BARRIERS TO THE TEACHING-LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS IN MASABA SOUTH DISTRICT, KISII COUNTY, KENYA

BY

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Barriers to the teaching-learning of
DECLARATION

This is my original work and has not been submitted for a degree to any university.

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DEDICATION

This work is dedicated to the Almighty God who is the source of knowledge and wisdom. His tendering mercies, love and strength he gives us day to day.

I also dedicate this work to my parents Richard Oisebe and Esther Nyang’ate who educated, guided and counseled me. Finally, to my wife Ruth Nyaboke and my children Christine, Deborah, Ezra and Dan for their earnest prayers and encouragement.
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TABLE OF CONTENTS

Declaration............................................................................................................................... ii
Dedication................................................................................................................................. iii
Acknowledgement..................................................................................................................... iv
Table of Contents....................................................................................................................... v
List of Tables ............................................................................................................................. x
List of Figures............................................................................................................................ xi
List of Abbreviations ................................................................................................................ xii
Abstract.................................................................................................................................... xiv

1.0 CHAPTER ONE: INTRODUCTION ................................................................................... 1

1.1 Introduction to the Chapter .............................................................................................. 1
1.2 Background to the Study .................................................................................................. 1
1.3 Statement of the Problem ............................................................................................... 6
1.4 Purpose of the Study ........................................................................................................ 6
1.5 Objectives of the Study .................................................................................................... 7
1.6 Research Questions .......................................................................................................... 7
1.7 Significance of the Study ............................................................................................... 7
1.8 Limitations of the Study .................................................................................................. 8
1.9 Delimitations of the Study ............................................................................................. 8
1.10 Theoretical Framework ................................................................................................... 8
1.10.1 Application of Thorndikes’ Connectionism Theory of Learning................................. 9
LIST OF TABLES

Table 1.1: Performance in KCSE Mathematics Paper 121.................................3
Table 1.2: Percentage of Candidates in Grade A, A-, D, D- and E in KCSE...........4
Table 1.3: Candidates Performance by Gender in the Years 2008 and 2009
KCSE Examination in Mathematics Paper 121...........................................4
Table 1.4: Candidates Overall Performance in KCSE Mathematics for the last
Four Years.................................................................5
Table 2.1: Masaba District Joint Evaluation Tests (2009).................................22
Table 2.2: Percentage of Candidates as per Grades in Mathematics
Paper 121 (2009)........................................................................22
Table 4.1: Teaching Experiences of Mathematics Teachers .........................57
Table 4.2: Professional Qualifications of Mathematic Teachers......................58
Table 4.3: Teachers’ Responses on Sitting Arrangement of Students in the Mathematics
Class...................................................................................61
Table 4.4: Main Instruction Methods used by Teachers ..................................63
Table 4.5: Frequency of Activities in the Mathematics Lesson ....................64
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1:</td>
<td>Conceptual Framework: Five Dimensions of an Intervention to Low Performing Schools</td>
<td>11</td>
</tr>
<tr>
<td>Figure 2:</td>
<td>Gender Distribution of Teachers</td>
<td>53</td>
</tr>
<tr>
<td>Figure 3:</td>
<td>School Status</td>
<td>55</td>
</tr>
<tr>
<td>Figure 4:</td>
<td>Student’s Responses on Barriers to Teaching-Learning of Mathematics</td>
<td>59</td>
</tr>
<tr>
<td>Figure 5:</td>
<td>Mathematics Teachers’ Responses on their Expectation on the Student Achievement</td>
<td>72</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
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<tr>
<td>ASEI</td>
<td>Activity Student Experiment and Improvisation</td>
<td></td>
</tr>
<tr>
<td>CEMASTEA</td>
<td>Centre for Mathematics, Science and Technology Education in Africa</td>
<td></td>
</tr>
<tr>
<td>EFA</td>
<td>Education For All</td>
<td></td>
</tr>
<tr>
<td>FAWE</td>
<td>Forum for African Women Educationalists</td>
<td></td>
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<tr>
<td>ICIAM</td>
<td>International Congress on Industrial and Applied Mathematics</td>
<td></td>
</tr>
<tr>
<td>INSET</td>
<td>In-Service Training</td>
<td></td>
</tr>
<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
<td></td>
</tr>
<tr>
<td>KCPE</td>
<td>Kenya Certificate of Primary Education</td>
<td></td>
</tr>
<tr>
<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
<td></td>
</tr>
<tr>
<td>KIE</td>
<td>Kenya Institute of Education</td>
<td></td>
</tr>
<tr>
<td>KIRIMA</td>
<td>Kiamokama, Rigoma and Masimba</td>
<td></td>
</tr>
<tr>
<td>KNEC</td>
<td>Kenya National Examination Council</td>
<td></td>
</tr>
<tr>
<td>MDGs</td>
<td>Millennium Development Goals</td>
<td></td>
</tr>
<tr>
<td>MoEST</td>
<td>Ministry of Education Science and Technology</td>
<td></td>
</tr>
<tr>
<td>MSE</td>
<td>Mathematics and Science Education</td>
<td></td>
</tr>
<tr>
<td>PDSI</td>
<td>Plan, Do, See and Improve</td>
<td></td>
</tr>
<tr>
<td>PGDE</td>
<td>Post Graduate Diploma in Education</td>
<td></td>
</tr>
</tbody>
</table>
R  Response
S  Stimulus
SMASSE  Strengthening of Mathematics and Science in Secondary Education
TIMSS  Trends in International Mathematics and Science Studies
TSC  Teachers Service Commission
UK  United Kingdom
UNESCO  United Nations Educational, Social and Cultural Organization
US  United States
WGMSE  Working Group on Mathematics and Science Education
Mathematics is the key to Science and Technology. However, the teaching-learning of the subject encounters many barriers. This study was meant to help understand barriers to the teaching-learning of Mathematics in secondary schools in Masaba South district, Kisii County and how they impacted on the teaching-learning outcomes. The results from the study were to be beneficial to the teachers in terms of providing an understanding of what interventions lack in teaching and learning of Mathematics in order to realize an effective teaching-learning process. The study also was to help the planners for pre-service and in-service programs to be able to develop an appropriate curriculum for the courses. The study adopted a descriptive survey design. A simple lottery random sampling method was used to determine the sample population. Data was collected from 30% of the population. Questionnaires were used to collect data on barriers to teaching-learning of Mathematics from teachers and students, whereas, interview schedules were used to collect data from principals of schools. The research instruments were piloted in order to ensure validity and split-half technique was applied on the instruments in order to confirm their reliability. Upon using Spearman-Brown prophecy method, a reliability coefficient of 0.8 was arrived at. Data collected were organized and analyzed. Findings were presented using pie charts, bar graphs and percentages. Poor method of teaching that the Mathematics teacher uses was revealed by 60% of the Mathematics teachers, a barrier to teaching-learning of the subject. Other barriers revealed by the study included, low expectations of Mathematics teachers on the learners, lack of regular in-servicing of the Mathematics teachers, poor sitting arrangements of learners in the Mathematics class. The study further revealed Mathematics vocabulary and negative attitude of learners' to the subject as barriers. Mathematics vocabulary was reported by 80% of the teachers and confirmed by 71% of the learners. Negative attitude was reported by 94% of the learners and confirmed by 50% of the teachers. The study had the following main recommendations: Regular in-service training of the Mathematics teachers, some of the in-service training can be organized by the principals of schools in their respective schools or by the Ministry of Education at various centres. Mathematics teachers to monitor the sitting arrangement of their learners in every Mathematics lesson. The study proposes students to be sitting in mixed ability arrangement. These will promote the use of student centered methods of teaching like cooperative learning and peer tutoring. Kenya Institute of Education (KIE), to develop mathematics vocabulary instruction curriculum, which can be derived from dialogue with teachers. Secondary schools to set up mathematics clubs so as to aid in developing love for Mathematics in learners’. Barriers in teaching-learning Mathematics ought to be eliminated in order for our country to achieve vision 2030 as envisaged in the country’s national plan.
1.0 CHAPTER ONE

