

Programs in schools would be flexible and must satisfy the need of the learners. Appropriate time for attending classes, adjusting the program depending on the weather condition can have significant contribution on the teaching learning process. In examining its advantage on learning, Robinson (1980:1) state that... such flexibility can be predicted to allow both the teacher and the student more efficient use of time and talent.

2.1.2 The School Administration

Any organization or institution be it production oriented or service giving has to design organizational structure in which the key actors or the line and staff personnel are clearly identified with their specific tasks performed and chain of command.

However, education can not employ all the quantitative criteria of good administration which are relevant in profit making organization. In schools there are principals, who are supposed to give leadership for the effective and efficient use of the existing human and material resources to facilitate the teaching and learning process. With the leadership process they possess, they encourage teachers in coordinating and organizing the teaching performances by giving them the necessary guides, directives on the accomplishment of educational objectives. All the trials done by the school principal and other administrative bodies in school is for nothing but to satisfy the needs and interests of the school boys and girls. In determining the major purpose of administration Hsn McFarland (1971:262) states that the principal purpose of administration is to serve the needs of boys and girls in learning situation as a direct relationship to the organization of the personnel. The author went on to say, under such a concept, the guiding principle of organizations is directed towards ways and means to meet the need of children.

All techniques, methods, directives and educational services are practiced to achieve the broadest goal and specific objectives of education which primarily aims on the intellectual, mental and physical development of the learner. As Sills (1981) writes "supervision is an

expert technical service primarily concerned with studying and improving the condition that surround learning and pupils' growth."

2.1.3 Teacher Student Relationship

The school ground, a well equipped classroom and fully substantiated resourceful school will remain partial, or may be wasteful, unless the key person or the teacher in the teaching learning process is in class to guide the instructional process (Sills, 1981). The success of the goal and specific objectives of the educational system is mainly determined by the teacher. Additionally, the expected change of behavior or the development of positive attitude of students towards learning can be affected by the teacher. In most situations, the teacher exercises of a great deal of influence on the personal lives of the learners as well as on what they learn (Klausmeier and Goodwin, 1968:5).

In most situations, communications can be more effective and the development of positive attitudes towards intended goals or learning in this particular context is more grasped when the learners understand their teacher. Unless students understand their teacher or his/her purpose, the trial of the teacher will remain uni-dimensional and the result will be partial or even may last with undesirable results, since students may consider the process as sanctions not necessarily as learned for ones own benefit (Michael, 1968). So the teacher must be accepted and understood by the students as a helpful person in order to make improvement towards directed educational objectives in the basic three skills (i.e. cognitive, psychomotor and affective skills).

Klausmeier and Goodwin (1968:202) generalized that early learned attitude which are firmly established with increasing experience are fostered and others may undergo change. This situation is more common at all school levels. Pleasant feelings, success and rewards produce favorable and lasting attitudes; unpleasant feelings, failure and punishments lead to unfavorable attitudes and in some cases to the extinction of previously favorable attitudes.

2.1.4 Teaching Facilities

Teachers teach and students learn properly when there are enough materials to be used as guides for prescribed courses or subject areas. These materials usually list not only the content of the subject matter but the appropriate learning experiences and Medias to be used. This factor is more significant because of the many advantages it provides in the teaching learning situation. The wide variety use of materials in schools enables education to be more concrete and direct. Discussing the appropriate references and resources, Bowntree (1974:34) writes: "students who know the objectives of a course and who are given appropriate references and resources can teach themselves in half the time taken by normal class."

The materials and the use of proper media for teaching are important not only to motivate the students as passive listeners but help them to be active participants in the teaching learning process. This can be more effective if students are really interested on the subject mater taught, the learning experience applied, and the media used. Both the subject matter

to be learned and the media and materials by which it is to be learned must be geared to the pupils interest, abilities and readiness to become involved in the learning situation (Bowntree, 1974).

2.2 Students' Attitude towards Learning

Attitude, according to Trow (1960:22), is a feeling of liking or disliking by an individual towards somebody or something. On the other hand, attitude is also considered in terms of negative or positive responses by the individual towards the situation involved. Taking this point, Morgan (1966) wrote, "an attitude is a tendency to respond positively; that is favorably or negatively; that is, unfavorably, to certain objects, persons, or situations" (p. 594). According to Morgan favorable attitude of an individual implies a positive tendency towards a given situation which involves acceptance; and on the other hand, a negative attitude towards a given situation indicates a tendency of rejecting or disliking of the situation. According to Santrock (2000) attitudes are beliefs or opinions about people, objects, and ideas. In a way, behavioral differences among people, though not in all cases, spring from attitudinal differences (Brimer and Pauli, 1971). In some cases individuals will say one thing and do another. In others, what they say is what they do. Studies over the course of the last half century indicate that under some conditions attitudes guide actions (Eagly and Chalkin, 1998). It thus appears that attitude towards school learning, to a great extent, affects ones' performance.

The achievement of educational objectives partly requires pupils' positive attitude towards learning (Tekeste, 1990). In his findings Tekeste further

remarks that pupil's attitude is an important factor in their potential to receive education. As positive attitude towards learning facilitates pupils' progress in school, a negative attitude is a hindrance to pupils' successful progress in school work. Predicting behavior from attitudes is more reliable when person's attitudes are strong (Petty and Krosnick, 1995).

From the foregoing discussion, it can be deduced that an interest and positive attitude towards school learning will likely reduce low achievement.

Some investigators are interested in the attitudes of students towards a specific subject. For instance, Kaplan (1986), states that attitudes toward mathematics are particularly important, because they are related to mathematics performance in both sexes. After reviewing a number of studies, Aiken (1972) concluded that children with positive attitudes toward mathematics tend to like detail work, to view them as more persevering and self confident. In relation to this, Schofield (1982) in his review of affective factors of mathematics learning, maintains that teachers and other mathematics educators generally believe that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics. Therefore, continual attention should be directed towards creating, developing, maintaining and reinforcing positive attitudes.

Thus, one would expect that a student's attitude toward mathematics would be important in determining his/her achievement in the subject.

inversely related to grade level (Aiken, 1976). Aiken further noted that the correlation between attitude and achievement varies not only with grade level but also with the sex of the student. The finding in this instance seems mixed. For Badger (1981), for instance, the correlation between mathematics achievement and attitude is some what higher for girls. The study conducted by Schofield (1982) on grade 3, 4, 5 and 6 students, on the other hand, reveals a stronger relationship between mathematics achievement and attitude for boys than girls.

After reviewing a number of studies, Aiken (1976) noted that there is a dynamic interaction between attitude and ability in mathematics. Consequently it is possible to say that lack of success in mathematics could easily lead to a negative attitude toward the subject. Besides, many investigators in the area seem to recognize the relationship between mathematics achievement and attitude and their reciprocal influence (eg. Johnson, 1984; Tsai and Walberg, 1983). More specifically, Tsai and Walberg (1983) stated that the higher the attitude, the more one learns; and the more one learns, the higher the attitude. They further noted that achievement was significantly associated with attitudes and gender.

Going one step further, Tocci and Engelhard (1991) investigated the relationships of attitudes toward mathematics with mathematics achievement, parental support, and gender among 3846 thirteen year old students from the United States and 3528 thirteen year old students from Thailand. In both countries, achievement, parental support, and gender were found to be significant predictors of attitudes toward mathematics.

On the whole, the review discussed so far indicates a low to moderate positive correlations between achievement in mathematics and attitudes toward mathematics. It must also be noted that these correlations are significant, regardless of differences in measures of achievement and attitudes employed. Moreover, gender and grade level are seen as important moderator variables in the relationship between achievement and attitudes. In other words, the dependence of mathematics achievement and attitudes on each other and on other factors (variables) like gender and grade level has been observed.

2.4 Factors that Influence Students' Achievement

2.4.1 Background and Community Factors

Different studies emphasize a number of factors, be it external or internal to schools to have influences on student achievement. Among the external factors the influence of student home background, personal and community characteristics are widely acknowledged.

With reference to student home background, well known influences to student achievement relate to parental socio- economic status (SES), family configuration and parental support. Among the indices of SES are parental occupation, parental level of education, parental income and occupational prestige. Husen (1967) reported that in the first *IEA mathematics study, the total mathematics score at 13-year-old level correlated 0.16 with father's education and 0.12 with mother's education over 12 countries. The correlations between father's occupational status and the mathematics scores were 0.25 at the same age level of the same

• International Association for the Evaluation of Educational Achievement

populations. In family configuration, family size was found to have a negative relationship with students' achievement.

When it comes to students' personal characteristics, it has been observed that the relationship between gender and achievement varies based on the subject and the level of students under investigation. Parelius and Parelius (1987) noted that girls' grades in both elementary and high schools tend to be higher than that of boys. However, boys often scored higher on standardized tests. Fagerlind and Saha (1989) observed that in most developed countries, girls performed equally with boys at primary school level, but at secondary school, girls began to do more poorly. Subjects also make a difference in achievement of boys and girls. For instance, a comparison of the reading performance of boys and girls in many countries has frequently shown differences in favor girls (Thorndike, 1973). However, girls fall behind boys in mathematics and science. In the second IEA science study in 17 countries, it was found that boys scored higher than girls at all levels, and the gap increased from the 10-years olds to the 14-year- olds (Chen, 1996). TV watching, as the other student characteristics, is inversely associated with student achievement (Comstock, 1994). However, leisure or voluntary reading as well as the average amount of time spent on homework of all countries have shown positive relations with student achievement.

Just as students may be influenced by their classmates, their teachers and the norms of their schools, they are influenced by the communities in which they live. Some of this influence can be transmitted through families, but some may happen through direct influence of communities. Variations among communities can take various forms and this has a great deal of influence on students' achievement (Stockard and Mayberry, 1992). Further more they noted that the resource available to

schools depend to a large extent on the economic basis of its inhabitants. Parental and community involvement in schools, community participation in school control, and community values all have their influences on student achievement.

2.4.2 School Based Factors

The analysis of contextual or external factors provides only a partial view of the influences on student learning. To fully understand how higher achievement is facilitated, it is important to examine internal factors at school and classroom levels. Stockard and Mayberry (1992) discuss these factors under two generic divisions: school and classroom environment, and school resources. In the school climate/ environment, they include academic expectations and excellence, school leadership, orderly environment, and school coherence, teacher and student morale, and effective teaching. School resources comprise school facilities and per-pupil expenditures, teacher qualifications, classroom size and school size. Fuller (1986) analyzes these factors under the generic concept school quality. This construct comprises material inputs, teacher quality, teaching practices and classroom organization, school management and structure. Chen (1996) discusses internal factors influencing student achievement as school background factors. In this category, he included school structure, instructional facilities, teachers' instructional time, and the curriculum.

