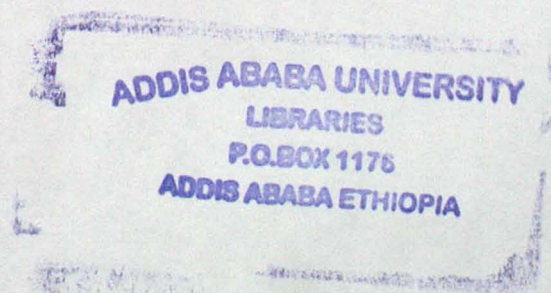


SOCIAL SCIENCE PREPARATORY I STUDENTS' MATHEMATICS
ACHIEVEMENT AND THEIR ATTITUDE TOWARDS MATHEMATICS
THE CASE OF GOVERNMENT SCHOOLS IN ADDIS ABABA

BY
KIFLE YILMA



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SCHOOL OF GRADUATE STUDIES
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**A THESIS SUBMITTED TO THE DEPARTEMENT OF CURRICULUM AND
TEACHER PROFESSIONAL DEVELOPMENT STUDIES IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER
OF ARTS IN CURRICULUM AND INSTRUCTION**

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Abbreviations and Acronyms

AAU	Addis Ababa University
HSIU	Haile Sellassie I University
ICDR	Institute for Curriculum development and research
math	Mathematics
PPS	Probability Proportion to Sample Size
SPSS	Statistical Package for the Social Sciences
SSPI	Social Science Preparatory I
UNBC	University of British Columbia

Abstract

The primary purposes of this study were to investigate Social Science Preparatory I students' mathematics achievement and attitude towards mathematics and also to determine whether or not selected variables such as attitude, liking mathematics, interest to and attention in learning mathematics were related with mathematics achievement.

Achievement test, attitude scale and some open and close-ended questionnaire items were administered to a sample of 221 girls and 121 boys who were selected by using multi-stage sampling method from four randomly selected government preparatory schools.

One sample t-test, Pearson Product moment correlation, biserial correlation and descriptive analyses were employed on the data for tests of significance. The overall achievement score of the students was found to be lower than 50% (as per national criterion for promotion) at 0.05 level and their attitude towards mathematics was unfavourable (less than the test value of 60). Results of biserial correlations analyses indicated that liking mathematics and achievement in mathematics were moderately related ($r = 0.399$), interest to learn mathematics and achievement in mathematics were moderately related ($r = 0.376$) and also attention to learn mathematics and achievement in mathematics were moderately related ($r = 0.368$) at 0.05 level. It was found that attitude variability accounted the highest (54%) achievement variability among the students. It was concluded that attitude and achievement were highly and positively related ($r = 0.731$).

Based on the findings, some possible suggestions were forwarded to students, teachers, parents, curriculum planners and Addis Ababa Education Bureau that would help to improve students' achievement in mathematics and raise their attitude towards the subject.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Generally mathematics holds a key position in education. Together with language and science, it forms part of a core of school subjects that are accepted world-wide (Orton & Wain, 1994). That means, in practice countries all over the world include mathematics in their curricula.

Countries around the world teach mathematics to their students at different levels, from elementary to university, for many reasons. For instance, according to the Encyclopedia of Educational Research (1992) the main purpose of teaching mathematics falls into two categories. One concern is the proper foundation which has to be laid for further study of mathematics at school and college for one's future life. The other concern is the proper foundation for adult occupation.

It seems that mathematics has undergone a gradual process to take its present form. Regarding its origin, Boyer & Merzbach (1989) noted that:

Mathematics is unlikely to have been the discovery of any one individual or of any single tribe; it is more probably a gradual awareness which may have developed as early in man's cultural developments as the use of fire, probably some 300,000 years ago (P.3).

Thus, it is assumed that the subject mathematics arose as an answer to practical needs for human beings in their long effort to cope up with the challenges of nature.

On the other hand, the historical thread of the secondary-school mathematics curriculum may be traced back to the Latin grammar school, the academics, the public high schools, and, to a more limited extent, colleges and

universities (Encyclopedia of Educational Research, 1992). Since then, as Roszkopf (1970) asserted, various changes have been taking place in the mathematics curriculum and in mathematics instruction as a result of progressive developments in the world. This clearly shows that mathematics has been alive within society. As society is always changing, definitely a change will occur in the contents of the mathematics curriculum.

In Ethiopia, the first curriculum guide that included a list of books for secondary schools was developed in 1956 (Ministry of Education & HSIU, 1967). In this document, it is stated that mathematics was one of the seven compulsory subjects to be offered for academic secondary schools. In fact, it is still one of the basic subjects taught at all grade levels.

Whatever the historical development of mathematics curriculum in our country was, we should be aware of the wide importance of mathematics for it has a significant influence on our everyday lives. For instance, we use arithmetic to display information by means of graphs and numbers many times every day. Signs along the highway tell us speed limits, and speedometers in the dashboard tell us whether or not we are violating traffic laws (Brown & Porter, 1996).

Mathematics is also important for the advancement of science and technology, and our understanding of the workings of the universe. As Brown and Porter (1996) indicated, it is mathematics which underpins the science and technology that support modern society. Furthermore, it has an indirect use to individuals in strengthening their powers of reasoning.

The usefulness of mathematics can further be considered when thinking of a future career, since one of the obvious functions of education is to provide a preparation for the world of work.

Thus, because of its various practical uses, the vast majority of university degree programmes require students to take mathematics courses. For example, in many universities of the world, degrees in areas like physical sciences, life and health sciences, business and commerce and medicine require good knowledge of mathematics and statistics (UNBC, 2008).

Regardless of its importance, however, the public image of mathematics is a poor one. For instance, after having spent between eleven and seventeen years in full-time education, many intelligent people are still claiming that mathematics has been, and will always be, a meaningless activity (Orton & Wain, 1994). In addition pupils in many developed countries acquire poor attitudes to the subject and find it difficult (Ibid, 1994). Similarly, according to (ICDR, 1998) the Ethiopian high school students had a negative attitude towards mathematics.

Negative attitude and low academic achievement in mathematics have initiated considerable interest among educationalists and researchers. As a result of this, a number of studies have been conducted on academic achievements of students in relation to attitude (Cheung, 1988; Kouassi, 1999; Rech, 1994; Schofield 1982).

With regard to achievement and attitude, relatively little research has been done in our country (e.g., Yoseph, 1997). In his survey, Yoseph examined the relationship between attitude and achievement on a randomly selected students (boys = 216 & girls = 215) of grades 6, 7, and 8). The results of Yoseph's findings have shown that students with high attitudes scores performed significantly ($p < 0.001$) better on mathematics test than those with low attitude scores.

Thus further investigation at the high school level particularly on SSPI students' academic achievement and attitude will minimize the gap in the existing literature which has implications to mathematics education at the preparatory level.

1.2 Statement of the Problem

Based on the Strategy of Education and Training Policy of Ethiopia (1994), students who pass the Ethiopian General Secondary Education Certificate Examination (EGSECE) are admitted to preparatory classes where they study at least for two years according to their area of interests: Social or Natural science streams.

Mathematics, being one of the compulsory subjects, is taught to the two groups in both grades (Preparatory I and Preparatory II). Since the implementation of the program, the issue of preparatory I social science students' low academic performance in mathematics has been a hot agenda, among teachers in general and students in particular in the school where the present researcher is teaching (Bole senior secondary school). Because of this, some of the researcher's colleagues went to the extent of refusing to teach these groups of students, when assigned by the school administration.

So, my own experience as a teacher provided me with some initial ideas and data. Then, I decided to have discussions with some mathematics teachers outside my school and ask if they had noticed anything similar. It was really useful to do this because they helped me to think about things which I had not thought of. One of them told me about a survey research made by ICDR (1998). It was useful for me to read the research, as it raised some of the issues I had already identified (For example, method of teaching, medium of instruction and overcrowded classrooms). It also helped me to adjust the focus of my work slightly.

Accordingly, such related experiences have led me decide to investigate why SSPI students score less than the minimum standard set in the policy document, as little has been known about this particular issue. According to the Education and Training policy (1994), "In order to get promoted from one grade level to the next, students will be required to have a minimum of fifty percent achievement" (p.18).

1.3 Objective of the Study

The purposes of the present study were twofold:

- I) to investigate the mathematics achievement and attitude of Social Science Preparatory I Students at some selected government schools of Addis Ababa;

II) to investigate whether or not selected variables such as attitude, liking, interest and attention are related with mathematics achievement.

More specifically, the study has the following objectives:

- 1) To investigate Social Science Preparatory I students' achievement in mathematics relative to the cut-off score of 50 percent for promotion as specified by the policy.
- 2) To investigate social Science Preparatory I students' attitude towards mathematics.
- 3) To find out the relationship between mathematics achievement and attitude towards mathematics.
- 4) To investigate SSPI students' opinions on liking of mathematics, interest to and attention in mathematics and their views about mathematics learning.

Based on the above objectives, the study sought to answer the following research questions.

Research Questions

- 1) How is the mathematics achievement of Social Science Preparatory I (SSPI) students' relative to the cut-off score of 50 percent for promotion as specified by the policy?
- 2) What is the attitude of Social Science Preparatory I students' towards mathematics?
- 3) Is there any relationship between academic achievement in mathematics and attitude towards mathematics?
- 4) What is the opinion SSPI students' on liking of mathematics, interest to and attention in mathematics and their views about mathematics learning?

1.4 Significance of the Study

This study will have at least the following significances:

- ❖ It helps mathematics teachers to know what kind of assistance SSPI students need most.
- ❖ It serves as an indicator to show the general problems of SSPI students in math.
- ❖ It encourages the Addis Ababa Education Bureau to take initiatives to devise appropriate measures to minimize the problem.
- ❖ It helps curriculum planners to evaluate the quality and significance of the textbook being implemented.
- ❖ It serves as a starting point for other researchers in the field to study the problem in a broader sense.

1.5 Operational Definitions

For the purpose of this study, the following terms and concepts were defined as follows:

Mathematics achievement: Students' Mathematics performance as determined by their scores on a test constructed by the investigator on the basis of the mathematics syllabi for preparatory I students.

Under- achievers: students whose mathematics scores on the investigator made test were less than 50%.

Attitude: The tendency of the students to respond favourably or unfavourably toward the values and usefulness of mathematics and the confidence they have in solving mathematical problems as measured by Likert- scale.

Liking mathematics: Preference to mathematics rather than other subjects.

Attention: The tendency to participate actively during mathematics class.

Interest: The tendency to become absorbed in solving mathematical problems.

Government preparatory Schools: Schools that run from grades 9-12 and are administered mainly by the city government of Addis Ababa.

Preparatory I Students: First year students enrolled in the second cycle of secondary schools of Addis Ababa.

Social science students: Preparatory I students who were assigned to study Social sciences on the basis of their preference.

Mathematics teachers: Teachers who were teaching mathematics to SSPI students in the academic year 2006/7.

1.6 Delimitations of the Study

This study was delimited conceptually to achievement, attitude, liking of mathematic, interest and attention in learning mathematics and geographically to government preparatory schools in Addis Ababa. The participants of the study were those social science Preparatory I students found in the aforementioned schools. Thus, the conclusions will be confined only to this population.

1.7 Limitations of the Study

Constraints of time and the sampling procedure employed at the beginning are the major drawbacks of this study. As a result of this, the study has been limited only to four schools.

1.8 Organization of the Study

This study is divided into five chapters. Chapter one consists of the introduction, background of the study, statement of the problem, objective of the study, research questions, significance of the study, operational definitions, delimitations of the study, limitations of the study and the organization of the study. Chapter two includes the review of the literature. Chapter three contains

the research design and methods used in the data analysis. Chapter four contains the presentation, the findings and analysis of the data. Chapter five presents the summary, conclusions, and recommendations.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 Conceptualization of Academic Achievement

It is clear that one of the principal tasks of a school is to facilitate cognitive learning. Like all important educational goals this cognitive learning must make an observable difference among students. In other words, at some time, under some circumstances a person who has more of it must behave differently from a person who has less of it.

Undoubtedly we have taken many achievement tests during our educational career. For example, classroom tests that we took during our elementary and secondary school days that were used to measure our mastery of arithmetic, spelling, reading, history, natural science subjects, and other basic skills are achievement tests. We probably also could specify the types of items included on such tests-for example, questions measuring knowledge of specific facts, principles, and concepts; problems involving the manipulation of numbers and formulas; questions requiring us to draw conclusions from information contained in a reading passage; items requiring application of our knowledge to situations.