INTRODUCTION

1.1 Introduction to the Chapter

The chapter explains background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, theoretical framework, conceptual framework and finally definition of operational terms.

1.2 Background to the Study

Mathematics is part of daily life; as such there is need for proper teaching and learning because Mathematics is extremely essential. Mathematics is an excellent vehicle for the development and improvement of a person’s intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought. Students develop numeracy, reasoning, thinking skills, and problem solving skills through learning and application of Mathematics. These are valued not only in science and technology, but also in everyday living and in the workplace. Increased needs and demands have been placed on schools to educate students and make them mathematically competent. The development of highly skilled scientists and technical manpower requires a strong grounding in Mathematics. An emphasis on Mathematics education will ensure that we have an increasingly competitive workforce to meet the challenges of the 21st century (Neunzert, 2005).

According to International Congress on Industrial and Applied Mathematics (ICIAM) (2007), held at Zurich, Switzerland, Science and technology were the driving force behind the industrial revolution in Europe and the United States. The telephone, the new steel, railroads and electricity in general led to the shift from a rural economy to a technological and industrial America. The
key to science and technology is Mathematics, which has been treated as the mother of all
technologies in US and other industrialized nations.

It is well known that Galileo highlighted Mathematics as the language of nature. Commonwealth
countries understand it as the queen of all sciences. Behind each major achievements, may it be
landing at the moon, invention of television and fax machine, planning and designing of rockets
and satellites, planning and determining strategies of war, manufacturing of sophisticated
weapons and armors, invention of computers and their various variants, scanning of brain,
manufacturing of powerful telescope, weather forecast, prediction of stock markets, there is a
mathematical technology and a mathematical brain (Neunzert 2005).

ICIAM (2007) found there are many branches of Mathematics which can be applied to solve real
world problems. These branches are put under the umbrella of industrial and financial
Mathematics. Further, according to ICIAM (2007), emerging technologies and challenging real
world problems are: (i) Advanced materials (ii) Advanced semiconductor devices (iii) Artificial
vision and intelligence (iv) Bio-technology (v) Digital image technology (vi) Supper conductors
(vii) Nano-technology (viii) Simulation of processes and products (ix) Optimization and control
(x) Uncertainty and risk (x) Food and health related problems. Mathematics has been
successfully used in all these areas. Neunzert (2005), has emphasized teaching of Mathematics as
a technology. For example, by application of mathematical methods the exploration cost of oil,
and communication cost of images could be reduced.

According to Schloglmann (2002:143-144), Mathematics is a part of our culture and democratic
principles such as equality, justice and so on need an operational concretization. On the one
hand, democracy demands a means of community and discussing principles in rational way.
Mathematics, with its close relationship to rationality, is our concept to do this. On the other
hand, democracy demands operations procedures for its concrete implementation. Mathematics is again the tool that facilitates this. Kenya’s Vision 2030 the country’s new development blueprint covering the period 2008 to 2030 aims at transforming Kenya into a newly industrializing middle-income country providing a high quality life of all its citizens by the year 2030. Then as discussed above, Mathematics has a central role in the development of new technologies to enable Kenya live to this dream. However, teaching-learning of Mathematics is experiencing many hurdles. This can be clearly seen in the performance in national examinations which is poor. According to the Kenya National Examinations Council (KNEC) (2010), 739,545 candidates sat for the KCPE Mathematics examination. These candidates registered a mean score of 26.90. This was an improvement when compared to the previous year 2009, which had a mean score of 24.78. Further, KNEC (2010), reported that male candidates performed better with a mean score of 28.03 compared to the female candidates who had a mean score of 25.67. Male scores had a better spread than the female scores with a standard deviation of 10.52 and 9.82 respectively. Generally, the mean score for Mathematics is low compared to other subjects at primary school level and slightly higher than that of the same subject at secondary school level.

The performance in KCSE Mathematics is evident as in Tables 1.1, 1.2, 1.3 and 1.4.

Table 1.1: Performance in KCSE Examinations; Mathematics Paper 121

<table>
<thead>
<tr>
<th>YEAR</th>
<th>A</th>
<th>A-</th>
<th>D</th>
<th>D-</th>
<th>E</th>
<th>ENTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2259</td>
<td>1495</td>
<td>25416</td>
<td>39974</td>
<td>17592</td>
<td>178608</td>
</tr>
<tr>
<td>2001</td>
<td>32502</td>
<td>2098</td>
<td>28407</td>
<td>40914</td>
<td>75421</td>
<td>192539</td>
</tr>
</tbody>
</table>

Source: Adapted from KNEC 2000 and 2001 Examination Report.
Tables 1.1 and 1.2 indicate that a large percentage of candidates scored grade ‘E’ that is 40.08% and 39.16% in the years 2000 and 2001 respectively as compared with 1.26% who scored grade ‘A’ in the year 2000 and 1.68% in the year 2001. The trend in performance in Mathematics might have not changed seven years down the line. See, Table 1.3 which shows the performance in Mathematics by gender.