With the reference to school environment, stockard and Mayberry (1992) refer to various materials to indicate the significance of four main dimensions. These are the ecology (the physical environment), milieu (the social characteristics of individuals and groups participating in

organizations), social system (patterned relationships of persons and groups, and culture (the collectively accepted beliefs, values, and meanings of the group). School environments are commonly measured using indices containing a variety of items based upon the above factors. Various studies in the area demonstrate that school environment is linked to school achievement.

According to Ellet and Walberg (1979) strong school leadership and management is another internal characteristic of schools which determines student achievement. Several investigations indicate that principals, who are involved in instruction, communicate high expectations, promote good feelings and collegiality between faculty and administrators and among faculty members. They also encourage teacher participation in the school's decision – making processes which is effective in promoting success. Effective administrators promote cohesive relations with in schools performing a balancing act. They promote higher achievement and develop ethos or culture that enhances morale, mutual trust and respect, and shared norms and values (Fullan ,1990).

Specific material inputs enhance student learning. According to Fuller (1986), material inputs that consistently relate to student achievement in developing countries include instructional materials (texts, desks and reading materials) , instructional media, and school building quality library size and quality and nutrition and feeding programs . His report indicates that class size, school size and laboratories do not consistently relate to student achievement.

The length of instructional time is an important indicator / school factor that boost achievement. Instructional time varies from the number of

school days in the school year to the hours the subject is studied during a week. This instructional time is bounded by the variety of material resources and management practices. Teacher's knowledge of the subject is strongly and consistently related to student performance. Although there is no specific teaching practice that is universally effective, teachers with out a limited repertoire of teaching skills appear to be more effective than those with a limited repertoire (Chen, 1996).

2.5 Gender and Academic Performance

As Heyneman (1980) believes, an individual's sex is one of the major factors associated with academic performance and a powerful predictor of achievement difference. Heyneman further contends that higher performance among boys could not be explained by chance and that the difference must have some deep-rooted reasons from society. In a way, the difference in academic performance between males and females seems more of social than biological (Neale, 1969; Brimer and Pauli, 1971; Fennema, 1980; Hyneman, 1980; Sherman, 1980). The value attached to the education of boys and girls by parents and society at large is the source of the difference. Substantiating this, Scott and Clark (1986) state, "the school as a macrocosm of society reflects the fact that the society values males over females" (P. 523), and this reaches the classroom. As a result of the attached value to female education, teachers give little attention to female pupils (Shakeshaft, 1986).

Recently, however, gender differences in performance have become smaller as a result of recent cultural awareness of sexism and related reduction in gender differentiated socialization and education (Good and Brophy, 1990).

Furthermore, after reviewing a number of recent studies, Good and Brophy (1990) concluded that gender differences in intellectual and personal attributes are not large enough to support society's still powerful cultural tendencies to expect sizeable gender differences and thus to treat boys and girls differently. They also noted that in the intellectual sphere, males tend to score higher on tests of visual-spatial ability and mathematical ability, and females tend to score higher on tests of verbal abilities.

2.5.1 Gender Differences in Mathematics Achievement

To examine gender differences in mathematics achievement in general and the change in these differences across grade levels in particular, longitudinal studies seem to be more useful. One such study (Hilton and Berglund, 1974) uses data from Educational Testing service on 1959 grades five, seven, nine and eleven students. The study reveals no significant gender differences in mathematics achievement at grade five level though boys' mean scores were higher than girls'. Nonetheless, the study discloses significant gender differences in favor of males at subsequent grade levels (7, 9 and 11). The investigators further reported that the observed differences increase with age.

Another longitudinal study by Benbow and Stanely (1980) reports substantial gender differences in mathematical reasoning ability in favor of boys in intellectually gifted 9927 junior high school students. The investigators further reported that large gender differences in mathematical reasoning ability are observed in boys and girls with

essentially identical formal educational experiences in mathematics. Besides, the researchers concluded that differential course taking in mathematics cannot alone explain gender differences in mathematical reasoning ability.

Similarly, in a relatively comprehensive longitudinal study, Benbow and Stanely (1983) have found significant gender differences in favor of males initially in grades seven and eight, and later in grades eleven and twelve on mathematical precocious students.

One recent study examined gender differences in mathematics performance using data on 388, fifth and eighth graders (Felson and Trudeau, 1991). The investigators concluded that boys performed better than girls on the Stanford Achievement Test (SAT).

In sum, from the above longitudinal studies, one can see that the results favoring males are consistent at seventh and eighth grade levels. The results are particularly inconsistent at fifth grade level. Males achieve higher than females in some studies (e.g., Lummis and Stevenson, 1990; Felson and Trudeau, 1991), while no significant differences are found in other studies (e.g., Hilton and Berglund, 1974).

The aforementioned studies examined mathematics achievement in general. Other cross-sectional studies employed subtests such as geometry, algebra, and measurement. For instance, Fennema and Carpenter (1981) have analyzed data from a representative sample (over 70, 000) of 9-13, and 17-years old that participated in the National Assessment of Educational Progress (NAEP). The investigators' objectives were to examine gender related differences and to detect the significance

of these differences. The investigators reported that no clear pattern of differences in achievement was observed at ages nine or thirteen, whereas at age seventeen males' average performance exceeded that of females at every cognitive level (knowledge, understanding, and applications). More specifically, females scored higher on lower level number and numeration skills at ages nine and thirteen, whereas males scored higher on multi step word problems in this content area at all ages. There was also a consistent pattern of lower averages for females on geometry and measurement exercises overall cognitive levels.

The above data on 13 and 17- year old (from NAEP) were also analyzed using different subtests (i.e., applications and algebra). No significant gender differences were found at either age on algebra subtest; whereas, males at both ages scored significantly higher on applications subtest. In line with this, Hanna (1988), as cited in Halpern (1989), examined gender differences in a cross-cultural study of eighth graders in 20 countries. She found significant gender effects for measurement and geometry, both areas of mathematics with substantial visual-spatial components, and a non- significant gender effects in algebra, an area of mathematics that may rely more heavily on verbal skills.

In contrast, in a cross-cultural study, Engelhard (1990) analyzed mathematics achievement of nationally representative samples of 13-year old children in the United States (N=3924) and Thailand (N=3740) who participated in the Second International Mathematics Study. The results of the study showed that gender differences become more favorable toward boys as the level of cognitive complexity increased and as the content changes from arithmetic through algebra to geometry. Furthermore, these relationships appear to replicate over the cultures

examined here. In another study (Meyer, 1990), a significant male advantage was seen on computation and concepts at eighth grade level. But no significant gender differences were found at sixth grade on computation and concepts though the mean scores for males were higher on both variables.

In short, in studies that employed subtests, generally males achieved higher than females on the applications, geometry, and measurement subtests especially at eighth grade (13 year old) level. But no consistent gender differences were observed on the algebra and computations subtests at eighth grade level.

Other cross-sectional studies employed general mathematics achievement tests (rather than subtests). Fennema and Sherman (1978), for instance, examined gender differences in mathematics achievement among a sample of sixth, seventh, and eight grades (N=1320) and found significant differences favoring males in every grade. These differences were, however, found in only one school out of the four schools from which the sample was chosen.

One other study (Murray, 1976) that involved students from junior schools revealed significant gender differences in cognitive achievement favoring males. The investigator also noted that, controlling for IQ, this result was due to the superior achievement of boys in mathematics. In contrast, after employing multivariate statistical analysis, Sherman (1980) found that, although girls and boys were not different in mathematics background or performance in grade eight, there were significant differences favoring males in grade eleven.

In the Ethiopian context, after examining the scores in Grades Six and Eight National Examinations, Gennet (1991) concluded that girls in grades 6 and 8 performed poorly compared with boys over the last ten years (1978-1987) in mathematics and science. In line with this, in a study which included students in grades 8 to 11 in Northern Shoa region, Seleshi (1995) has found significant gender differences in mathematics achievement in favor of boys in all grade levels.

Overall, in most studies conducted on students of grades seven and eight, a significant males' advantage is found at this level. In some rare cases, either no gender differences or a difference favoring females in some mathematics content areas are found.

2.5.2 Gender Differences in Attitudes toward Mathematics

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

Using questionnaire, Hilton and Berglund (1974) examined gender differences longitudinally. They found that more males than females were interested in mathematics and perceived it as useful, whereas more females than males reported that mathematics was boring to them. Such a significant difference was, however, evident among students of grades nine and eleven but not among students of grade seven. On the other hand, using a some what similar questionnaire on 1324 randomly selected students of grades two through twelve, Ernest (1976) found no relationship between gender and attitudes toward mathematics. This is true for all grade levels involved in the study. However, the popularity of mathematics declined from junior high school onwards. Similarly, Sherman (1980) found no gender differences in attitudes toward mathematics among eighth-graders although such difference was observed when he same students reached the eleventh grade. Tsai and Walberg (1983) also endorse this conclusion.

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

In contrast, in a longitudinal study, Preece and Stureon (cited in Badger, 1981) assessed attitudes toward mathematics among approximately 2500 boys and girls aged 10 to 15. The investigators found gender differences in favor of boys. Moreover positive attitudes toward mathematics generally declined among all pupils throughout the five years, the drop was more dramatic in the case of girls. From this study, it appears that the most significant factor that distinguishes between

girls' and boys' attitudes toward mathematics is girls' lower estimation of their ability.

The aforementioned studies suggest that favorable attitudes toward mathematics show a decline as students ascend the academic ladder.

Some studies have employed subscale measures of attitudes toward mathematics. Fennema and Sherman (1978), for instance examined gender differences among middle school students (Grades 6,7 and 8, N=1320). They found significant differences favoring males on two subscales (confidence in learning mathematics and stereotyping of mathematics as a male domain) in all grades. But no significant gender differences were found in any of the grades on the remaining six subscales (usefulness of mathematics, attitude towards success in mathematics, effectance motivation in mathematics, the perceived attitude of father, mother, and teacher toward one as a learner of mathematics).

Stipek and Gralinski (1991), by involving 194 third graders and 279 junior high schools students, found some what similar results with Fennema and Sherman. That is, girls rated their ability lower, expected to do less well, were less likely than boys to attribute success to high ability and failure to luck, and were more likely to attribute failure to low ability. Moreover, girls also reported less pride in their success and a stronger desire to hide their paper after failure and were less likely to believe that success could be achieved through effort. Similarly, Tocci and Engelhard (1991) found significant gender differences in attitudes toward mathematics among 13-year old students (N= 7374) in the US and Thailand; particularly on mathematics as a male domain.

One other study (Hyde, Fennema, Ryan, and Frost, 1990) conducted a meta-analysis of gender differences in attitudes toward mathematics using 70 studies and 63,229 students. The investigators concluded that when gender differences were found the pattern was for females to hold more negative attitudes. They further noted that attitudes toward mathematics are important influences on the development of gender differences in mathematics performance.

