FACTORS INFLUENCING THE PERFORMANCE OF MATHEMATICS AMONG PUBLIC SECONDARY SCHOOL STUDENTS IN NAIROBI PROVINCE.

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BY:

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DECLARATION

"This research project is my original work and has not been submitted for a degree in any other University".

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This research project has been submitted with my approval as the University supervisor.

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DEDICATION

This work is dedicated to my husband Peter Njaggah and my children Catherinelbin Wanjiku, Mariajayne Wanjiku and Faith Njeri whose support and encouragement has been a source of inspiration. They showed, love patience and understanding at times when progress seemed impossible.

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ABSTRACT

This study was conducted in Nairobi province, Kenya. The main purpose of the study was to attempt to find out the existence or non-existence of a significant relationship between the following variables:

Attitude of students and mathematics teachers and students performance, teachers' qualifications and students' performance, students' gender and career aspirations and their performance and teachers' teaching experience and students' performance. The population of the study was made up of all public secondary schools in Nairobi province, from which a research sample was drawn from sixteen schools. The sample comprised of three hundred and eighty four (384) mathematics students and thirty- three (33) - mathematics teachers. Three research instruments were used to collect data. The research instruments were: Students Questionnaire (SQ), Mathematics Students Performance Test (MSPT) and Mathematics Teacher Questionnaire (MTQ).

Data was collected from all the sixteen (16) schools in the sample. Data was tabulated and analyzed using simple descriptive statistics like percentages, means and other measures of central tendencies, Pearson Product Moment Correlation Coefficient (r) and Fisher's Exact Test were used to determine relationships between variables.

From the data collected the following findings were made:

- A significant relationship existed between attitudes towards mathematics by secondary school students and performance in mathematics.
- A significant relationship existed between teachers' professional qualifications and students' mathematics performance.
- There was a significant relationship between attitudes of the teachers towards mathematics and performance of students.

- There existed a significant relationship between teachers teaching experience and students' performance in mathematics.
- A significant relationship existed between students' gender and mathematics performance.
- A significant relationship existed between students' career aspirations and their performance in mathematics.

On the strength of the main findings some of the recommendations made were:

- There is need to take measures to train mathematics teachers in terms of giving them professional content as well as subject matter content.
- There is need to ensure that students' attitude is enhanced which in turn will improve their performance in mathematics
- There is need to enhance career guidance in schools so that students can decide on their future careers early enough. This will enhance performance in mathematics since most careers are mathematics oriented.

TABLE OF CONTENTS

CHAPTER ONE

INTRODUCTION

CHAPTER TWO

LITERATURE REVIEW

CHAPTER THREE

RESEARCH METHODOLOGY

CHAPTER FOUR

CHAPTER FIVE

Summary, Conclusion and Recommendations

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EAST AFRICANA COLLECTION

LIST OF TABLES

ABBREVIATIONS

APU	-	Assessment of Performance Unit
ATS	-	Approved Teachers Status0
IGCSE	-	International General Certificate of Secondary Education.
K.N.E.C.	-	Kenya National Examination Council
K.C.P.E.	-	Kenya Certificate of Primary Education
K.I.E.	-	Kenya Institute of Education
MSPT	-	Mathematics Student Performance Test
MTQ	-	Mathematics Teacher Questionnaire
NGO	-	Non-Governmental Organization
RMAS	-	Revised Mathematical Attitude Scale
S.Q	-	Students' questionnaire
SMASSE	-	Strengthening Science and Mathematics in Secondary School Education.
U.S.A.	-	United States of America

CHAPTER ONE

INTRODUCTION

1.1 Background to the Problem

The characteristic of industrially developed countries is that apart from scholarly advancement there has been a rapid rate of economic growth. This has been brought about by the rapid development of science and technology. Mathematics, according to Kiragu (1986) is a strategic subject since science subjects and technology require a thorough grounding in mathematics. The science subjects and mathematics are the determinants of economic progress. Thus the importance of mathematics and its usefulness in other fields cannot be over emphasized.

The importance of mathematics is strongly expressed by Cockcroft Committee Report (1982), which observed that: "There can be no doubt that there is a general agreement that every child should study mathematics at school. Indeed the study of mathematics.., is regarded by most people as essential". The usefulness of mathematics to the child and the society can be perceived from very many different perspectives. Mathematics has a primary duty to serving the goals of education in a country. In this respect mathematics is strategically placed to enhance individual development and self-fulfillment. Magoci (1992), noted that mathematics was a basic requirement for the study of several subjects of secondary school, courses at universities and tertiary institutions. The importance of mathematics in communication cannot be underscored as Irumbi (1990) noted:

> Mathematics plays a key role in the communication of information and ideas. It can be used to communicate ideas by use of figures, letters, tables, charts, graphs, diagrams and even geometrical constructions. It is also quite useful for the development of logical thinking

accuracy, and spatial awareness. These are essential ingredients in mental development of man and there is need to promote their development.

The fact that mathematics is taught in every educational system at some stage, underscores the central part it plays in the learners. The need for mathematics education not only at secondary level but also at the university level cannot be overemphasized. Sellinger (1994) observed that there was a general concern about the falling standards of numeracy, raising the possibility of the need for a professional review of mathematics needed by industry at various levels. In the Kenyan situation, the government has made mathematics a compulsory subject of study at the primary and secondary school levels. It is also compulsory in all primary school teacher-training colleges.

Irumbi (1990), noted that the government had taken great pains to improve the quality of teaching secondary school mathematics in various ways. These included, provision of in-service training for secondary school teachers, expansion of teaching and educational facilities and constant review of the curriculum. The government of Kenya has also encouraged several non-governmental organizations (NGO) to strengthen the teaching of mathematics and sciences. An example of such an NGO is SMASSE (Strengthening Mathematics and Sciences in Secondary School Education).

Siringi, (1999, Daily Nation, August 28), reported that the government of Kenya and Japan were assembling senior teachers in the country for a brain storming forum. This was in a bid to improve standards in the performance of mathematics and science subjects in the national examinations. To emphases the poor performance in mathematics, Siringi further reported that according to 1998 KCSE results seventy five (75) percent of the total mathematics candidature of one hundred sixty nine thousand five hundred and six (169,506) obtained between grades E and D.

In spite of the curriculum effort by the government and its importance in various aspects of development, performance in mathematics continues to be a problem facing Kenyan educators and other stakeholders. This poor performance is in both Kenya Certificate of Primary Education (K.C.P.E) and Kenya Certificate of Secondary Education (K.C.S.E). According to Magoci (1992), the causes of this relatively poor performance have not been established. This has led to apportioning of blame at the beginning of every year, on each other by different interested parties. The school administration, parents and pupils tend to apportion blame to the teachers for poor performance. They accuse teachers of adopting a "relaxed attitude" towards teaching, leading to mass failure. These accusations may lead to low morale and a negative attitude towards the teaching of mathematics in particular. Parents usually show great concern in their children's achievement and especially in mathematics since they feel that it is an indication of the general performance of their children in National Examinations. The following report was reported in the Editorial, The East African Standard (1997, January 7):

> If there is anything in the education sector that generates a lot of interest and sometimes heat in this country, it is examinations. This is expected given that in Kenya examinations are not so much used to assess what skills the learner has gained but whether he has scored good enough marks for the next grade. Examination, for many is the same thing as the Day of Judgment and as educationalist Maclintosh said they were viewed as alpha and Omega of learning.

Such is how examinations are viewed in Kenya and mathematics performance is of no exception. Mwangi (1986) commented that there had been an outcry from the government and the general public on the way students learnt and performed in mathematics. Similar sentiments were expressed by Kiragu (1986), who noted that despite national efforts made in developing a

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curriculum that is appropriate to the needs of this country, performance in K.C.S.E. mathematics had been relatively poor over the last ten years. More sentiments were expressed by Mukasa Mango (The Standard 1997, July 16), while addressing parliament. Mango called for a probe into mathematics due to poor performance by students. The editorial, (Daily Nation 2003, February 28) noted: "More damming is the fact that overall results in mathematics and science subjects were still unimpressive. For all practical purposes, these subjects are fundamental for allotment into higher education places, the labour market and overall socio-economic set-up". Commenting after releasing K.C.S.E. results, the Minister for Education, Saitoti,

(The East African Standard 2003, February 27), noted that overall performance in mathematics and science subjects was below average. He urged teachers to ensure that there was improvement in the subjects. He emphasized that mathematics and science subjects were a necessity as engines of development in Kenya and that the government was committed to the issues of performance.

The table below shows the means per subject in KCSE since 1998.

Table 1: Subject Means of Sixteen Subjects for the Years 1998, 1999, 2000 and 2001.

Year/subject	1998	1999	2000	2001
Mathematics	17.52	12.23	17.61	18.72
Kiswahili	47.14	40.55	48.26	42.71
English	31.62	31.34	37.17	34.42
Biology	29.79	31.21	27.81	27.49
Physics	22.04	22.67	23.06	18.86
Chemistry	19.43	21.32	22.02	15.93
Metal work	43.50	48.27	55.59	57.05
History/Government	41.44	44.78	40.80	50.02
Geography	40.37	39.03	36.64	34.29
Christian Religious (C.R.E).	43.59	48.76	49.49	46.28
Islamic Religious Education (IRE)	54.07	58.88	58.32	44.53
Social Education & Ethics. (SEE)	45.94	47.43	45.06	53.98
Home Science	48.78	52.41	60.36	57.43
Agriculture	48.05	46.98	49.93	46.57
Art and Design	41.48	45.49	53.45	54.30
Wood work	42.24	52.16	48.15	48.86

(Table adapted from K.C.S.E. Report, KNEC, 2002).

From Table 1, mathematics registered the lowest means among the sixteen subjects shown in table 1 above. It also ranked the last among all sixteen subjects in all the four years. This indicates among other things that students may not be properly prepared in mathematics or lack qualified teachers. Shiundu (1982) stated that, "Teachers without proper (academic) qualifications and proper (professional) training, fail to do 'justice' to the subject. An adequate qualification of the teacher develops self-confidence in the teacher and serves as a source of inspiration in the pupils". According to Onditi A, (Daily Nation; 1995 April 8), the Minister of Education, while speaking in a performance improvement meeting, attributed poor performance to shortage of qualified teaching personnel among other factors. It was further noted that this factor prevailed in most public schools. Another factor that has an influence on the learner's performance in mathematics is the difference between the performance of boys and on various mathematical tasks. Several research studies conducted both in the Western countries and in Africa revealed a striking difference between the performance of boys and girls in mathematics. These studies showed that boy's achievement in mathematics was slightly higher than that of girls (Kibanza, 1980).

Other studies have shown that learners with higher career aspirations tended to perform better than those who had lower aspirations. One such study was carried out by Durajoiye (1974). The study revealed significant positive correlations between pupil's educational aspirations and their academic performance in mathematics.

The attitude of the learners towards mathematics is of paramount importance. A survey of research literature indicates that attitude towards mathematics of the learners has an influence on their achievement in mathematics as has been emphasized by Onyango (1988). Munguti (1984), found out that teachers attitude either enhanced or hindered the learning of mathematics and

hence affected performance. This finding is in agreement with Mwangi (1986) who found out that the teachers' negative attitude was being reflected in the student's poor performance in mathematics. The poor performance in mathematics has been noted in all parts of the Republic of Kenya and Nairobi province is no exception.

1.2 Statement of the Problem

The National education system was overhauled and streamed into the 8-4-4--education system from 7-4-2-3 systems with a great emphasis on practical aspects of learning. The Kenya government spends a substantial amount of money on education part of which goes to the improvement of mathematics education in schools. There is little evidence however, that this increased expenditure on education, has necessarily been associated with improved performance in mathematics, Kibanza, 1980). Mathematics education is characterized with huge investments in terms of physical facilities and human resources. It would thus be expected that the learner's performance would improve. However, this has not been the case, though mathematics is a compulsory and very useful subject in secondary school curriculum, irrespective of how well a student performs in the other subjects at the end of the course, the final grade is affected by mathematics performance. That dismissal performance in mathematic continues to be a big problem to mathematics educators, curriculum planners, policy makers and the government, is a fact. The poor performance still persists in the country and Nairobi province is of no exception. This is in spite of the governments' effort to promote teacher education. This poor achievement with a worsening trend every year has a serious implication for the supply of manpower needed in the labour market. The table below shows overall performance of both mathematics papers 1 and 2 since 1998.

Table 2 Candidates Overall Performance in Mathematics in Kenya for the Last Four Years.

Year	Paper	Candidature	Maximum score	% Mean score	Standard deviation
	1		100	19.59	18.23
1998	2		100	15.64	15.25
	Overall	169,506		17.52	32.71
	1		100	13.46	13.85
1999	2		100	11.01	11.76
	Overall	172,879		12.23	24.94
	1		100	17.46	16.44
2000	2		100	15.05	16.06
	Over all	181, 947		16.61	31.00
	1		100	18.83	18.45
2001	2		100	18.62	17.15
	Overall	193,702		18.72	34.15

(K.C.S.E. Report, K.N.E.C.-2002)

From the table, the subject mean through the years is very low. A significant improvement was noted in 2001 overall performance but never the less performance was still relatively low. This dismal achievement will obviously have a multiple effect on the general development of the country. There is thus dire need for effort to be made to try and improve the below-average achievement in secondary school mathematics especially in public secondary schools. In Nairobi province mathematics performance follows the same trend as that shown by the national results. The table below shows mathematics performance for the year: 2002, 2001, 2000 and 1999 in Nairobi Province.

Table 3: Candidate's Performance in Mathematics since 1999- Nairobi Province.