### Table 1.3: Candidates Performance by Gender in the years 2008 and 2009 KCSE Examinations in Mathematics Paper 121

<table>
<thead>
<tr>
<th>Year</th>
<th>All No. of Candidates</th>
<th>All Mean %</th>
<th>Girls No. of candidates</th>
<th>Girls Mean %</th>
<th>Boys No. of candidates</th>
<th>Boys Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>335,014</td>
<td>21.13</td>
<td>151,091</td>
<td>18.11</td>
<td>183,099</td>
<td>23.63</td>
</tr>
<tr>
<td>2008</td>
<td>302,648</td>
<td>21.30</td>
<td>138,255</td>
<td>17.71</td>
<td>164,393</td>
<td>24.31</td>
</tr>
</tbody>
</table>

Source: The Kenya National Examination Council (2010)

Table 1.3, indicate girls score a lower mean grade than boys in the subject in 2008 and 2009. The number of male candidates is large compared to the female candidates. Although this was not a concern to the study, it is a point worth noting. Cumulatively, the performance of Mathematics in the years 2006 to 2009 are expressed in Table 1.4.
Table 1.4: Candidates Overall Performance in KCSE Mathematics for the last Four Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Candidature</th>
<th>Mean score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>335,615</td>
<td>21.13</td>
</tr>
<tr>
<td>2008</td>
<td>304,908</td>
<td>21.29</td>
</tr>
<tr>
<td>2007</td>
<td>273,504</td>
<td>19.73</td>
</tr>
<tr>
<td>2006</td>
<td>238,684</td>
<td>19.04</td>
</tr>
</tbody>
</table>

Source: Adapted from Kenya National Examination Council (2010)

KNEC (2010), notes that the overall performance in Mathematics had slightly declined from a mean of 21.29 in the year 2008 to 21.13 in the year 2009 and there had been a significant increase in the candidature from 302,648 in the year 2008 to 335,014 in the year 2009. Further KNEC (2010) revealed 930 (0.27%) candidates obtained an overall grade A in 2009 KCSE examination compared to 817 (0.27%) candidates in 2008. 29,652 (8.87%) candidates obtained grade B (plain) and above in the 2009 KCSE examination compared to 28,712 (9.51%) in 2008. The number of candidates with minimum university entry qualification of grade C+ and above were 81,048 (24.7%) in 2009 compared to 72,649 (24.08%) in the year 2008 KCSE examination. However, the mean score for the subject for the years between 2006 and 2009 is barely grade “D minus”. The same case applies to Masaba South district in which a large percentage of candidates score grade ‘E’ as can be seen in Table 2.1 and Table 2.2. The tables testify Mathematics is the worst performed subject with a large number of candidates scoring grade ‘E’. As the KNEC statistics reveal from above, a huge percentage of candidates in KCSE score either grade D- or E in Mathematics. This hinders form four school leavers from taking science oriented courses in tertiary institutions even if they have better mean grades. Such candidates are compelled to take bridging courses in Mathematics before they are allowed to enroll in the courses admitted. Further parents have begun to send students for hired tuition in Mathematics.
According to the Standard (2005), studies conducted at the University of London’s Institute of Education, show that private tuition does not add value to the pupils’ performance.

1.3 Statement of the Problem

Despite the importance of Mathematics in industrialization, the teaching-learning of the subject in Kenya Secondary Schools is faced with many obstacles as evidenced in the reports above. The subject is compulsory both at Primary and Secondary level, but poorly performed. Mathematics dictates the career a student is to pursue after secondary and almost all careers more so competitive careers like Medicine and Engineering need a firm background of the subject. A negligible percentage of candidates join these careers from Masaba South district. Hence the crucial question is what challenges face the teaching-learning of Mathematics in secondary schools in Masaba South District, Kisii County?

1.4 Purpose of the Study

The purpose of this study was to examine barriers to the teaching-learning of Mathematics in secondary schools in Masaba South district and possible solutions to curb the barriers identified. This could aid in strengthening and raising the performance of the subject as proposed by the national plan; the Vision 2030 (Republic of Kenya, 2007).

1.5 Objectives of the Study

The specific objectives of the study were to:

i. Identify barriers to the teaching-learning of Mathematics in secondary schools.

ii. Find out the main methods of teaching Mathematics

iii. Determine the students’ views about Mathematics.

iv. Find out the professional and academic preparation of teachers of Mathematics
v. To determine the effect of teachers’ expectations towards learners in the learning of Mathematics.

1.6 **Research Questions**

The study was guided by the following research questions:

i. Which barriers were encountered in teaching-learning Mathematics?

ii. Which methods were mainly used in teaching Mathematics?

iii. Were the Mathematics teachers professionally qualified?

iv. What were the Mathematics teachers’ expectations on learners’ achievement in Mathematics?

v. What were the attitudes of learners towards Mathematics?

vi. What were the attitudes of learners towards the Mathematics teacher?

1.7 **Significance of the Study**

The knowledge generated by this study would assist Mathematics teachers understand and appreciate various challenges facing them as they teach Mathematics and increase an understanding of the barriers in teaching-learning Mathematics. Also the study was to assist Mathematics teachers identify their deficiencies and limitations as regards teaching and learning of Mathematics. The student will become alert on the negative effects of their attitudes. To the Government of Kenya, the study would assist the Directorate of Quality Assurance and Standards in the Ministry of Education organize relevant in-service courses for the mathematics teachers also do a reform in teacher training. In addition both locally and internationally the study would aid in improving student achievements in Mathematics. This could be possible, through the understanding the teachers were to posses on barriers to teaching-learning
Mathematics and consequently, speed up technological development of these countries as Mathematics is key to such development.

1.8 Limitation of the Study

The study was confined to secondary schools in Masaba South District, primary schools were not included, as this would make the study cumbersome. The findings on barriers to teaching-learning of Mathematics in primary schools were to be crucial for comparison purposes with those of secondary schools. Some secondary schools in the district were in remote locations which made traveling by car difficult.

1.9 Delimitations of the Study

The study was confined to secondary schools in Masaba South district where Mathematics teachers, principals of schools and students were main respondents thus researcher didn’t have a chance to interview parents for the sampled schools. It is important to note that learning Mathematics occurs both at home and in school and that the parents’ attitudes towards Mathematics have influence on their children’s performance in Mathematics. The study had a delimitation of administering interview schedules as many of the principals were preoccupied in executing K.C.S.E examinations thus had little time to spare for the interviews.