The results of the studies discussed above are partly consistent with what Aiken (1976) concluded in his review:

Although some studies have failed to find significant sex differences, differences in both attitude and achievement are frequently to favor boys over girls at the junior high level and beyond (p. 296).

But in those studies that employed subscale measures, consistent gender differences were found in confidence and stereotyping mathematics as a male domain in the late elementary school as well. In conclusion, some investigators (Dutton, 1968; Aiken, 1970; Callahan, 1971; Aiken, 1976; Ernest, 1976) have generally agreed that attitude towards the learning of mathematics becomes increasingly less favorable beginning from the late elementary and early junior high grades for both boys and girls.

CHAPTER THREE

3. METHODS OF THE STUDY

3.1 DESIGN OF THE STUDY

The study was aimed at assessing the current status of the students' attitudes toward mathematics and their achievement in Adama city secondary schools. Then, comparing the current status of the students' attitudes toward mathematics and the achievement level in mathematics between private and government secondary schools. Based on the nature of the data statistical analysis was used. Thus, descriptive survey method of research was employed.

3.2 Samples

This study deals with students of grades 9 and 10 in selected private and government secondary schools in Adama city.

Before going into the main study, a pilot study was conducted in order to test and make improvement on the instruments. To this end, 60 students from two grade levels were randomly selected in St. Joseph school Nazereth. The subjects were 30 (Male = 15 and Female = 15) from grade 9 and 30 (Male = 15 and Female = 15) from grade 10.

The main study was carried out on 200 students. A simple random sampling method was employed to select the subjects (sampled students). The total number student in each type of selected school, in grade and sex is as follows.

Grade	Type of school					
	Private			Government		
	M	F	T	M	F	T
9	183	182	365	835	845	1680
10	147	111	258	455	565	1020

There were two government and three private schools in Adama city. From the two government schools, Goro secondary school was purposely selected for the school has better manageable size in the selection of the students, administration of the instruments and collection of data. Then 60 (Male=30 and Female= 30) students from grade 9 and 60 (male = 30 and Female= 30) students form grade10 were selected. A total of 120 students were selected randomly with the help of their respective subject teachers.

From the three private schools, Nafyad School was purposely selected for the sake of convenience. There were 6 sections in grade 9 and 4 sections in grade 10. Then 40 (Male = 20 and Female = 20) students from grade 9 and 40 (Male= 20 and female= 20) students from grade 10 were selected using simple random sampling method. These students were selected with the help of their respective subject teachers.

Out of the total, 3 subjects (male=1 and female= 2) were not included in the analysis of the main study because they failed to come on the administration of achievement test. Hence, the main study is comprised of 197 (male = 99 and female = 98) students. Of these, 99 were ninth graders and 98 were tenth graders.

3.3 Instruments

3.3.1 Mathematics Achievement Tests

For the purpose of assessing students' achievement level in mathematics, achievement tests were used. To this end, based on curriculum content and objectives, a table of specifications was prepared for each grade level (see appendix A for table of specifications). In line with this, 30 items were constructed for each grade level. Then, the tests were tried out on 30 students from each grade, and item analysis was carried out. The

item analysis was based on the subjects whose total scores fall in the upper and lower 27 percent of the total scores (Ebel, 1979). The item analysis was carried out to see the discrimination power, difficulty level, and effectiveness of distracters of each item. The internal consistency reliabilities of the pilot tests, using KR₂₀ (Kaplan and Saccuzzo, 2001), ranged from 0.84 to 0.85.

According to the result obtained from the item analysis, 8 items were improved and 5 items were substituted by other items from the two grade levels. These were items with item difficulty level above 84% (Ogunniyi, 1984) and discrimination indices below 0.19 (Ebel, 1979). Each tests for the main study contained 30 multiple choice items with internal consistency reliabilities [KR₂₀] that ranged from 0.87 to 0.89. (See appendix B for items of mathematics achievement tests administered in grades 9 and 10.)

3.3.2 Mathematics Attitude Scale

A Likert type five point scales, ranging from strongly disagree to strongly agree was used to examine attitudes of students toward mathematics. The scale comprised of 22 items (or statements) which were selected from two mathematics attitude scales; that is, eight items from Callahan (1971) and fourteen items from Aiken (1988).

In the scale equal number of positively and negatively stated items were included. The major criterion for selection was that the items should be easy to understand. The statements or items were then translated into Amharic so that the students at both grade levels would be able to comprehend the statements.

The attitude scale was administered to the pilot sample in the form of questionnaire. Then positively stated items were scored 1, 2, 3, 4 and 5 as strongly disagree, disagree, undecided, agree and strongly agree, respectively. For negatively stated items, the scoring was reversed (Kaplan and Saccuzzo, 2001). Thus, a respondents' total score on the attitude item set was computed as the sum of scores for the individual items. The internal consistency reliabilities of the attitude scale (using KR₂₀) was obtained to be 0.92.

Since the attitude scale in the pilot sample was highly reliable (with internal consistency reliabilities were found to be greater than 0.90), all of the 22 items were included for the final form of the scale, 11 of which were positively and the remaining 11 were negatively stated. This was in line with Edwards (1957) suggestion that the investigator can select 20 to 25 items. Then, the final scale was highly reliable (internal consistency reliabilities were found to be, $r > 0.90$ for each grade level; that is, 0.91 for grade nine, and 0.93 for grade 10) (see appendix C for the items of the attitude scale).

3.4 Procedure of Data Collection

In the Pilot study, one of the instruments (attitude scale, in the form of questionnaire) was administered to grade 10 students. Then, after orienting that they were going to take a mathematics test, the other instrument (achievement test) was conducted to both grades during the students' free time.

In the main study, first the administration of questionnaire for the attitude scale was carried out in the students' free time. On the other

hand, the achievement tests were administered three days later after the students had been informed to prepare themselves for the tests. The administration of each of the instruments was carried out by the investigator so that the students may give information about their attitudes as well as achievement in mathematics honestly and freely.

3.5 Method of Data Analysis

The data gathered through the above instruments were analyzed quantitatively. The achievement test scores were recorded. The scores on the attitude scale were summed up and recorded. The mean and standard deviation of the achievement test scores as well as the scores on the attitude scale were calculated. Their mean scores were analyzed using t-test. The students' mean scores were correlated with their attitude scales using Pearson correlation (r). The correlation of achievement test scores and attitude scale were sought among different groups (variables); type of school, sex and grade level.

CHAPTER FOUR

4. PRESENTATION AND ANALYSIS OF DATA

This chapter is concerned with the presentation of the analysis of the data gathered from different sources to answer the main questions in the study. The data were analysed in accordance with the research questions. The results of the study are presented in the following order: attitude difference in type of schools, gender difference in attitude, mathematics achievement difference in type of schools, mathematics achievement difference in both sexes and attitudes toward mathematics and their achievement. This chapter is also concerned with the discussion based on the research questions indicated in chapter one.

4.1 Attitude Difference in Type of Schools

Table 4.1 t- test for comparison of students' attitudes toward mathematics between private and government secondary schools

Grade level	Sex	Type of school	N	Mean	SD	t-value
9	M	Government	30	86.67	15.67	-0.13
		Private	20	87.30	18.57	
	F	Government	29	88.60	14.94	2.00
		Private	20	78.70	20.75	
	T	Government	59	87.59	15.35	1.18
		Private	40	83.00	20.13	
10	M	Government	29	88.48	18.14	1.44
		Private	20	79.30	27.85	
	F	Government	29	84.48	20.09	1.83
		Private	20	73.55	22.60	
	T	Government	58	86.48	19.08	2.06
		Private	40	76.43	25.20	
Merging the two grades (9 & 10)	M	Government	59	87.56	16.93	0.95
		Private	40	83.30	23.89	
	F	Government	58	86.52	17.67	2.40
		Private	40	76.13	21.57	
	T	Government	117	87.04	17.23	2.63
		Private	80	79.71	22.90	

P<0.05

From table 4.1, for grade 9 male students' attitude scores the calculated t- value -0.130 in absolute value is less than 2.021 which is the t- critical for two tailed test at df48 and $p < 0.05$. It could, therefore, be said that the difference in attitudes toward mathematics between private and government grade 9 male students is not significant. Similarly, the obtained t-value for grade 9 female students' attitude scores 2.000 is less than 2.021 which is the t-critical for two tailed test at df47 and $p < 0.05$. It could, therefore, be said that the difference in attitudes toward mathematics between private and government grade 9 female students is not significant. In addition, when both male and female students' attitudes were considered together in grade 9, the obtained t- value 1.180 is less than 2.000 which is the t-critical for two tailed test at df97 and $p < 0.05$. It could, therefore be concluded that the difference in attitudes toward mathematics between private and government grade 9 students is not significant.

Regarding grade 10 male students' attitude scores, the calculated t- value 1.440 is less than 2.021 which is the t-critical for two tailed test at df47 and $p < 0.05$. Therefore, it can be said that the difference in attitudes toward mathematics between private and government grade 10 male students is not significant. Similarly, the obtained t-value for grade 10 female students' attitude scores 1.830 is less than 2.021 which is the t-critical for two tailed test at df47 and $p < 0.05$. Thus, it can be said that the difference in attitudes toward mathematics between private and government grade 10 female students is not significant. On the other hand, when both male and female students' attitudes considered together in grade 10, the obtained t-value 2.060 is greater than 2.000 which is the t-critical for two tailed test at df96 and $p < 0.05$. This leads to say that there is a significant difference in attitudes toward

mathematics between private and government grade 10 students. Even though there isn't significant difference when both sexes were considered separately, the result obtained shows that there is a significant difference in taking both sexes together. It needs further investigation for why it happened so.

Considering the two grades (9 and 10) together, for the male students' attitude scores the calculated t-value 0.951 is less than 2.000 which is the t-critical for two tailed test at $df=97$ and $p<0.05$. Hence, it can be said that the difference in attitudes toward mathematics between private and government grade 9 and 10 male students is not significant. On the other hand, the obtained t-value for grade 9 and 10 female students' attitude scores 2.400 is greater than 2.000 which is the t-critical for two tailed test at $df=96$ and $p<0.05$. It could, therefore, be said that there is a significant difference in attitudes toward mathematics between private and government grade 9 and 10 female students. Besides, when both male and female students' attitudes considered together in grade 9 and 10 as the whole, the obtained t-value 2.630 is greater than 1.980 which is the t-critical for two tailed test at $df=195$ and $p<0.05$. It could, therefore be concluded that there is a significant difference in attitudes toward mathematics between private and government first cycle secondary school students in Adama city. This happened since the observed significant difference biased to female students' difference rather than to male students' difference. It is because of the difference in female students' mean scores is greater than the difference in male students' mean scores.