A question that must be clear for us is this: How can achievement tests be differentiated from other types of tests? Probably the answer from our experience could be that achievement tests measure what a person has learned. This is obviously true, but a little reflection will show that all tests measure what an individual has learned. We may take another direction and say that achievement tests assess mastery of academic subjects, yet the written test that is given to obtain a driving license is an achievement test. We might try to distinguish achievement tests by their uses. That is, if a test is

designed to evaluate teaching, it is an achievement test. However, there are instances where achievement tests are used primarily to predict future performance, since past performance is frequently the best predictor of future performance (Brown, 1983).

So what is an achievement test? Although it is difficult, if not impossible, to list all the definitions given by different educators, an attempt will be made to give clear and concise definitions cited by some scholars.

For instance, (Brown, 1983 & The World Book 1994), defined achievement test as a test if it measures learning that has occurred as a result of experiences in a relatively circumscribed learning situation, particularly in a classroom, and when the focus is on what has been learned.

The primary function of achievement test, according to Husen and Postlethwaite (1994) is to measure the extent of student learning with respect to what schools teach and students formally learn. Also achievement tests make use of the distinction between measuring individual student performance, class group or school group performance, and school performance (Ibid, 1994).

Achievement test as it has been mentioned above incorporates many and interrelated concepts. Achievement tests could mean measuring the degree of students' performance and mastery of academic subjects and predicting an individual student future performance. It also includes evaluating teaching methods and measuring an overall school performance.

With regard to achievement test as a measurement of academic achievement, Jones (1963) noted that in order to find what habits and skills have been developed after a period of study or exercise, we use achievement tests. Similarly, Ebel (1972) asserted that teachers often use different methods of achievement tests (for instance, homework, term papers and quizzes) to determine the academic achievements of their students.

Thus, it is possible to conclude that achievement tests are used to measure mastery of school subjects with particular reference to what has been taught in schools.

On the other hand Jones (1963) claimed that academic achievement tests have their own limitations, since they don't measure all the desirable outcomes on any subject. Despite some criticisms, however, achievement tests have been used by many educators as measurement of academic achievement.

Hence, for all types of learners, the periodic administration of well-constructed and properly chosen achievement tests serves to facilitate learning (Anastasi, 1976).

2.2 Types of Achievement Test

Achievement tests can be classified in various ways. As the World Book (1994) put it, one major distinction is between standardized and teacher-built classroom achievement tests. Standardized tests as the World Book (1994) revealed are tests that have been used, revised, and used again until they set average levels of performance. Standardized tests usually are developed by experts and are designed for use in a wide variety of schools to compare performances of similar students.

Thus, their coverages are necessarily broad and include materials taught in many schools. Norms are generally national in scope (Brown, 1983).

2.3 Standardized Tests: Why Are They Useful?

According to the world Book of study power (1994), Schools must know how well students are doing, individually and as a group. Most often teacher's tests provide some information but leave important questions unanswered. Such questions include how skilled are our students compared with students in other parts of the country? What goals are realistic for each student? What problems prevent each student from performing better in school? What should schools do to help students' overview these problems?

Standardized tests are designed to answer questions like these. They try to objectively report every individual's progress to their community, their schools, and to themselves.

Schools that give standardized tests have three goals. One is to tell their community about its students' progress. This reporting is sometimes called *accountability*. That is, to report results to the community. This is because all government schools are indirectly collecting money from the larger community.

Thus, naturally, those who pay the money for the proper function of the schools want to be sure that the school is doing its job (Ibid, 1994).

According to the World Book of Study Power (1994), Standardized tests are also designed to answer questions such as: what learning goals are realistic for each student? How is each student progressing toward learning goals? What future courses of study may be advisable for each student? Are students achieving more or less now than they were in the past? Thus, standardized tests are assumed to assess the performance of every student and his school.

Teacher-built tests, in contrast, are constructed or selected by the classroom teacher, or possibly by several teachers in the same school. Teachers are often the only ones who decide what appears in the test they make. So students must pay attention to what their teachers emphasize in the classroom discussion. Teacher-built tests are sometimes called classroom tests, because they measure how much each student is learning in the classroom. The contents will be more circumscribed, being based on the curriculum of a particular course or school. And, because the test covers a narrower domain than standardized tests, materials will be covered in more detail.

Achievement tests can also be classified by their function, *Survey tests* are designed to provide an estimate of a student's overall level of knowledge in a given content area. Survey tests, therefore, generally sample a broad range of content and yield only one total score. The typical classroom test is an example of a survey test. A *diagnosis test*, in contrast, attempts to assess

relative strengths and weakness in important component skills. Thus, diagnostic tests are divided into subsets, and scores are provided for each important component. A *readiness test* indicates whether the individual possesses the skills needed to learn the material at the next higher level. *Proficiency tests* are designed to measure whether a student has attained a designated level of competence in a particular area (The World Book, 1994).

One final distinction to consider is, between norm-referenced and content referenced achievement tests.

2.4 Norm –Referenced and Content –Referenced Tests

On norm referenced tests items are selected by their ability to differentiate between students having varying levels of knowledge, and scores will be interpreted as relative ranking within a designated comparison group; That is, norm-referenced tests contrast an individual's work with that of others who took the test. For instance, if student A answers two questions incorrectly on a norm- referenced test, while most other students answer four questions incorrectly, student A will rank high despite his mistakes. Most standardized tests as the world book (1994) asserted, are norm- referenced since they draw comparisons.

On the other hand in content –referenced (criterion –referenced) tests, the primary concern is to determine an individual's level of mastery of the material tested. In short, criterion-referenced tests match an individual's results against a standardized, or criterion, established before the test. Thus, rather than selecting items primarily to differentiate between students, items are selected to cover important instructional outcomes. And rather than expressing a person's score in comparison with scores of other students, scores are interpreted in relation to a content defined standard. Sometimes this standard is a minimal level of competence. The important point, however, is that scores are interpreted in terms of content mastery. Moreover on content-referenced tests

items are selected if they measure important instructional objectives, regardless of their difficulty (Brown, 1983).

Thus the major distinction between norm-referenced and criterion referenced tests is that the former is used to show where a pupil stands in comparison with other pupils who have taken the same test and the latter is used to display whether or not a pupil has been able to perform some well-defined task to an acceptable standard. Hence it is possible to deduce that many teachers' tests are Criterion –referenced.

2.5 Characteristics of a Good Achievement Test

As has been mentioned before, an achievement test has a number of uses in any educational process. Regardless of its uses, however, the most common characteristics of a good achievement test are validity and reliability (Smith & Adams, 1972).

Validity. Validity is the most crucial characteristics an achievement test should possess. According to Gay and Airasian (2000), test validity is concerned with the appropriateness of the interpretations made from test scores. That is, validity is specific to the intended interpretation being used.

2.5.1 Types of Validity

Since tests are constructed and given for different purposes, the actual approach to validity depends on the purpose of the test. However, the basic concept remains the same. The major approaches mentioned by Smith and Adams (1972) are: Face validity, content validity and construct validity.

face validity. This is determined by examination of the title and appearance of the test. A test may be said to have face validity if it appears to measure what its author says it measures.

content validity. This is the degree to which a test measures an intended content area. Content validity requires both items validity and sampling validity. Item validity is concerned with whether the test items are relevant to

measurement of the intended content area. Sampling validity is concerned with how well the test sample the total content area being tested (Ibid, 1972).

construct validity. Construct validity is the most important form of validity because it asks the fundamental question: What is this test really measuring? We can not see construct validity, we can only observe its effect. That means, the process of determining validity is by no means easy (Gay and Airasion, 2000).

In general, a number of factors can minimize the validity of tests used in research. They include:

- Unclear test directions
- Confusing and ambiguous test items
- Using vocabulary too difficult for test takers
- Overly difficult and complex sentence structures
- Untaught items included on the achievement test
- Failure to follow standardized test administration procedures
- Cheating, either by participation or by someone teaching the correct answers to the specific test items.

All this factors diminish the validity of tests because they distort the actual test scores, which in turn distorts the desired interpretation of the test scores (Ibid, 2000).

Most commonly, achievement tests are designed to measure command of specified content and/or skills domain, and as the test items are selected to represent this domain, in most situations the appropriate method of validation is content validation. That is, the most important question is whether the test items do, in fact, represent the content domain. This will generally be judgmental evaluation rather than a quantitative index (Brown, 1983).

2.5.2 Test Reliability

Test scores are said to be reliable if the scores obtained from the test would have been essentially the same when the test were administered to the same test takers. Reliability is expressed numerically (between -1 and 1) as a reliability coefficient, which is obtained by using correlation. But these correlational values are not the same for every test scores, as Ebel (1979) put it in the following way:

Expertly constructed educational achievement tests often yield reliability coefficients of 0.90 or higher. In contrast, the achievement tests used in many elementary, secondary, and college classrooms often show reliability coefficients of 0.50 or lower (p.274).

2.5.3 Methods of Estimating Reliability

Although there are different methods of estimating the reliability of a test score, internal consistency reliability is a commonly used form of reliability. Internal consistency, according to Gay and Airasian (2000), deals with one test at one time. It is obtained through three different approaches: Split-half, Kuder –Richardson and Cronbach's alpha. Each provides information about the consistency among the items in a single test. Since internal consistency approaches require only one test administration, sources of measurement errors, such as differences in testing conditions, are eliminated (Ibid).

Item analysis. The analysis of student response of objective test items is an important instrument for improving test items. The processes of item analysis begin with the counting of responses made by the upper and lower 27 percents of the total group to each of the items in the test. Item analysis usually involves indices of item difficulty and discrimination power of each item (Ebel, 1979).

The index of item difficulty (P). It is the proportion of a defined group of examinees who answer the item correctly (Ebel, 1979). An accepted value of item difficulty for a Criterion –Referenced achievement test ranges from 50% to 70% (Roid and Haladyna, 1982).

The index of item discrimination (D). It is the difference in proportion of correct response between upper and lower groups. An accepted value of item discrimination ranges from 0.30 to up (Ebel, 1979).

2.5.4 Item Analysis and a Criterion –Referenced Test

The item analysis procedures used with norm-referenced tests are not directly applicable for criterion –referenced tests, as Gronlund (1981) explains it as follows:

Criterion-referenced tests are designed to describe pupils in terms of the types of learning tasks they can perform, rather than to obtain a reliable ranking of pupils, indices of item difficulty and item discriminating power are less meaningful (p.264).

2.5.5 Achievement Test Scores

Evaluating students' test scores is an essential part in any test, since the results scored by the students tell us useful information about them.

Achievement tests serve four general purposes: namely summative assessment, formative assessment, placement assessment, and diagnosis (Bloom et al, 1971; cited in Husen & Postlethwaite, 1994). They are so widely used in educational practice that many attempts have been made to define meaningful scales that assist in the interpretation of the results (Husen & Postlethwaite, 1994).

In this section the different types of achievement test scales that have been developed by Husen and Postlethwaite (1994) and the world Book (1994) were presented and discussed.

2.5.6 Raw Scores Scales

Raw scores are the most widely used in practice. Many school teachers use it for formative assessment. They tell us the exact number of correct answers obtained by the student (i.e., the test taker). When a test is divided into

sections; the items that are correctly answered in each section will be reported. The items selected for inclusion are, in general, a judgmental sample.

According to the World Book (1994), raw scores are significant when shown as the results of criterion-referenced tests, where we must get a certain number of items right to pass.

2.5.7 Percentages and Mastery Scales

Though raw scores, as explained above, are the most widely used ways of showing academic performances of students, there is a different scale which provides more meaning than this. This score scale method expresses the scores obtained on an achievement test in terms of percentages to assign meaning for pass or fail.

Long-standing educational practice assigns meaning to more than 50 percent correct as a pass and less than 50 percent correct as a fail when achievement test scores are being used in summative assessment. In formative assessment, on the other hand, it is common for meaning to be assigned to more than 80 percent as mastery, and less than 80 percent correct as non-mastery (Husen & Postlethwaite, 1994).

So achievement tests which are used for formative assessment or as mastery tests generally involve a representative of sample of items from a limited domain. When achievement tests are being used for pass-fail purposes, the domain covered is generally much broader (Ibid.1994).

2.6 Research Findings on Mathematics Achievement

In the following section, brief reviews of the few available relevant studies on mathematics are presented.

In the USA, since 1969 a national as well as an international assessment have been conducted by the National Assessment Education Progress (NAEP) center to know what the American students know and can do (NAEP, 1996;

cited in Desalegn 2004). For instance, in the second cross cultural mathematics study (Mc- Knight et al; 1987 cited in Alken, 1992) indicated that 8th and 12th graders in the United States showed less knowledge of mathematics than their counterparts in most other countries in which the tests were given. The study further noted that even the best US students (that is, the top 10% and top 5%) did poorly in comparisons to the best students in other countries.