1.10 Theoretical Framework

The study was based on Thorndike’s (1922) Connectionism Theory of Learning. The theory represents the original Stimulus-Response (S-R) framework of behavioral psychology. It states that learning is the result of associations forming between stimuli and responses. Such associations or “habits” become strengthened or weakened by the nature and frequency of the S-R pairings. The paradigm for S-R theory was trial and error learning in which certain responses
come to dominate others due to rewards. The hallmark of connectionism (like all behavioral theory) was that learning could be adequately explained without referring to any unobservable internal states. Thorndikes’ (1922) theory consists of three primary laws. First, law of effect which states that responses to a situation which are followed by a rewarding state of affairs will be strengthen and become habitual responses to that situation. Second, law of readiness, which states, a series of responses can be chained together to satisfy some goal which will result in annoyance if blocked. Third, law of exercise, which states that connections become strengthened with practice and weakened when practice is discontinued. A corollary of the law of effect was that responses that reduce the likelihood of achieving a rewarding state (i.e., punishment, failures) will decrease in strength. The theory suggests that the transfer of learning depends upon the presence of identical elements in the original and new learning situations: i.e. transfer is always specific, never general. In later versions of the theory the concept of “belongingness” was introduced: connections are more readily established if the person perceives that stimuli or response go together. Another concept introduced was “polarity” which specifies that connections occur more easily in the direction in which they were originally formed than the opposite (Thorndike, 1922).

1.10.1 Application of Thorndikes’ Connectionism Theory of Learning

Connectionism was meant to be general theory of learning for animals and human beings. Thorndike was especially interested in the application of his theory to education including Mathematics (Thorndike, 1921) and measurement of intelligence (Thorndike 1927). The classic example of Thorndike’s S-R theory was a cat learning to escape from a “puzzle box” by pressing a lever inside the box. After much trial and error behavior, the cat learns to associate pressing the lever (S) with opening the door (R), this S-R connection is established because it results in a
satisfying state of affairs (escape from the box). The law of exercise specifies that the connection was established because the S-R pairing occurred many times (the law of effect) as well as forming a single sequence (law of readiness). Thorndike's (1922) theory of learning was preferred for this study because of its principles listed below:

- Learning requires both practice and rewards (laws of effect/exercise)
- A series of S-R connections can be chained together if they belong to the same sequence (law of readiness)
- Transfer of learning occurs because of previously encountered situations.
- The most basic form of learning is trial and error learning.

Law of exercise emphasizes that we learn by doing and forget by not doing, although to a small extent only. Connections between a stimulus and response are strengthened as they are used (law of use) and also connections between a stimulus and response are weakened as they are not used (law of disuse). Law of effect states if a response in a connection is followed by a satisfying state of affairs, the strength of the connection is considerably increased whereas if followed by any annoying state of affairs, then the strength of the connection is marginally decreased. The law of readiness: interference with goal directed behavior causes frustration and causing someone to do something they do not want to do is also frustrating. All of these principles can be applied in the teaching-learning of Mathematics in secondary schools. In order to raise Mathematics achievement, students require regular practice, motivation from their teachers, sequencing of the mathematics topics according to how they are related, linkage of previously learnt experiences to current lessons and trial and error attempts in solving mathematics problems. This made Thorndike (1921) connectionist theory relevant to this study.
1.1 Conceptual Framework

The conceptual framework in Figure 1 below, presents five dimensions to low performing schools. It is related to Thorndike (1921) connectionism theory of learning as the theory can be applied in eliminating some of the barriers in teaching-learning Mathematics. Educators are faced with challenges regarding how to improve the teaching-learning outcomes in Mathematics which is a queen of all sciences. This may not be an easy task unless the barriers are identified and done away with. The study proposed the conceptual framework as illustrated in Figure 1.

Figure 1: Conceptual Model-Five Dimensions of an Intervention to Low Performing Schools

Source: Adapted from National Council of Teachers of Mathematics (2006).
Key

- Pedagogy - the kind of instructions given to students.
- Curriculum - what students are expected to learn and its coherence.
- Organizational/social atmospheric factors - such as the way students are grouped for mathematics instruction and support structures provided for learning.
- Teacher expectations/knowledge - teacher's attitudes regarding their students' capabilities, as well as their knowledge of Mathematics and how to teach it.
- Learner's initiative and attitudes - learners' attitudes regarding Mathematics and the efforts they put in learning the subject.

The Figure 1 summarizes a research-based Conceptual Framework developed to help educators and researchers comprehensively understand the factors involved in improving Mathematics instruction. To develop the conceptual framework, a team of researchers examined two research literatures: the cognitive Sciences research literature on how people learn and think about Mathematics, and the international comparison literature examining approaches to teaching and learning mathematics in different countries.

Teaching-learning outcomes (the dependent variable) are affected by pedagogy used to teach Mathematics, the curriculum, organizational and social climate of the Mathematics class, learner's attitudes and initiatives, teacher attitudes towards Mathematics, teacher knowledge and expectations. All the variables listed above are interrelated and influence each other. For instance, different teaching strategies used in different combinations with different groupings of students will improve learning outcomes. Teacher knowledge, competencies, nature of learners and curriculum dictate the teaching strategies used. Teachers play a significant role during the learning process and they can directly or indirectly influence the student's attitudes towards
Mathematics which in consequence can influence students’ achievement. Teachers need not to distance themselves from the students they teach. In the learner centered environment, they must be prepared to learn about and from their students. A two way open dialogue needs to be part of all learning activities. Kaplan (1998), argues that teachers must learn to create an environment in which students feel free to openly express and share their ideas, therefore organizational and social climate is crucial in teaching-learning of Mathematics.

1.12 Definition of Operational Terms

Some of the terms used in this were defined as below:

**Barrier**

The word barrier means any condition that makes it difficult to make progress or to achieve a set objective. It may also be defined as something that prevents or obstructs passage, access or progress. It is something that prevents action or slows progress. Therefore the word barrier in this context means those things/issues that prevent/inhibit the smooth teaching-learning process in Mathematics in order to achieve the set goals/objectives.

**Learning**

Learning can be defined as the relatively permanent change in an individual’s behavior (or capability) as a result of experience or practice.

**Teaching**

It is the purposeful direction and management of the learning process. For this study teaching is the process through which knowledge and skills are imparted to learners, it includes providing
opportunities to students so as to produce relatively permanent change through the engagement in experiences provided by the teacher.

Teaching-learning

Teaching-learning refers to a process through which learners, the curriculum and other variables are organized in order to attain some predetermined goals. The study treats teaching and learning as relative terms.
2.1 Introduction

The chapter explores literature on barriers in teaching-learning Mathematics. These were categorized as pedagogy; curriculum; teacher’s mastery of knowledge; expectations and attitudes; organizational; and social climate factors.