One of the questions that are to be answered in this study was whether there is a significant difference in attitudes toward mathematics between private and government secondary schools. As table 4.1 shows, considering the two grades (9 and 10) together, the significant difference

was not observed in attitudes toward mathematics between private and government school male students [$t(0.05, 97) = 0.95$]. However, a significant difference was observed in attitudes toward mathematics between private and government first cycle secondary school female students [$t(0.05, 96) = 2.40$]. And, the difference was also observed when both grades and sexes were considered together [$t(0.05, 195) = 2.63$]. This means that when the total subjects were divided into private and government secondary school, a significant difference was observed in attitudes toward mathematics between private and government first cycle secondary school students in favor of government school students.

From table 4.1, specific questions such as whether there is a significant difference in attitudes toward mathematics between private and government secondary school: grade 9 male, grade 9 female, entirely grade 9 subjects, grade 10 male, grade 10 female and totally grade 10 subjects. As a result, in all those cases, there is not significant difference except that a significant difference is observed between private and government secondary school grade 10 students [$t(0.05, 96) = 2.06$]. That difference is in favor of government school; which means grade 10 students in government school have better feelings toward mathematics than grade 10 students in private school.

4.2 Gender Difference in Attitude

Table 4.2 t- test for comparison of students' attitudes toward mathematics between male and female students

Type of school	Grade level	Sex	No	Mean	SD	t-value
Government	9	M	30	86.67	15.94	-0.496
		F	29	88.55	14.94	
	10	M	29	88.48	18.14	0.853
		F	29	84.48	20.09	
	9 &10	M	59	87.56	16.93	0.260
		F	58	86.52	17.67	
Private	9	M	20	87.3	19.03	1.365
		F	20	78.7	20.75	
	10	M	20	79.3	27.85	0.717
		F	20	73.55	22.6	
	9 &10	M	40	83.3	23.89	1.287
		F	40	76.13	21.3	
Merging both schools	9	M	50	86.92	17.05	0.681
		F	49	84.53	18.02	
	10	M	49	84.73	22.8	1.061
		F	49	80.02	21.61	
	9 &10	M	99	85.84	20.03	1.258
		F	98	82.28	19.92	

$$P < 0.05$$

As shown in Table 4.2, for grade 9 students' attitude scores in government school the obtained t-value -0.496 in absolute value is less than the t-critical value 2.021 for two tailed test at df57. It could, therefore, be said that the difference in attitudes toward mathematics between grade 9 male and female students in government school is not significant. Similarly, the calculated t-value for grade 10 student's attitude scores in government school 0.853 is less than the t-critical value 2.021 for two tailed test at df56. It could, therefore, be said that the difference in attitudes toward mathematics between grade 10 male and female students in government school is not significant. In addition, when the attitudes of both grades (9 and 10) students considered together

in government school, the obtained t-value 0.260 is less than the t-critical value 2.000 for two tailed test at df115. It could, therefore, be concluded that the difference in attitudes toward mathematics between male and female students in government first cycle secondary school is not significant.

Regarding grade 9 students' attitude scores in private school, the calculated t-value 1.365 is less than the critical value of t 2.042 for two tailed test at df38. Therefore, it can be said that the difference in attitudes toward mathematics between grade 9 male and female students in private school is not significant. Similarly, the calculated t-value for grade 10 students' attitude scores in private school 0.717 is less than the t-critical value 2.042 for two tailed test at df38. Thus, it can be said that the difference in attitudes toward mathematics between grade 10 male and female students in private school is not significant. In addition, when the attitudes of both grades (9 and 10) students considered together in private school, the obtained t-value 1.287 is less than the t-critical value 2.000 for two tailed test at df78. It could, therefore, be concluded that the difference in attitudes toward mathematics between male and female students in private first cycle secondary schools is not significant.

Merging the two types of schools (private and government) together, for grade 9 students' attitude scores the obtained t-value 0.681 is less than the t-critical value 2.000 for two tailed test at df97. Hence, it can be said that the difference in attitudes toward mathematics between grade 9 male and female students of first cycle secondary school in Adama city is not significant. Similarly, the calculated t-value for grade 10 students' attitude scores in first cycle secondary school 1.061 is less than the critical value of t 2.000 for two tailed test at df96. It could, therefore, be said that the difference in attitudes toward mathematics between grade 10 male and female students of first cycle secondary school in Adama

city is not significant. Besides, when the attitudes of both grades (9 and 10) students considered together in first cycle secondary school, the obtained t- value 1.258 is less than the t-critical value 1.980 for two tailed test at df195. It could, therefore, be concluded that the difference in attitudes toward mathematics between male and female students in the first cycle secondary school in Adame city is not significant.

From the previous chapter, another question that needs to be answered in the study was whether there is a significant difference in attitudes toward mathematics between male and female students in the first cycle secondary schools. As it was shown in table 4.2, in the analysis of attitude scores, the observed difference in attitudes was not statistically significant between male and female in both grade levels as well as in types of schools. The absence of statistically significant gender difference in attitudes is consistent with the findings of previous studies as revealed in the literature. From the report that who likes mathematics most, Ernest (1976) found no gender difference in boy-girl proportions among students of grades 2 through 12. Seleshi (1995) also found no gender differences in attitudes toward mathematics among eighth graders.

On the other hand, though not statistically significant, males (means=85.84) received higher attitude scores than did females (mean=82.28), when both schools and grades were merged together. At both grade levels and type of schools, except grade 9 students in government school, males obtained higher attitude scores as compared to females.

As a whole, from this consistent finding, one may partly suggest that males have better attitudes toward mathematics as compared to females. An explanation for such slight difference in attitude may be due to other

variables which could influence the attitudes of males and females differently.

Among those factors, teacher and peer-group expectations tend to favor males over the females (Fennema and Leder, 1990). They reported that these interpersonal expectations influence female students’ attitude toward mathematics negatively. Hence, the females’ less favorable attitudes toward mathematics could be attributed to the lower expectations teachers and peers hold for females in relation to mathematics achievement.

4.3 Mathematics Achievement Difference in Type of Schools

Table 4.3 t- test for comparison of students’ mathematics achievement between private and government secondary schools

Grade Level	Sex	Type of School	N	Mean	SD	t-obt
9	M	Government	30	56.33	17.52	-1.549
		Private	20	64.40	9.71	
	F	Government	29	42.72	12.48	-2.092
		Private	20	52.50	21.18	
	T	Government	59	49.64	16.60	-2.128
		Private	40	58.45	21.07	
10	M	Government	29	51.79	16.26	0.503
		Private	20	49.80	9.75	
	F	Government	29	39.41	12.28	-3.402
		Private	20	51.85	13.82	
	T	Government	58	45.60	15.59	-1.650
		Private	40	50.83	11.85	
Grade 9 and 10 taken together	M	Government	59	54.10	16.92	-0.792
		Private	40	57.10	17.03	
	F	Government	58	41.07	12.39	-3.367
		Private	40	52.18	17.65	
	T	Government	117	47.64	16.17	-2.966
		Private	80	54.64	17.41	

P<0.05

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Table 4.3 shows that, for grade 9 male students' mathematics achievement test scores, the calculated t-value -1.549 in absolute value is less than 2.021 which is the t-critical for two tailed test at $df=48$ and $p<0.05$. It could, therefore, be said that the difference in mathematics achievement between private and government grade 9 male students is not significant. However, the obtained t-value for grade 9 female students' mathematics achievement test scores -2.092 in absolute value is greater than 2.021 which was the t-critical for two tailed test at $df=47$ and $p<0.05$. It could, therefore, be said that the difference in mathematics achievement between private and government grade 9 female students is significant. In addition, when both male and female students' mathematics achievement considered together in grade 9, the obtained t-value -2.128 in absolute value is greater than 2.000 which is the t-critical for two tailed test at $df=97$ and $p<0.05$. It could, therefore, be concluded that the difference in mathematics achievement between private and government grade 9 students is significant. This is so happened since the observed significant difference biased towards females students' difference rather than towards males students' difference. It is because of the difference in females' students mean scores is greater than the difference in males' students mean scores.

Regarding grade 10 male students' mathematics achievement test scores the obtained t-value 0.503 is less than 2.021 which is the t-critical for two tailed test at $df=47$ and $p<0.05$. Therefore, it can be said that the difference in mathematics achievement between private and government grade 10 male students is not significant. Nevertheless, the calculated t-value for grade 10 female students' mathematics achievement test scores -3.402 in absolute is greater than 2.021 which is the t-critical for two tailed test at $df=47$ and $p<0.05$. Thus, it can be said that the difference in mathematics achievement between private and government grade 10 female students is significant. However, when both male and female

students' mathematics achievement considered together in grade 10, the obtained t- value -1.650 in absolute value is less than 2.000 which is the t-critical for two tailed test at df96 and $p < 0.05$. It could, therefore, be concluded that the difference in mathematics achievement between private and government grade 10 students is not significant. From Table 4.3, it can clearly be seen that the obtained difference in mean scores for males is in favor of government school while the obtained difference in mean scores for females is in favor of private school. That is why we don't see a significant difference in the totality (taking both sexes together).

Considering the two grades (9 and 10) together, for the male students' mathematics achievement test scores the calculated t-value - 0.792 in absolute value is less than 2.000 which is the t critical for two tailed test at df97 and $p < 0.05$. Hence, it can be said that the difference in mathematics achievement between private and government grade 9 and 10 male students is not significant. On the other hand, the obtained t-value for grade 9 and 10 female students' mathematics achievement test scores -3.367 in absolute value is greater than 2.000 which is the t-critical for two tailed test at df96 and $p < 0.05$. It could, therefore, be said that there is a significant difference in mathematics achievement between private and government grade 9 and 10 female students. Besides, when both male and female students' mathematics achievement considered together in grades 9 and 10 as the whole, the obtained t-value -2.966 in absolute value is greater than 1.980 which is the t-critical for the two tailed test at df195 and $p < 0.05$. It could, therefore, be concluded that there is a significant difference in mathematics achievement between private and government first cycle secondary school students in Adama city. This is so happened since the observed significant difference biased towards female students' difference rather than towards male students difference. This is because of the difference

in female students' mean scores is greater than the difference in male students' mean scores.

The other research question that was raised in chapter one was if there is a difference in mathematics achievement between private and government secondary schools. From table 4.3, considering the two grads (9 and 10) together, the significant difference was not observed in mathematics achievement between private and government school male students [$t(0.05, 97) = 0.792$]. However, a significant difference was observed in mathematics achievement between private and government first cycle secondary school female students [$t(0.05, 96) = -3.367$]. And, the difference was also observed when both grades and sexes were considered together [$t(0.05, 195) = -2.966$]. This means that when the total subjects were divided in to private and government secondary school, a significant difference was observed in mathematics achievement between private and government first cycle secondary school student in favor of private school.