Year	**1999**	**2000**	**2001**	**2002**
Mean Grade	D+	D-	D	D

In an attempt to understand this unsatisfactory achievement in mathematics, certain factors need to be considered in relation to performance in mathematics. This study thus, attempted to investigate factors that influence performance of mathematics among public secondary school students in Nairobi Province.

1.3 Purpose of the Study

The purpose of this study was to investigate factors influencing performance in mathematics among secondary schools students in Nairobi province.

1.4 Objectives of the Study

From the purpose of the study, the objectives generated were as follows:-

1. To investigate if there is a significant relationship between attitude towards mathematics and performance among public secondary school students.
2. To establish the if there is a significant relationship between gender of secondary school students and their performance in mathematics among secondary school students.
3. To examine the relationship between teachers qualifications and performance in mathematics among secondary school students.
4. To investigate if there is a significant relationship between students' career aspirations and performance in mathematics among secondary school students.

1.5 Research questions

The following research questions were generated from the objectives of the study.

1. Is there any significant relationship between attitudes towards mathematics by teachers and performance of secondary school students in mathematics?
2. Is there any significant relationship between attitudes towards mathematics by secondary school students and their performance in mathematics?

3. Is there any significant relationship between professional qualifications of teachers and mathematics achievement of their secondary school students?
4. Is there any significant relationship between teachers' teaching experience and mathematics performance among secondary school students?
5. Does a significant relationship exist between secondary school students' gender and achievement in mathematics?
6. Is there a significant relationship between students' career aspirations and their performance in mathematics at secondary school level?

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EAST AFRICANA COLLECTION

1.6 Significance of the Study

Mathematic is an important subject and a major determinant of future careers of the learners in Kenya secondary schools. Mathematics is a compulsory subject of study for both public secondary school and primary schools in Kenya. Performance in mathematics in national examinations by learners causes a lot of concern among the general public, educators, learners and the schools. This study analyses and attempts to establish the relationship between various factors and their effect on performance in mathematics.

The study is particularly useful to the mathematics teachers in public secondary schools in Nairobi Province and in the country. Once the teacher understands the problems that might hinder one from achieving aims of teaching mathematics, the teacher can adjust and become a better teacher. The findings of this study will provide policy makers, planners, curriculum developers (based in Kenya Institute of Education-KIE), school administrators and other Educationists with information on various factors that persistently lead to dismal performance in mathematics in secondary schools. Thus, the findings of the study will be very important and helpful in future curriculum changes,

innovations and interventions in mathematics. The findings of this study may therefore serve as a basis of improvement of secondary mathematics syllabus.

In view of the above, the findings of the study may lead to a registered improvement in mathematics performance in both primary and secondary schools. This may be as a result of the stakeholders putting in mechanisms that enhance desirable performance as indicated in the research study.

1.7 Limitations

As much as all efforts were made to make the respondents as objective as possible, it may have been difficult to get honest response from the respondents. This is especially so on the attitude towards mathematics. The respondents might have tended to please or impress the researcher by giving positive response only and concealing the negative attitudes.

In this study, only a few variables or factors influencing performance were studied. Those factors to be studied already have measuring instruments devised or are such that measuring instruments can be devised. Other equally important factors or variables, for example, intelligence, self-concept and others for whose measuring instruments the researcher has not yet come across or are not easily improvised for the population of study, were left out in the study.

The researcher thus, does not attempt to suggest that the results of this study necessarily hold for other schools or other provinces other than those in the study.

1.8 Delimitations

The factors that influence achievement in mathematics in secondary schools are many and diverse. It was not logistically possible to study all the factors that are related to performance in mathematics in this research study. The researcher thus delimited the study to the following factors: attitudes of teachers and students towards mathematics, gender of students, qualification and experience of

teachers and career aspiration of student and their relationship with performance in mathematics. This study is limited since it was mainly based on performance in the National examination (KCSE) at the end of form four and a performance test given by the researcher. This was due to the fact that other examinations exist in schools, which evaluate learner's performance.

1.9 Assumptions of the Study

The following assumptions are made in this research study:

1. That the respondents (teachers and learners) gave honest and objective responses.
2. That all mathematics' teachers in secondary school completed the specified mathematics syllabus before the mathematics KCSE examination at the end of the fourth year.

1.10 Definition of Terms used in the Study

The following terms used in the study were defined as below: -

Attitude: Refers to individual's organized manner of thinking, feeling and reacting to people, objects or events in the environment.

Positive attitude: Refers to expressions of feelings, which are favorable.

Negative attitude: Refers to expressions of feelings, which are unfavorable.

Teaching experience: Refers to the number of years a teacher has taught secondary school mathematics.

Professional Grade: Refers to professional level of attainment or qualification.

Kenya National Examination Council (K.N.E.C): Refers a body that sets, moderates, administers and marks national examinations and evaluates the secondary school curriculum.

Kenya Certificate of Secondary Examination (K.C.S.E): Refers to the national examination that is given at the end of secondary school four-years course.

Kenya Certificate of Primary Examination (K.C.P.E): Refers to the national examination given at the end of primary school cycle.

Kenya Institute of Education (K.I.E): Refers to the body whose main objective is to develop curricula for schools and colleges.

Performance: Refers to learners mathematics achievement as given in K.C.S.E and the Mathematics Student Performance Test administered in the study.

1.11 Organization of the Study

Chapter One forms introduction of the study. It describes the background to the problem, problem statement, purpose and objectives of the study. The researcher has also described the significance, limitations, delimitations and assumptions of the study. The last sub-section of the chapter defines

the terms commonly used in the study. Chapter two deals with literature review. It consists of attitude towards mathematics, qualifications of mathematics teachers, effects of teaching experience on student's performance in mathematics, gender of the students and performance in mathematics, students educational aspirations and mathematics performance.

Chapter Three is on design and methodology of the study. It describes the design of the study, the population of the study, sample and sampling procedures, the research instruments, pre-testing of the instruments, data collection and data analysis procedures. Chapter four describes how the data collected was analyzed and the procedures and techniques of analyzing the data. It describes the analysis of data on demographic information, gender of students and performance in mathematics, attitude of students, career aspirations of students and performance, academic and professional qualifications of teachers and students performance, teaching experience and attitude of teachers and performance of the students. Chapter five is on summary conclusions and recommendations. It describes the summary of main findings, conclusion, recommendations and recommendations for further reading.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

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A number of studies have been carried out by specific researchers to identify and analyze factors that influence performance of students in mathematics and in National examinations in general. One such study is an international study of achievement in mathematics where Hus'en (1967) considered the relationship between achievement in mathematics and schoolteachers plus pupil's characteristics and social factors. Other notable studies on factors affecting performance of mathematics include those by Begle (1973) and Callaghan (1971). In Kenya, a number of studies have been conducted in the same area. Kibanza (1980) in his study on some factors associated with performance in mathematics among form two pupils in Kenya considered such factors as pupils' sex, attitude towards mathematics future aspirations as well as their socio-economic backgrounds. Mwangi (1986) studied factors influencing the performance in and learning of mathematics among secondary school students in Kenya. He considered the following factors:- students' backgrounds, characteristics of mathematics teachers and school characteristics.

Riungu (1988) studied factors that influence performance in zonal mathematics evaluation examination by standard seven pupils in Township Educational Zone of Gachoka Division of Embu District. In his study, he compared the performance of rural and urban primary schools in Gachoka Division by considering the influence of such factors as teacher's attitudes, sex, professional qualifications, teaching experience and age.

From all these researcher studies the factors related to teachers, pupils, school and social backgrounds have formed the basis of the studies of factors that affect performance in mathematics. However, the findings from these studies and others conducted else where in the world seem to be at

variance. The researcher thus intends to conduct a study into some of the factors that affect achievement in mathematics specifically at secondary school level since most of the studies carried out in the country are based at primary school level.

This chapter reviews literature related to the following:-

- Attitude towards mathematics
- Professional qualifications of mathematics teachers
- Experience of mathematics teachers and performance in mathematics
- The gender of secondary school students, and performance in mathematics
- Students career aspirations and expectations and performance in mathematics.

2.1 Attitudes Towards Mathematics

Many educators agree that attitudes play an important role in the teaching and learning of mathematics. Attitudes refer to how one thinks feels about and acts towards objects and ideas. Keil (1985), defines attitudes as: "Positive or negative feelings that an individual holds about objects, persons or ideas". The learners join school with prior experiences upon which the teacher draws and further organizes these experiences into mathematical concepts. The learners are clear about what they expect from the teachers and the teachers also feel that they knows what they expect from the learners. This causes a conflict in which the teachers emerge as the winner. The learners start viewing the teacher as an authority. The role of the mathematics teacher is to give the learners formal education in mathematics most suitable for their capabilities and environmental interests. It is important that teachers understand the attitudes of their students towards mathematics because by so doing they will help them develop positive attitudes towards the subject. This is a very important ingredient in desirable performance in mathematics.

Attitudes are mental superposition's that express that express the connections between situations. For example a child who expresses that mathematics is an important and useful subject, which should be taught in school, is in effect expressing a relationship between mathematics and how people regard it as a school subject. Attitude has been defined by Bell (1980) as: " a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individuals response to all objects and situations with which is related". From the above definitions, attitudes can be seen to be learned and not innate. Attitudes can also be modified by experience and persuasion. Thus it should be possible for the mathematics teachers and all the other teachers to change the attitudes of their students.

Dutton (1958) reported that most of the children he tested in his study in California involving 459 junior High School students felt that they knew when their feelings towards arithmetics were developed. Grade three (3) to eight (8) and especially grades five (5) to seven (7) (approximately age ten (10) and twelve (12) were most significant for attitude formation. Dutton also asked them if their attitudes had changed at all in the course of their careers. About one-third (1/3) of the children claimed that they probably had changed. These data collectively would suggest that attitudes according to Dutton are a factor of the immediate syllabus and may not be deeply rooted. Griffiths (1963), on the development of attitudes stated that:-

> The crucial period in developing attitudes in a child seems to lie in the infant, where his first formal acquaintances with arithmetic is made, thereafter, should proceed at a place commensurate with his understanding so that he is not baffled on the one hand or bored on the other hand.

Churchill (1958), suggested that the faulty development of concepts was probably the most likely cause of the "strong dislike and even fear" which many intelligent adults were known to manifest

towards arithmetical operations. This conceptualization placed the origins of the phenomenon as far back as the infant school, where critics of the current practice asserted that while children were taught perhaps to calculate, the number understanding was rarely developed. If the young child did not grasp the significance of number operations at this stage, subsequent arithmetic lessons were only meaningless and puzzling.

Begle (1973), observed that students attitudes toward mathematics was positive in the early years of primary schooling but a decline appeared as they progressed to higher levels. It should be noted that at secondary school level the teachers should try as much as possible to sustain positive attitudes towards mathematics for better performance in the subject. The effect of these attitudes on performance was an important aspect in this study. Pritchard (1935), pointed out that boys and especially girls disliked arithmetic because of a feeling of in capacity and strain when dealing with difficult items in the curriculum. Freeman (1948) quoted inability to master technical difficulties as the most frequently expressed reason for not liking arithmetic. Freeman however noted an improvement in the students' attitudes towards arithmetic possibly due to the overhaul of the syllabus and improvement of the teaching techniques apparent from previous studies such as Prichards' work in the 1930's.

Poffenberger and Norton (1956), interviewed a group of 16 university students to explore previous influences upon attitudes towards arithmetic and mathematics. They found out that parental influence had a great impact on the learners' initial attitudes and do affect their achievement. They also claimed that the personality of the teacher and whether they were liked or disliked also influenced the learners' attitudes towards the subject. According to them, liking for the teacher was closely related to the fear of failure, which the learners might have experienced. The more they liked their teachers, the more anxious they became that they may fail and thus offend their teacher. Liking

for the teacher could also serve as a motivator to the learners. This influenced them to work harder in mathematics since the teacher had a pleasant personality in their view.

Kibanza (1980) in his study found out that pupils score on the attitudes towards mathematics correlated significantly with pupil's achievement scores in mathematics at 0.01 and 0.05 levels. Oketch (1982) reporting Aiken noted that there was a modest positive relationship between attitudes and achievement in elementary school mathematics. Mwangi (1986) observed that a very significant relationship existed between attitudes towards mathematics as a process enjoyment of mathematics and performance in mathematics. However he found no significant relationship between attitudes about the place of mathematics in the society and attitude towards mathematics teaching. Ogoma (1987) in his study of relationship between achievement and attitudes towards mathematics among students in Nairobi found out that attitudes towards mathematics and achievement were positively correlated. However the magnitude of the correlation was found to be statistically insignificant. Irumbi (1990) in his study on pupil's characteristics that affect performance in mathematics found that attitudes played a vital role in determining the pupils' performance in mathematics since those pupils with negative attitudes failed in the examination in his sample. Kibanza (1980), in his study of some factors associated with performance in mathematic among form two pupils in Kenya concluded that there was a significant relationship between pupils attitudes towards mathematics and achievement in mathematics at each cognitive level for boys and girls. He further noted that this relationship though not casual, it did indicate that pupils with favourable attitude towards mathematics tended to do better than those with less favourable attitude towards mathematics. Although these studies above have found a consistent and positively significant relationship between attitude towards mathematics and achievement in mathematics, some of the studies show negative relationship. Dutton and Blum (1968), reported no consistent relationship between pupils relative

preference for mathematics and their achievement level. Chase (1958), came up with similar findings. The inconsistency of these findings may have been due to poor research designs and the type of instruments used which are often of questionable validity.