Fennema and Tarte (1995) examined the relationship of selected cognitive and affective variables to mathematics achievement for a random sample of 60 (32 females & 28 males) students as they progressed through 6th, 8th, 10th and 12th graders. The results of the findings have shown the existence of no consistency gender difference for mathematics achievement, although the overall achievement of the students was lower than the average score.

In Ethiopia, a cross –sectional survey was conducted by ICDR (2002) to assess the level of students' behavioral changes in accordance with the objectives of primary education of (NATP). The target population were both the first and the second cycles of primary students found in Addis Ababa, Amhara, and Tigray, Dire Dawa, SNNPR, Afar, Oromia, Benshangul, Gambela and Harari. Regarding mathematics, all the surveyed regions scored less than 50% in both cycles.

The drawbacks of this study were that neither the sampling technique employed to select the sample nor the validity and reliability of the test have been mentioned.

Similarly, in order to examine the effectiveness of the second cycle Secondary school (Preparatory) program, an evaluative study was done by ICDR (2005). The outcome of this study revealed that students scored below 50% in mathematics, natural and social sciences. In particular, social science stream students in both grades mathematics average score was only 31.89%. In the same study the students were asked to rate subjects according to their difficulty level. Accordingly, 35 % of grade 12 social science students responded mathematics to be very difficult.

At the high school level, Desalegn (2005) made a comparative study of students' achievement in English and mathematics. Desalegn sampled ($F = 365$ & $M = 536$) grade 10 students from three different regions of Ethiopia. His results showed that only 12.3% of the sampled students were able to score above the criterion score (50%). That means, 87% of the sampled students scored below 50%. Desalegn further concluded that students' overall achievement in mathematics in the selected regions was very low.

On the other hand a different result was obtained by Surafel (2004). The purpose of Surafel's study was to investigate the relationship between general secondary education, EGSECE and one year preparatory students' academic performances. Academic achievements were found from record offices of the schools and the mean score of the students was found to be 60.83%. The reason for this could be that Surafel did not use self-constructed test which are more reliable and valid than regularly prepared teacher-made test. The major drawback of this study was no clear description have been mentioned whether the obtained mean score represented social or natural science students.

In a nutshell, most of the above findings implied that students' achievements in mathematics from elementary to secondary (preparatory) level were below 50%.

2.7 Attitudes – A preliminary overview

It is obvious that one of the main objectives of education is the development of desirable attitudes in the students. Thus, it is necessary that teachers ought to understand both the definition and the various dimensions of an attitude. Moreover, as Aggarwal (1998) pointed out teachers are required to develop several attitudes in the students – attitude toward self, attitude toward group-work, attitude towards subjects, and attitude towards colleagues.

The ways of looking at things and persons, forms of readiness, approaching and withdrawing behaviour, feelings of rightness and wrongness,

and liking or disliking for objects are interrelated with the working concepts of attitude which may be defined as a group of ideas predisposing the organism to action with reference to attitude objects (Lahey ; 2004, Remmers 1954).

Similarly, Edwards (1957) defined attitudes as the degree of positive or negative feeling associated with some psychological object which includes any symbol, phrase, slogan, person, institution or idea. A particular subject in a given school curriculum, for instance, may be considered as a psychological object.

An individual who has associated positive feeling with some psychological object is said to like that object or to have a favourable attitude toward the object. And an individual who has associated negative feeling with the same psychological object would be said to dislike or to have an unfavorable attitude toward the object (Ibid, 1957).

Thus, attitudes may be considered as tendencies to react favourably or unfavourably towards objects or ideas.

2.7.1 Origins of Attitudes

The origins of most of our attitudes are fairly obvious (Remmers, 1954). We frequently learn them directly from our experiences, and we occasionally learn them from others. Some of our attitudes are learned from first-hand experiences. For instance, children who are bitten by dogs often carry a negative attitude toward dogs for the rest of their lives, especially toward the kind of dog that bit them. In contrast, sweet chocolates generally lead to a favourable attitude toward them. In other words, some attitudes appear to be classically conditioned.

That is, If a stimulus (dogs or chocolates) is paired with a positive or negative experience, the attitude will be similarly positive or negative.

On the other hand attitudes are commonly learned from others. For instance, parents who model positive attitude toward their neighbours are likely

to have children who have positive attitudes toward their neighbours. On the other hand, children whose best friends think mathematics is difficult and boring may pick up this attitude through modelling (Ibid, 1954).

In summary, our attitudes are a combination of self-experiences and influences of other people.

2.7.2 The Determiners of Attitudes

Why does a given individual have certain attitudes? Where shall we look for the causes or origins of a person's attitude? How do people become different in attitudes? That is, why are some pupils favourable or unfavourable toward a given teacher, a given subject, or any other attitude object?

One possible answer to these questions has been provided by (Allport, 1936; cited in Remmers, 1954). He pointed out four ways in which attitudes are developed. These are: (1) **Integration** (2) **Differentiation** (3) **Shock**, and (4) **Adoption**

Integration. Integration is the development of an attitude through accumulation of a large number of experiences over a long period of time in which the sum of all these influence the individual in a specific direction. For instance, a long continued failure in solving arithmetic problems will be integrated by a pupil into an unfavourable attitude toward arithmetic.

Differentiation. Differentiation is the development of an attitude by splitting off a specific attitude from a more general one. For example, when an individual has an unfavourable attitude towards arithmetic because of his unfavourable attitude towards all school subjects.

Shock. Attitude development by shock is due to an unusual, violent, or painful experience. A child's attitude towards teachers may be shaped by the negative experience caused by a teacher when he punished him.

Adoption. An attitude develops by adoption means the individual merely follows the example of friends, teachers, parents, newspapers, and other

opinion –shaping agencies. For instance, a student may dislike a teacher because his friends dislike the teacher.

2.7.3 Persuasion and Attitudes

As our experiences show us, different people attempt to influence our attitudes through persuasion, and thus our attitudes are often reflected in our behaviour toward others. However, as Lahey (2004) revealed, attitudes and social behaviour are not perfectly related by any means. But there is enough relationship between the two to make attitudes a favourable topic of study for social psychologists, especially attitudes related to important aspects of social behaviour such as prejudice based on a person's gender, ethnicity, age, sexual preference, or other factors (Ibid, 2004). This means attitudes are not absolutely fixed. They can be changed after they have been formulated through persuasion.

2.7.4 Behaviour and Attitude change

As it has been mentioned above, persuasion is an important source of attitude change, but the discrepancy that often exists between our attitudes and behaviour is another key cause of changed attitudes.

Even though attitudes are partially defined in terms of a disposition to behave, there is sometimes a great difference between our attitude and our behaviour. For example, opinion pollsters know that not everyone who has a favourable attitude toward a product will buy it (Lahey, 2004).

2.7.5 Attention

Attention is the basic need for all successful teaching and the primary precondition of all types of our mental activity cognitive (knowing), affective (feeling), and conative (acting).

Attention is also the heart of the conscious process. It is the concentration of consciousness upon one object or idea rather than the other.

Other objects are left in the background in the unconscious or subconscious. Every single moment of the student is attracted by a large number of stimuli of the environment. His/her mind is not able to concentrate on all these at one and the same time. Some objects occupy the center of consciousness. They are within the field of attention. Other objects which do not receive his/her attention are included in the field of inattention (Aggarwal, 1998). Thus, it is on this account that attention has also been defined as a selective process of the mind (Sarantakos, 1996).

It is worth mentioning that attention increases efficiency, helps to remember, arouses interest and motivates students to study. It is based on the above arguments that Sarantakos (1996) asserted that attention is the key for any desired achievement.

In summary, attention plays a significant role in the teaching learning process. It helps both teachers and students to work closely. Energies of the teachers and the students are utilized to the maximum level, if they are absorbed in the teaching- learning process.

2.7.6 Measurement of Attitudes

Since scientific treatment of attitudes requires quantification, in most measurement of attitudes we are really measuring opinions (Remmers, 1954). Therefore, opinions can be considered as expressed attitudes. Although attitudes can be measured using different techniques-observational, interview, and questionnaire items, the most popular is the attitude scale (Aiken, 1970).

2.7.6.1 Scaling

Attitude scales have been prepared for the measurement of attitude. They determine what an individual believes, perceives, or feels about self, others, and a variety of activities, institutions and situations (Gay & Airasian, 2000). They consist of a number of statements or questions and a set of

response categories, related to a score. They place respondents in a continuum between very low (negative) over neutral, to a very high (or positive) position (Edwards, 1957).

Each item is chosen so that persons with different points of view on this item react to it in a different way.

According to Sarantakos (1993), two of the measurements of attitudes that are employed almost exclusively by quantitative researchers are: the Turnstone scale and the Likert scale.

a) The Thurstone Scale

This scale which was developed in the USA in the 1920s consists of a list of items constructed with the aid of experts who are closely related to the construction of the scale (Burroughs, 1975). In Turnstone's method, according to Aiken (1970), each of a series of statements reflecting different degrees of negative and positive attitudes toward something is given a scale value –the median of the scale values assigned to it by a group of judges. A respondent's score on a scale consisting of a series of such statements is the sum or mean of the scale values of the statements which he indorses. However, this method is criticized for, among other things, its demanding and time-consuming manner of construction, and the emphasis it places on the views of the judges (Aggarwal, 1998).

a) The Likert scale

This scale developed by Likert in 1932 operates in a way similar to that of the Turnstone scale (Burroughs, 1975). It consists of a set of items of equal value and a set of response categories constructed around a continuum of agreement /disagreement to which participants are asked to respond (Aiken, 1970).

Likert scales are very popular among social scientists and have been so for more than half a century. The reason for this is that they: (1) have a high

degree of validity even if the scale contains only a few items; (2) provides single scores from a set of items ; (3) have high reliability (between .85 and .94); (4) allow ranking of respondents and (5) are relatively easy to construct. Nevertheless, it has its own drawbacks. For example total scores referring too many and diverse items say little about a person's response to the various aspect of the research project. It is also difficult to achieve equal items in the scale (Kimmon, 1990; cited in Sarantakos, 1996).

2.8 Related Studies on Mathematics Attitude

Students' attitudes towards mathematics were the other focus of this study. Some summarized previous research results are given below.

Pupils attitude towards mathematics are thought to be important factors in learning the subject (O'Reilly, 1980) and a powerful predicator of achievement in mathematics (Kouassi, 1999). In particular, the attitude that mathematics is a useful subject is an important for early-adolescent success in mathematics (Iben, 1991). In support of this view, Malone and Freel (1957) cited in Kinney and Tulock (1957) constructed an instrument to measure the attitude of high school students towards mathematics. They found that students generally realized its practical value.

In order to examine the attitude of ninth and tenth grade students toward school and school subject a five point Likert- type attitude scale and a questionnaire were administered by (Assebe,1997) to a total of 526(F= 255 and M= 271) randomly selected students from three rural and three urban schools. Assebe's results suggested more favourable attitude toward school. He also noted that boys showed more favourable attitudes than girls toward science and math, English and social studies were favoured by boys and girls. He indicated that there was a decline in attitude towards math and social studies in grade 10. That is, the favourable attitude towards math decreased with rising grade level.

Similarly Sileshi (1995) concluded that students' attitudes towards math become increasingly less favourable as they progress to higher classes.

On the other hand, Desalegn (2005) reported that most high school students (grade 10) had positive attitude and strong interest towards math despite low achievement scores in the subject.

Thus high school students have been found to have both positive and negative attitudes towards math.

2.9 The Significant of Attitude to Achievement in Mathematics

Different researchers in different countries have been trying to understand factors which manipulate students' academic achievement. Although a number of factors could be listed, only papers that dealt specifically with the link between attitudes toward mathematics and mathematics achievement were reviewed.

The assessment of attitudes toward mathematics would be less concern if attitudes were not thought to affect performance in some way (Aiken, 1970). In support of this view, few researchers confirmed that students' attitudes toward mathematics affect both their choice to study mathematics and the amount of effort they are willing to exert the subject (Aiken, 1972; Fellows, 1973; Fennema and Sherman, 1976; cited in Sileshi, 1995).

In a study of the attitudes towards problem solving of a group of Brazilian elementary school children, Lindgren et al. (1964) cited in Aiken (1970) obtained a small but significant positive correlation ($r = .24, N = 108$) between problem solving attitudes and scores on an arithmetic achievement test, and a positive but not significant correlation between attitudes and marks in arithmetic.