From table 4.3, specific questions such as whether there is a significant difference in mathematics achievement between private and government secondary school: grade 9 male, grade 9 female, entirely grade 9 subjects, grade 10 male, grade 10 female and totally grade 10 subjects. As a result, statistically significant difference was not observed in mathematics achievement between private and government secondary schools of grade 9 males; of grade 10 males and of grade 10 as a whole. But statistically significant difference was observed in mathematics achievement between private and government schools of grade 9 females in favor of private; of grade 9 as a whole in favor of private and of grade 10 females in favor of private secondary school.

4.4 Difference in Mathematics Achievement by Sex.

Table 4.4 t- test for comparison of students' mathematics achievement between male and female students

Types of School	Grade	Sex	N	Mean	SD	t-value
Government	9	M	30	56.33	17.52	3.649
		F	29	42.72	12.48	
	10	M	29	51.79	16.26	3.507
		F	29	39.41	12.28	
	9 & 10	M	59	54.10	16.92	4.387
		F	58	41.07	12.39	
Private	9	M	20	64.40	19.71	1.839
		F	20	52.50	21.18	
	10	M	20	49.80	9.75	0.542
		F	20	51.85	13.82	
	9 & 10	M	40	57.10	17.03	1.163
		F	40	52.18	17.65	
both Margining schools	9	M	50	59.56	18.66	3.589
		F	49	46.71	17.09	
	10	M	49	50.98	13.89	2.310
		F	49	44.49	14.21	
	9 & 10	M	99	55.31	16.94	4.117
		F	98	45.60	15.67	

$P < 0.05$

As shown in Table 4.4, for grade 9 students' mathematics achievement test scores in government school the obtained t-value 3.649 is greater than the t-critical value 2.021 for two tailed test at df57. It could, therefore, be said that the difference in mathematics achievement between grade 9 male and female students in government school is significant. Similarly, the calculated t-value for grade 10 students'

mathematics achievement test scores in government school 3.507 is greater than the t-critical value 2.021 for two tailed test at df_{56} . It could, therefore, be said that there is a significant difference in mathematics achievement between grade 10 male and female students in government school. In addition, when the mathematics achievement test scores of both grades (9 and 10) students considered together in government school, the obtained t-value 4.387 is greater than the t-critical value 2.000 for two tailed test at df_{115} . It could, therefore, be concluded that there is a significant difference in mathematics achievement between male and female students in government first cycle secondary school.

Regarding grade 9 students' mathematics achievement test scores in private school, the calculated t- value 1.839 is less than the critical value of t 2.042 for two tailed test at df_{38} . Therefore, it can be said that the difference in mathematics achievement between grade 9 male and female students in private school is not significant. Similarly, the calculated t-value for the grade 10 students' mathematics achievement test scores in private school 0.542 is less than the t.critical value 2.042 for two tailed test at df_{38} . Thus, it can be said that the difference in mathematics achievement between grade 10 male and female students in private school is not significant. In addition, when the mathematics achievement test scores of students of both grades (9 &10) considered together in private school, the obtained t-value 1.163 is less than the t-critical value 2.000 for two tailed test at df_{78} . It could, therefore, be concluded that the difference in mathematics achievement between male and female students in private first cycle secondary school is not significant.

Merging the two types of schools (private and government) together, for grade 9 students' mathematics achievement test scores, the obtained t-value 3.589 is greater than the t-critical value 2.000 for two tailed test at df_{97} . Hence, it can be said that the difference in mathematics

achievement between grade 9 male and female students of first cycle secondary school in Adama city is significant. Similarly, the calculated t-value for grade 10 students' mathematics achievement test scores in first cycle secondary school 2.310 is greater than the critical value of t 2.000 for two tailed test at df96. It could, therefore, be said that the difference in mathematics achievement between grade 10 male and female students of first cycle secondary school in Adama city is significant. Besides, when the mathematics achievement test scores of both grades (9 and 10) students considered together in first cycle secondary school, the obtained t-value 4.117 is greater than the t-critical value 1.980 for two tailed test at df195. It could, therefore, be concluded that there is a significant difference in mathematics achievement between male and female students at the first cycle secondary school in Adama city.

An investigation was made on mathematics achievement difference between male and female students in the first cycle secondary school. Consequently, a significant difference was found between males and females in government secondary school. Males had substantially higher achievement (mean=54.10) as compared with females (mean =41.07) in government secondary school. While, there is no significant difference in mathematics achievement between males and females in private secondary school. But, when the subjects in these two schools were taken as a single population, a significant difference was found between males and females in the first cycle secondary school. Males had substantially higher achievement (mean=55.31) with females (mean=45.60). This implies that males perform better than females in mathematics. Some of the earlier studies in the area reported similar findings (Benbow and Stanely, 1983; Gennet, 1991; Yoseph, 1997).

4.5 Attitudes toward Mathematics and its Achievement

Table 4.5 Pearson correlation coefficients between attitudes toward mathematics and mathematics Achievement

Types of School	Grade level	Sex	Pearson's r	Direction
Government	9	M	0.15	Positive
		F	0.23	Positive
		T	0.19	Positive
	10	M	0.25	Positive
		F	0.26	Positive
		T	0.27	Positive
	9& 10	M	0.19	Positive
		F	0.26	Positive
		T	0.21	Positive
Private	9	M	0.16	Positive
		F	0.15	Positive
		T	0.21	Positive
	10	M	-0.02	Negative ✓
		F	0.16	Positive ✓
		T	0.06	Positive
	9 &10	M	0.14	Positive
		F	0.15	Positive
		T	0.16	Positive
Merging the two schools	9	M	0.16	Positive
		F	0.09	Positive
		T	0.14	Positive
	10	M	0.15	Positive
		F	0.08	Positive
		T	0.13	Positive
	9 & 10	M	0.16	Positive
		F	0.09	Positive
		T	0.14	Positive

As it can be seen from Table 4.5, there is a negative correlation between attitudes toward mathematics and mathematics achievement of grade 10 male students in private school. This is because the value of r (correlation coefficient) was calculated to be -0.02. This value indicates that the correlation is very low as the number ($r=-0.02$) is close to zero rather than close to 1. Therefore, there is very low negative correlation

between attitudes toward mathematics and its achievement of grade 10 male students in private school. This correlation is not significant.

However, all the rest cases, except for grade 10 male students in private school, there is a positive correlation between attitudes toward mathematics and mathematics achievement. This is because the value of r (correlation coefficient) was obtained to be positive. Besides, all the values of r indicate that the correlation is very low as the number for r are close to zero rather than close to 1. Therefore, it can be said that there is very low positive correlation between attitude toward mathematics and its achievement in both grades, schools or sexes.

The last question that was raised in a research question was that the correlation of attitudes toward mathematics and mathematics achievement. The result of this study revealed that there is positive and low or very low correlation of students' attitudes and achievement in mathematics in both grade levels as well as in type of schools. Even, when the schools and the grades were merged and taken as single population, the correlation of students' attitudes toward mathematics and its achievement is 0.16 for males, 0.09 for females and 0.14 for the whole sampled population. These values show that there is less inter dependency of attitudes toward mathematics and its achievement in mathematics among the first cycle secondary school students in Adama city.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The objective of this study was to compare the private and government school students' attitudes toward mathematics and their achievement in the first cycle secondary (grade 9-10) schools in Adama city. To this effect, the following five basic research questions were formulated:

1. Is there a difference in attitudes toward mathematics between private and government first cycle secondary school students?
2. Is there a difference in attitudes toward mathematics between males and females students in the first cycle secondary school?
3. Is there a difference in mathematics achievement between private and government first cycle secondary school students?
4. Is there a difference in mathematics achievement between male and female students in the first cycle secondary school?
5. Is there a significant relationship between students' attitude and mathematics achievement in the first cycle secondary school?

There are two government and three private secondary schools in Adama city. From each type of secondary school one school was purposely selected for the sake of convenience. From the government secondary school (grades 9-10) 60 students (30 males and 30 females) were randomly selected from each grade level. From the private secondary school (grades 9-10) 40 students (20 males and 20 females) were randomly selected from each grade level.

In order to answer the research questions two instruments of data collection were employed: an attitude scale and mathematics

achievement tests. The attitude scale in the form of questionnaire was the same for both grade levels, while the mathematics achievement tests were different as they were constructed for each grade level based on the objectives and curriculum contents. Both of the instruments were tried out in a pilot study and refined before being used for the main study.

The data collected was analysed using t-test and Pearson correlation. Thus, the analysis yielded the following results

1. There is statistically significant difference in attitudes toward mathematics between private and government first cycle secondary school students in favor of government.
2. There is no statistically significant difference in attitudes toward mathematics between male and female students in the first cycle secondary school.
3. There is statistically significant difference in mathematics achievement between private and government first cycle secondary school students in favor of private school students.
4. There is statistically significant difference in mathematics achievement between male and female students in the first cycle secondary school in favor of males.
5. There is very low positive correlation between students' attitudes and mathematics achievement in the first cycle secondary school. This means that the observed correlation is not significant. That is because the calculated value of r is not close to rather it is close to zero. More over, it can be seen that the government school students have positive attitudes, but lower achievement than that of government school students while, the private school students have negative attitudes, but higher achievement than that of government schools students.

5.2 Conclusions

From the preceding findings, therefore, it may be possible to arrive at the following conclusions.

1. Type of schools influences students in acquiring affective behavior. The kind of attitudes students develop toward mathematics depends on the type of school in which student are learning. Thus, schools make a difference for students in gaining either positive or negative attitudes toward mathematics. With this regard, government school is a conducive environment for students to have a better feeling toward mathematics than the private school is.
2. Both male and female students equally like or dislike mathematics subject in the first cycle secondary school. So , the type of school does not make a difference in the development of attitudes toward mathematics between male and female students
3. The average scores of students in mathematics test significantly differ according to the type of school in which they are following. Types of school in which students attend affect the results of the learners in mathematics achievement. In this respect, private school is a conducive learning sector for students to have better results in mathematics achievement.
4. The significance difference observed in mathematics achievement between male and female students in favor of males has a great implication on unequal participation of females and males in achievement.
5. Students' attitudes toward mathematics and their achievement in mathematics are related variables that play important roles in the learning of the subject. Even though the correlation is low, a positive correlation between attitudes toward mathematics and

mathematics achievement indicates that a positive attitude is a necessary condition for a better achievement in mathematics.

5.3 Recommendations

Eventually, even though this study can not be taken as perfect and final, the findings seem to have some practical implications to mathematics education and future directions of research.