2.1.1 Achievements in Mathematics Globally

According to the Standard, of 6th September 2007, one of the most disturbing trends in education in Africa is low academic achievement in Mathematics and Sciences. Most countries have adopted the ‘chalk and talk education system’ which has no practical teaching in Mathematics and the subject has been introduced as a tough nut for less gifted students to crack. Subsequently Africa has the least number of scientist and engineers per population in the world (Standard 2007). The situation is like so because many Science oriented courses depend on Mathematics and performance in Mathematics in many countries is characterized by low academic achievement. This, strongly indicated that there were barriers to the teaching-learning of Mathematics and yet Mathematics is crucial for technological development and equipping of the states with the required human personnel. Indeed recognition of Mathematics as a catalyst to economic development is something that African countries can ignore at their own peril (Standard, 2007). Unless Mathematics and Science education is improved the continents’ economies would fail to meet the Millennium Development Goals (MDGs) and the Kenya’s Vision 2030. Low achievements in Mathematics have necessitated many countries to conduct
research on the causes leading to this. A study carried out by Sao (2008) in Eastern Cape province of South Africa, revealed the following barriers to learning Mathematics in the rural secondary schools:-(i) Learners exhibit attitudinal barriers towards learning mathematics- they do not make serious attempts to solve problems once they encounter difficulty. (ii) The educators seem to lack the mathematics competencies to handle their teaching –they still teach instrumentally in the way they are taught which constitutes a barrier to learning. (iii) The educators’ interaction with the learners takes place only in the classroom time and is therefore limited. (iv) Lack of reading culture among the learners is prominent; learners therefore experience difficulties in comprehending mathematical texts because of inadequate vocabulary and reading skills. (v) Learners experience lack of support in their home environments. (vi) Basic and prerequisite numeracy skills do not seem to have been acquired at necessary levels; in earlier grades. Goswami’s (2008), research conducted in Cambridge University revealed the typical barriers to learning, but specifically prevalent in the acquisition of math’s skills. The barriers include; high levels of anxiety, emotions such as panic, switching off and feeling stupid, being teased by their peers, avoidance tactics and frustration when older pupils realize that their peers are able to do what they cannot.

Studies conducted in Bostwana by Mapolelo (2009), reveal that students consider learning and understanding Mathematics to mean being successful in getting the correct answers. Students reported that in majority of the cases teaching of Mathematics was lecture-oriented. This has become a barrier to teaching-learning of Mathematics in the country. In US, Lim (2006), reported barriers in teaching-learning Mathematics which include limited mathematics content knowledge. To counter this, a Conference Board of the Mathematical Sciences recommended a minimum number of mathematics courses pre-service teachers should take in preparation to
teach in secondary level. Lim (2006), further noted that mathematics textbooks run hundreds of pages without a coherent scope and sequence. Even though computers are common in US schools many teachers feel unprepared to integrate technology into the subject they teach. Similarly Dawe (2001), reported that secondary teachers in the United Kingdom are reluctant in integrating technology in teaching Mathematics. However, encouraging is that teachers in the UK do not generally work alone; the subject departments acts as a ‘community of practice’, sharing resources, approaches, cultural values and aims. They collaboratively develop schemes of work (Lave and Wenger, 1991). What might be the barriers in teaching-learning Mathematics in Kenya?

At independence in 1963, the Kenyan government inherited the then existing western system of education which was 8-4-2 system and changed to 7-4-2-3 system in 1966 (Eshiwani, 1993: 36-38). The current education system, (8-4-4 system) was introduced in Kenya early 1985 with an important feature of curriculum as ‘course of study’ as opposed to the previous system where national textbooks were interpreted to be the curriculum. In the current education system Mathematics is a compulsory subject up to secondary school level. Student performance in Mathematics in secondary schools is getting poorer and poorer year after year (KNEC, 2004). KNEC identified inadequate coverage of syllabus and inability to master simple and basic concepts as hindrances to good performance. Studies carried out on reasons for poor performance in Mathematics by Thuo (1985) attribute it to factors such as: inappropriate teaching methods; lack of learning resources and students’ negative attitudes towards the subjects.
In an intervention to improve student’s performance in Mathematics, the Ministry of Education, Science and Technology (MOEST) of Kenya and Japan International Cooperation Agency (JICA) started a project called Strengthening of Mathematics and Science in Secondary Education (SMASSE) (1998). This initiative was aimed at addressing the quality of teaching and learning of secondary school Mathematics and Science subjects. The pilot study started in nine Districts which included; Kakamega, Butere –Mumias, Lugari, Murang’a, Maragua, Makueni, Kajiado, Gucha and Kisii District the mother District of Masaba South District. The nine Districts are those which were performing poorly in Mathematics and Science subjects.

SMASSE (1998) conducted baseline studies in the nine districts and the findings were as follows: Students perform poorly in the concepts of Mathematics, the quality of teaching is poor; most students said that classroom environment is harsh and unfriendly; students do not understand the basic Mathematics needed to function effectively in the society; students appear to lose interest in the learning of Mathematics as they progress through the school system; performance of students in Mathematics at the end of secondary school education is the lowest compared with other subjects in the secondary curriculum. Studies conducted by KIE and SMASSE (2003) found the following as the problems facing the education sector; inappropriate teaching methods used by teachers, lack of integration of theory and practical by students, low morale of learners and inadequate teaching/learning facilities and materials. Further, an overloaded curriculum, high teacher-pupil ratios at secondary school level, understaffing and under-qualification of teachers in some areas of curriculum were also reported as problems facing the education sector. These identified problems have an impact in the teaching-learning of Mathematics. In an effort to curb some of the above problems SMASSE project has start In-Service Training (INSET) courses for Mathematics teachers in secondary schools in Kenya.
The overall goal of the INSET is to upgrade the capability of Kenyan teachers in Mathematics and Sciences. The INSET advocates the use of Plan, Do, See and Improve (PDSI) and Activity, Student Experiment and Improvisation (ASEI) pedagogical methods of instruction.

Also the Working Group on Mathematics and Science Education (WGMSE) was launched in November 2004 to help Africans Mathematics and Science Education (MSE) programs improve and adapt the challenges of 21st Century. WGMSE strives to promote regional cooperation by sharing information among member countries regarding challenges and successful innovative experience in MSE. WGMSE is hosted by Kenya’s Ministry of Education. The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) based in Nairobi, Kenya is the coordinating institution and JICA, as the overseer.