Similarly in his correlational study Cheung (1989) sampled 5644 grade 7 students from 130 classes to investigate the relationship between achievement

and attitude towards mathematics learning. Achievement and attitude tests were used as tools of data.

The findings of the study showed a good achievement score and a low positive correlation between attitude and achievement ($r=.21$).

Also Anttonen (1968) cited in Aiken (1970) obtained consistently low correlations of mathematics attitude scores with grade averages among a group of fifth and sixth grade pupils.

On the other hand a different result was obtained by Schofield (1982) who surveyed 1,896 elementary school children to investigate the relationship between attitude in mathematics and achievement in connection with grade level, sex and time during which the school year at which the measurement were taken. The methods used to gather data were tests measuring attitude and achievement. He found a strong relationship between attitude and achievement, although the direction of the relationship was not mentioned. The relationship was also found to increase as the grade level increases, but not statistically. The results obtained by Schofield were less explanatory than the results obtained by Cheung (1989) in terms of statistics.

Drawbacks of this study were that nothing has been mentioned about the sampling techniques and the types and, validity and reliability of both tests and the number of attitude items used.

As far as high-school students are concerned, a recent study of Teacher-instruction conducted in the United States of America, student attitudes and mathematics performance among 10th and 12th grade Black and Hispanic students (Butty, 2002) reported that 10th grade students with better attitudes toward mathematics had a significantly higher achievement score than those poorer attitudes toward mathematics. Also it was found that students with good attitudes toward mathematics in the 10th grade achieved better mathematical scores in the 12th grade (Ibid, 2002). Similarly, in his longitudinal study of attitudes, (Anttonen,1968;cited in Aiken,1970) obtained

moderate correlations of mathematics attitude scores with mathematics averages and standardized test scores in eleventh and twelfth grades .

In contrast, a study made by (Cleveland, 1962; cited in Aiken, 1970) revealed that attitude scales, among six graders, did not generally discriminate between high and low achievers in arithmetic.

In Ethiopia, Sileshi (1995) have found that students with high scores on attitude scales performed significantly better on the achievement scores than those who scored low on the attitude scales. Furthermore, his findings witnessed the correlation between attitude and achievement to be moderate (0.41). Also, Assebe (1997) have arrived at the same conclusion in his correlational study among 6, 7, and 8 graders. Moreover, his results seemed to agree with that of Anttonen (1968) cited in Aiken (1970).

To sum up, the above findings underlined the significance of attitudes toward mathematics achievement. Nevertheless, most of the results were more consistent with high school students than elementary school students.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 Research Methodology

As has been mentioned in the introduction section, the objectives of this study were basically:

- I) to investigate SSPI students' mathematics achievement and attitude towards mathematics and
- II) to investigate whether or not selected variables such as attitude, liking math, interest and attention are related with mathematics achievement in which both numerical and verbal descriptions of data were needed to obtain pertinent information. Consequently, both quantitative and descriptive methods were employed in this study.

3.2 Sources of Data and Sampling Techniques

According to the unpublished Education Statistic Annual Abstract 2006/07 of Addis Ababa Education Bureau, there were 10 preparatory Schools in Addis Ababa. But during the time of data collection the relevant information regarding one school was missing. However, as a research does not necessarily include all the population under investigation (in this case all the social Science Preparatory I students in Addis Ababa government schools), a combination of simple random sampling and cluster sampling were employed to select the sample schools and the sample students. That is, first the schools and then the sections (clusters) from each sample schools were selected using multi-stage random sampling.

The two main reasons for choosing this multi-stage sampling technique method were:

- I. The total number of government social science preparatory I students in Addis Ababa was very large.
- II. Sampling of individual students was not convenient for several administrative reasons.

Thus, four out of nine schools were randomly selected for the final study. The selection was done, using a table of random numbers, by assigning consecutive numbers from one to nine to each school (see appendix A for lists of Preparatory I schools in the population). Moreover, using a similar random sampling technique one school (Kefteгна 4) was selected from the remaining five schools for the pilot study.

The objective of the pilot study was to test the research instruments (specifically, the attitude scale along with the questionnaire and the achievement test) and their suitability. The pilot study was administered on a randomly selected section, which comprised 50 students (F = 27 & M = 23). Out of the 50 participants, 13 students (F = 7 & M = 6) failed to provide complete data. Consequently, the pilot sample comprised 37 students (F = 17 & M = 20).

In order to determine the sample size for the main study, a table of values developed by (Krejcie & Morgan, 1970; cited in Gay & Airasian, 2000) was used (See Appendix B). Since the selected schools had a total of 2725 students and 39 classrooms, the estimated sample size was found to be 338 students.

Similarly, to select the representative classrooms from the selected schools probability proportion to sample size (PPS) was employed, as the number of sections and students vary in each school (See appendix C for the detail of sections in each school). Regarding PPS technique, Koul (1984) asserted that it is generally better, during cluster sampling, to select a sample using the method of PPS, when the units vary in size. Thus, one classroom from Abyot kirs, which has 90 (68 F & 22 M) Students; one classroom from Addis ketema, which has 69 (38 F & 31M) students; one classroom from Bole,

which has 72 (48 F & M) students and two classrooms from Higher 23 which has 111(67 F & 44 M) students were selected.

3.3 Tools for Data Collection

In order to gather relevant data for this study, three different tools were employed: Achievement test, attitude scale and some open and close-ended questionnaire items.

3.3.1 The Achievement Test

After a close analysis of the mathematics syllabus, the textbook and the respective teacher's guide for preparatory I students', an achievement test was prepared. In order to construct the achievement test, the investigator followed the two general approaches suggested by Brown (1983).

Firstly, objectives were formulated for each unit, adapting from the syllabus. Here, an attempt was made to classify the objectives by level of cognitive complexity. Secondly, contents and cognitive skills mentioned in the materials were prepared before writing the test items (See Appendix D for table of specifications).

Finally, items that fulfilled the above two approaches were constructed. Because of the nature of the subject, however, more emphasis was given to knowledge application.

The type of the test format was multiple choice, since it can be used to measure any understanding or ability that can be tested by means of any other item forms –short answer, completion, true- false, matching, or essay (Ebel, 1979). Another important reason to use multiple choice items is that it was possible to include a large number of items (Brown, 1983). Consequently, 40 items were prepared.

In order to have logically reviewed items, the questions were given to four colleagues of the researcher who have been teaching the textbook for the last

six years and an expert in ICDR (who has edited the textbook) for comments. Then after making the necessary adjustments, based on comments and suggestions provided on some of the items, the questions were administered to the selected samples in the pilot study for empirical item review based on item analysis. More specifically, indices of item difficulty and discrimination were analyzed on the upper (27%) and lower (27%) scores (Ebel, 1979). That is, an item analysis was conducted, to discard unnecessary items, based on the following two criteria:

- I. If less than 50% or more than 70% of the students in the upper and lower groups got right (item difficulty analysis)
- II. If the difference between the number of respondents in the upper 27% and lower 27% groups fell below 0.30 (discriminating analysis)

Consequently, a total of 14 items were eliminated (see Appendix E for the difficulty and discrimination indices of the pilot items).

In the analysis process, the relative worth of each distracter for every item was not considered, as the test was primarily used to measure outcomes of learning. In such cases, as Brown (1983) noted, the critical consideration is whether the test validly measures the student's present level of achievement.

The reliability of the pilot test was found to be 0.57 (using Cronbach's alpha). This result could be acceptable enough as a teacher made-test (Ebel, 1979).

Finally to keep the total number of items as planned in the table of specification 14 items were replaced. Consequently, the final test for the main study contained 40 items and was highly reliable (Cronbach's alpha being 0.84) (see appendix F for the final achievement test). Here no item analysis was conducted, as they were not useful for a Criterion –referenced tests (Gronlund, 1981).

3.3.2 The attitude scale

To explore the attitudes of students toward mathematics, a categorical Likert –Scale, ranging from strongly agree to strongly disagree was used. The scale was composed of 36 items which were selected and then adapted from two mathematics attitude instruments; particularly, 3 items from Tapia and Marsh (2004) and 33 from Doepken, Lawskey and Linda (2006). The basic principles used for the selection of the items were that the statements should be clear, simple and non-ambiguous. Burroughs (1975) suggested that attitude statements should follow all the rules of clarity, simplicity, specificity and so on. Furthermore, the statements were translated from English to Amharic by two second year postgraduate students of psychology and English Department in AAU. The translation was done to enable the students to understand the statements easily. In this regard, Sarantakos (1993) suggested that questionnaire items should be easy to understand.

Finally, the scale was administered to the selected pilot sample and was found to be highly reliable (Cronbach's alpha being 0.90). Also the items were analyzed for their discrimination power with respect to measurement of the attitude in question by taking the top and bottom 27% of the subjects on the distribution of the total scores, and calculating the mean of the responses to each item for these groups separately. Those items which showed the greatest discrepancy in mean responses between high and low extreme groups were retained. In this regard Ebel (1979) noted that items that discriminate best between high scorers and low scorers on the total scale should be retained for the final form of the scale. Furthermore Burroughs (1975) asserted that these differences should be preferably not less than 1 and definitely not less than 0.5 if the statements are to be retained as good ones.

Consequently, 20 items (10 positively and 10 negatively worded) were selected for the final attitude scale which showed the highest discriminatory power ($D > 1$) (see Appendix G for the pilot attitude scores). According to (Remmers, 1954), twenty to twenty- five items from the total list which show the

greatest discrimination could be selected for the final attitude scale. The final scale was highly reliable (Cronbach's alpha being 0.93). (See appendix H for statements of the final attitude scale).

In addition to the attitude scale, an additional questionnaire that consisted of both open and closed type items was administered. The questionnaire was conducted along with the other two instruments to both the pilot study and the main samples to collect data on students' liking of mathematics, interest and attention in learning mathematics and their perceptions about math.

3.4 Data Collection Procedure

The data were collected during the last week of April 2007 from the sample schools. The last week of the month of April was selected for data collection because it was the appropriate time to cover many of the chapters of Preparatory I mathematics textbook. Accordingly, a total of 40 items for the achievement test were prepared based on the syllabi of Preparatory I mathematics. The following steps were taken to obtain all the necessary data.

Firstly, a pilot study was conducted on the three instruments: achievement test, attitude scale and a questionnaire to check any ambiguities which the investigator had not noticed.

The study also checked the reliability and discrimination power of the items in both the achievement test and attitude scale. Both tools were administered in one session. The session was conducted in the students' free time after the students and the investigator reached consensus regarding the time.

On the basis of the pilot study, which was conducted by the investigator, the instruments were revised.

Secondly, the revised instruments (the attitude scale along with the questionnaire and the achievement test) were conducted. Here, the attitude

scale along with the questionnaire was administered at the same time, whereas the achievement test was carried out after three days. This was deliberately done to give preparatory days for the students for study.

The final attitude scale that included the questionnaire and the achievement test were conducted and supervised by non-mathematics teachers in each school.

3.5 Methods of Data Analysis

All the data collected for this study were organized and processed separately for each instrument in a way appropriate for analysis. The data were analyzed using the computer software package, SPSS 15.0 for windows and manually as well.

Initially descriptive statistics were used and then statistical tests like t-test and the correlation coefficients. In addition to these, Pearson product moment correlation coefficients were used to measure the degree of correlation between achievement and the independent variables (attitude, liking of mathematics, interest and attention in learning mathematics). The sequences of analyses were presented as follows:

To analyze the first research question which says, how is the mathematics achievement of Social Science Preparatory I (SSPI) students' relative to the cut-off score of 50 percent for promotion as specified by the policy? the sum of the scores of each respondent was converted into percentage and then mean and standard deviation of the students' scores were calculated. Moreover, to check the existence of significant difference (if any) between the mean score of the total sample schools and the expected mean value, a one sample t-test was employed.

To analyze the second research which says, what is the attitude of Social Science Preparatory I students' towards mathematics? a Likert scale with five response categories, ranging from strongly agree to strongly disagree

was employed. Then numerical values that range from 1 to 5 were assigned to each statement. Then, each respondent's attitude scores were calculated by adding those numerical values assigned to the responses he or she gave to each statement and then the mean and standard deviation of the attitude scores of the students were calculated. Moreover, to check the existence of significant difference (if any) between the mean score of the sample schools and the test value, a one sample t-test was employed.

In order to analyze the third research question which says is there any relationship between academic achievement in mathematics and attitude towards mathematics? Pearson –product moment correlation was used to determine whether, and to what degree, a relationship exists between mathematics and attitude.