Specifically, the findings imply the need to improve students' attitude toward mathematics in private schools. Thus, it would be advisable for private school mathematics teachers to focus not only on cognitive aspects of the subject but also to be equally concerned with the affective domain (e.g., development of favorable attitudes toward mathematics). Various techniques may be employed by teachers to improve students' attitudes toward mathematics. These include associating mathematics with things that the learner views as pleasant and demonstrating the usefulness of mathematics both in every day life and careers. These techniques may develop the students' self-confidence in learning mathematics. The school directors as well as parents of the students in private school endeavor to help mathematics teachers and students in equipping the necessary materials as well as awareness for the development of positive attitude toward mathematics.

The findings indicate the need to improve students' level of achievement in mathematics in government schools. Otherwise, these students may score poorer results at national level when compared to other school students' results. This may lead them to difficulties in joining higher level institutions like universities. Therefore, it might be advisable for government school directors, mathematics teachers and parents to help their students in scoring better results. Particularly, it might be better if

government school mathematics teachers help their students to understand the subject matter very well.

The findings also show the need to bridge the gap between male and female students in mathematics achievement. Thus, it might be better if opportunities are given for students to observe female mathematics role models so that their belief of mathematics as the male domain subject could be changed. It might also be advisable for mathematics teachers to focus on classroom activities and encourage female students to actively participate in the classroom instruction. In addition, teacher training institutions should give special attention to the gender issue and train teachers in a way that they could assist, help and guide the female students in learning.

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APPENDIX A

TABLE OF SPECIFICATION

Table of specification for grade 9-10 mathematics test prepared as an instrument for the comparative study of private and government secondary school students' mathematics achievement in Adama city.

Grade 9

Major and Specific Content Areas	BEHAVIORAL OUTCOMES				
	Knowl edge	Compre hension	Applic ation	Analysis, Synthesis Evaluation	Total
1. Sets					5
1.1 Revisions with Sets	1	1			
1.2 Operations With Sets		1	1		
1.3 Some Properties of Set Operation				1	
2. Elementary Concepts on Binary Operations					4
2.1 Definition of a Binary Operation	1	1			
2.2 Properties of a Binary Operation			1	1	
3. Real Numbers					5
3.1 Revision on the Set of Rational Numbers	1				
3.2 Real Numbers		1	1		
3.3 Rationalization , Simplification of Radicals			1	1	
4. Working with Variables					6
4.1 Using Variables , Computing	1	2			

and Transforming Terms					
4.2 Powers and Calculating with Powers		1	1	1	
5. Linear Equations, Inequalities and Systems of Simultaneous Equations					6
5.1 Revision on Linear Equations and Inequalities with one Variable	1				
5.2 systems of Simultaneous Equations		1	2		
5.3 Equations and Inequalities Involving Absolute Value			1	1	
6. Quadratic Equations and Inequalities					4
6.1 Introduction to Quadratic Equations and Inequalities					
6.2 Solutions of Quadratic Equations		1	2		
6.3 Solving Quadratic Inequalities				1	
Total	5	9	10	6	30

Grade 10

Major and Specific Content Areas	BEHAVIORAL OUTCOMES				
	Knowl edge	Compre hension	Applic ation	Analysis Synthesis Evaluation	Tota l
1. Introductory Logic					3
1.1 Statements and Open Statements					
1.2 Introduction to the Fundamental Connectives		1			
1.3 Equivalent Propositions	1				
1.4 Applications of the Five Fundamental Connectives			1		
2. Numeration Systems					4
2.1 Revision on Numeration Systems and Decimal System.	1				
2.2 Bases and other than Base Ten			1		
2.3 Base Two Numeration System and the Computer		1			
2.4 Computations in Different Bases				1	
3.Exponential and Logarithmic Functions					6
3.1 Irrational Exponents and Exponential Functions	1		1		
3.2 Logarithmic Functions		1			
3.3 Logarithms and Computations with Logarithms		1	1	1	
4. Descriptive Statistics and Introductory Probability.					8
4.1 Descriptive Statistics	1	1	1		
4.2 Basic Ideas Concerning		1	1	1	

Probability.					
4.3The Binomial Theorem	1			1	
5. Congruence and Similarities of Triangles					4
5.1 Revision on Congruence of Line Segments, Angles and Triangles	1				
5.2 Postulate and Theorems on Congruence of Triangles		1			
5.3 Isosceles Triangle Theorem and the Converse of Isosceles Triangle Theorem			1		
5.4 Theorems on Similarity of Triangles		1			
6. Solid Geometry					5
6.1 Revision of Solid Figures	1	1			
6.2 Frustums of Pyramids and Circular Cones		1	1	1	
Total	7	10	8	5	30

APPENDIX B
MATHEMATICS ACHIEVEMENT TEST
Mathematics Achievement Test for *grade 9*

ADDIS ABABA UNIVERSITY
COLLEGE OF EDUCATION
DEPARTMENT OF CURRICULUM AND TEACHER PROFESSIONAL
DEVELOPMENT STUDIES

Time allowed 1:30

Direction: This booklet contains 30 multiple –choice items. Read each statement carefully. Each item is followed by four possible answers. there is only one best answer for each question. Choose the one that best answers the question and write the letter of your choice on the space provided on the separate answer sheet attached to the question paper.

1. Which of the following is an empty set?

A) $\{x : x \text{ is a factor of } 24\}$

B) $\{x : x \in \mathbf{N} \text{ and } 2x+4=0\}$

C) $\{x : x \in \mathbf{Z} \text{ and } x < 3\}$

D) $\{x : x \in \mathbf{N} \text{ and } x+6=9\}$

2. If $A = \{1\}$ and $B = \{1, \{2\}\}$, then which one is **true** ?

A) $\{\{2\}\} \in B$

B) $\{2\} \subseteq B$

C) $\{1\} \subset A$

D) $\{2\} \in B$

3. If $A = \{0, 2, \{\phi\}\}$ and $B = \{3, \phi, \{0\}, \{\phi\}\}$, then $A \cap B =$ _____

- A) $\{\phi\}$ B) $\{0, \phi, \{\phi\}\}$
 C) $\{\{\phi\}\}$ D) $\{\{0, \phi\}\}$

4. Given $U = \{-1, 0, 1, 2\}$, $A = \{-1, 0\}$ and $B = \{0, 2\}$ then which one is **true** ?

- A) $A' = \{0, 2\}$ B) $A \Delta B = \{-1, 2\}$
 C) $B \times A = \{(-1, 0), (-1, 2), (0, 0), (0, 2)\}$ D) $B \setminus A = \{-1\}$

5. In a class of 60 students, 30 are taking mathematics, 25 are taking physics and 10 are taking both. How many of the students are taking mathematics but not physics?

- A) 35 B) 15 C) 20 D) 30

6. Consider the set $S = \{-2, 0, 2\}$. If the operation Δ is defined on S by

$$x \Delta y = \frac{x+y}{2} + 1, \text{ then which one is } \mathbf{true}?$$

- A) $-2 \Delta 0 = 0$ B) $0 \Delta (2 \Delta 2) = 2$
 C) $0 \Delta 4 = 3$ D) Δ is a binary operation

7. Let $A = \{X, Y, Z\}$ and let the binary operation $*$ be defined by the table given below. Then which one is **not** true?

- A) $*$ is Commutative
 B) $*$ is a binary operation on A
 C) The identity element is Z
 D) The inverse of Y is Y itself

$*$	X	Y	Z
X	Y	Z	X
Y	Z	X	Y
Z	X	Y	Z

8. If the operation Δ on the set of integers $\mathbf{Z}$ is defined by $a \Delta b = a + b - ab$, then $(0 \Delta 4) \Delta (-1) =$ _____

- A) 3 B) 7 C) -1 D) -2

9. The operation $*$ and Δ defined on the set of even natural numbers by $a * b = a + b - 2$

$$a \Delta b = a b$$

Then $(0 * 2) \Delta (4 * 6) =$ _____

- A) 0 B) 8 C) 16 D) 2

10. Which of the following is **not** a rational number ?

- A) 0 B) $-\frac{13}{4}$ C) $\sqrt{6}$ D) $\sqrt{9}$

11. Which of the following numbers is **not** between $\frac{6}{11}$ and $\frac{5}{7}$?

- A) $\frac{7}{11}$ B) $\frac{4}{7}$ C) $\frac{50}{77}$ D) $\frac{8}{11}$

12. From the numbers given below, one of them is **not** a real number.

Which one is it?

- A) $\sqrt{0.001}$ B) $-\frac{11}{13}$ C) 0.333..... D) $\{x: x^2 = -4\}$

13. If $a = 3\sqrt{2/3}$, then $a =$ _____

- A) $\sqrt{6}$ B) $\sqrt{2}$ C) $2\sqrt{2}$ D) $3\sqrt{6}$

14. When we simplify $\sqrt{48} - \sqrt{108} + \sqrt{12}$ we get

- A) $6\sqrt{3}$ B) 0 C) 1 D) $12\sqrt{3}$

15. Let the number x be given. Then what is the sum of the square of the number and six times the number?

- A) $x^2 + 6x$ B) $x^2 + 6$ C) $x^2 + 6^2$ D) $(x + 6)^2$

16. When we transform the difference $9a^2 - 25b^2$ into the product we obtain:

- A) $(3+5)(a^2 + b^2)$ B) $(3a+5b)(3a+5b)$
C) $(3a-5b)(3a - 5b)$ D) $(3a-5b)(3a + 5b)$

17. When we perform the indicated division

$$\left(\frac{a^2 - b^2}{a} \right) \div \frac{a - b}{a} \text{ for } a \neq 0, a \neq b, \text{ we obtain:}$$

- A) $a - b$ B) $a + b$ C) $a^2 - b$ D) $a - b^2$

18) In the expression $\left(\frac{2}{3} \right)^5$ which one is **true**?

- A) 3 is the base B) 2 is the base
C) 5 is the power D) $\frac{2}{3}$ is the base

19) If $81^x = \frac{1}{3}$, then the value of x is _____.

- A) 4 B) $-\frac{1}{4}$ C) $\frac{1}{4}$ D) -4

20) The simplest name for $\left(\frac{64}{125} \right)^{-2/3}$ is:

- A) $\frac{16}{25}$ B) $\frac{25}{16}$ C) $\frac{8}{25}$ D) $\frac{25}{8}$

21) Which one of the following is a linear equation?

- A) $\frac{3}{4}x - 7 = 8$ B) $x^2 + 4x = 4$
C) $3^x = 9$ D) $4x - 5 < 7$

22) The solution set of $\begin{cases} y - x = 2 \\ y - 2x = 0 \end{cases}$ is:

- A) $\{(1, 3)\}$ B) $\{(0, 2)\}$ C) $\{(2, 4)\}$ D) $\{(3, 5)\}$

23) The sum of two numbers is 14 and the sum of their squares is 100.