A number of studies have been carried out to study the attitudes of schoolteachers toward mathematics. The research findings showed that attitudes towards mathematics were gradually acquired through the students' interaction with the learning process and the curriculum. In a study by Dutton (1962), the researcher investigated the changes in attitudes of prospective elementary teachers towards arithmetic since 1954. The study revealed that thirty eight (38) percent disliked arithmetic twenty four (24) percent liked arithmetic fairly well. The study further showed that prospective elementary school teachers tenaciously held attitudes towards arithmetic once developed. Teachers' attitudes are believed to be an important factor in determining the teaching and learning of mathematics. If a teachers' attitude was negative towards mathematics, it could in turn affect students' learning and hence their performance. Cockroft (1982), noted that:

> "There is no area of knowledge where a teacher has more influence over attitude as well as understanding of his pupils than he does, in mathematics. During his professional life, a teacher of mathematics may influence for good the attitudes for mathematics of several thousand young people and decisively affect many of their career choices".

This indicated that teachers' attitude towards mathematics had a great impact on mathematics than any other area of knowledge. Gatanzano (1977) giving his experience with prospective teachers noted that, during their first few days of classes, prospective teachers had a tendency to make one or more of the following comments. "Mathematics has always been my poorest subject", or "I will never pass this course" such comments indicated, to some degree, the feelings and emotions of many of the prospective teachers towards mathematics. Unless these prospective teachers' attitudes were

changed, then the pupils taught by teachers with these feelings were likely to reflect the same attitude and to achieve accordingly. Those sentiments were in agreement with Johnson (1967), who noted that: "It is the attitudes which were build that are highly involved in the learning and retention of our subject and it is often the attitude you (teacher) build that are the basis of your rank as a successful teacher". This indicated that if a pupil developed a positive attitude then the chances of liking a subject and at the same time performing well were increased.

Aiken (1970), studied the relationship between attitude and performance and concluded that: "The relationship between attitude and performance is certainly the consequence of a reciprocal influence in that attitude affects achievement and it in turns affects attitudes". Looft (1971), Parker (1974) Wamani (1980) and Thuo (1984) found a strong relationship between achievement in mathematics and attitude towards mathematics. Munguti (1984) in a study of factors affecting the teaching and learning of mathematics in Mbooni division found out that teacher's attitudes towards mathematics was a factor that may affect the teaching of mathematics.

Mwangi (1986) had similar findings when he found out that teachers' attitude was being reflected in the students' poor performance. Aiken (1970) revealed that teachers' attitude and effectiveness were determinants of students' attitude and performance in mathematics. Therefore if teachers' attitude was negative it would affect the pupils learning of a subject and hence their performance. Syndoam (1972) studied teachers as a possible source of pupils' attitude towards mathematics. She found out no evidence to the effect that teachers' attitudes affect pupils' attitude towards the subject. These studies hold overwhelming opinion in favour of the view that teachers' attitude towards mathematics is an important factor in learning mathematics. The problem of attitude towards mathematics and how it influences performance is quite serious at the higher levels.

2.2 Qualification of Mathematics Teachers

Much of the literature in mathematics education by scholars such as Muhandik (1983), Riungu (1988), Kathuri (1986),Kirembu (1991) and Magoci (1992) seemed to indicate a universal belief that a professionally trained teacher contributed more positively to effective learning than an untrained teacher. This was the reason why teacher training existed as a major part of education systems throughout the world. According to Eshiwani (1985), qualification of a teacher was a very important indicator of the quality of education provided. Eshiwani noted that in 1980, seventy percent (70%) of the teachers in Kenya were trained while thirty percent (30%) were untrained. In 1981, the respective figures were sixty six percent (66%) trained teachers and thirty four percent (34%) untrained teachers. Today the status of teaching profession needs determination.

Muhandik (1983) observed that many parents and educators had often expressed their concern about the poor performance of students in mathematics and that teachers shouldered most of this blame mainly due to lack of training. According to the report of the National Committee on educational Objectives and Policies (Gachathi 1976), the role and quality of teachers must be given the most critical consideration. The report also noted that the qualitative improvement of education can only occur if there is a major improvement in the quality of the teachers and teacher training.

Studies by Riungu (1988), Eshiwani (1974) and Kathuri (1986) show a general agreement that the qualification of teachers is of crucial importance in students' performance in mathematics. Teachers training should therefore stress the issue of quality. Smuthers (1990) observes in reference to training of teachers that: "Instead of remaining pre-occupied with entry qualifications the new tact would judge the ability of aspiring teachers to meet specific criteria of a good classroom teacher".

Kiragu reporting Hus'en (1978) observed that in the developing world research evidence showed that trained teachers made a difference and in particular, she said that teacher' qualifications,

UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION

experience, and amount of education and knowledge were positively related to students achievement.

As noted by Muthwii (1981), in Kenyan schools there were two types of teachers. There were trained teachers who had no grades but had different levels of academic achievements or attainment. At secondary level, there were trained graduate teachers, Approved Teacher Status (ATS), Graduate untrained teachers, Diploma in Education teachers and "A" level untrained teachers. Training and lack of training for teachers affected students' performance in mathematics. The untrained teachers relied on their academic qualifications to teach. The researcher thus found it necessary to find out the relationship between the various academic and professional qualifications of mathematics teachers and students performance in mathematics.

2.3 Effects of Teaching Experience on Students' Performance

According to Irumbi (1990), teaching experience was frequently included as a variable in educational research, but no clear picture of its effects seemed to emerge. Barnes (1985) pointed out that teacher effectiveness, while it may have increased through the early years of teaching, it may not have directly followed the same pattern in the later years of teaching. This was observed in longitudinal studies conducted by Fuller and Felder, which documented stages in the development of teachers and focused particularly on their concerns. Barnes observed that the teaching career probably did not continue to do so. He asserted that, the teaching career certainly did not do so in a linear fashion. He noted that, as suggested in a substantial proportion of the studies, increased teaching experience, at least after the early years in the classroom, were associated with tendency for teachers to reject innovations and alterations in educational policies.

Sidhu (1982), seemed to contradict this when he suggested:-

> Successful teaching experience… is also a valuable asset. It will enable the person to acquire certain commendable characteristic such as promptness, adaptability, efficiency, the technique of arousing and maintaining interest, adequate command of instructional materials and the ability to face the class with confidence.

The relationship between teaching experience of the teachers and secondary school students' performance in mathematics is of paramount importance and was thus studied.

2.4 Gender of the Students and Performance in Mathematics

One of the major factors to be considered in this study, in relation to performance in mathematics is the gender of the students. Research studies conducted both in western countries and in Africa have found gender in achievement of mathematics in favour of boys over girls. A study by Jarvis (1964), tested 347 girls and 366 boys of the 6^{th} (sixth) grade arithmetic fundamentals and reasoning. The pupils were placed in three groups according to their intelligence quotient (I.Q.) scores. The major finding was that in general, sixth grade boys of all I.Q levels were slightly superior to their peer groups of girls in arithmetic reasoning. More specific evidence for this was been reported by Tyler (1958) and Anastasia (1958) who in a survey of gender differences in aptitude and achievement reported that girls usually do better in verbal and linguistic tasks and boys generally had stronger and special aptitudes and did better in tests of arithmetical reasoning. Evidence from around the world that there were gender related differences in mathematical ability was inconsistent. Differences in attainment in mathematics, as measured by public examination scores, were well documented in Britain and many other countries. In Britain little difference had been reported at the primary school level, through the assessment of performance unit (APU). Leder (1985) also pointed out to: "… few consistent sex related differences… at the primary school level". In many countries, according to Orton, (1991), the post primary pattern was the same, more boys than girls succeeded in public

examinations taken around the age of sixteen (16) years. Orton reported that: "Many more boys than girls choose mathematics as one of their specialist subjects and comparatively few females have, in the past, taken up employment directly related to mathematics or dependent on qualifications in mathematics".

In Russia, however, it was claimed that such marked differences were not evident. Concluding from his studies of the mathematical ability of boys and girls, Krutetskii (1976) noted that: "...there was no clear evidence of any difference". Reasons for differences in attainment had been investigated from a variety of different standpoints including biological, psychological and sociological. The best conclusion emerged in the domain of societal attitudes and expectations. Orton said there was a strong indication that in a variety of ways, girls were consistently discriminated against in terms of mathematical education. The influence of the society and from the environment, which might affect the mathematical development of girls, was varied.

There were differences in the kind of toys that were given to boys and girls and also the kinds of games and activities encouraged for each type. There were always been differences in parental expectations and desires, which could even, have been exerted within the home. Orton also added that: "the usefulness and value of mathematics has always generally been considered to be in other school subjects also regarded as boys subjects and in careers which have been viewed by the society as male occupations".

Russel (1983), reported, that pressures might work equally, unfairly against individuals from genders in that girls were not encouraged to opt for mathematical studies. Boys were however encouraged even when their ability and interests in the subject were, at best, barely adequate. Boys often, opted for mathematics because it was expected of them and not because they enjoyed the subject. The society always appeared to have conveyed the message that mathematics was a male subject and that

certain other subjects were female subjects. Peer group pressures therefore added to the difficulties faced by girls when choosing subjects in a mixed school.

Russell also drew attention to the ways boys and girls regarded themselves in relation to mathematical ability. Girls tended to underestimate their potential whereas boys tended to overestimate. Boys displayed confidence about their ability in mathematics, which was sometimes not justifiable, while girls perhaps with better test results, displayed unjustifiable anxiety.

The school environment also created other difficulties for the girls. Most mathematics teachers were men. Many textbooks, presumably unknowingly, insinuated a male model or image to mathematics. Some books included men and boys into the text and exercises and left out women and girls almost completely. This could have been due to the fact that many authors, perhaps because they were male, made mathematics in a context, which was of greater interest to males than to females. Teachers during mathematics lessons were alleged of interacting more in the classroom with the boys than the girls and gave more positive encouragement to boys than to girls (in mixed schools).

Some research studies showed that girls achieved more in mathematics in a single gender school than they did in mixed schools. Boys on the other hand tended to perform better in mixed schools than boys schools. All these variables or influences, resulted in differences in performance in mathematics. Leder (1985) concluded that: "Sex differences possibly due to biological constraints are drafted by the far greater pressure imposed by social and cultural stereotypes about cognitive skills and occupations". Attention thus needed to be paid to the biological and social constraints to improve performance for both genders. In a discussion of differences between intelligent and special ability males and females, Hutt (1972) clearly accepted that there were factors, which originated from the biological and psychological domains. The main differences raised, reported by Orton, were as follows: first, scores obtained from applying tests designed to measure overall intelligent or

ability consistently produced different distributions for males and females. The scores for males tended to spread more widely across the range whilst the scores for females were more clustered around the mean. The difference was not a large one but there was a tendency for males to predominate in both extremes, the most able and the least able. Secondly males were said to excel in spatial ability while females excelled in verbal ability. Thirdly females were much more superior in both manual dexterity and in the rote learning ability whereas tests of divergent thinking tended to produce higher scores for males. These differences between the genders were however very small and thus conclusion was to be drawn carefully. Benbow and Stanley (1980) carried out research involving intellectually gifted pupils. Their results which were disputed by other researchers, suggested: "that sex differences in achievement and attitude towards mathematics result from superior male mathematical ability, which may in turn be related to greater male ability in spatial tasks".

Table.4 below shows performance by gender in mathematics in KCSE between the years 2000 and 2001. In both years the mean score for males is significantly higher than that of females. The candidature for males is also higher than that of female.

Table 4: Performance by Gender (in mathematics)

Year	Female		Male	
	Number of Candidates	`mean %	Number of candidates	mean %
2000	84,013	13.4	97,967	18.7
2001	89,481	15.8	104,334	21.2

(Table adapted from K.C.S.E. Report, K.N.E.C.-2002).

UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION

Kimani G. (1991) in his study reported a research by Eshiwani (1974) who sought to determine if there were gender differences in the learning of mathematics. He used a sample of four classes from four high schools in Nairobi and noted that gender differences existed as shown by the studies done in the Western countries. This study also revealed that there was a significant difference in favour of boys in arithmetic reasoning and one in probability test. He further observed that slight differences were found in favour of boys on attitudes towards mathematics.

Sweney (1953), carried out a series of experiments in problem solving involving college students. He found that males were significantly better at solving problems than females. He further reported that even when sexes were equated from general intelligence, verbal ability and background factors, the differences were still persisting. Sheikh (1976) who reviewed most of the above studies summarized the review on gender differences. The most important part of the summary for the purposes of this study was the observation that the studies conducted with African children by Eshiwani in (1974) and Parker (1974) among others have found significant differences in

achievement generally favouring boys over girls. Eshiwani also found significant gender differences in achievement in mathematics among Kenyan urban pupils in his study.

Kibanza (1980) found that there were significant gender differences in achievement in mathematics in favour of boys at the higher cognitive levels while at the lower cognitive levels; no significant gender differences were found at 0.01 and 0.05 levels of significance.

Cockcroft (1982) quoting similar findings by Fennema who conducted her research in USA with children of ages between ten (10) and fourteen (14) in 1974 stated that:

> Girls performed better than did boys in the least complex skills (computation)... in the 77 tests of more complex cognitive skills (comprehension, application and analysis) five tests had results that favoured girls, while 54 tests showed significant differences in favour of boys. The conclusion is in escapable that the boys of this population learned the mathematics measured by these tests better than girls did... in overall performance on tests measuring mathematics learning... there is no significant differences, that consistently appear between the learning of boys and girls in the fourth to ninth grade... if a difference does exist, girls tend to perform better in tests of mathematical computation and boys tend to perform better in tests of mathematical performance.

Although these findings showed that boys were better than girls in higher cognitive levels while girls were better than boys in lower cognitive levels, it could be deduced that boys were generally better than girls in mathematics achievement. Mwangi (1986) indicated that the gender of the student was significantly related to performance in mathematics in favour of boys. However, this study was centred at the age bracket of between sixteen to eighteen years.