In an effort to sharing information a team of SMASSE participants from Kenya who visited Malawi in May 2000 found out that Malawi and Kenya, like any developing countries, share similar problems with regard to the teaching-learning of Mathematics at secondary schools. Prominent issues raised amongst the problems included:

- High teacher-pupil ratios at secondary school level.
- Backlog of untrained and under-qualified secondary school teachers.
- Inadequate teaching and learning materials and infrastructure.
- Lack of a well structured INSET programme in Mathematics and Sciences.
- Attitudinal, unprofessional, stereotyped and gender unfriendly approaches to the teaching and learning of Mathematics and Sciences at secondary school level.
- Inadequate innovation in the teaching methodologies of Mathematics and science.
- In-availability of Mathematics and Science associations at country level.
A study conducted by Wasiche (2006), on Teaching Techniques that enhances students performance in Mathematics in selected public secondary schools in Butere-Mumias district Kenya recommends:- Mathematics teachers to assist individual students and provide frequent feedback especially to low achievers in the subject. Teachers to be told the importance of seminars and INSETs like SMASSE before they attend them. Once the teachers appreciate the importance they are likely to practice what they learn in the mathematics seminars and workshops and every mathematics teacher to ensure that all students are participating in class by providing a conducive and supportive learning environment. This can be done by using various teaching techniques and teaching/learning resources, well structured INSET programme in Mathematics and Sciences and friendly approaches to the teaching and learning of Mathematics and Sciences at secondary school level.

The Daily Nation of 26th February (2000), stated that the root cause of poor performance in Mathematics is poor preparation of Mathematics teachers. The Daily Nation of 3rd March (2010) also reported that performance in key curriculum subjects like Mathematics and Sciences at KCSE examinations has not been satisfactory for quite a long time. According to Ramari (2004), performance in Mathematics has been generally poor. Auma (2004) and Achieng (2007) looked at the relationship between teacher factors and student mathematical achievement as factors affecting Mathematics performance and found that there is a positive relationship. Manoah, Indoshi and Othuon (2011) studied on influence of attitude on performance of students in Mathematics curriculum. All the above researchers although dealing with low achievements in Mathematics didn’t look at barriers to the teaching-learning process in mathematics curriculum for secondary schools. The study was to explore into the barriers in teaching-learning Mathematics in secondary schools in Masaba South District.
Masaba South district is a new district carved from Kisii Central district. The district had thirty-nine secondary schools of which majority have been started recently through community initiative projects. Teaching-learning of Mathematics in the secondary schools in Masaba South experience obstacles as evidenced in Table 2.1 and Table 2.2 with very low achievements in Mathematics.

According to the Masaba District (2009) Joint Evaluation Tests involving three divisions i.e. Kiamokama, Rigoma and Masimba (KIRIMA), it was evident that Mathematics was poorly performed with a mean of 1.872 (D-) with a shocking figure of 2611 out of 3444 scoring grade Es. Mathematics comes at the bottom of all subjects apart from Building Construction which had one candidate who scored grade ‘E’ with a mean of (1.00). The candidates who scored grades D, D- and E comprised 85.58%, meaning it was only less than 15% of the students that scored grade D+ and above.

The performance in Mathematics indicated strongly that there were barriers to teaching-learning of Mathematics in the district. The KIRIMA Joint Evaluation Tests Panel attributed the poor performance to widespread lack of mastering of mathematical concepts such as: reading of Mathematical tables, use of calculators and failure to interpret mathematical questions. Out of the dismal performance in Mathematics the researcher was justified to explore on the barriers to the teaching-learning of Mathematics in the district. Attached below, are Tables 2.1 and 2.2 which show the performance students in various subjects including Mathematics in KIRIMA test evaluations.
TABLE 2.1: Masaba District Joint Evaluation Tests (2009)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Code</th>
<th>Entry</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C-</th>
<th>D+</th>
<th>D-</th>
<th>E</th>
<th>Mean Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>101</td>
<td>3477</td>
<td>1</td>
<td>13</td>
<td>58</td>
<td>142</td>
<td>253</td>
<td>286</td>
<td>451</td>
<td>453</td>
<td>429</td>
<td>463</td>
</tr>
<tr>
<td>Kiswahili</td>
<td>102</td>
<td>3500</td>
<td>7</td>
<td>76</td>
<td>144</td>
<td>225</td>
<td>311</td>
<td>370</td>
<td>418</td>
<td>455</td>
<td>465</td>
<td>370</td>
</tr>
<tr>
<td>Mathematics</td>
<td>121</td>
<td>3444</td>
<td>7</td>
<td>19</td>
<td>31</td>
<td>44</td>
<td>62</td>
<td>74</td>
<td>113</td>
<td>129</td>
<td>159</td>
<td>184</td>
</tr>
<tr>
<td>Biology</td>
<td>231</td>
<td>3009</td>
<td>2</td>
<td>43</td>
<td>74</td>
<td>127</td>
<td>174</td>
<td>191</td>
<td>287</td>
<td>314</td>
<td>365</td>
<td>420</td>
</tr>
<tr>
<td>Physics</td>
<td>232</td>
<td>968</td>
<td>2</td>
<td>20</td>
<td>54</td>
<td>59</td>
<td>89</td>
<td>128</td>
<td>152</td>
<td>199</td>
<td>126</td>
<td>98</td>
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<tr>
<td>Chemistry</td>
<td>233</td>
<td>3400</td>
<td>22</td>
<td>72</td>
<td>92</td>
<td>102</td>
<td>132</td>
<td>188</td>
<td>224</td>
<td>277</td>
<td>380</td>
<td>494</td>
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<tr>
<td>History</td>
<td>311</td>
<td>1960</td>
<td>18</td>
<td>85</td>
<td>124</td>
<td>182</td>
<td>186</td>
<td>189</td>
<td>189</td>
<td>175</td>
<td>159</td>
<td>1380</td>
</tr>
<tr>
<td>Geography</td>
<td>312</td>
<td>846</td>
<td>5</td>
<td>35</td>
<td>62</td>
<td>85</td>
<td>80</td>
<td>77</td>
<td>67</td>
<td>86</td>
<td>88</td>
<td>74</td>
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<tr>
<td>CRE</td>
<td>313</td>
<td>1916</td>
<td>1</td>
<td>56</td>
<td>97</td>
<td>150</td>
<td>204</td>
<td>215</td>
<td>214</td>
<td>221</td>
<td>195</td>
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</tr>
<tr>
<td>Home science</td>
<td>441</td>
<td>30</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>383</td>
</tr>
<tr>
<td>Wood work</td>
<td>444</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Building const</td>
<td>446</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Electricity</td>
<td>448</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.0000</td>
</tr>
<tr>
<td>Computer studies</td>
<td>451</td>
<td>21</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Agriculture</td>
<td>443</td>
<td>1569</td>
<td>4</td>
<td>19</td>
<td>34</td>
<td>65</td>
<td>73</td>
<td>105</td>
<td>136</td>
<td>136</td>
<td>167</td>
<td>172</td>
</tr>
<tr>
<td>Business studies</td>
<td>565</td>
<td>1321</td>
<td>0</td>
<td>51</td>
<td>11</td>
<td>50</td>
<td>83</td>
<td>70</td>
<td>105</td>
<td>129</td>
<td>113</td>
<td>275</td>
</tr>
</tbody>
</table>