Finally to analyze the fourth research question which says What is the opinion SSPI students' on liking of mathematics, interest to and attention in mathematics and their views about mathematics learning? a biserial correlation and descriptive analyses were used. All results were tested at $\alpha = .05$.

CHAPTER 4

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

The results of the study are presented in the following order: The mean achievement score of the total participant group in math and its corresponding t-test, the mean attitude score of the total participant group and its corresponding t-test, the correlation between achievement and attitude, achievement and liking of math, achievement and interest to learn math, achievement and attention in learning math, and the opinion of students on liking of mathematics, interest to and attention in mathematics and their views about mathematics as a subject.

4.1 Mathematics Achievement

In order to answer the research question which focuses on academic achievement of students in math, mean and standard deviation of the students' scores were found and they are presented in Table 1 below (See Appendix I for the distribution of math scores).

Table 1

*Number of Observations, Frequencies, Means and SD
for Achievement scores*

Achievement Scores	Frequency	Percent	Mean of the sample	Standard Deviation
Valid < 50%	255	74.6	45.51	16.39
≥ 50%	87	25.4		
Total	342	100.0		

Note: maximum score =100

Table 1 above (page 38) shows that the mean and standard deviation were 45.51 and 16.39 respectively. The mean value of the students' score was below the expected average (50%). The obtained mean score was a result of a test labelled by math teachers as moderate and as easier than they often give to natural science students.

Table 2
One sample T-Test for Achievement Scores

	Test Value = 50					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
ach	-5.062	341	.000	-4.48830	-6.2324	-2.7442

When the statistical significance of this difference was tested, as shown in the t-test analysis in Table 2 above using one sample t-test against a test value of 50, which was the expected average, the result was statistically significant at $\alpha = 0.05$ level as the following comparisons shows.

The calculated t value in absolute value = 5.062, $\alpha = 0.05$, $df = 341$ and the table value for $\alpha = 0.05$ and $df = 341$ is 1.96. Since the obtained value 5.062 was greater than 0.96, it was possible to conclude that in the population of SSPI students of which this sample was representative the math achievement of the students was lower than the cut-off score set by the policy document. More specifically, the analysis showed that about 75% of the students (see Table 1 page 38) were found to be below the minimum standard required to be promoted to the next grade level. This finding was consistent with the findings of (ICDR, 2000; Fennema & Tarte 1995).

At the preparatory level, mathematics is one of the compulsory subjects given for all social science stream students. It is also a major criterion to join universities and colleges in Ethiopia, irrespective of one's future field of study.

Thus, it was on this ground that the students were supposed to give due emphasis on this key subject.

Although knowledge of math is obligatory and a prerequisite for advanced study, the above finding implied that SSPI students were in a critical condition as far as their math ability was concerned. In fact it was difficult for the investigator to pinpoint all the major reasons for such low achievement. Nevertheless, possible explanation from my own experience could be that the nature of math as a school subject or the curriculum might be difficult. More specifically, some of the contents of the textbook are not related to their field and are also very difficult.

4.2 Attitude towards Mathematics

The research question handled in this section was the attitude of students towards math. The mean and standard deviation of the students' attitude scores were found and they are presented in Table 3 below (See Appendix J for the distribution of attitude scores).

Table 3

***Number of Observations, Frequencies, Means and SD
for Attitude scores***

Attitude Scores	Frequency	Percent	Mean of the sample	Standard Deviation
Valid < 59%	201	58.8	58.12	9.56
≥ 60%	141	41.2		
Total	342	100.0		

Note: maximum score =100

As indicated in Table 3 above (page 40), the mean and standard deviation of the attitude scores were 58.13 and 9.56. This shows that attitude of the sample students towards math was unfavourable. When the statistical significance of this difference was tested, as shown in the t-test analysis in Table 4 (page 38) using one sample t-test against a test value of 60, the result was statistically significant at $\alpha = 0.05$ level as the following comparisons shows.

The calculated t value in absolute value = 3.620, $\alpha = 0.05$, $df = 341$ and the table value for $\alpha = 0.05$ and $df = 341$ is 1.96. Since the obtained value (in absolute value) $3.620 > 1.96$, it was possible to conclude that the overall attitude of the students towards Math seemed unfavourable. This finding was in agreement with the findings cited by (Orton & Wain, 1994; ICDR 1998) who asserted that students' acquired negative attitude towards math.

Obviously these students are expected to join universities or colleges that are related to their fields and ultimately they will be the work force of the country, yet they did not have clear understanding about the usefulness of the subject to their future career. Moreover, they did not have a strong confidence to solve math problems.

Consequently, absence of confidence in solving mathematical problems and lack of awareness about the usefulness of the subject have made students' develop unfavourable attitude towards the subject, which ultimately affected their achievement.

If one of the objectives of schools is the development of favourable attitudes toward school subjects, these data constituted evidence that the objective concerning math was not widely reached.

Table 4

One-Sample t- Test for Attitude Scores

	Test Value = 60					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Attitude	-3.620	341	.000	-1.87135	-2.8882	-.8545

4.3 Correlation between Achievement and Attitude

The research question handled in this section was the correlation between achievement and attitude. The calculated Pearson product moment correlation is presented below.

Table 5

Achievement and Attitude Correlation Summary Table

		Achievement	Attitude
Achievement	Pearson Correlation	1	.731 **
	Sig. (2-tailed)		.000
	N	342	342
Attitude	Pearson Correlation	.731 **	1
	Sig. (2-tailed)	.000	
	N	342	342

** . Correlation is significant at the 0.01 level (2-tailed).

As the Table 5 above shows, math achievement was highly and positively related to attitude ($r = 0.73$, $p < 0.01$). That is, these two variables affected one another.

As has been mentioned in most parts of the literature, attitude and achievement have been found to be interrelated to each other. Also the results of this study showed that students who scored high on the attitude scale tended to score high on the achievement test, while students who scored low on the attitude scale tended to score low on the achievement test. More importantly, this finding showed the significance of attitudes to math achievement. In addition to these, the result was in agreement with the assertions made by (Aiken, 1979; Sileshi, 1995; Butty, 2002) who claimed that attitudes are important to actual math scores.

Furthermore, the coefficient of determination (r^2) between achievement and attitude was 0.543. That is, nearly 54% of the variability in achievement was due to the variability in attitude. This was a relatively high contribution to the variance that might be accounted for by other factors.

4.4 Students Opinions on Issues Related to Mathematics Learning

In order to obtain data on students' liking, interest and attention in learning mathematics and their general views about math, a brief questionnaire was administered to the students. Biserial correlations and descriptive analyses of the obtained data produced the following results.

4.4.1 Liking of Mathematics

The participants were asked to indicate whether or not they liked math. As shown in Table 6 below, about 65% of the students did not like math while nearly 35% of the students responded their liking of math.

Table 6
Frequencies and Percentages of Liking Mathematics

Do you like mathematics?		Frequency	Percent	Valid percent	Cumulative Percent
Valid	No	221	64.6	64.6	64.6
	Yes	121	35.4	35.4	100.0
	Total	342	100.0	100.0	

To examine the relationship (if any) between math achievement and liking of math, the responses to liking of math were taken as no or yes while the achievement scores were taken as continuous data. Then, the biserial correlation between achievement and the two artificially dichotomized groups was calculated (see Table 7 below). Accordingly, the calculated value for r was found to be 0.399. The obtained result indicated that the relationship was moderate.

Table 7
Achievement and Liking of Mathematics Correlation
Summary table

		Achievement	Liking
Achievement	Biserial Correlation	1	.399 **
	Sig. (2-tailed)		.000
	N	342	342
Liking	Biserial Correlation	.399 **	1
	Sig. (2-tailed)	.000	
	N	342	342

**. Correlation is significant at the 0.05 level (2-tailed).

When the statistical significance of this correlation was tested using critical values of the correlation coefficient, the result was statistically significant at $\alpha = 0.05$ level as the following comparisons shows.

The calculated r value = 0.399, $\alpha = 0.05$, $df = 340$ and the table value = 0.195 (for $\alpha = 0.05$, $df = 340$). Since the calculated value 0.399 was greater than 0.195, it was possible to conclude that in the population of SSPI students of which this sample was representative math achievement and liking of the subject were significantly related ($r = 0.39$, $p < 0.05$). Moreover, the coefficient of determination (r^2) between achievement and liking of math was about 0.1592. That is., nearly 16% of the variability in math achievement scores was due to the variability in liking math.

Reasons for 'not –liking' mathematics

As it was indicated earlier in Table 6 (page 43), nearly 64.6% of the students responded as I do not like math. The most frequent reasons which the students gave for not liking math were:

- Lack of strong background in the subject (7.4%)
- Too many rules to remember (10.0%)
- Many of the examples are not related with the real world (19.8%)
- Being unsuccessful since elementary school (21.2%)
- Discouraging words from their math subject teachers (6.0%)

The above mentioned reasons were contributory factors not to like the subject. Also it was found that a long continued poor achievement in the subject and being disappointed by their respective math teachers led students turn against the subject.

4.4.2 Interest to learn Mathematics

The participants were asked to indicate whether or not they were interested in learning math. According to the Table 8 below only 34.5% had an interest to learn math while 66.5% of the students showed no interest in learning math.

Table 8
Frequencies and Percentages to Learn Mathematics with Interest

Do you have an interest to learn mathematics?		Frequency	Percent	Valid percent	Cumulative Percent
Valid	No	224	65.5	65.5	65.5
	Yes	118	34.5	34.5	100.0
	Total	342	100.0	100.0	

In order to examine the relationship (if any) between math achievement and interest to learn math, the responses to interest in learning math were taken as yes or no while the achievement scores were taken as continuous data. Then, the biserial correlation between achievement and the two artificially dichotomized groups was calculated (see Table 9 below). Accordingly, the calculated value for r was found to be 0.367. This result indicated that the relationship was moderate.

When the statistical significance of this correlation was tested using critical values of the correlation coefficient, the result was statistically significant at $\alpha = 0.05$ level as the following comparisons shows.

The calculated r value = 0.367, $\alpha = 0.05$, $df = 340$ and the table value = 0.195 (for $\alpha = 0.05$, $df = 340$). Since the calculated value 0.367 was greater than 0.195, it was possible to conclude that in the population of SSPI students of which this sample was representative math achievement and interest to learn the subject were significantly related ($r = 0.37$, $p < 0.05$). Moreover, the coefficient of determination (r^2) between achievement and liking of math was about 0.1346. That is, nearly 13% of the variability in math achievement scores was due to the variability in interest to learn the subject.

Table 9

Achievement and Interest to learn Mathematics Correlation Summary table

		Achievement	Interest
Achievement	Biserial Correlation	1	.367 **
	Sig. (2-tailed)		.000
	N	342	342
Interest	Biserial Correlation	.367 **	1
	Sig. (2-tailed)	.000	
	N	342	342

** . Correlation is significant at the 0.05 level (2-tailed).

Reasons for lack of interest

As it was indicated in Table 8 (page 45), 65.5% % of them responded as having no interest to learn math. The major reasons these students mentioned for not to have an interest to learn the subject included:

- Difficulty of the subject (45.1%)
- Methods of teaching (13%)
- Lack of appropriate background in elementary and junior secondary schools (7.4%)

The above listed reasons might have affected students' achievement by losing their interest to learn the subject.

4.4.3. Attention to Learn Mathematics

The participants were asked to indicate whether or not they pay an attention when learning math. As table 10 below shows, about 60% of the students indicated that they were not attentive when learning math.

Table 10

***Frequencies and percentages to learn
Mathematics with Attention***

Are you attentive during Mathematics class?		Frequency	Percent	Valid percent	Cumulative Percent
Valid	No	204	59.6	59.6	59.6
	Yes	138	40.4	40.4	100.0
	Total	342	100.0	100.0	

To examine the relationship (if any) between math achievement and attention in learning math, the responses to attention in learning math were taken as no or yes while the achievement scores were taken as continuous data. Then, the biserial correlation between achievement and the two artificially

dichotomized groups was found to be 0.368 (see Table 11 below). This result indicated that the relationship was moderate.

When the statistical significance of this correlation was tested using critical values of the correlation coefficient, the result was statistically significant at $\alpha = 0.05$ level as the following comparisons shows.

The calculated r value = 0.368, $\alpha = 0.05$, $df = 340$ and the table value = 0.195 (for $\alpha = 0.05$, $df = 340$). Since the calculated value 0.399 was greater than 0.195, it was possible to conclude that in the population of SSPI students of which this sample was representative math achievement and attention in learning the subject were significantly related ($r = 0.37$, $p < 0.05$). Moreover, the coefficient of determination (r^2) between achievement and liking of math was about 0.1354. That is, nearly 14% of the variability in math achievement scores was due to the variability in paying attention to learn the subject.