Samunkut (1987) found that there was a significant gender difference in performance between boys and girls of standard eight in favour of boys. However, his research was carried out in Narok where

there may have been more emphasis on the education of men than women. Riungu (1988) found no significant differences between males and females in mathematics performance by standard seven pupils.

Although this area of gender differences in achievement in mathematics had been a field of great deal of research work there did not seem to be conclusive findings. The sex differences could have been due to the age of the pupils, their socio economic and cultural backgrounds or other factors. Hence the research findings varied from country to country or from one educational level to the next. Gender differences however seemed to have an important bearing on the mathematics achievement of the students and that differential attainment of the sexes were important when designing a curriculum for schools. This research was based on secondary students in order to find out whether there existed a gender difference in mathematics performance.

2.5 Students' Educational Aspirations and Mathematics Performance.

Several studies indicated that pupil's aspirations to some extent influenced their scholastic performance. This was easy to understand when one recognized that education was thought as a preparation for the future. On this basis, it was argued that the students' present learning was influenced by their future plans or aspirations. A student whose aspiration was to be an architect or an engineer or a pilot, would work hard in mathematics and other related subjects and hence show relatively higher achievement in mathematics. A student whose aspiration was to become a mechanic (at certificate level) would not put a lot of emphasis in mathematics, leading to relatively low achievement in the subject. Therefore future aspirations had a big bearing on performance of mathematics. The Hus'en et al study (1967) investigated the relationships between pupil's educational career plans and mathematics performance as shown in table 5 below.

Table 5: Partial Correlations Between Mathematics Scores, Educational Plan and Educational Aspirations in the "Huse'n" Study.

Country	Population 1b		Population 3a		Population 3b	
	Educ+ Plans	Educ+ Aspirations	Educ+ Plans	Educ+ Aspirations	Educ Plans	Educ Aspirations
Australia	0.37	0.35	0.20	0.20	-	-
Belgium	0.36	0.34	0.28	0.22	0.24	0.21
England	0.58	0.56	0.28	0.16	0.22	0.20
Finland	0.35	0.32	0.17	0.15	0.17	0.14
France	0.10	0.10	0.07*	0.05	-	-
Germany	0.06*	0.06*	0.19	0.13	0.14	0.04*
Israel	0.39	0.30	0.23	0.12	-	-
Japan	0.52	050	-	-	-	-
Netherlands	0.41	0.36	0.25	0.08*	-	-
Sweden	0.36	0.31	0.26	0.23	0.12	0.10
US	0.35	0.34	0.31	0.31	0.35	0.31
Countries	0.30	0.28	0.18	0.14	0.14	0.10

Significant *P - 0.05

Educ. – Educational.

Table 5. Extracted from Huse'n et. al.

It was hypothesized that students who planned for higher education and had aspirations for higher education performed better than students who did not have such plans when the level of mathematics was held constant. This hypothesis was studied by means of partial correlations between mathematics scores, and educational plans and aspirations, holding the level of mathematics constant. Table 5 indicated that educational plans and aspirations were related to mathematics performance (scores) in almost all countries, in population 1b as well as in population 3a and 3b. In population 1b the relationships were generally substantial, the typical value being about 0.35 for either plans or aspirations. The study also set up another hypothesis stating that students planning or desiring to enter careers in which mathematics was relevant higher mathematics scores than those who did not have such desires or plans. The hypothesis was studied by means of partial correlations between mathematics achievement scores, career plans and career aspirations holding the level of instruction constant. Table 6. Shows the results of this investigation. The table indicated there was a significant relationship in all countries in the study except countries like France and Germany.

Table 6 Partial Correlations between Mathematics Scores, Career Plans and Vocational Aspirations in the "Huse'n" Study.

Country	Population 1b		Population 3a		Population 3b	
	Career Plans	Career Aspirations	Career Plans	Career Aspirations	Career Plans	Career Aspirations
Australia	0.15	0.14	0.08*	0.09*	-	-
Belgium	0.25	0.31	0.18	0.13	0.20	0.20
England	0.40	0.33	0.08*	0.06*	0.13	0.14
France	0.01*	0.01*	0.01*	0.04*	-	-
Germany	0.07*	0.08*	0.07	0.08*	0.07	0.09*
Israel	0.27	0.23	0.03*	0.04	-	-
Japan	0.13	0.24	0.06*	0.01	-0.01	
Netherlands	0.17	0.15	0.10*	0.02	-	-
Sweden	0.20	0.21	0.06*	0.00	0.07*	0.03
	0.12	0.12	0.25	0.19	0.19	0.14

*Significant P - 0.05

Table 6 extracted From: Huse'n et. al.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0Introduction

This chapter describes procedures and strategies to be used in the implementation of the study. It describes research design, of study the population, sample selection, research instruments, pre-testing of the instruments and an outline of the methods used to collect, analyze and present data.

3.1 Design of Study

The research study was of the type of a descriptive survey design. The survey method was chosen by the researcher because it was most appropriate in achieving the stated objectives. This type of design allowed collection of data from a relatively large sample.

3.2 Population of the Study

The population of this study consisted of two categories: The first consisted of Form three students in public secondary schools in Nairobi who take mathematics as an examinable subject at K.C.S.E. level. The second category of the population consisted of all teachers who teach mathematics in Nairobi province. Thus the data required for the study will be collected from Form three mathematics students and mathematics teachers in public secondary schools in Nairobi province. Public schools are those that are assisted by the government through the provision of teachers and other resources. Private schools on the other hand are those schools that are owned and managed by individuals or groups of individuals. Private schools do not receive assistance from the government. This study did not include private schools due to their diversity of the curricula offered. For example, the mathematics syllabus in 8-4-4- system of education is notably different from mathematics syllabus in International General Certificate of Secondary Education (I.G.C.S.E.) some

private schools also have very high levels of resources and facilities in comparison with public schools. Nairobi province was chosen for this study because of its cosmopolitan and pluralistic nature. The number of public secondary schools in Nairobi Province is forty- seven (47). Only forty-six (46) secondary schools were used in drawing the sample. This was because part of the respondents used in the study were form three students and one of the schools, Kahawa Garrison Secondary, is a new school that only has form one. The school was thus excluded from the sample drawn. The number of mathematics teachers in Nairobi province is about three hundred and twenty four (324) while the number of form three students taking mathematics, as an examinable subject is about twenty thousand (20,000).

3.3. Research Sample and its Selection

The research sample for the study was drawn from forty- six out of the forty-seven public secondary schools in Nairobi province.The sample of schools was selected through stratified sampling method. The schools were first divided into three strata as follows: boys' schools, girls' schools and mixed schools. This method of sampling was appropriate for this study so as the three categories of schools are represented in the sample. The schools from each stratum were randomly selected using the blind folding technique or lottery method. This was done by first writing down all the schools in each of the three strata. Each of the school was then allocated a number. The numbers representing the schools were then written, each on a different piece of paper. The papers were folded and placed in separate containers according to the strata. This was done as follows: One container for girls' schools one for boys' schools and another for mixed schools. A research assistant was then asked to pick, at random, a certain specified number of papers from each container. The schools so selected were used to represent the study sample. A representative sample of one third (1/3) of the total population was chosen as shown in Table 7 below. This size of sample is supported by Cohen et. al.

(1994) who noted that one third (1/3) of the total population is generally accepted to be a representative sample in a socio science study.

Table 7: Sampling Frame and Categories of Sample Schools.

Categories of schools	Schools	Sample of school
Boys' schools	15	5
Girls' schools	17	6
Mixed schools	14	5
Total	46	16

The total population of mathematics teachers in Nairobi province is about three hundred and twenty four (324). A representative sample of ten percent of mathematics teachers in the province was taken. This is according to Mugenda et. al. (1999) who quoting Gay says that "... for descriptive studies, ten percent of the accessible population is enough and for experimental studies30 cases are required per group". The number of teachers in the sample thus was 33. This size of sample is also acceptable according to Mulusa (1990) who says that "for training purposes it was agreed in Kenya programme that a sample of thirty (30) to fifty (50) cases would be acceptable sample of thirty or more cases is therefore recommended". These teachers were drawn from the 16 schools in the sample.

The total number of Form three students in Nairobi province is about twenty thousand (20000). A representative sample of three hundred and seventy seven students recommended from this population. This is according to Mulusa(1990), quoting Krejcie et. al. from the table for

determining sample size from a given population. The number however used in the sample was increased to four hundred and twenty (420) in order to cater for questionnaires not properly filled. The actual number of students' questionnaires that was returned was 384. This sample of mathematics students was large enough to be used to show relationships between variables. The students and teachers in the sample were drawn from the schools as shown on the Table 8 below.

Table 8: Sampling Frame and Categories of Sample Schools, Number of Mathematics Teachers and Students in the Schools.

Category of schools	Number of schools in the sample	Number of mathematics Teachers	Approximate number of form 3 mathematics students by school
Boys' schools	5	11	131
Girls' schools	6	12	158
Mixed schools	5	10	131
Total	16	33	420

3.4 Research Instruments

The research instruments were designed based on the objectives and research questions of the study. There were three types of instruments. These were:-

- Student questionnaire (SQ)
- Mathematics teacher questionnaire (MTQ)
- Mathematics student's Performance test (MSPT)

These instruments are described below: -

3.4.1. Student Questionnaire (SQ).

This questionnaire was a useful tool for collecting data due to anonymity of the respondents. It thus encouraged greater honesty and free expression of feelings. SQ was administered to

all the 420 students in the sample. The questionnaire had three sections: Section I, II and III. Section I of the questionnaire was designed by the researcher and elicited responses that yielded demographic data of the student. It consisted of five items, personal information and gender of the student. This information was analyzed to show existence or non-existence of a relationship between demographic variables of the students and achievement in mathematics.

UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION

Section II of the questionnaire had three items on career aspirations and expectations of the students. This information was useful and was analyzed against relationship between students' career aspirations and expectations and achievement in mathematics.All the items in section I and II of the student's questionnaire were close ended. This was due to the fact that these items are easy to administer and have a relatively high level of objectivity.

Section III of the student's questionnaire contained a Likert type of scale. This is a five-point scale where the respondents chose appropriate responses by putting a tick inside the relevant box. These five responses were: Strongly agree (SA), Agree (A), undecided (UD), Disagree (D) and Strongly disagree (SD). This is based but modified, on the Revised Mathematical Attitude Scale (RMAS), which was developed by Aiken and Dredger (1961) and modified by Oketch (1978). It was used to determine mathematical attitudes for elementary school teachers. It has a total of twenty items based on a five point Likert scale. The respondents were presented with an equal number of positive and negative statements on attitudes towards mathematics. The statements with a positive connotation were: - 3,4,5,9,11,14,15,18,19,20 while those with a negative connotation were:- 1,2,6,7,8,10,12, 13,16,17. The information obtained from this section was analyzed to show existence or non-existence of a relationship between attitudes of secondary school students and achievement in mathematics.

3.4.2. Student Performance Test (SPT)

This was a test that had been designed by the researcher and was used to measure performance in mathematics among Form three secondary school students. The test was administered to all the Four hundred and twenty (420) students in the sample. The test was a standard complete form three examination paper that took two and a half hours. The students were not required to indicate their names on the test. Anonymity of the respondents thus encouraged greater honesty and hence greater reliability. It covered the whole of form one, two and part of form three syllabi. MSPT was made up of two sections, section I and II. Section I consisted of sixteen relatively short items while section II consisted of eight questions that had a relatively higher level of difficulty. All questions in Section I were compulsory but in section II, the students were to attempt six out of eight questions. Each question in section II was marked out of eight marks to give a total maximum of forty-eight marks. Section I was marked out of fifty marks. This was in accordance with the marking done by K.N.E.C. The main interest of the researcher was the mark that the student attained. This information was then analyzed to show performance of secondary school students in mathematics.

3.4.3. Mathematics Teacher Questionnaire (MTQ)

This research instrument was an important tool for collecting data because of anonymity of the respondents. This instrument will had two sections, Section I and Section II. Section I consisted of demographic questions. There were six items that were designed to give, information on the following areas: personal, teaching experience and qualifications of the mathematics teachers. The information obtained was analyzed to show existence or non-existence of a significant relationship between the teachers' teaching experience and professional qualifications and achievement in mathematics among secondary school students. The items in this section were all close-ended since they were relatively more objective and easy to administer.

Section II of the instrument consisted of an attitude scale based on the Revised Mathematic Attitude Scale (RMAS). This was a five point Likert scale almost similar to the one used in the student questionnaire. RMAS had twenty items ten of which had positive connotation and ten were negatively connoted. The items were easy to administer. The negatively connoted items were:- 2,3,4,7,9,11,12,15,18,20, while those with positive connotation were:- ,6,8,10,13,14,16,17 and 19.

3.5 Pre-testing of the Instruments

The research instruments were pre-tested in three schools. These schools were selected from the three categories of schools in the population of study, one school from each category as follows:- Boys school –1,mixed school –1 and girls school-1. The schools were Highway Secondary School (boys), Our Lady of Mercy Secondary School (girls) and Hospital Hill Secondary School (mixed). This is in agreement with Mulusa (1990) who noted that for effective pre-testing of instruments, the items should be selected from all the categories under study. The schools in the pilot study were randomly selected from the schools not in the sample. After administering the instruments, the necessary adjustments were made.