Table 2.2: Percentage of Candidates as per Grades in Mathematics Paper 121 (2009)

<table>
<thead>
<tr>
<th>GRADE</th>
<th>%</th>
<th>GRADE</th>
<th>%</th>
<th>GRADE</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-</td>
<td>0.406</td>
<td>C</td>
<td>2.146</td>
<td>E</td>
<td>75.719</td>
</tr>
<tr>
<td>B+</td>
<td>0.551</td>
<td>C-</td>
<td>3.277</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.899</td>
<td>D+</td>
<td>3.741</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td>1.275</td>
<td>D</td>
<td>4.524</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>1.798</td>
<td>D-</td>
<td>5.336</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Tables 2.1 and 2.2 Adapted from Masaba South District (2009) KIRIMA Test Evaluations.
In order to enhance the learners thinking skills and thinking habits, Yeap (2006) recommends that teachers should create environment and opportunities to engage learners in developing good thinking skills and habits. He further indentified characteristics of good practices in the Mathematics classroom such as: providing students opportunities to develop competence and attitude that put them in good state in the global, technological economy; develop good thinking by enhancing students thinking skills and thinking habit; engage students in the learning process and still among students a belief that they are able to extend their own knowledge. The National Council of Teachers of Mathematics (2006) proposed areas to be looked into in order to comprehensively understand the factors involved in improving Mathematics instruction. If not well addressed they constitute barriers to teaching-learning process of Mathematics. The reseacher divided the factors into five categories:-

i. Curriculum factors.

ii. Teacher knowledge, expectations and attitudes.

iii. Organizational and social climate factors.

iv. Learner’s attitudes.

v. Pedagogical approach factors. Each category will be discussed as below:

2.2 Curriculum Factors

Curriculum is considered integral to any attempt to improve mathematics instruction. One often discussed theme is curricular coherence. Within the school curriculum learning Mathematics is uniquely challenging in that it is highly organized, sequential and progressive. Simple elements must be learned successfully before moving to the others. It is a subject where one learns the parts; the parts build on each other to make a whole; knowing the whole enables reflection with more understanding on the parts, which in turn strengthens the whole. Knowing the whole also
enables an understanding of the sequence and interactions of the parts and the way they support each other so that getting there clarifies the stages of the journey (Chinn and Ashcroft, 1998:4). This can be compared with "Systems Approach" developed by Kaufman (1984). He defines Systems Thinking as an approach to problem solving, by viewing "problems" as parts of an overall system, rather than reacting to specific part, outcomes or events and potentially contributing to further development of unintended consequences. Kaufman (1984) further suggests that component parts of a system can best be understood in the context of relationships with each other and with other systems, rather than in isolation. The Mathematics curriculum should embrace this approach in sense that concepts of Mathematics in one topic build from concepts of yet another topic. According to Schickendanz (2008) an integrated Mathematics curriculum is very essential. Integration is the blending together of two or more content areas in one activity or learning experience. The purpose of integrated curriculum is to make content meaningful and accessible to students. Integration also enables more content to be covered during the limited school day.

Curriculum materials in Japan and China are commonly designed with significant content for teachers. Japanese and Chinese teachers regularly turn to their mathematics curriculum materials content, pedagogy, student thinking and the connections between mathematics ideas within and across school years (Ma, 1999). Such materials may not be effective without additional professional development. Ball and Feiman-Nemser (1988) reported pre-service teachers need minimal guidance on how to use textbooks and contradictory messages about the value of using textbooks for planning and instruction.

According to Lambdin and Preston (1995) teachers vary greatly in their acceptance of or resistance to new curriculum materials. Teachers may enact lessons in very different ways from
how curriculum developers or educational reformers intended (Ball, 1990). This variation in curriculum may affect opportunities learners have to learn from the curriculum and learners may not benefit a lot from the teaching-learning process. Cohen and Ball (1990) argue that teacher beliefs and knowledge about the subject matter, pedagogy, and attitudes towards learners may influence teachers’ responses to curriculum materials including how they use materials and what they learn from them. Because of the interrelated nature of the subject, learners who have learning difficulties in Mathematics may sometimes appear to feel even more lost and disempowered than those who encounter problems in other subjects (Frederickson and Cline, 2009:387-388).

Schmidt and Wang (2005) found that in the United States, most of the curriculum covered an enormous number of topics and lacked a core set of ideas linking concepts in the curriculum. Consequently, Schmidt and Wang (2005) reported American curriculum has being a mile wide and an inch deep. The large number of topics and lack of coherence in US curriculum meant the topics were not presented in a meaningful way (Hiebert and Carpenter, 1992). By contrast in countries that perform well on mathematics assessments- (like the Trends in International Mathematics and Science Studies (TIMSS) (1999), there is often a standard, well, organized curriculum that uses core concepts as a way to help students anchor their new knowledge and mathematics is presented as a coherent set of ideas related in logical ways (Charles, 2005). Schmidt and Wang (2005) colleagues consider the disorganization in curriculum a primary reason for US students’ poor performance on international mathematics assessments.

According to the Ministry of Education Singapore (2006), the education system has evolved over time and so has school mathematics curricula. The present day school mathematics curricula can best be described as one that caters for the needs of every child in school. It is based on a frame-
work that the attainment of problem solving ability is dependent on five inter-related components-concepts, skills, processes, attitudes and meta-cognition. For all pupils in school irrespective of their abilities, mathematics education aims to enable pupils to: (i) Acquire and apply skills and knowledge relating to number, measurement and space in mathematical situations that they will meet in life. (ii) Acquire further study in mathematical concepts and skills necessary for further study in Mathematics and other disciplines. (iii) Use mathematical ideas and arguments precisely, concisely and logically (iv) Develop positive attitudes towards Mathematics including confidence, enjoyment and perseverance. (v) Develop the ability to make logical deduction and induction as well as to explicate their mathematical thinking and reasoning skills through solving of mathematical problems.