Then what is the product of the numbers?

- A) 24 B) 40 C) 96 D) 48

24) Ayele thinks of a number. Beyene also thinks of a number which is 5 plus twice Ayele's number. If the sum of their numbers is 20, then what are the numbers?

- A) 12 and 8 B) 15 and 5 C) 13 and 7 D) 16 and 4

25) The solution set of $|7x-1| = 13$ is:

- A) $\{2, 1\}$ B) $\{-\frac{12}{7}, 1\}$ C) $\{2, -\frac{12}{7}\}$ D) $\{2, \frac{12}{7}\}$

26) When we solve the inequality, the solution set of $|x-2| < 0$ is:

- A) $\{ \}$ B) $\{x : x > 2\}$ C) $\{x : x < 2\}$ D) **R**

27) When we factorize $9x^2 + 49$, we obtain:

- A) $(3x-7)(3x+7)$ B) $(3x+7)(3x+7)$
C) $(3x-7)(3x-7)$ D) none of the above

28) The solution set of the quadratic equation $3x^2 + 8x + 4 = 0$ is:

- A) $\{-\frac{1}{2}, -2\}$ B) $\{-\frac{2}{3}, -2\}$ C) $\{-2, 2\}$ D) $\{\frac{1}{2}, 2\}$

29) A rectangular garden place, 12 meters long and 5 meters wide, has a path of uniform width around it. If the area of the path is 84m^2 , then the width of the path is:

- A) $2\text{m}; -\frac{21}{2}\text{m}$ B) $2\text{m}; \frac{21}{2}\text{m}$ C) 2m D) $\sqrt{24}\text{m}$

30) Given the quadratic equation $kx^2 - 2kx + 4 = 0$ then which of the following is **true**?

- A) The equation has two real roots if $0 < k < 4$
B) The equation has no real roots if $k < 0$ or $k > 4$
C) The equation has one real root if $k = 4$
D) The equation has one real root if $k = -2$ or $k = 2$

Mathematics Achievement Test for *Grade 10*

ADDIS ABABA UNIVERSITY

COLLEGE OF EDUCATION

DEPARTMENT OF CURRICULUM AND TEACHER PROFESSIONAL
DEVELOPMENT STUDIES

Time allowed 1:30

DIRECTION: This booklet contains 30 multiple choice items. Read each statement carefully. Each item is followed by four possible answers. There is only one best answer for each question. Choose the one that best answers the question and write the letter of your choice on the space provided on the separate answer sheet attached to the question paper.

1. Let P has the truth value 'F' and q has the truth value 'T', then which of the following has the truth value 'F'?
A) $\neg (P \wedge q)$ B) $\neg p \vee q$ C) $\neg p \wedge q$ D) $p \wedge q$
2. Compound statements that have the same truth values in all possible cases are called _____.
A) Tautology B) equivalent C) Contradiction D) A & C
3. Which of the following statement has the truth value 'true'?
A) $(6=10) \wedge (5^2 = 25)$ B) $(5<3) \vee (-3 > 0)$
C) If $5 > 3$, then $-3 < -5$
D) $2 + 7 = 8$ if any only if $2 > 3$
4. The scientific notation for the number 4078 is

- A) $(4 \times 10^3) + (7 \times 10) + 8$ B) 4.078×10^4
 C) 4.078×10^3 D) 4.78×10^3
5. If $(xET)_{\text{twelve}} = (430)_{\text{ten}}$, then, the value of x is:
 A) 1 B) 3 C) 2 D) 0
6. When we change $(11101)_{\text{two}}$ to base four we obtain:
 A) 29 B) 131 C) 31 D) 13
7. When we compute $(310)_{\text{four}} - (122)_{\text{three}}$, we obtain:
 A) 25_{ten} B) 120_{three} C) 55_{six} D) 302_{four}
8. If $x = (1/3)^{-2}$, then the value of x is:
 A) 9 B) -6 C) $\frac{1}{9}$ D) $-\frac{1}{6}$
9. If you deposit 750 birr at 8.2% compounded annually and paid from day of deposit to day of withdrawal, your balance is given by $B(t) = 750(1.08)^t$. How much will you have after 2 years?
 A) 800 birr B) 810birr C) 875birr D) 855birr
10. The equivalent logarithmic statement for $(3)^7 = k$ is
 A) $k = \log_3 7$ B) $7 = \log_3 k$
 C) $7 = \log_k 3$ D) $3 = \log_7 k$
11. Which of the following is **true** for $x, y > 0$ and $k \in \mathbf{R}$?
 A) $\log_2 x \cdot \log_2 y = \log_2 (x+y)$
 B) $\log_2 x \div \log_2 y = \log_2 (x-y)$
 C) $\log_2 (x^k) = (\log_2 x)^k$
 D) $(\log_2 5) - (\log_2 6) = (\log_3 5) - (\log_3 6)$
- 12) In the logarithmic equation $\log_6 (x^2 - 3) = \log_6 13$ the value of x is

A) -4 and 4

B) only 4

C) { }

D) $\sqrt{10}$

13) Given $\log 7.23 = 0.8591$, then $\log 0.0723 =$ _____

A) -2.8591

B) 2.8591

C) -1.1409

D) 1.1409

14) Given the data:

8,12,15,9,12,2,10,9,15,15,12 what is the range of the values given?

A) 7

B) 15

C) 13

D) 4

15) From the frequency distribution table given below what should be the median of the distribution?

A) 0

B) -1

C) 2

D) 2.5

v	0	-1	2	3	5
f	7	5	4	1	3

16) Given the data: 3.5, -1, -2.5, 0, x, 7, what should be the value of x so that the mean is 2?

A) 3

B) 5

C) 1

D) 19

17) In a survey, the weights of people that visited a certain clinic were recorded and the results were as follows:

Weight (kg)	40-49	50-59	60-69	70-79	80-89
No. of people	13	7	14	7	9

The probability that a person picked at random is greater than 59 kg is

A) $2/5$

B) $3/5$

C) $8/25$

D) $7/25$

18. A jar contains 3 white and 4 red balls. If 3 balls are drawn at random, what is the probability that all the balls drawn are red?

A) $\frac{4}{35}$

B) $\frac{1}{35}$

C) $\frac{4}{7}$

D) $\frac{12}{35}$

19) $C(5, 5) + C(5, 4) + C(5, 3) + C(5, 2) + C(5, 1) + C(5, 0) = \underline{\hspace{2cm}}$

A) 75

B) 32

C) 125

D) 25

20) When we expand $(x+y)^4$ we obtain

A) x^4+y^4

B) $x^4 + 4x^3y + 4x^2y^2 + 4xy^3 + y^4$

C) $x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$

D) $x^4 + x^2y + xy^2 + xy^3 + y^4$

21) What is the coefficient of x^{17} in the expansion of $(2x-x^2)^9$?

A) 18

B) -144

C) -18

D) 144

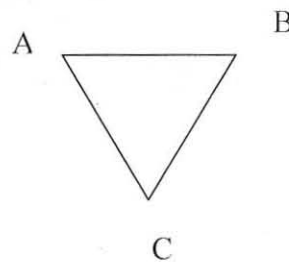
22) In the $\triangle ABC$, if $m(\angle C) = x^\circ$, $m(\angle B) = 2x^\circ$ and $m(\angle A) = 3x^\circ$, then which of the following is **true**?

A) the triangle is acute

B) the triangle is obtuse

C) the triangle is isosceles

D) the triangle is a right

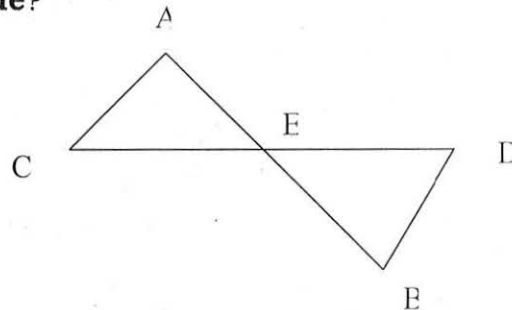
23) In the figure, if the line segments $\overline{AB}$ and $\overline{CD}$ intersect at E and $\overleftrightarrow{AC} \parallel \overleftrightarrow{BD}$, then which one is **True**?

A) $\overline{AC} \equiv \overline{BD}$

B) $\overline{AE} \equiv \overline{BE}$

C) $\triangle ACE \equiv \triangle BDE$

D) $\angle A \equiv \angle B$

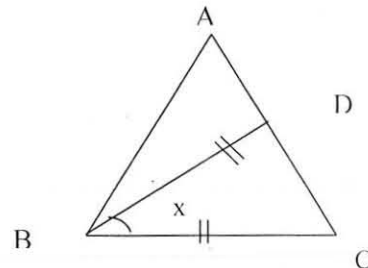
24) If in the figure, $\overline{AB} \equiv \overline{AC}$, $\overline{BD} \equiv \overline{BC}$ and $m(\angle CBD) = x^\circ$, then the measure of angle A is

A) $2x^\circ$

B) x°

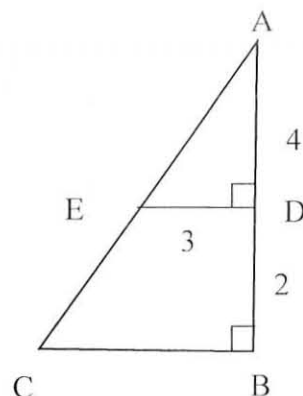
C) $\frac{x^\circ}{2}$

D) $\frac{180^\circ - x^\circ}{2}$



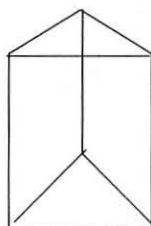
- 25) If in the figure, $\overline{AD} \perp \overline{ED}$, $\overline{AB} \perp \overline{CB}$, $\overline{AD} = 4\text{cm}$, $\overline{DB} = 2\text{cm}$, $\overline{ED} = 3\text{cm}$, then how long is $\overline{AC}$?

- A) 7.5 cm B) 4.5 cm
C) 5 cm D) 7cm



- 26) The solid figure in the right is called _____

- A) Triangular Prism
B) Triangular Pyramid
C) Circular cylinder
D) Cone



- 27) The radius of the base of a right circular cylinder is 2 cm and its altitude is 3 cm, then its total surface area is _____

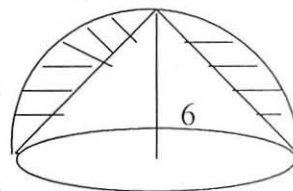
- A) $12\pi \text{ cm}^2$ B) $8\pi \text{ cm}^2$ C) $20\pi \text{ cm}^2$ D) $16\pi \text{ cm}^2$

- 28) The altitude of a pyramid is 10 cm. The base is a square whose sides are each 6 cm long. Then the area of a cross section parallel to the base and at a distance of 5cm from the vertex is:

- A) 36cm^2 B) 9cm^2 C) 18 cm^2 D) 24 cm^2

- 29) In a hemispherical solid of radius 6 cm a conical part is removed as shown in the figure. What is the volume of the resulting solid?