According to Mulusa (1990) the purpose of piloting the instruments is to assess their clarity, the validity and reliability of each of the items in the instruments and suitability of the language used. The pilot study helps the researcher to modify or redesign some of the items in the research instruments. This helped to control the problems of ambiguity and irrelevance and hence improve on the quality of responses that were generated by the respondents in the research study and general improvement of the instruments. Presence of blank spaces, inaccurate responses inconsistencies and other weaknesses indicated that there was need for review of the instruments. The improvements in the questionnaires increased reliability and validity of the instruments. Any item that required information that the respondents did not have was eliminated or replaced.

The method used for assessing reliability in the data collected was split-half technique. This requires only one testing session. In this technique, an instrument is designed in such away that there are two parts. The advantage of this method is that it eliminates chance error that may be due to differing test conditions. Data with high split-half reliability with have a high correlation coefficient.

$$r = \frac{NEXY - EXEY}{\sqrt{[EX^2 - (EX)^2]\ [NEY^2 - (EY)^2]}}$$

$$r = 0.8$$

The value of r (0.8) gives a reliability coefficient for half test. The reliability for a whole test (R) may then be estimated from the above reliability coefficient using spearman – Brown formula:-

$$R = \frac{2r}{1+r}$$

Where: r is the reliability of the half test,

R = 0.71 is the reliability of the whole test.

This shows a relatively high level of reliability.

3.6 Data Collection Procedure

The researcher obtained authority to collect data from the Directorate of Personnel Management (DPM). The researcher then visited the schools sampled for purposes of familiarization and to gain consent from school heads to administer the instruments. The researcher administered the instruments with the help of two research assistants to the selected respondents in the respective schools. The respondents were required to fill in the questionnaires independently and as honestly as possible. This was to ensure that there was a relatively high degree of reliability and validity of the

information obtained. The questionnaires, once completed were collected for processing and analysis.

3.7 Data Analysis

The data collected was organized, processed and analyzed. Descriptive statistics were used to present data guided by the objectives of the study. The only part of the questionnaires that required scoring was the attitude scale. There were twenty (20) items in each Section II and III of the teachers' and students' questionnaires respectively. The respondents were required to choose one appropriate response from five possibilities, which were provided. These possibilities were:- Strongly agree (SA) Agree (A), Not sure (NS), Disagree (D) and Strongly disagree (SD).

For statements portraying positive feelings towards mathematics points were awarded as follows:-

Strongly Agree	-	5 points
Agree	-	4 points
Not sure	-	3 points
Disagree	-	2 points
Strongly disagree	-	1 point

For statements portraying negative feelings the points were awarded as follows:-

Strongly Agree	-	1 Point
Agree	-	2 points
Not sure	-	3 points
Disagree	-	4 points
Strongly disagree	-	5 points

The maximum points that were scored is one hundred (100) and the minimum marks were twenty (20). A score of twenty (20) was interpreted as an extreme or perfect negative attitude towards

mathematics while a score of a hundred (100) points was interpreted to mean a perfect positive attitude towards mathematics. To determine whether the attitude of a respondent was negative or positive, the average score was calculated as follows:-

$$\text{Average score} = \frac{\text{Maximum score} + \text{Minimum score}}{2}$$

$$= \frac{100 + 20}{2}$$

$$= 60 \text{ Points}$$

Thus any respondent scoring sixty (60) points was said to be neutral; whereas if the score was above sixty (60) points one was said to be positive while below sixty points it was interpreted as having a negative attitude. The attitudes were grouped into three categories as follows:

Positive attitude with scores above 60, neutral attitude with a score of 60 and negative attitude with scores below 60. The attitude scores were analyzed against performance using Pearson Product Moment Correlation Coefficient (r) .

In the MSPT, students scored between 0 and 98 percent. The test scores were grouped in three categories as follows:- 'high' – this included scores that were above sixty (60) percent, 'medium'- this included scores that ranged from forty (40) to fifty nine (59) percent and 'low' which included scores that were below thirty nine (39) percent . Frequency tables and percentages were used to give the number of students in each category. Students mean score was also calculated. To show relationship between attitude of teachers and students and performance, Pearson Moment Correlation Coefficient (r) was used. Chi-square (X^2) tests were used to show relationship between the following:- students' gender and performance, students career aspirations and performance, teachers'

teaching experience and students performance and teachers' qualification and students performance. Significance of relationships between the variables was tested at 0.05 level of significance in all the cases in the study. Fisher's Exact Test was used to show association between variables in cases where more than twenty five percent of the cells had a frequency below five.

CHAPTER FOUR

DATA ANALYSIS

4.0.Introduction

In this chapter, the researcher outlines details on how the data colleted was analyzed. The data was mainly analyzed using descriptive statistics. Analysis of the data was guided by the research questions of the study. This was done under six subtopics as follows:

- Demographic data.
- Students' attitude towards mathematics and performance.
- Gender of students and performance in mathematics.
- Career aspirations of students and performance in mathematics.
- Attitudes of the teachers and performance in mathematics.
- Teaching experience of mathematics teachers and performance.
- Academic and professional qualification of teachers and students performance in mathematics.

4.1.Demographic data

The total number of questionnaires administered to the students was four hundred and twenty while that administered to the mathematics teachers was forty. The total number of questionnaires that was returned comprised of three hundred and eighty-four SQ and thirty-three MTQ. Thus a total of four hundred and seventeen questionnaires were adequately filled and returned. In the SQ, item questions: one, two, three, four and five were intended to yield demographic data as shown in table 9 below.

Table 9: Age of Students.

Age (in years)	Frequency	Percentage (%)
13-14	83	21.6
15-16	200	52.1
17-18	80	20.8
19-20	20	5.2
21-22	1	0.3
Total	384	100.0

Table 9 indicates that the highest number of students were in the 15-16 years age group with a percentage of 52.1% this may have been because most students start schooling (class one) at the age of six years some however start schooling at the age of seven years while others start earlier (5years) and hence the relatively high percentages of 20.8% and 21.6% respectively. Some of the students may have high repetition rates and hence the presence of a few students with 19 years and above. The age group 21-22 had a meager 0.3% since this was a very high age for the class. The student here may have repeated about four classes or joined school very late. The study found that students spent varied amount of time doing Mathematics as shown in Table 10 below.

Table10: Number of Hours Devoted for Mathematics by Students per day.

Time	Frequency	Percentage %
Less than 1-2 hour	200	52.1
1-2to 2hours	120	26.0
2 hours to 4 hours	60	15.6
More than 4 hours	24	7.3
Total	384	100.0

Table 10 indicates that the majority of the students (52.1%), spent half an hour or less in mathematics, 26.0% spent 1-2 hour to 2 hours and 15.6% spent 2 hours to 4 hours. Only a small percentage (6.3%) spent more than 4 hours in mathematics. When most students spent less time in mathematics the performance was bound to be relatively low. The proportion that spent more than four hours in mathematics was very low which may have been due to the large number of subjects in the curriculum requiring more time by the students. The finding on the level of formal education that the students' parents attained is shown on Table 11.

Table 11: Level of Formal Education of Father and Mother.

Parent	Level of Formal Education											
	None at All		Primary Education		Secondary Education		University		Missing		Total	
	N	% of Total	N	% of total	N	% of total	N	% of total	N	% of total	N	% of total
Mother	10	2.6	30	7.8	192	50.0	152	24.0	-	-	384	100.0
Father	2	0.5	12	3.1	142	37.0	223	58.1	5	1.3	384	100.0

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EAST AFRICANA COLLECTION

Table 11 indicates that the percentage of mothers whose level of formal education was secondary school was 50%. This is the highest percentage in the category. Thus secondary education was the mode for this distribution, however university had the modal frequency for the fathers level of education in the distribution, with a percentage of 58.1%. Only 3.6% of the sample had fathers with primary education and below. The responses that were blank in this item of fathers' education were 5. This may have been due to the issue of single parenthood. High level of parent's education is considered as a favorable variable towards performance.

4.2. Gender of Students and Performance in Mathematics.

The total number of student respondents in the study was three hundred and eighty four (384). The number of males was 205 while that of females was 179. Their respective percentages were as shown in Table 12 below:

Table 12: Students Gender:

Gender	Frequency	Percent (%)
Male	205	53.4
Female	179	46.6
Total	384	100.0

The percentage of male respondents was higher (53.4%) than that of the female students (46.6%). This was because in the mixed schools there were more male respondents than females. In all the mixed schools in the sample, the number of boys was higher than that of girls. Performance of students in mathematics was also tabulated in three categories of: 'high' with a score of 60% and above, 'medium' with scores between 40% and 59% both scores inclusive and 'low' with a scores of 39% and below. The findings were as shown on the Table 13 below.

Table 13: Students Mathematics Performance.

Performance	Frequency	Percent (%)
Low	249	64.8
Medium	70	18.2
High	65	16.9
Total	384	100.0

Table 13 above indicates that more than half of the students (64.8%) had a 'low' score (between 0-39%) the mathematics test administered. Only16.9% of the students attained a 'high' score (about 60%) in the test. The highest score attained was 98% while the lowest was 0%. This gave a range of 98, which was a very high range. The scores if plotted on a normal curve would be skewed negatively. The mean obtained from the scores in the test was 24.3% percent. This is a relatively low mean depicting poor performance in the test. This mean however, follows the same trend depicted in both national and Nairobi province performance in K.C.S.E mathematics. The table below compares students' gender and performance in mathematics.

Table 14: Comparison between Students' Gender and Performance in Mathematics.

Gender	Students' Performance							
	Low		Medium		High		Total	
	N	% of total	N	% of total	N	% of total	N	% of total
Male	131	34.1	51	13.3	23	6.0	205	53.4
Female	118	30.7	19	4.9	42	10.9	179	46.6
Total	249	64.8	70	18.2	65	68.9	384	100.0

Table 14 above indicated that the male students with a low performance formed 34.1% of the total sample, while the female students formed 30.7%. The total percentage of students with medium performance was 18.2 % of the whole sample, out of this; the boys formed 13.3% while girls represented 4.9% of this total sample population. Thus a higher proportion of students with medium performance were boys. The percentage of students with high performance was 16.9 %. Girls represented 10.9% of this category while boys formed 6.0%. More girls were higher achievers in mathematics than the boys from this table. More boys than girls were medium achievers while more boys than girls were low achievers.

Table 15: Chi – Square

	Value	df	Asymp Sig. (2 – sided)
Pearson chi-square	19.189	2	0.00
Likelihood Ratio	19.739	2	0.00
Linear by linear association	1.694	1	0.193
Number of cases	384	1	0.193

The critical chi - square value at 5% (0.05) level of significance is 5.99(X^2 = 5.99) at two (2) degrees of freedom. The calculated chi -square value was19.19. The calculated chi-square value was greater than the critical value of Chi -square. This thus showed the existence of a relationship between gender of students and their performance in mathematics at 0.05 level of significance (X^2 Calculated > X^2 critical). Thus gender of the learners and their performance in mathematics are significantly related.

This finding was in agreement with Eshiwani (1975) who found that a significant relationship existed between gender of students and mathematics performance. This was in favor of boys than girls among high school students. Onyango (1988) had similar findings in a study of pupils in primary schools. Orton (1991) also agreed with Onyango's findings. He found the existence of a relationship between gender of students and performance in mathematics. He found that more boys than girls succeeded in public examinations.

The study found that the mean score of boys (24.1%) was slightly lower than that of girls (24.4%). The discrepancy, which was insignificant, may have been due to the cosmopolitan nature of Nairobi province where the research was carried out. Generally girls had the same opportunity to participate in class. The slight difference in the mean between the two genders may also have between as a result of the larger size of the sample for boys (205) as compared with that of girls (179). This difference may have lowered the mean performance of boys.

4.3. Students' Attitude towards Mathematics and Performance.

Students' attitude towards mathematics was categorized into three groups as follows: positive attitude (scores above sixty), neutral (a score of sixty) and negative attitude (scores below sixty).

Table 16: Students Attitude towards Mathematics.

	Frequency	Percent
Positive	175	45.6
Neutral	110	28.6
Negative	99	25.8
Total	384	100.0

From the Table 16 above, the number of students with a positive attitude towards mathematics formed the bulk of the sample (45.6%), while those with a negative attitude were 25.8% of the total sample.

Table 17: Students' Attitude towards Mathematics Compared with Performance.

Attitude Towards Mathematics	Performance							
	High		**Medium**		**Low**		**Total**	
	N	% of total	N	% of total	N	% of total	N	% of total
Positive	61	15.9	36	9.4	78	20.3	175	45.6
Neutral	4	10.0	22	5.7	84	21.9	110	28.6
Negative	0	0.0	12	3.1	87	22.6	99	25.8
Total	65	15.9	70	18.2	249	64.8	384	100.0

The categories of students' performance were; high -60 % and above, medium-40 % to 59 %, low - 0% to 39 %. Table 17 indicates that 45.6% of the students in the sample had a positive attitude while 28.6% had a neutral attitude towards mathematics. Students with a negative attitude formed 25.8%. The students with a high performance and at the same time positive attitude formed 15.9% of the sample, those with high performance and neutral attitude represented 1.0% of the sample. There were no students with high performance and negative attitude thus the highest percentage of students with high performance had a positive attitude. The students with medium performance and a positive attitude represented 9.4% of the sample. Those with medium performance and neutral attitude towards mathematics formed 5.7% while those with medium performance and negative attitude formed 3.1%. Thus the highest percentage of students with medium performance had a positive

attitude. The students with low performance and a positive attitude formed 20.3% percent of the sample, those with low performance and neutral attitude towards mathematics represented 21.9% of the sample while those with low performance and a negative attitude towards mathematics formed 22.7% of the sample. Thus most of the students with low performance had a negative attitude towards mathematics.

Table 18: Chi – square of Attitude towards mathematics.