TABLE 11

***Achievement and Attention to learn mathematics
Correlation Summary table***

		Achievement	Attention
Achievement	Biserial Correlation	1	.368 **
	Sig. (2-tailed)		.000
	N	342	342
Attention	Biserial Correlation	.368 **	1
	Sig. (2-tailed)	.000	
	N	342	342

**. Correlation is significant at the 0.05 level (2-tailed).

Reasons for 'lack of Attention'

As it was indicated in Table 10 (page 43), 59.6% of them responded as having no attention to learn math. The major reasons these students gave for not paying attention in learning the subject were:

- Complex calculations (14%)

- Inappropriate teaching method (9.0%)
- Considering the subject as difficult (25.2%)
- Lack of assistance from the teachers (5.0%)
- Lack of appropriate background (6.4%)

As can be observed from what the students scored and from what they said, lack of attention might contributed negatively to academic achievement. This finding supported the theory that was formulated by (Sarantakos, 1998) who concluded that attention plays a meaningful role for any intended achievement.

Thus, from the aforementioned results, it was possible to conclude that the variables attitude, liking of mathematics, interest to and attention in learning math were the most pertinent dimensions in explaining the variance of mathematics achievement of SPPI students in government school of Addis Ababa. In particular, attitude showed a relatively large unique contribution of 54% than the contributions of the other variables.

4.4.3 Students' views about the Subject

In support of the result obtained statistically regarding attitude, students generally did not enjoy learning mathematics. The most frequently given opinions about the subject included:

- Learning math is a waste of time (6%).
- Math is a very difficult subject (71%).
- Math is a monotonous subject (10%).
- Mathematics is an important subject (13%).

From what they said, the investigator believed that students generally perceive math to be difficult.

Since the study was descriptive, it was impossible to investigate further why such low math achievement was obtained. Nevertheless it was found, at least, that certain variables like attitude, liking the subject, interest to and attention in

learning the subject have accounted for the disparities among the students in their academic achievement. In terms of percentages, however, attitude took the highest share as compared to the other variables investigated. In addition to these, it was observed from the opinions of the students that 87% of the students had negative beliefs toward the subject. These beliefs by themselves might have prevented the students not to actively participate in the class which in turn might have affected their achievement scores.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The primary objectives of this study were to investigate Social Science Preparatory I students' mathematics achievement and attitude towards mathematics and also to determine whether or not selected variables such as attitude, liking mathematics, interest to and attention in learning mathematics were related with mathematics achievement.

In order to achieve the above objectives, the following basic research questions were formulated:

- 1) How is the mathematics achievement of Social Science Preparatory I (SSPI) students' relative to the cut-off score of 50 percent for promotion as specified by the policy?
- 2) What is the attitude of Social Science Preparatory I students' towards mathematics?
- 3) Is there any relationship between academic achievement in mathematics and attitude towards mathematics?
- 4) What is the opinion SSPI students' on liking of mathematics, interest to and attention in mathematics and their views about mathematics learning?

In the academic year 2006/7 there were ten government preparatory schools in Addis Ababa. Nevertheless, during the time of data collection the necessary information about one school was not available. Thus, five schools (four for the final study and one for the pilot study) were selected randomly using random number tables. Furthermore, to select representative sample students from the selected schools a cluster sampling technique that depends on probability to sample size (SSPI) was employed. That is, instead of randomly selecting individual students from each school clusters of sections were

randomly selected to reach at the desired sample size. Specifically first the schools and then the sections (clusters) from each sample schools were selected using multiple random sampling.

Consequently, a total of 50 (F= 27 & M= 23) and 342 students (221 girls and 121 boys) were selected for the pilot and final study respectively.

Achievement test, attitude scales and some closed and open-ended questionnaire items were used as means of data gathering instruments. The three instruments were tested in the pilot study and some necessary adjustments have been performed to improve their validity and reliability. The reliabilities of the pilot achievement test and the attitude scales were 0.57 and 0.90 respectively.

The collected data were analyzed using statistical tests such t-test and critical values for the correlation coefficient. Also, qualitative analyses were done. Finally, the analysis yielded the following results.

- 1) The mathematics achievement score of SSPI students in Addis Ababa government schools was lower than the cut-off score set by the policy document.
- 2) The overall attitude of students toward mathematics seemed unfavourable.
- 3) Mathematics achievement was highly and positively related to attitude ($r=0.73$, $p<0.01$).
- 4) Liking of mathematics, interest to learn mathematics and paying attention in learning mathematics were significantly related with mathematics achievement at $\alpha =.05$ level.

5.2 Conclusions

Based on the findings, the following conclusions were reached:

- 1) The results of this study showed that about 75% of SSPI students were below the minimum standard in their mathematics achievements. Thus, it was possible to conclude that these students will face serious problems in their future mathematical course performances.
- 2) The overall attitude of students towards mathematics was unfavourable.
- 3) Attitude towards mathematics and achievement in mathematics were highly and positively correlated in such a way that students with low attitudes were likely to score low in mathematics achievement whereas students with a high attitude were likely to score high in mathematics.
- 4) About 59% of the students were found to lack the necessary knowledge regarding the usefulness of mathematics. Also they had a feeling of less self confident in doing mathematics.
- 5) About 65% of the students did not like the mathematics.
- 6) Sixty-five point five percent the students have shown no interest to learn mathematics.
- 7) Nearly 59.6% of the students did not pay attention during mathematics Class
- 8) Seventy one percent of the students reported that math was a difficult subject for them.

5.3 Recommendations

Based on the findings and the conclusions, the following recommendations are formulated:

- 1) Generally students need to give serious attention to their future. The career world is competitive. The competition and the opportunities in the career world would be a serious problem for them if they do not do well in mathematics, because they are excluding themselves from the many career paths that need mathematics. Therefore, they need to take mathematics seriously during their preparatory years' and try to score

good results, achieve a level of excellence in order to join into any of the social science universities or related colleges with a good background in this subject. So that they would be successful in their future.

- 2) As attitudes are not fixed, parents and teachers need to become active change agents in fostering positive attitude in those low achievers in order to enhance their interest and achievement in mathematics. Much of the input for such role must come from teachers. It is important that teachers need to apply different techniques to raise the attitude and interest of the students. These include demonstrating the usefulness of math both in everyday life and in future careers, telling about the role models in mathematics, and giving examples that are directly related to their streams and their real life.
- 3) Further research is needed to examine the causes, effects and solutions of SSPI students' bias towards mathematics.

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Appendix A

A list of Government Preparatory Schools in Addis Ababa

1. Addis Ketema Senior Secondary School
2. Abiyot Kirs Senior Secondary School
3. Bole Senior Secondary School
4. Higher 4 Technical and Vocational School
5. Higher 23 Senior Secondary School
6. Dagmawi Minilik II Senior Secondary School
7. Derartu Tulu Secondary School
8. Wondyirad Senior Secondary School
9. Yekatit 12 Senior Secondary School

Appendix B

Sample Sizes(S) Required for Given Population Sizes (N)

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384

Source: Gay, L.R and Airasian, R (2000).

Appendix C

A list of Number of Sections and Students (Social Science) in the Selected Schools

School Name	No. of Sections	Section	Female	Male	Total
Abiyot Kirs	8	11 ⁰⁸	49	41	90
		11 ⁰⁹	46	44	90
		11 ¹⁰	58	31	89
		11 ¹¹	68	22	90*
		11 ¹²	61	31	92
		11 ¹³	51	40	91
		11 ¹⁴	53	36	89
		Total	432	286	718
Addis Ketema	10	11 ⁰⁹	38	31	69*
		11 ¹⁰	20	50	70
		11 ¹¹	37	35	72
		11 ¹²	35	36	71
		11 ¹³	28	46	74
		11 ¹⁴	50	25	75
		11 ¹⁵	50	22	72
		11 ¹⁶	44	29	73
		11 ¹⁷	46	21	67
		11 ¹⁸	39	34	73
		Total	392	329	721
Bole	8	11 ¹⁰	46	26	72
		11 ¹¹	48	24	72*
		11 ¹²	52	20	72
		11 ¹³	47	21	68
		11 ¹⁴	47	22	69
		11 ¹⁵	43	26	69
		11 ¹⁶	46	24	70
		11 ¹⁷	43	20	63
		11 ¹⁸	41	22	63
		Total	413	205	618
Higher 23	12	11J	28	25	53
		11K	31	26	57
		11L	37	19	56*
		11M	32	25	57
		11N	39	18	57
		11O	31	25	56
		11P	31	24	55
		11Q	31	24	55
		11R	32	23	55
		11S	30	25	55*
		11T	26	29	55
		11U	38	19	57
		Total	386	282	668

* The selected sections

Appendix D

Table of Specifications for Social Science Preparatory I Maths Achievement Test

Form of item	Number				
Multiple choice	40				
Instructional objectives	Students will be able to	Content Areas	Number of items	Period allotted for Each chapter	% of items in terms of period allotment
- Identify polynomial functions and quadrilaterals Items Nos. 1 and 22 - State properties of poly and rational functions and elements of conic sections Items Nos.3, 7,12,13,15,16,18,and 37 (Knowledge)		Chapter 1 - Polynomial functions - Zeros of polynomials - Graphs polynomials functions - Remainders and factors	1 2 2 2	20	7.0
Solve poly.,rational , exponential and logarithmic equations and rational inequality Items Nos. 2,4,10,17,19,and 21 (comprehension)		Chapter 2 - Rational functions - Working with rational exp. - Simplifications of rational exps. - Rational equations and inequalities - Graphs of rational functions	1 1 1 2 4	28	9.7
Apply their knowledge to calculate unknown values, simplify rational expressions and also to solve word problems. Items Nos. 5,6,8,9,11,14,19,20,23,24,25,26,27, 28,29,31,32,33,34,35,36,38,39,40 (Application)		Chapter 3 - Revision on exponential and logarithmic functions - Exponential equations - Logarithmic equations - Applications of exponential functions.	1 1 2 1	13	4.5
Predict relationships Item No. 30 (Synthesis)		Chapter 4 - More on circles & spheres - Theorems on angles and arcs determined by lines intersecting inside and outside of a circle. - Theorems on properties of some special quadrilaterals & some theorems on triangles - Theorems on areas of plane figures and their proofs	1 2 1 1	14	4.9
		Chapter 5 - Distance formula - Slope of a line - Division point of a line segment - Angles between two lines - Slopes of parallel and perpendicular lines - Equation of a line - Equation of a circle - Ellipses - Hyperbola - Parabolas	1 1 1 1 2 1 1 2 2 2	40	13.9

Appendix E

Difficulty and Discrimination Indices for the pilot test items (N=33)

Question no. of each Item	No of students in the upper 27%(n=10) Making correctly	No of students in the lower 27%(n=10) Making correctly	Indices	
			Difficulty	Discrimination
1	9	2	55%	0.70
2	8	4	60%	0.40
*3	10	8	90%	0.20
4	8	3	55%	0.50
5	8	5	65%	0.30
*6	7	10	95%	-0.30
*7	10	9	95%	0.10
*8	5	1	40%	0.40
9	7	3	50%	0.40
*10	6	2	40%	0.40
11	7	4	55%	0.30
*12	4	6	50%	-0.20
13	10	2	60%	0.80
14	7	4	55%	0.30
15	7	3	55%	0.40
16	9	3	60%	0.60
*17	3	0	15%	0.30
18	7	3	50%	0.40
*19	2	1	15%	0.10
20	8	5	65%	0.30
21	9	5	70%	0.40
22	10	4	70%	0.60
*23	5	2	35%	0.30
24	8	3	55%	0.50
25	7	4	55%	0.30
26	9	4	65%	0.50
27	8	5	65%	0.30
28	8	4	60%	0.40
*29	4	8	60%	-0.40
30	9	4	65%	0.50
*31	6	5	55%	0.10
*32	7	2	45%	0.50
33	8	5	65%	0.30
34	7	4	55%	0.30
35	9	4	65%	0.50
36	6	6	60%	0.00
37	8	5	65%	0.30
*38	7	5	60%	0.20
39	9	2	55%	0.70
*40	6	4	50%	0.20

*discarded items

Appendix F

ADDIS ABABA UNIVERSITY
COLLEGE OF EDUCATION
SCHOOL OF GRADUATE STUDIES
DEPARTEMENT OF CURRICULUM AND TEACHER PROFESSIONAL
DEVELOPMENT STUDIES
MATHEMATICS TEST FOR SOCIAL SCIENCE PREPARATORY I
STUDENTS

School's name _____ Time: 2 hours

Grade and Section _____ Sex _____

Instruction. For each of the following questions choose the best answer from the given alternatives and write the letter of your choice in the space provided before the question number.