- A) $144\pi \text{ cm}^3$ B) $36\pi \text{ cm}^3$
C) $96\pi \text{ cm}^3$ D) $72\pi \text{ cm}^3$



- 30) The lower base of a frustum of a regular pyramid is a square 4 cm on a side; the upper base is 2 cm on a side. The slant height is 6cm. Then its total surface area is:

- A) 36cm^2 B) 38cm^2 C) 72cm^2 D) 48cm

ANSWER SHEET

Code No. _____ Grade and Section _____

Sex _____ School _____

1. _____

11. _____

21. _____

2 _____

12 _____

22 _____

3. _____

13. _____

23. _____

4 _____

14 _____

24 _____

5 _____

15 _____

25 _____

6 _____

16 _____

26 _____

7 _____

17 _____

27 _____

8 _____

18 _____

28 _____

9 _____

19 _____

29 _____

10 _____

20 _____

30 _____

APPENDIX C

QUESTIONNAIRE USED TO MEASURE ATTITUDES TOWARD MATHEMATICS

ADDIS ABABA UNIVERSITY

COLLEGE OF EDUCATION

DEPARTMENT OF CURRICULUM AND TEACHER PROFESSIONAL

DEVELOPMENT STUDIES

Questionnaire to be filled by students

The purpose of this questionnaire is to examine attitudes of pupils toward mathematics in grades 9 and 10. The success of the study highly depends on your honesty rating the scale. Hence, you are kindly requested to rate the scale carefully and honestly.

Thank you in advance

For your cooperation!

Code No. _____ Grade & section _____

Sex _____ School _____

Directions:- Each of the statements in this questionnaire expresses a feeling or attitude toward mathematics. You are to indicate, on a five – point scale, the extent of agreement between the attitude expressed in each statement and your own personal feelings. The five points are:

SD = strongly disagree

D = Disagree

UD= undecided

A = Agree

SA = strongly Agree

Mark (✓) the point which indicates how closely you agree or disagree with the attitude expressed in each statement as it concerns you.

No	Statements	SD	D	UD	A	SA
1	I like mathematics because it is practical					
2	I would like to spend more time in school working on mathematics.					
3	Mathematics is very interesting to me, and I enjoy arithmetic courses					
4	I avoid mathematics because I am not very good with figures.					
5	I feel a sense of insecurity when attempting mathematics.					
6	Mathematics is fascinating and fun					
7	Sometimes I enjoy the challenge presented by a mathematics problem.					
8	I detest mathematics and avoid using it at all time					
9	I don't get upset when trying to work mathematics problems					
10	I am not motivated to work very hard on mathematics problems.					
11	I like trying to solve new problems in mathematics					
12	Mathematics is dull and boring.					
13	I feel at ease in mathematics, and like it very much					
14	I am happier in a mathematics class than in any other class.					
15	Mathematics is not especially important in very day life					
16	It makes me nervous to even think about having to do a mathematics problem.					
17	Mathematics is a course in the school that I have always enjoyed studying.					
18	I approach mathematics with a feeling of hesitation, resulting from a fear of not being able					

	to do math.					
19	I have seldom liked studying mathematics.					
20	I am not willing to take more time than the required amount in mathematics.					
21	Mathematics is not of the most important subjects for people to study.					
22	Mathematics helps to develop the mind and teaches a person to think.					

APPENDIX -D

DISTRIBUTION OF MATHEMATICS SCORES AND ATTITUDE SCORES BY GRADE AND GENDER IN GOVERNMENT SECONDARY SCHOOL

GRADE 9

MALES			FEMALES		
<u>Code No.</u>	<u>X</u>	<u>Y</u>	<u>Code No.</u>	<u>X</u>	<u>Y</u>
GSS/01/99	97	94	GSS/31/99	60	103
GSS/02/99	87	100	GSS/32/99	17	88
GSS/03/99	43	90	GSS/33/99	57	84
GSS/04/99	53	98	GSS/35/99	53	99
GSS/05/99	50	79	GSS/36/99	27	69
GSS/06/99	40	92	GSS/37/99	53	77
GSS/07/99	53	98	GSS/38/99	50	95
GSS/08/99	60	97	GSS/39/99	40	75
GSS/09/99	47	88	GSS/40/99	37	84
GSS/10/99	53	89	GSS/41/99	33	99
GSS/11/99	47	85	GSS/42/99	50	73
GSS/12/99	47	51	GSS/43/99	50	95
GSS/13/99	43	97	GSS/44/99	50	93
GSS/14/99	43	89	GSS/45/99	63	107
GSS/15/99	63	99	GSS/46/99	57	101
GSS/16/99	63	93	GSS/47/99	57	100
GSS/17/99	53	69	GSS/48/99	43	85
GSS/18/99	70	102	GSS/49/99	43	101
GSS/19/99	67	104	GSS/50/99	60	91
GSS/20/99	77	93	GSS/51/99	43	74
GSS/21/99	73	94	GSS/52/99	43	101
GSS/22/99	30	86	GSS/53/99	40	56
GSS/23/99	80	72	GSS/54/99	40	94
GSS/24/99	80	106	GSS/55/99	33	95
GSS/25/99	27	99	GSS/56/99	30	78
GSS/26/99	20	89	GSS/57/99	30	98
GSS/27/99	57	86	GSS/58/99	30	96
GSS/28/99	60	45	GSS/59/99	30	47
GSS/29/99	50	61	GSS/60/99	20	110
GSS/30/99	57	55			

Note: x represents mathematics score.

Y represents attitude score.

GRADE 10**MALES**

<u>Code No.</u>	<u>X</u>	<u>Y</u>
GSS/01/99	83	98
GSS/02/99	73	93
GSS/03/99	53	99
GSS/04/99	20	91
GSS/05/99	57	96
GSS/06/99	60	43
GSS/07/99	50	103
GSS/08/99	47	45
GSS/10/99	47	99
GSS/11/99	53	97
GSS/12/99	60	104
GSS/13/99	43	105
GSS/14/99	53	89
GSS/15/99	63	95
GSS/16/99	40	101
GSS/17/99	63	91
GSS/18/99	37	92
GSS/19/99	37	41
GSS/20/99	67	94
GSS/21/99	33	81
GSS/22/99	33	71
GSS/23/99	70	101
GSS/24/99	33	101
GSS/25/99	70	90
GSS/26/99	30	96
GSS/27/99	57	95
GSS/28/99	27	63
GSS/29/99	70	93
GSS/30/99	73	99

FEMALES

<u>Code No.</u>	<u>X</u>	<u>Y</u>
GSS/31/99	10	102
GSS/32/99	50	104
GSS/34/99	47	94
GSS/35/99	50	93
GSS/36/99	47	103
GSS/37/99	50	83
GSS/38/99	17	56
GSS/39/99	57	88
GSS/40/99	47	101
GSS/41/99	40	85
GSS/42/99	40	99
GSS/43/99	40	100
GSS/44/99	40	103
GSS/45/99	40	101
GSS/46/99	37	43
GSS/47/99	53	96
GSS/48/99	23	80
GSS/49/99	57	94
GSS/50/99	37	88
GSS/51/99	23	91
GSS/52/99	20	82
GSS/53/99	37	31
GSS/54/99	37	87
GSS/55/99	57	47
GSS/56/99	50	91
GSS/57/99	30	98
GSS/58/99	30	81
GSS/59/99	37	47
GSS/60/99	40	82

APPENDIX -E

DISTRIBUTION OF MATHEMATICS SCORES AND ATTITUDE SCORES BY GRADE AND GENDER IN PRIVATE SECONDARY SCHOOL

Grade 9

Males

<u>Code No.</u>	<u>X</u>	<u>Y</u>
NS/01/99	97	93
NS/02/99	93	100
NS/03/99	57	110
NS/04/99	50	75
NS/05/99	67	92
NS/06/99	43	93
NS/07/99	67	94
NS/08/99	77	94
NS/09/99	70	87
NS/10/99	70	41
NS/11/99	60	35
NS/12/99	53	75
NS/13/99	20	93
NS/14/99	27	84
NS/15/99	70	97
NS/16/99	83	105
NS/17/99	73	101
NS/18/99	67	83
NS/19/99	57	97
NS/20/99	87	97

Females

<u>Code No.</u>	<u>X</u>	<u>Y</u>
NS/21/99	33	54
NS/22/99	37	96
NS/23/99	43	84
NS/24/99	40	88
NS/25/99	73	86
NS/26/99	80	98
NS/27/99	27	91
NS/28/99	90	84
NS/29/99	27	65
NS/30/99	40	78
NS/31/99	97	103
NS/32/99	73	96
NS/33/99	53	61
NS/34/99	37	87
NS/35/99	50	58
NS/36/99	23	103
NS/37/99	57	104
NS/38/99	60	35
NS/39/99	53	56
NS/40/99	57	47

GRADE 10**MALES**

<u>Code No.</u>	<u>X</u>	<u>Y</u>
NS/01/99	37	99
NS /02/99	40	85
NS /03/99	40	74
NS /04/99	53	110
NS /05/99	57	99
NS /06/99	57	91
NS /07/99	30	53
NS /08/99	47	33
NS /09/99	57	102
NS /10/99	63	92
NS /11/99	37	86
NS /12/99	47	106
NS /13/99	40	100
NS /14/99	60	51
NS /15/99	57	100
NS /16/99	57	110
NS /17/99	47	88
NS /18/99	63	35
NS /19/99	50	27
NS /20/99	57	45

FEMALES

<u>Code No.</u>	<u>X</u>	<u>Y</u>
NS/21/99	60	89
NS/22/99	37	27
NS/23/99	80	89
NS/24/99	73	95
NS/25/99	60	55
NS/26/99	63	49
NS/27/99	37	99
NS/28/99	53	79
NS/29/99	33	92
NS/30/99	37	79
NS/31/99	53	95
NS/32/99	30	74
NS/33/99	57	70
NS/34/99	67	91
NS/35/99	40	32
NS/36/99	50	92
NS/37/99	40	88
NS/38/99	60	82
NS/39/99	50	53
NS/40/99	57	41

DECLARATION

I, the under signed, declare that this thesis is my original work and has not been presented for a degree in any other university and that all sources of material used for this thesis have been duly acknowledged.

Name: Kebede Tefera

Signature: 

Place: Addis Ababa University

Date of submission: 20/08/2007