	Value	df	Asymp Sig. (2-Sided)
Pearson Chi -square	85.659	4	.000
Likelihood Ratio	100.694	4	.000
Linear by Linear Association	54.861	1	.000
Total Number of Valid Cases	384		

Table 18 above indicates that, the calculated chi-square value was 85.65 at 4 df while the critical value of chi -square at 0.05 level of significance and at 4 degrees of freedom is 9.49 (X^2 Critical = 9.49). The calculated value was higher than the critical value of chi -square thus at 5% level of significance a significance relationship exists between attitude of the students and mathematics performance. The value of chi -square is very large (85.66); this shows that there are large discrepancies between the expected and obtained frequencies.

Table 19: Correlations between Students' Performance and Students Attitude towards Mathematics.

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		Students' Performance	Attitude towards Mathematics
Students'	Pearson Correlation	1.000	.378**
Performance	Sign (2-tailed)	.0	.000
	N	384	384
Attitude	Pearson correlation	.378**	1.000
Towards	Sign (2-tailed)	.000	
Mathematics	N	384	384

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

From the Table 19 above, the value of r at the 1% (0.01) level of significance (two -tailed test) was 0.378. This shows that there was a significant correlation between students' attitude and performance in mathematics. This finding was in agreement with other studies. One such study is the one carried out by Irumbi (1990). In his study on pupils' characteristics that affect performance in mathematics, he fund out that attitude played a vital role in determining pupils performance Kibanza (1990), Oketch (1992), Ogoma (1987) and Mwangi (1986) also found out that there was a positive correlation that was significant between attitude of the students and performance. Most of the other studies carried out showed a positive correlation between these two variables.

4.4. Career Aspirations of Students and Performance in Mathematics.

The future careers of the students stated were grouped into three categories to make computation easier. These categories were; 'high', which included careers such as medicine, engineering architecture and aviation; 'medium' careers, which included teaching, law and economics and 'low' careers that comprised of other middle level college careers. Careers categorized as 'high' had a great association with mathematics while those grouped as 'low' had little or no association with mathematics.

Table 20: Future Career of Students.

Category	Frequency	Percent
High	232	60.4
Medium	87	22.7
Low	65	16.9
Total	384	100.0

Table 20 indicates that the highest percentage of students was 60.4%, which represented students with high career aspirations. This was followed by the medium careers with a percentage of 22.7 and low with a percentage of 16.9. This showed that very few students aspired for low ranking careers. Most of them aspire for careers that were highly oriented towards mathematics.

Table 21: Students' Choice of Careers.

Career	Frequency	Percentage (%)
Medicine	110	30.0
Engineering	103	28.3
Law	64	18.0
Piloting	25	6.5
Auditing	20	5.5
Journalism	13	3.6
Teaching	13	3.6
Economics	12	3.3
Tours and Travel	5	1.4
Graphic Design	5	1.4
Computer Science	5	1.4
Actuarial Science	5	1.4
Insurance	2	0.5
Mass Communication	2	0.5
Total	384	100.0

From the Table, the most popular and most occurring careers were those that were mathematically oriented for example engineering and medicine. Law also had a relatively high frequency of 64. Most of the careers categorized as low had very low frequencies. On whether the future career involved mathematics, the results were as shown in Table 22 below.

Table 22: Future Career involvement with Mathematics.

Does your Future Career involve Mathematics	Frequency	Percentage %
Yes	270	71.4
Not sure	64	15.4
No	50	13.2
Total	384	100.0

Table 22, indicates that most of the students in the sample responded that their future career involved mathematics (71.4%), 15.4% of the sample were not sure whether it involved mathematics and only 13.2% of the sample said that the future career did not involve mathematics. On the level of education that the students wished to stop formal education, the results were as follows:

Table 23: The Level of Education that the students wished to stop Formal Education.

Level of education	Frequency	Percentage (%)
University	358	93.5
K.C.S.E	26	6.5
Total	384	100.0

Table 23 indicates that the modal frequency was 358 for university level of education. About 93.5% of the sample responded that they wished to stop formal education at university level. Only 6.5% of

the students in the sample wished to stop formal education at K.C.S.E level. This percentage is almost insignificant in comparison with that for university.

Table 24: Comparison Between Students Performance and their Future Career

Students Performance	**Future Career**							
	High Count	% of total		Medium Count	% of total	Low Count	% of total	Total Count % of total
High (60% and above)	56	14.6	4	1.0	7	1.8	67	17.4
Medium (40- 59%)	48	12.5	14	3.6	8	2.1	70	18.2
Low (39%and below)	128	33.3	69	18.0	50	13.0	247	64.4
Total	232	60.4	87	22.6	65	16.9	384	100.0

This Table indicates that the number of students with high career aspirations and high mathematics performance was 56 which was 14.6% of the total count. Those with high aspirations and medium performance formed 12.5% of the total count, while those with high career aspirations and low mathematics performance formed 33.3% of the total count. Students with medium career aspirations and high mathematics performance formed 1.0%, those with medium aspirations and medium mathematics performance represented 3.6% of the sample count while those of medium aspirations but with low performance formed 18.0%.The students with low aspirations and high performance represented 1.8% of the total count, those with low aspirations and medium performance 2.1% while

those with low aspirations and with low mathematics performance formed 13.0% of the total count. The highest percentage represented the students with high aspirations and low students performance. Most of the students who chose high careers had low mathematics performance.

Table 25: Chi - Square –Career Aspirations of Students.

Value	Df	Asymp Sign (2-Sided)	
Pearson Chi – Square	9.626	4	.00
Likelihood Ratio	15.280	4	.000
Linear by Linear Association	19.305	1	.000
Total	384		

From Table 25, the calculated value of chi -square was 9.626. At 5% level of significance the critical chi- square value at 4 df is 9.49. The calculated value of chi-square was greater than the critical chi - square value (X^2 calculated > X^2 critical at df = 4), thus there was a significant relationship at this level of confidence.

Table 26: Correlations between Gender, Career Aspirations and Performance in Mathematics.

		Performance	Gender	Future Career
Performance	**Pearson Correlation**	1.000	-0.007	-0.225**
	Sig. (2-Tailed)	-	-	.000
	N	384	384	384
Gender	**Pearson Correlation**	-0.67	1.000	.147**
	Sig. (2-Tailed)	.193	-	.007
	N	384	384	384
Career	**Pearson Correlation**	.225**	.147**	-
	Sig. (2-Tailed)	-	.004	-
	N	384	384	384

**Correlation is Significant at the 0.01 level (2 - Tailed)

From Table 26 above, the value of r at the 0.01 level of significance (two-tailed test) for correlation between students' future career and mathematics performance was + 0.225. This indicated existence of correlation between the two variables. The finding in this study on career aspirations and performance in mathematics was in agreement with other studies. One such study was by Hus'en et. al. (1967). In their studies in several countries such as Australia, Belgium, England, Finland, France, Germany, Israel, Japan, Netherlands, Sweden, U.S.A. and others, a significant relationship between performance and educational aspirations was noted in most of the countries.

The relatively high career aspirations of this sample may have been due to the location of the study. In Nairobi, most students have well-informed parents and guardians who through guidance and counseling educate the students on the various careers and their implications. Since the students are well exposed to the opportunities in these careers, they thus tend to select high-ranking careers. Such

may not be the case in a typically rural environment. Another reason for the high percentage of students with high career aspirations might have been due to the relatively high careers that their parents or guardians were having. They thus viewed their parents and guardians as doyens for emulation.

4.5. Academic and Professional Qualification of Teachers and Students' Performance in Mathematics

Teachers' academic qualification is an important factor in the teaching of any subject, as it is generally believed that the higher the qualification the more knowledge content a teacher has. Items two, three, four and five attempted to solicit information about academic qualification of mathematics teachers and their gender. Table 27 shows the findings.

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EAST AFRICANA COLLECTION

Table 27: Gender and Academic Qualification

Gender	**What is the level of your academic qualification**									
	Post graduate		Graduate		From six		From four		Total	
	N	% of total	No	% of total	N	% of total	N	% of total	N	% of total
Male	2	6.1	11	33.3	0	0.0	1	3.0	14	42.4
Female	0	0.0	15	45.5	3	9.0	1	3.0	19	57.6
Total	2	6.1	26	78.8	3	9.0	2	6.1	33	100.0

Table 27 indicates that 84.9% of the mathematics teachers were graduates and postgraduates. Only 9.7% had form four as highest level of academic qualification. Thus teachers in Nairobi were qualified to teach mathematics as shown in Table 28.

Table 28: Professional Qualification and performance

Professional qualification	**Students' Performance**							
	High		**Medium**		**Low**		**Total**	
	N	% of total	N	% of total	N	% of total	N	% of total
Graduate	5.3	13.8	60	15.6	160	41.7	273	71.1
Diploma	16	4.2	38	9.9	47	12.2	101	26.3
M.Ed	0	0.0	2	0.5	8	2.1	10	2.6
Total	69	18.0	100	26.0	215	56.0	384	100.0

Table 28 above indicates that 13.8% students with high performance were taught by graduate teachers and only 4.2% by diploma teachers. Also, 15.6% of those with medium performance were taught by graduate teachers while 9.9% were taught by diploma teachers. Only 0.5% were taught by postgraduate teachers. The same trend is seen among the low achievers in mathematics where the highest percentage of 41.7% was taught by graduate teachers, 12.2% by diploma teachers and only 2.1% by postgraduate teachers.

This trend may have been due to the relatively high percentage of graduate teachers (71.1%) as compared to the rest. The numbers of graduate teachers teaching the various categories of students is shown in table 29.

Table 29: Number of Teachers Teaching Various Categories of Students and their Qualification.

Qualification	Students Performance							
	High		**Medium**		**Low**		**Total**	
	N	% of total	N	% of total	N	% of total	N	% of total
Graduate	4	12.1	2	6.1	14	42.4	20	60.6
Diploma	1	3.0	3	9.1	8	24.3	12	36.4
M.Ed	1	3.0	0	0.0	0	0.0	1	3.0
Total	6	18.2	5	15.2	22	66.7	33	100.0

Table 29 indicates that there was only one postgraduate teacher in the sample and hence the low percentages in all the categories of students' performance taught by postgraduate teacher. All the students taught by the teachers with this qualification had high performance. Chi-square was not used to show relationship between teachers' qualification and students' performance since there were more than twenty five percent of the cells with a frequency less than five. Fisher's Exact Test was used. The scores for the test, range between 0 and 1 if the value is 0, then there is no association between variables. A value of one shows high degree of association. The value obtained in this test

was 0.339. This showed that there was a moderate degree of association between teachers' qualification and students' performance.

Studies by Muhandik (1983), Riungu (1988), Kathuri (1986), Kirembu (1991) and Magoci (1992) indicated a universal belief that a professionally trained teacher contributed more positively to effective learning than untrained teacher. In this study the researcher did not have any untrained teacher in the sample. Eshiwani (1985), reported that qualification of a teacher was a very important indicator of the quality of education provided. Kiragu quoting Hus'en (1978) reported that the amount of education and knowledge were positively related to students' performance in mathematics.

4.6. Teaching Experience of Mathematics Teachers and Performance.

Item 6 of MTQ was aimed at soliciting information on the years the respondents had taught. It is generally assumed that more teaching years adds commendable characteristics in the teacher for example confidence. Tables 30 and 31 below give the findings.

Table 30: Teaching Experience and Students' Performance

Teaching experience	Students Performance							
	High		Medium		Low		Total	
	N	% of total	N	% of total	N	% of total	N	% of total
1 year and below	0	0.0	1	3.0	1	3.0	2	6.1
2 –4 years	1	3.0	1	3.0	8	24.2	10	30.2
5 – 8 years	2	6.1	2	6.1	8	24.2	12	36.4
9 –12 years	1	3.0	1	3.0	3	9.1	5	15.2
13 years and above	2	6.1	0	0.0	2	6.1	4	12.1
Total	6	18.2	5	15.2	22	66.6	33	100.0

Table 30 indicates that the mode for teaching experience was 12 and the modal group of years was 5 – 8 years. Thus majority of the teachers had a teaching experience of 5 – 8 years (36.4%). Those with a teaching experience of 2 – 4 years also had a relatively high percentage (30.2%) In terms of frequencies of teachers with various teaching experience it decreased as follows;5 – 8 years (12), 2 – 4 years (10), 9 – 12 years (5), 13 years and above (4) and 1 year and below (2). The lowest percentage was that of teachers with teaching experience of 1 year and below.

Table 31: Teaching Experience, Number of Students and Students' Performance

Teaching experience	Students Performance							
	High		Medium		Low		Total	
	N	%of total	N	% of total	N	% of total	N	% of total
1 year and below	2	0.5	1	0.3	17	4.4	20	5.0
2 –4 years	1	0.3	2	0.5	16	4.2	19	4.9
5 – 8 years	25	6.5	20	5.2	70	8.2	115	29.9
9 –12 years	12	3.1	16	4.2	58	5.1	86	22.4
13 years and above	25	6.5	31	8.1	88	22.9	144	37.5
Total	65	16.9	70	18.3	249	64.8	384	100.0

Table 31 indicates that the highest percentage (6.5%) of students with high performance were taught by teachers with teaching experience of 13 and above and 5 to 8 years. This trend was the same for the students with medium performance with percentages of 8.1% and 5.2% respectively. The highest percentage of students with low performance were taught by teachers with 13 years and above. Due to the high number, over 25%, of cells with a frequency less than 5, chi-square value

would not be used to show association between teaching experience of the teachers and students' mathematics performance. Fisher's Exact Test was used. The value of Eta obtained was 0.267. This value showed the existence of an association between the two variables with students' performance as the dependent variable. The association was however not of a high degree.