_____ 1) Which of the following functions is a polynomial?

A) $f(x) = 5$

B) $f(x) = \sqrt{x} + 71$

C) $f(x) = x^4 + 3x^{-2} - \frac{1}{5}$

D) $f(x) = 4^x + 2x - 12$

_____ 2) The solution set of the equation $\frac{5x-5}{x^2+1} - \frac{4}{x+1} = 0$ is

A) $\{1,3\}$

B) $\{0,1\}$

C) $\{-1,3\}$

D) $\{3,-3\}$

_____ 3) Which of the following is true about the graph of the polynomial function given by

$$f(x) = -6x^3 + 2x^2 + 3x + 2?$$

A) It has a sharp corner at one of its turning points

B) It has at most three turning points

C) It rises to the left and falls to the right

D) It falls to the left and rises to the right

_____ 4) Which of the following is the solution set of the polynomial function

$$f(x) = x^3 - 4x^2 - 25x + 100?$$

- A) $\{-4, 4, 5, 5\}$ B) $\{4, -, 5, 5\}$ C) $\{-4, 5, -5\}$ D) $\{-4, , 5, 5\}$

_____ 5) If $x - 1$ is a factor of $f(x) = x^3 - px^2 - x - 3$, then the value of p is:

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

_____ 6) When the polynomial function $f(x) = x^{1999} + 1$ is divided by $x - 1$, the remainder will be:

- A) 0 B) -1 C) 1 D) 2

_____ 7) Which of the following is **NOT** true about the function defined by

$$f(x) = x^3 - 3x^2 - x + 3?$$

- A) It has at least one x - intercept.
 B) It has at least one real root between 4 and 6
 C) Its range is the set of all real numbers.
 D) It crosses the y - axis exactly at one point.

_____ 8) Simplifying the expression $\frac{2}{x^2 - x} - \left(\frac{3}{x^2 - 1} - \frac{5}{x^2 - x^3} \right)$ yields:

- A) $\frac{-x^2 - 3x - 5}{x^2(x-1)(x+1)}$ B) $\frac{x^2 + 3x - 5}{x^2(x-1)(x+1)}$
 C) $\frac{5x^2 - 3x + 5}{x^2(x-1)(x+1)}$ D) $\frac{5x^2 + 3x - 5}{x^2(x-1)(x+1)}$

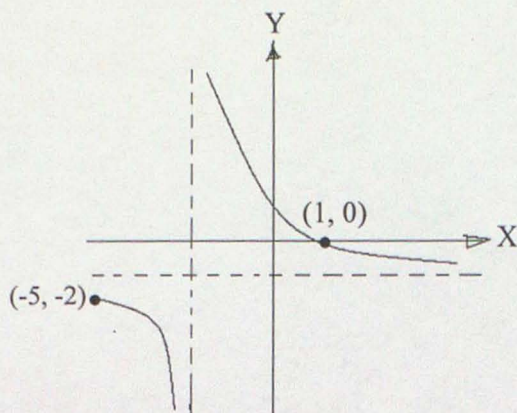
_____ 9) The simplified form of the expression $\frac{x^2 - 5x + 4}{\frac{x^2 - 4x}{x^2 + x - 2}}$, when $x \neq -2, 0, 1, 4$ is:

- A) $\frac{1}{x}$ B) $2x$ C) x D) x^2

_____ 10) The solution set of $\frac{x-2}{x-1} > 1$ is:

- A) $(1, \infty)$ B) $\{ \}$ C) $(-\infty, 1)$ D) $(-1, 1)$

_____ 11) Which one of the following functions best describes the graph given below?



A) $f(x) = \frac{-3}{x+2} - 1$

B) $f(x) = \frac{3}{x+2} - 1$

C) $f(x) = \frac{3}{x-2} - 1$

D) $f(x) = \frac{-3}{x+2} + 1$

_____ 12) If $f(x) = \frac{x^2 + 5x + 6}{x^2 - x - 12}$, then which of the following is true about the function?

A) $x = 4$ and $x = -3$ are its vertical asymptotes

B) $y = 0$ is its horizontal asymptote

C) $x = 4$ its vertical asymptote.

D) $y = x$ is its oblique asymptote.

_____ 13) The domain of the function defined by $f(x) = \frac{x}{x^2 + 3x}$ is;

A) $\mathbb{R}$

B) $\mathbb{R} / \{0\}$

C) $\mathbb{R} / \{-3\}$

D) $\mathbb{R} / \{0, -3\}$

_____ 14) A man buys a certain number of condoms for 4 Birr. If the price of each condom had been 5 cents less, he would have got 4 more condoms for the same money. How much was the original price of each condom?

A) 30 cents

B) 15 cents

C) 25 cents

D) 20 cents

_____ 15) which of the following is **NOT** true about the graph of $f(x) = \frac{1}{x^2}$?

A) It has both horizontal and vertical asymptotes

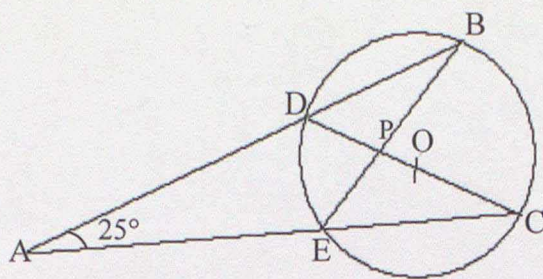
B) It is symmetrical with respect to the y - axis.

C) Range = $(0, \infty)$

D) It has one oblique asymptote

- _____ 16) Which one of the following is true?
- A) All polynomial functions are rational functions
 B) All rational functions are polynomial functions.
 C) The graph of any rational function must have either an x- intercept or y- intercept.
 D) The graph of any rational function is continuous.
- _____ 17) The solution set of the equation $\left(\frac{9}{25}\right)^{x-1} \times \left(\frac{125}{27}\right)^x = \left(\frac{3}{5}\right)^{x+2}$ is
- A) $\{1\}$ B) $\{-2\}$ C) $\{-1\}$ D) $\{2\}$
- _____ 18) Which of the following is **NOT** true?
- A) $\log_{\frac{1}{2}} 16 = 4$ B) $\log_6 2 + \log_6 3 = 1$
 C) $\log_8 16 - \log_8 2 = 1$ D) $\log_{\sqrt{a}} a^4 = 8$ ($a > 0, a \neq 1$)
- _____ 19) The solution set of the equation $\log(x-2) + \log(2x-3) = 2 \log x$ is:
- A) $\{1, 6\}$ B) $\{-6\}$ C) $\{-1, 6\}$ D) $\{6\}$
- _____ 20) If the world population at time t is given by the function $p(t) = p_0 e^{rt}$, where p_0 is the present population, then how long will it take the world population to double?
- A) $\frac{r}{\ln 2}$ B) $\frac{\ln 2}{r}$ C) $\frac{2r}{\ln 2}$ D) $\frac{2 \ln r}{r}$
- _____ 21) The solution set of $2^{4x-2} = 64$ is:
- A) $\left\{\frac{1}{2}\right\}$ B) $\{-2\}$
 C) $\{2\}$ D) $\left\{\frac{7}{4}\right\}$
- _____ 22) If a quadrilateral has one pair of sides parallel, then it is
- A) Trapezium B) Rectangle C) Rhombus D) Parallelogram
- _____ 23) If a chord of a circle is 8cm long and it is 3cm from the center, then the length of the diameter of the circle is ;
- A) 12cm B) 14cm C) 16cm D) 10cm
- _____ 24) In the figure given below, $\overline{AB}$ and $\overline{AC}$ are secants drawn to circle O. If $m(\angle BAC) = 25^\circ$

and $m(\hat{BPC}) = 70^\circ$, then which of the following is **NOT** true?



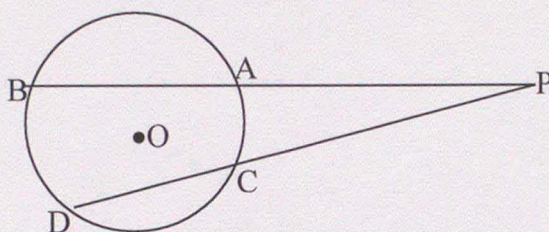
A) $m(\widehat{BC}) = 95^\circ$

B) $m(\widehat{BDC}) = 50^\circ$

C) $m(\widehat{DE}) = 95^\circ$

D) $(\widehat{DCE}) = 22.5^\circ$

- 25) In the figure below, $\overline{PB}$ and $\overline{PD}$ are secants drawn to circle O. If $PA = 4\text{cm}$, $AB = 5\text{cm}$, and $PD = 12\text{cm}$, then PC equals



A) 6cm

C) 5cm

B) 2cm

D) 3cm

- 26) What is the area of a rhombus if its altitude is 12cm and the smaller diagonal is 13cm?

A) 202.8cm^2

B) 405.6cm^2

C) 60cm^2

D) 312.4cm^2

- 27) The point which divides the line segment whose end points are $A(1, 2)$ and $B(7, -4)$ in the ratio 1:2 has coordinates;

A) (3, 0)

B) (3, -2)

C) (5, -2)

D) $(\frac{8}{3}, -\frac{4}{3})$

- 28) The equation of the line that passes through the points $P(4, -3)$ and $Q(-4, -4)$ is

A) $x + 8y - 28 = 0$

B) $-x - 8y + 28 = 0$

C) $x - 8y - 28 = 0$

D) $-x + 8y - 28 = 0$

- 29) The equation of the line which passes through the point $(2, -1)$ and parallel to the line $2x - 3y = 5$ is

A) $3x + 2y - 7 = 0$

B) $2x + 3y - 7 = 0$

C) $3x - 2y + 7 = 0$

D) $2x - 3y - 7 = 0$

- 30) If the lines $ax + by = 7$ and $Ax + By = 8$ are perpendicular, then it follows that

A) $a/B = b/A$

B) $aA = -bB$

C) $aB = -Ab$

D) $-a/A = b/B$

- 31) The distance between the point $(3, 0)$ and the line $x - 2y + 2 = 0$ is equal to:

- A) 5 B) $5\sqrt{5}$ C) $\sqrt{5}$ D) $\sqrt{2}$
- _____ 32) The angle between the lines $y = \sqrt{3}x + 1$ and $x - \sqrt{3}y + 2$ is
 A) 30° B) 60° C) 45° D) 120°
- _____ 33) What value of k makes the points (k,1), (2,-3), and (-5,4) are collinear?
 A) 2 B) 4 C) -4 D) -2
- _____ 34) The equation of the circle passing through (4,5) having its center at (2,2) is;
 A) $x^2 + y^2 + 4x + 4y - 5 = 0$ B) $x^2 + y^2 - 4x - 4y - 5 = 0$
 C) $x^2 + y^2 - 4x + 13 = 0$ D) $x^2 + y^2 - 4x - 4y + 5 = 0$
- _____ 35) The foci of the ellipse $9x^2 + 25y^2 - 18x - 100y = 116$ are
 A) (-3,2) and (5,2) B) (-4,2) and (6,2)
 C) (1,5) and (1,-1) D) (1,2) and (9,2)
- _____ 36) The length of the latus rectum of the hyperbola given by the equation
 $4x^2 - 9y^2 + 16x + 18y - 29 = 0$ is:
 A) $\frac{\sqrt{13}}{3}$ B) $\frac{7}{3}$ C) $\frac{8}{3}$ D) $\frac{\sqrt{15}}{3}$
- _____ 37) The vertices of the hyperbola $\frac{x^2}{25} - \frac{y^2}{9} = 1$ is
 A) $(-\sqrt{34}, 0)$ and $(\sqrt{34}, 0)$ B) $(-5, 0)$ and $(5, 0)$
 C) $(0, -\sqrt{34})$ and $(0, \sqrt{34})$ D) $(0, -5)$ and $(0, 5)$
- _____ 38) The focus of the parabola $y^2 - x - 2y + 2 = 0$ is:
 A) $(\frac{1}{4}, 0)$ B) $(1, 2)$ C) $(\frac{3}{4}, 1)$ D) $(\frac{5}{4}, 1)$
- _____ 39) Which of the following is the equation of the directrix of the parabola
 $x^2 - 4x - 3y + 10 = 0$?
 A) $y = -5/4$ B) $y = 5/4$ C) $y = -3/4$ D) $y = 3/4$
- _____ 40) The earth moves in an elliptical orbit about the sun, with the sun at one of the foci. If the least distance of the earth from the sun is about 91,340,000 miles and its greatest distance is about 94,450,000 miles approximately, then how far is the sun from the other focus of the ellipse?
 A) 1,555,000 miles B) 3,070,000 miles
 C) 3,110,000 miles D) 92,895,000 miles