Barnes (1985), pointed out that teachers effectiveness, while it increased through the early years of teaching it may not have directly followed the same pattern in the latter years of teaching. He noted that increased teaching experience at least after the early years in the classroom were associated with tendency for teachers to reject innovations and alternations in educational policies. This was in agreement with the finding in this study as the teachers with a teaching experience of 13 years and above had the highest percentage of students with low performance (22.9%). According to Irumbi (1990), no clear picture of the effect of teaching experience on performance seemed to emerge. Most of the findings in other studies did not show a clear picture of the relationship. However, Sidhu (1982), reported that a successful teaching experience was a valuable asset in students' performance.

4.7 Attitude of the Teachers and Performance in Mathematics

Teachers' attitude towards mathematics is an important variable affecting performance. It is generally believed that if teachers' attitude is positive then it boosts the teachers' morale and that of the students thus enhancing performance. Section II of the MTQ had twenty items that solicited information on attitude. Table 32 shows the frequencies and percentages of teachers' attitude.

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EAST AFRICANA COLLECTION

Table 32: Frequencies of Attitude of Teachers

Attitude	Frequency	Percent %
Positive	17	51.5
Neutral	11	33.3
Negative	5	15.2
Total	33	100.0

Table 32 indicates that the mode of the distribution was positive attitude of teachers with a percentage of 51.5%. Those teachers with a negative attitude formed the lowest percentage of 15.2%. Teachers with neutral attitude represented 33.3%. Attitude of the teachers was calculated from the (20) items in section II of the teachers questionnaire (MSQ). The raw scores obtained were grouped into three categories as follows.

Positive attitude - above an attitude score of 60

Neutral attitude - a score of 60

Negative attitude - a score below 60 to 20

Teachers with an attitude score below 60 were said to have a negative attitude. Any teacher with an attitude score of 60 had a neutral attitude while those who scored above 60 had a positive attitude. Table 33 and 34 below show the findings of teachers' attitude as compared with students' performance.

Table 33: Teachers' Attitude Towards Mathematics and Students' Performance

Teachers' attitude	Students Performance							
	High		Medium		Low		Total	
	N	%of total	N	% of total	N	% of total	N	% of total
Positive	0	00.0	4	12.1	13	39.4	17	51.5
Neutral	4	12.1	0	0.0	7	21.2	11	30.3
Negative	2	6.1	1	3.0	2	6.1	11	15.2
Total	6	18.2	5	15.2	22	66.7	33	100.0

Table 33 indicates that the highest percentage of students with high performance, 12.1% were taught by teachers with a neutral attitude. The highest percentages of students with medium performance were taught by teachers with positive attitude (12.1%). Out of the students with low performance 39.4% were taught by teachers with a positive attitude. Actual numbers of students taught by various categories of teachers are shown in table 34.

Table 34: Numbers and Performance of Students and Attitude of Teachers.

Teachers' attitude	Students Performance							
	High		Medium		Low		Total	
	N	%of total	N	% of total	N	% of total	N	% of total
Positive	59	15.4	55	14.3	181	7.1	295	76.8
Neutral	2	0.5	8	2.1	35	9.1	45	11.7
Negative	4	1.0	7	1.8	33	8.6	44	11.5
Total	65	16.9	70	18.2	249	64.8	384	100

Table 34 indicates that the teachers with a positive attitude taught a total of 295 students forming 76.8%, those with a neutral attitude taught 45 students, which was 11.7% of the total sample while those with a negative attitude taught only11.5% of the total sample. The table also indicates that 59 out of 65 students with high performance were taught by teachers with a positive attitude. Only 1.0% of students with high performance were taught by teachers with a negative attitude. Out of the 44 students taught by teachers with a negative attitude, 33 (75%) had low performance and only 4 (25%) had high performance. The table indicates that out of the students taught by teachers

with a neutral attitude 77.8% had low performance while among those taught by teachers with a positive attitude 61.4% had low performance. Thus the teachers with a positive attitude produced the least percentage of low achievers and the highest percentage of highly performing students. Due to the high number of cells with a frequency less than 5, Chi-square value was not valid to show association between variables. An alternative test, Fishers Exact Test, was used. The value obtained with students' performance as a dependent variable was 0.385. This showed the existence of a significant relationship between teacher's attitude and students' performance in mathematics. The highest value to show perfect association between variables is 1.

This finding of the study is in agreement with Cockroft (1982), who emphasized the role of teachers' attitude on students' performance. Munguti (1984), Looft (1971), Parker (1974), Wamani (1980) and Thuo (1984) found a strong relationship between the two variables. Mwangi (1986), had similar findings when he reported that teachers' attitude was reflected in the students' performance. However, Dutton and Blum (1968) reported no consistent relationship between pupils' performance and teachers' attitude. The inconsistency may have been due to inadequate research designs and instruments used which may have been of questionable validity and reliability.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

5.0 Introduction

This study set out to investigate whether there is any significant relationship between some selected factors of both teachers and students on students' performance in mathematics. The independent variables in the study were students' attitude, students' gender, students' career aspirations, teachers' attitude, professional qualifications and teaching experience and the dependent variable was performance of students. The study was conducted in sixteen schools in Nairobi Province.

5.1. Summary

This study was carried out among Form Three students in public secondary schools.
It was carried out in the third school term of the year 2003. The sample of the study consisted of three hundred and eighty four form three students and thirty-three mathematics teachers. The respondents were from the sixteen schools selected randomly from three categories of schools (boys', girls' and mixed schools). The major assumption made by the researcher was that both the teacher and student form the crucial factors in mathematics performance.

The researcher used three research instruments as tools for data collection namely mathematics students' performance test, mathematics teacher questionnaire and students' questionnaire. These instruments yielded data related to attitude of both teachers and students, teacher qualification and teaching experience, students' career aspirations and gender (independent variables). The SPT yielded data related to the dependent variable (level of performance of students in mathematics). At the end of data collection, the data obtained was coded and analyzed using a computer.

5.1.1. Summary of main findings

From the analysis of the data collected, the researcher came up with the following findings regarding factors influencing performance of mathematics among public secondary school students in Nairobi Province.

1. Gender of Students and Performance in Mathematics

A relationship exists between gender of the students and mathematics performance at 0.05 level of significance. Girls in the sample performed slightly' (insignificantly), higher than boys. This may have been due to the composition of the sample. The girls schools selected were relatively better performing schools than those of boys. Most of the girls' schools were boarding schools while boys' schools were all day schools (sample selection was random).

2. Students' Attitude Towards Mathematics and Performance

The attitude of the students towards mathematics and performance were found to have significant relationship at 5% level of significance. Among the students with a positive attitude 34.9% scored highly, among those with neutral attitudes, 3.6% scored highly while among those with a negative attitude, none scored highly. Among the students with negative attitude, 87.9% scored lowly, 76.4%, while 44.6% of those with positive attitude had a low score. Thus attitude as a factor had significant influence on performance. The correlation between the two variables was tested using Pearson correlation and was found to be positive.

3. Career Aspirations of Students and Performance

Most students, 60.4%, said that they wanted to take high careers. An equally high number (71.4%) also were inclined towards careers that involved mathematics. A very high percentage, 93.5% of respondents implied that they wished to stop formal education at university level. A relatively high percentage of respondents with high future career had high performance. The finding, on this

variable was that there was a significant relationship between the two variables at 95% confidence level. Thus the researcher found that there was significant relationship between career aspirations and students performance.

4. Academic and Professional Qualification of Teachers and Students Performance

The finding on the above showed that there was a significant relationship between professional qualifications of the teachers and students performance at 0.05 level of confidence. The data showed that 87.7% of the mathematics teachers were graduate and postgraduate teachers'. This was a relatively high level of academic qualification. None of the teachers in the sample was untrained. All the teachers in the sample were professionally qualified. This was a very high level of professionalism and should have reflected an equally high level of students' performance. However, the contrast was the case. Students' performance was very low. This may be attributed to other factors but not necessarily qualification of the teachers.

5.Teaching Experience and Students' Performance

The finding in the study on the above variable was, there is a significant relationship between teaching experience and students' performance. The relationship however is of a small degree but is significant. Most teachers had a teaching experience of 5 – 8 years (30.3%) in the sample. The category of teachers with the highest mean was that with a teaching experience of 5 – 8 years. Thus teaching experience of the teachers could be used to predict students' performance of a degree of 0.267 (26.7%), which was quite low.

6. Attitudes of the Teachers and Students' Performance

The finding of this study indicates that a significant relationship does exist between attitudes of the teachers and performance of students. The association between these two variables was found to be significant. Most of the teachers had either a positive and neutral attitude towards mathematics, the percentages being 51.5% and 33.3% respectively. This did not however reflect the same way on performance of students as only 18.2 percent had high performance and 15.2% medium. When compared, the total percentage for the two categories of teachers (positive and neutral) was 84.8% while that of high performance was 33.4%. The percentage of teachers with a positive and a neutral attitude was very high while that of high and medium students' performance was very low.

5.2 Conclusion

This study set out to investigate the factors influencing the performance of mathematics among public secondary schools students in Nairobi province. Among the variables that indicated positive relationship with performance were Students' attitude, students' gender, students' career aspirations, teachers' attitude, teachers' qualification and teachers' teaching experience. This was an agreement with most of the reviewed literature, which showed relationship between these variables and performance. The variables are thus of paramount importance and should be taken in to consideration when reviewing mathematics syllabus or in any other form of evaluation by policy makers, curriculum designers and educators. Other variables however exist whose effect on mathematics performance is of significant levels.

5.3 Recommendations

On the strength of the main findings and conclusion presented above, a number of recommendations were made aimed at improving the teaching and learning of mathematics in secondary schools:

First, there is need to take measures to train mathematics teachers in terms of giving them professional content as well as subject matter content. This may entail more in-service courses being offered to mathematics teachers at all levels of the curriculum.

Secondly, there is need to ensure that students' attitude is enhanced which in turn would improve their performance in mathematics. This can be done through advocacy in schools and other forms of motivation in mathematics students and teachers.

Thirdly, there is need to enhance career guidance in schools so that students can decide on their future careers early enough. This will enhance performance in mathematics. if this careers are mathematically oriented as shown by the majority of cases in the study, the students will put in more effort in the subject thus improving performance in mathematics.

5.4. Recommendations for Further Research

From the findings of the study the following recommendations for further research were made:-

1) A study such as this to be carried out but with a large sample and more variables. The study should cover other areas not emphasized in this research study such as socio economic backgrounds of students, teacher turnover rates and teaching resources.
2) There is need to investigate the origin of the attitudes formed by both teachers and students towards mathematics and how these attitudes can be made favourable.
3) A study needs to be carried out to investigate causes of low numbers of female students in mixed schools in relation to mathematics performance.

4) A study on qualification of teachers and mathematics performance to be carried out. The sample used should be obtained from any other province. Such a study will establish the aspect of teachers' qualification affecting mathematics performance.
5) A study on the influence of biological and social constraints on performance for both sexes (genders). This would be important since some of the factors originate from the biological and psychological domains.
6) A study similar to this one should be carried out to show if any relationship exists between time spent studying mathematics and performance of students.
7) Studies similar to this one should be carried out to show factors affecting performance of all the science subjects in public secondary schools.

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EAST AFRICANA COLLECTION

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APPENDIX 1

STUDENTS QUESTIONNAIRE (SQ)

SECTION 1

Instructions

This is not a test.

Answer the following questions as honestly as possible.

Circle the appropriate answer on the answer sheet provided at the end M. ED projet, university of Nairobi

For example: -

1. What is the gender of your teacher?

    1. Male
    2. Female

If your teacher is a female, then put a circle around 2 on the answer sheet corresponding to the particular question number.

1. What is the name of your school?_____
2. What is your age?
    1. Female
    2. Male

3 . What is your age?

1. 10-12 years

2 .13-15 years

3. 16-18 years

4. 19-21 years

4.Approximately how many hours do you devote to mathematics, homework and practice after school?

1.Less than ½ hour

2. ½ to 2 hours

3. 2 hours to 4 hours

4. More than 4 hours

5.What level of formal education did your father attain?

1.None at all

2.Primary education

3. Secondary education

4.University

6.What level of formal education did your mother attain?

1.None at all

2.Primary education

3.Secondary Education

4.University

SECTION II

Career Aspirations and Expectations

7. What future level would you wish to stop formal schooling?

1. K.C.S.E.

2. University

What future career would you like to take?

1.Medicine

2.Teaching

3.Law

4.Engineering

5.Others (specify)_____

9.Does your future career involve the application of mathematics?

1.Yes

2.No

3.Not sure

SECTION III

Instructions

This is not a test

The questions below seek information concerning your attitude towards mathematics.

Answer all the questions as honestly as possible on the answer sheet.

Put a tick inside the box of the alternative that approximates to your response.

For example:-

I do not like mathematics.

1. Strongly agree
2. Agree
3. Not sure
4. Disagree
5. Strongly disagree

If your response is not sure, then put a tick at 3 so that it appears as below:

1 2 3✓ 4 5

	ITEM	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
1	I am always under terrible strain in a mathematic class.					
2	I do not like mathematics and it scares me to take it.					
3	Mathematics is very interesting to me and I enjoy mathematics courses.					
4	Mathematic is fascinating and fun					
5	Mathematics makes me feel secure and at the same time it is stimulating					
6	My mind goes blank and I am unable to think clearly when I hear of mathematics.					
7	I feel a sense of insecurity when attempting mathematics.					
8	Mathematics makes me feel uncomfortable, restless, irritable and impatient					
9	The feeling that I have towards mathematics is a good feeling					
10	Mathematics makes me feel as though I am lost in a jungle of numbers and cannot find my way out					

	ITEM	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
11	Mathematics is something, which I enjoy a great deal.					
12	When I hear the word mathematics, I have a feeling of dislike					
13	I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do mathematics					
14	Mathematics is a subject that is very easy					
15	I really like mathematics					
16	Mathematics is a course in school which I have always enjoyed studying.					
17	It makes me scared to even think about having to do arithmetic problems					
18	I am happier in a mathematics class than in any other class					
19	I feel at ease in mathematics, like it very much					
20	I feel a definite positive reaction to mathematics					

UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION

APPENDIX II

MATHEMATICS TEACHER QUESTIONNAIRE (MTQ)

This study attempts to investigation some of the factors influencing achievement of mathematics among secondary school students at K.C.S.E. level in public secondary schools in Nairobi province. It is hoped that the information collected will be useful to mathematics educators, students, parents and the Kenyan government. Your teaching experience is very valuable to this study and your honest response is highly appreciated.

Instructions:

1. Do not write your name anywhere in this questionnaire
2. The information you give concerning mathematics teaching will be treated with a lot of confidentiality, so kindly respond as honestly and accurately as possible.
3. This questionnaire consists of two sections; Section I and Section II, Answer both sections as instructed.

SECTION I

Put a tick in the bracket(s) corresponding to your answer(s)

1. What is the name of your school and address?

   _____

   _____

2. What is your gender?

   1. Male ( )
   2. Female ( )

3. What is your age in years?

   1. 24 years and below ( )

2. 25-30 years ( )

3. 31-35 years ( )

4. 36-40 years ( )

5. 40 years and above ( )

4. What is the level of your academic qualifications

   1. Post graduate ( )

   2. Graduate ( )

   3. Form six ( )

   4. Form four ( )

5. What is your highest professional qualification?

   1) Graduate ( )

   2. Diploma ( )

   3. Others (specify) ( )

6. What is your teaching experience?

   1. 1 year and below ( )

   2. 2 to 4 year ( )

   3. 5 to 8 years ( )

   4. 9 to 12 years ( )

   5. 13 years and above ( )

   (Indicate the number of years you have taught in the last category alongside it)

SECTION II

INSTRUCTIONS

This is not a test. The questions below seek information concerning you attitudes towards mathematics.

Please indicate how you feel about mathematics by showing your extent of agreement using the following words.

1. Strongly agree
2. Agree
3. Not sure
4. Disagree
5. Strongly disagree

Put a tick inside the box of your choice.

Note that there is no correct or incorrect answers in this section therefore answer all the questions as honestly as you can on the table.

	Items	**1 Strongly agree**	**2 Agree**	**3 Not sure**	**4 Disagree**	**5 Strongly disagree**
1	Mathematics is a subject which is quite stimulating					
2	Too many lessons each week are devoted to mathematics					
3	Girls are on the whole incapable of becoming good mathematicians					
4	Mathematics is difficult since it is important that pupils understand concepts rather than just memorizing					
5	Mathematics is enjoyable to me					

	Items	1 Strongly agree	2 Agree	3 Not sure	4 Disagree	5 Strongly disagree
6	Mathematics is the easiest subject to teach					
7	Pupils who persistently fail in mathematics should be punished					
8	Girls are as good as boys in mathematics					
9	Teaching mathematics is more demanding than teaching any other subject					
10	Mathematics is quite interesting to teach					
11	When I make a mistake in the classroom					

	Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
12	When students are learning mathematics their imagination is dull					
13	I am willing to acquire further knowledge in mathematics					
14	I like mathematics because there is always room for the correct answer					
15	I am always under terrible strain when I am teaching mathematics in class.					
16	Mathematics thrills me					

	Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
17	I feel a definite positive reaction towards mathematics					
18	Sometimes I am afraid that pupils will ask me questions					
19	Mathematics is quite applicable in our daily life					
20	I teach mathematics just because I am forced otherwise. I would rather teach other subjects					

STUDENTS QUESTIONAIRE FORM THREE MATHEMATICS EXAMINATION.
TERM THREE 2003.
TIME 2 $\frac{1}{2}$ HRS

GENDER Male
Female

(Tick where applicable)

SCHOOL.....

INSTRUCTIONS.

1. Attempt all questions in section I and any six (6) in section II.
2. Marks will be awarded for correct method and accuracy.
3. Answer the questions in the spaces provided.
4. Untidy work will be penalised.
5. Use of electronic calculators is not allowed.

SECTION I (52 MARKS)
(Attempt all questions)

1. Factorise $a^2 - b^2$. Hence find the exact value of

$2557^2 - 2547^2$ (3marks)

2. Use mathematical tables to evaluate

$$\frac{1}{\sqrt{0.003478}}$$

(3mks)

~~0.3478~~ ~~(3marks)~~

3. Find the ratio P:R if P:A=1:2, A:B=2:3, B:C=5:1, C:R=3:2. (3marks)

4. A rectangular room has length 12.0 metres and width 8.0 metres. Find the maximum percentage error in estimating the perimeter of the room. (3marks)

5. Given the vectors

$\underset{\sim}{a}=3\underset{\sim}{i}+5\underset{\sim}{j}$ $\underset{\sim}{b}=2\underset{\sim}{i}+4\underset{\sim}{j}$ $\underset{\sim}{c}=5\underset{\sim}{i}+7\underset{\sim}{j}$

Find the values of m and n such that $m\underset{\sim}{a}-n\underset{\sim}{b}=\underset{\sim}{c}$ where m and n are scalars. (3marks)

6. Express $5.\dot{3}\dot{6}$ in the form $\frac{x}{y}$ where x and y are integers. (3marks)

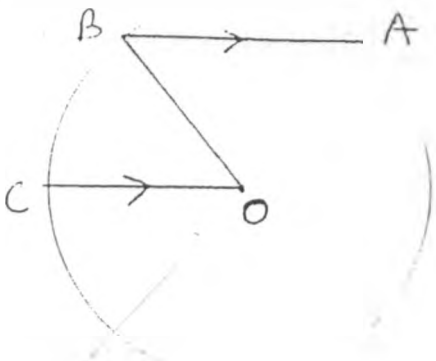
7. Find all the integral values of x if

$3x - 10 \leqslant x + 16 < 5x + 12$ (3marks)

8. Determine $\log_{10} 48$ if $\log_{10} 3 = 0.4771$ and $\log_{10} 2 = 0.3010$

(3marks)

9. In the figure below $\overline{AB}$ is parallel to $\overline{OC}$, $A\hat{O}B = 96^{\circ}$. Find the value of $C\hat{A}O$. (3marks)



10. Using ruler and a pair of compasses only, construct on $\overline{AB}$ a triangle ABC such that $\angle ABC = 30^{\circ}$ and $\overline{CA} = 12cm$. (3marks)

11. Solve the equation $2x^2 + 5x - 3 = 0$ (3marks)

12. Express in surd form

$$\frac{1}{2 + \sin 45^{\circ}}$$

hence rationalise the denominator. (4marks)

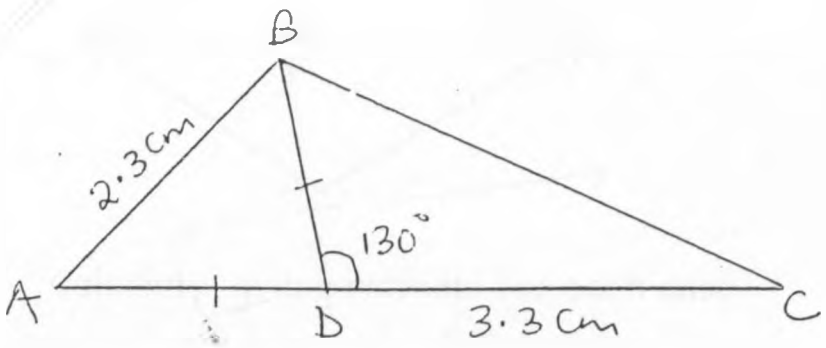
13. A jacket has a marked price of shs. 1000 A trader can allow a reduction of 15% on the marked price and still make a profit of 25% on the cost price. What was the cost price? (3marks)

14. Triangle PQR with vertices at P(2,1), Q(3,-2) and R(1,-3) maps onto triangle P"Q"R" after reflection in the line y-x=0 followed by a translation by vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$. State the coordinates of P"Q"R". (3marks)

15. A straight line L_1 has gradient $\frac{1}{2}$ and passes through the point P(-1,3). Find the equation of the line L_2 passing through R(4,5) and is parallel to L_1. (3marks)

UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION

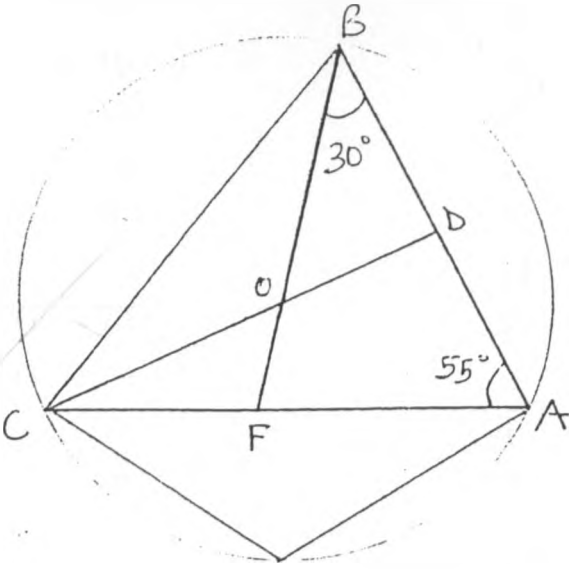
16. Calculate the area of the triangle ABC. (4marks)



SECTION II (48 MARKS)

(Answer any six questions in this section.)

17. In the figure below O is the centre of the circle. Angle ABF = 30° and angle BAF = 55°.



Calculate, giving reasons for each case,

(a) $B\hat{C}D$ (3marks)

(b) $A\hat{C}D$ (3marks)

(c) $A\hat{E}C$ (2marks)

18. The table below shows a frequency distribution of marks obtained by 40 students in a mathematics test.

Marks	Frequency
0 --- 9	1
10 --- 19	2
20 --- 29	4
30 --- 39	6
40 --- 49	9
50 --- 59	11
60 --- 69	2
70 --- 79	2
80 --- 89	1
90 --- 99	2

Calculate

(a) Mean mark (3marks)

(b) median mark (4marks)

(c) Write down the modal class. (1marks)

19. By shading the unwanted region of the following inequalities determine the area of the shaded region.

$x>0$, $Y<0$, $X+Y<10$, $Y<7$, $X<7$, $X+Y>5$. (8marks)

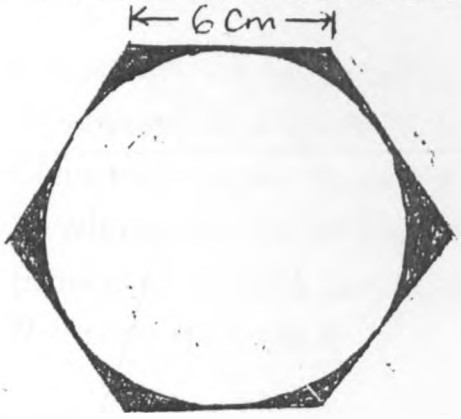
20. If $a=-1$ and $b=-2$ evaluate

(i) $a^3 - b^3$ (2marks)

(ii) $a^2 - b^2$ (3marks)

(iii) $\frac{a^2-ab}{b+1}$ (3marks)

21. The figure below shows a circle drawn inside a regular hexagon whose sides measure 6cm each.



(a) What is the value of each interior angle of the hexagon. (2marks)

(b) Find the radius of the circle. (2marks)

(c) Find the area of the hexagon. (2marks)

(d) Calculate the area of the circle hence find the shaded area. (2marks)

22. Use a ruler and a pair of compasses only

(a) Construct triangle ABC in which the base $\overline{AC}$ = 8cm, $\overline{AB}$ = 7.5cm and angle $\angle BAC = 30$.

(b) Construct a circle centre o, on the opposite side of BC as A, whose circumference touches the side BC, AB produced and AC produced only once each.
Measure its radius. (8marks)

23. Draw the graph of $y = 2x^2 - 3x - 5$ for $-3 \leqslant x \leqslant 6$

(a) Use your graph to solve $2x^2 - 3x - 1 = 0$.

(b) By adding a suitable line to your graph solve

$2x^2 - 3x - 1 = 0$. (8marks)

24. A man bought a car for shs. 500,000. If the depreciation rate is 12% per annum. Calculate

(a) The value of the car after 7 years. (3marks)

(b) The number of years it will take for the value to depreciate to shs. 75000. (5marks)

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and date

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NAIROBI

6th October 2003

Margaret N. Nyagah
University of Nairobi
P.O. Box 30197
NAIROBI

Dear Madam

RE: RESEARCH AUTHORIZATION

Following your application for authority to conduct research on Factors Influencing the Performance of Mathematics among Secondary School students in Nairobi Province, I am pleased to inform you that you have been authorized to conduct research in Secondary Schools in Nairobi Province for a period ending 31st December 2003.

You are advised to report to the Provincial Commissioner, Nairobi and the Provincial Director of Education Nairobi before commencing your study. It is noted that the research is a requirement in partial fulfilment for the award of Masters Degree in Education by the University of Nairobi.

You are further expected to avail two copies of your research report to this office upon completion of your research project.

Yours faithfully

A.G. KAARIA
FOR: PERMANENT SECRETARY

C.C.

The Provincial Commissioner
NAIROBI PROVINCE

The Provincial Director of Education
NAIROBI PROVINCE