Appendix G

PILOT ATTITUDE SCORES

stud2	0	8	5	5	5	5	4	4	5	5
stud1	0	8	5	3	5	3	5	4	5	5
stud34	0	8	4	4	4	4	5	5	4	5
stud36	1	8	5	4	5	4	5	5	2	5
stud20	1	8	5	4	5	4	4	1	4	5
stud10	1	8	3	5	5	3	5	4	2	5
stud33	0	8	5	4	5	4	5	5	2	5
stud9	1	8	5	3	3	4	5	5	4	1
stud5	0	8	5	4	4	4	4	4	2	5
stud13	1	8	5	3	5	5	5	1	4	5
			4.7	3.9	4.6	4	4.7	3.8	3.4	4.6
		item 1	item 2	item 3	item 4	item 5	item 6	item 7	item 8	
stud15	0	8	3	3	5	5	4	2	1	5
stud22	0	8	3	2	5	5	4	4	1	3
stud23	1	8	4	1	5	3	3	3	2	2
stud30	1	8	4	2	4	4	4	3	1	2
stud29	0	8	4	2	4	5	3	5	1	2
stud17	1	8	1	1	1	3	3	5	2	3
stud25	1	8	5	4	5	3	1	1	1	2
stud21	0	8	1	2	3	1	2	5	1	2
stud18	0	8	3	1	3	1	2	3	1	1
stud16	0	8	5	2	2	4	1	3	4	1
			3.3	2	3.7	3.4	2.7	3.4	1.5	2.3
			1.4	1.9	0.9*	0.6	2	0.4*	1.9	2.3

*Discarded items

5	5	4	3	5	5	3	5	3	5	5
5	3	4	2	5	5	5	4	5	4	5
3	4	5	5	5	5	5	5	4	3	5
4	5	4	5	5	3	3	5	5	5	5
3	4	5	4	5	1	5	5	5	3	5
1	5	4	5	5	4	5	5	4	5	5
4	5	5	2	4	5	5	5	3	4	5
3	5	3	2	5	4	5	5	5	5	4
3	4	3	4	5	4	4	4	5	4	5
5	5	5	1	5	3	2	5	4	3	5
3.6	4.5	4.2	3.3	4.9	3.9	4.2	4.8	4.3	4.1	4.9
item 9	item 10	item 11	item 12	item 13	item 14	item 15	item 16	item 17	item 18	item 19
1	1	3	2	5	3	2	3	3	4	5
1	2	5	3	5	5	3	4	3	2	3
2	2	3	2	3	2	3	4	5	5	3
2	2	2	3	4	2	2	4	4	4	4
2	1	3	1	2	3	5	4	4	1	5
2	4	3	4	4	4	4	5	4	4	2
3	1	4	1	1	5	4	1	3	5	4
1	1	3	5	4	2	5	2	4	2	3
1	5	5	3	5	5	3	5	3	5	1
2	1	2	1	2	1	2	4	3	2	2
1.7	2	3.3	2.5	3.5	3.2	3.3	3.6	3.6	3.4	3.2
1.9	2.5	0.9*	0.8	1.4	0.7*	0.9*	1.2	0.9*	0.7*	1.7

3	5	5	5	5	5	3	5	3	5	5
4	4	5	5	5	5	3	5	4	5	5
5	5	5	4	4	3	5	4	5	5	4
5	3	5	2	5	5	5	4	5	5	4
4	4	5	5	4	5	5	4	5	5	5
5	4	5	3	4	5	4	4	5	5	3
3	5	5	2	4	5	3	4	5	5	5
4	5	5	4	4	5	5	4	3	5	4
5	5	4	4	4	5	3	4	3	5	3
3	5	3	5	5	5	3	4	3	5	4
4.1	4.5	4.7	3.9	4.4	4.8	3.9	4.2	4.1	5	4.2
item 20	item 21	item 22	item 23	item 24	item 25	item 26	item 27	item 28	item 29	item 30
5	2	1	1	4	4	1	1	3	5	5
3	1	4	1	2	2	3	1	3	4	2
2	1	5	1	4	3	3	3	5	4	1
4	1	4	1	4	3	5	1	1	5	1
3	1	5	1	2	3	3	3	3	3	3
4	1	5	1	2	1	3	2	4	4	2
5	1	5	1	1	3	4	3	5	1	1
5	1	5	1	1	3	5	1	2	4	1
1	1	5	1	1	1	3	1	3	5	1
5	1	3	4	2	2	4	2	3	1	2
3.7	1.1	4.2	1.3	2.3	2.5	3.4	1.8	3.2	3.6	1.9
0.4*	3.4	0.5*	2.6	1.1	2.3	0.5*	1.4	0.9*	1.4	2.3

5	5	5	5	5	5	165
5	5	5	5	5	5	162
4	4	4	4	5	5	159
5	3	5	4	4	4	157
5	1	5	5	4	5	153
5	4	5	4	3	4	152
5	2	5	3	3	4	150
5	2	4	5	5	3	148
4	4	5	3	3	4	145
5	4	4	3	5	3	145
4.8	3.4	4.7	4.1	4.2	4.2	
item 31	item 32	item 33	item 34	item 35	item 36	
5	4	3	3	5	5	117
3	1	3	3	5	5	109
4	2	2	3	5	5	110
5	3	2	2	4	4	107
1	1	3	5	3	3	103
4	2	1	1	3	2	101
1	3	2	1	4	3	98
2	2	3	3	3	4	95
1	5	1	1	3	2	92
4	4	2	2	3	3	91
3	2.7	2.2	2.4	3.8	3.6	
1.8	0.7*	2.5	1.7	0.4*	0.6*	

Appendix H

Addis Ababa University
School of Graduate Studies
College of Education
Department of Curriculum and Teachers Professional Development
Studies

A questionnaire to be filled by social science preparatory I students'.

Dear students,

The main objective of this study is to determine the attitudes of social Science Preparatory I students' towards mathematics which may affect their achievement and ultimately to forward some possible solutions.

The success of this study mainly depends on your genuine responses. Therefore, you are kindly requested to respond accordingly.

Thank you in advance

General Instructions

Before you start responding to the questionnaires, please note the following.

You are **not** required to write your name.

All the questions have equal value for the fulfillment of the objective of the study. Therefore, all the questions should be attempted.

All your responses will be kept secret and are used only for the purpose this study.

Follow the specific instructions given for each part

Part one: Personal Data

1. Subcity_____School_____
2. Sex: _____ age_____Grade_____

Part Two (Attitude scales)

The objective of this scale is to find out the way you feel about Mathematics.

Instruction

As you read the sentences, you will know whether you agree or disagree. If you strongly agree, tick (✓) strongly agree (SA). If you agree, but not so strongly, tick (✓) agree (A). If you are not sure about a question or you can not answer, tick (✓) undecided (U). If you disagree with the sentence, but not strongly, tick (✓) disagree (D). If you disagree with the sentence very much, tick (✓) strongly disagree (SD).

No.	Attitude	Options				
		SA	A	U	D	SD
1	I am sure that I can learn maths					
2	I am always under a terrible strain in maths class					
3	Maths will not be important to me in my life's work.					
4	Maths is hard for me.					
5	I'll need mathematics for my future work.					
6	I am sure of myself when I do maths.					
7	I don't expect to use much maths when I get out of school.					
8	Maths is a worthwhile, necessary subject.					
9	Learning maths is a waste of time.					
10	Maths has been my worst subjects.					
11	I will use mathematics in many ways as an adult.					
12	I see mathematics as something I won't use very often when I get out of high school.					
13	Most subjects I can handle OK, but I just can't do a good job with maths.					
14	I can get good Marks in maths.					
15	I'll need a good understanding of maths for my future work.					

16	I know I can do well in maths.					
17	Doing well in maths is not important for my future.					
18	High school Mathematics courses would be very helpful no matter what I decide to study.					
19	Studying maths makes me feel nervous.					
20	I study maths because I know how useful it is.					

Part III

Instruction .For each of the following questions put a tick (✓) mark according to your choice in the appropriate box and whenever necessary write your reasons.

1) Do you like Mathematics?

Yes ☐

No ☐

If no, please write some of your reasons.

a) _____ b) _____

c) _____ d) _____

2) Do you have an interest to learn mathematics?

Yes ☐

No ☐

If no, please write some of your reasons.

a) _____ b) _____

c) _____ d) _____

3) Are you attentive during mathematics class?

Yes ☐

No ☐

If no, please write some of your reasons.

a) _____ b) _____

c) _____ d) _____

4) What general opinion do you have about Mathematics?

Appendix I

Frequency Distribution of Mathematics Scores

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15.00	1	.3	.3	.3
	17.50	5	1.5	1.5	1.8
	20.00	7	2.0	2.0	3.8
	22.50	20	5.8	5.8	9.6
	25.00	7	2.0	2.0	11.7
	27.50	16	4.7	4.7	16.4
	30.00	11	3.2	3.2	19.6
	32.50	13	3.8	3.8	23.4
	35.00	20	5.8	5.8	29.2
	37.50	19	5.6	5.6	34.8
	40.00	18	5.3	5.3	40.1
	42.50	24	7.0	7.0	47.1
	45.00	32	9.4	9.4	56.4
	47.50	62	18.1	18.1	74.6
	55.00	6	1.8	1.8	76.3
	57.50	5	1.5	1.5	77.8
	60.00	8	2.3	2.3	80.1
	62.50	15	4.4	4.4	84.5
	65.00	11	3.2	3.2	87.7
	67.50	8	2.3	2.3	90.1
	70.00	7	2.0	2.0	92.1
	72.50	3	.9	.9	93.0
	75.00	1	.3	.3	93.3
	77.50	5	1.5	1.5	94.7
	80.00	7	2.0	2.0	96.8
	82.50	3	.9	.9	97.7
	85.00	3	.9	.9	98.5
	87.50	3	.9	.9	99.4
	90.00	1	.3	.3	99.7
	92.50	1	.3	.3	100.0
	Total	342	100.0	100.0	

Appendix J

Frequency Distributions of Attitude Scores

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	37.00	1	.3	.3	.3
	38.00	1	.3	.3	.6
	39.00	1	.3	.3	.9
	41.00	10	2.9	2.9	3.8
	42.00	1	.3	.3	4.1
	43.00	3	.9	.9	5.0
	44.00	18	5.3	5.3	10.2
	45.00	2	.6	.6	10.8
	46.00	3	.9	.9	11.7
	47.00	2	.6	.6	12.3
	48.00	9	2.6	2.6	14.9
	49.00	8	2.3	2.3	17.3
	50.00	18	5.3	5.3	22.5
	51.00	27	7.9	7.9	30.4
	52.00	6	1.8	1.8	32.2
	53.00	3	.9	.9	33.0
	54.00	17	5.0	5.0	38.0
	55.00	20	5.8	5.8	43.9
	56.00	12	3.5	3.5	47.4
	57.00	12	3.5	3.5	50.9
	58.00	13	3.8	3.8	54.7
	59.00	14	4.1	4.1	58.8
	60.00	5	1.5	1.5	60.2
	61.00	5	1.5	1.5	61.7
	62.00	6	1.8	1.8	63.5
	63.00	5	1.5	1.5	64.9
	64.00	14	4.1	4.1	69.0
	65.00	13	3.8	3.8	72.8
	66.00	15	4.4	4.4	77.2
	67.00	16	4.7	4.7	81.9
	68.00	16	4.7	4.7	86.5
	69.00	9	2.6	2.6	89.2
	70.00	9	2.6	2.6	91.8
	71.00	3	.9	.9	92.7
	72.00	6	1.8	1.8	94.4
	73.00	4	1.2	1.2	95.6
	74.00	4	1.2	1.2	96.8
	75.00	3	.9	.9	97.7
	76.00	1	.3	.3	98.0
	77.00	1	.3	.3	98.2
	79.00	2	.6	.6	98.8
	82.00	1	.3	.3	99.1
	83.00	1	.3	.3	99.4
	88.00	1	.3	.3	99.7
	89.00	1	.3	.3	100.0
	Total	342	100.0	100.0	

Declaration

I here by declare that this thesis is my original work done under the supervision and guidance of Dr. Solomon Areaya. All relevant sources used for the thesis have been duly acknowledged.

Name KIFLE YILMA
Signature 
Date of submission June 30/08