Ministry of Education Singapore (MES) (2006), indicate that, School mathematics curriculum as part of the school curriculum has played a significant role in the economic development and progress of the country in the last five decades. The Mathematics syllabus has undergone a content reduction, learning in the subject is sequential and hierarchical in nature, topics which were less fundamental and not connected to other topics in the syllabus; which placed heavy emphasis on mechanical computation; which overlapped with those taught at other levels; that were too abstract for the intended level and concepts/skills that were taught in other subjects, were removed from the syllabus. MES (2006), further argue that The Mathematics syllabus undergoes periodic review to ensure that the content remain relevant so as to prepare the pupils for the challenges and opportunities in future. Goh (2001), reported every child in school should do Mathematics that is suited to his or her ability. This is yet to be borrowed by the Kenyan government. Discussed below are the aims of secondary Mathematics in Kenya.
According to KIE (2009), Kenya secondary mathematics aims at producing a person who will be numerate, orderly, logical, accurate and precise in thought. The person should be competent in appraising and utilizing mathematical skills in playing a positive role in the development of a modern society. Secondary curriculum is designed by KIE. Mathematics textbooks are developed by publishers and evaluated by the KIE. The approved textbooks are procured by schools for the appropriate classes at the beginning of each year of implementation. A total of six titles, which are found to satisfy the needs of the curriculum are approved for each class. The list of approved books is availed to all secondary schools and the mathematics teachers in each school determine the title they prefer to use as class textbooks. The mathematics teachers also prepare the schemes of work from the Mathematics syllabus which they use for teaching.

Kenyan mathematics teachers require INSETs on how to use mathematics textbooks, interpret mathematics syllabus and write schemes for instructional teaching in class.

Eshiwani (1974) points out that one of the weakest points of the New Mathematics in Kenya was the lack of evaluation to find out if valid progress was being made. He argues strongly for research in area of antipathy towards Mathematics, especially among girls and in many other areas. Ntarangwi (2003), reported the Kenya education system is one more about schooling, than ‘education’; it has failed to instill values, aesthetics and beliefs that are unique to peoples’ orientation. The education curriculum has been criticized for its lack of proper structure in the learning items, whereas certain high level concepts have been taught in lower levels. High teacher-learner ratios especially in Mathematics and Sciences thus overloading teachers. The system is competitive, picks the best in competition and is highly elitist. Similarly, Shujaa (1994), observed that Kenyas’ system of education has been criticized for promoting rote learning. Students study to pass by cramming their way through the educational curriculum.
Shujaa (1994), further observed rote learning especially in Mathematic inhibits creativity and innovativeness, making learning a passive affair for the students. The rote learning technique produces individuals who can’t think outside the ‘box’.

2.3 Teacher Knowledge, Expectations and Attitudes

Teacher knowledge, expectations and attitudes can be critical barriers to teaching-learning of Mathematics in Secondary schools.

2.3.1 Teacher Knowledge

Research suggests that greater teacher content knowledge is a contributing factor to increased student learning (Ball, Hill and Bass, 2005). Teachers in Asian countries have stronger Mathematics knowledge and more training, on average than teachers in the United States and students in Asian countries typically perform better than students in the US on international Mathematics Assessment (Stevenson 1998; Ball 2003; Siegel 2004). In addition to content knowledge, a teacher also needs pedagogical content knowledge, or specialized Mathematics knowledge for teaching that includes representing the subject to make it understandable to others; knowing what topics will be easy or not; and insight about what preconceptions students of different ages and backgrounds have (Shulman, 1986).

A successful Mathematics teacher needs a deep understanding of Mathematics content to create mathematically rich task structures and to adapt to meet the needs of individual students (Ma, 1999). Professional development focused in increasing teacher knowledge of Mathematics may increase students’ performance. There have been assumptions by teacher employers that content knowledge is not a problem for secondary teachers, who by virtue of specialized study in
Mathematics know their subjects well. However, research on secondary teachers repeatedly reveals the fallacy of the assumptions (Ball, 1988).

Stodolsky and Grossman (2000), argue that factors such as individual teachers’ beliefs about students, instructional repertoire, and knowledge and skill in the subject as key factors affecting individual teachers’ willingness and ability to change instructional practices. Teachers who feel confident about their content and pedagogical content knowledge, and who have high expectation for students’ success, are also more likely to adapt than teachers with strong commitment to the practices they currently use and no confidence of success with new pedagogical approaches.

As Stodolsky and Grossman (2000) argue teachers need access to new knowledge and support as they embark upon new instructional practices, hence the importance of the role of the local school context, such as the subject department in facilitating teacher change. Departments with strong collegial interaction and commitment in support of student learning help teachers gain access to needed instructional approaches and resources, thereby increasing teachers’ personal and collective efficiency (the belief that they are capable) for responding to the learning needs of student populations. Thus teacher knowledge is crucial for removing teaching-learning barriers to Mathematics by improving teacher delivery in class. Mathematics as a science requires diverse skills in delivery by the teachers and competency on the part of the teacher. However, teaching load, in-availability of teaching resources, lack of INSETs can inhibit teachers from making instructional changes in Mathematics. Otieno (2010), in a study looking at ‘the effects of teaching/learning resources on academic performance in secondary school Mathematics in Bondo District of Kenya’ recommends INSETs for trained Mathematics teachers and recruitment of more competent teachers to teach Mathematics in secondary schools.
2.3.2 Teacher Expectations

Another factor that affects student learning outcomes is teachers’ expectations. Teachers with low expectations of their students will most likely only teach remedial skills and not more on advanced concepts or stress conceptual understanding (Romberg, 1984). Teachers too often believe that attempting to teach higher-order thinking is inappropriate when students are struggling (Zohar, Degani and Vaalknin, 2001) only if teachers consistently set high expectations by engaging all students in challenging Mathematics can students be expected to learn more challenging Mathematics. One method of raising teacher expectations is to involve teachers in investigations of student work, when students do them.

2.3.3 Teacher Attitudes

Teachers’ attitude towards the teaching of Mathematics plays a significant role in shaping the attitude of students towards the learning of Mathematics. Studies conducted by Ogunniyi (1982), in Nigeria reported that students’ positive attitudes towards sciences could be enhanced by the following teacher related factors: teachers’ enthusiasm; teachers’ resourcefulness and helpful behavior; teachers’ thorough knowledge of the subject-matter and their making science quite interesting.

Bandura (1971), demonstrated that behaviors are acquired by watching another (the model teacher, parent, mentor friend) that performs the behavior. The model displays it and the learner observes and tries to imitate it. Teachers are, invariably role models whose behaviors are easily copied by student. What teachers like or dislike, appreciate and how they feel about their learning or studies could have a significant effect on their students. Unfortunately, however many teachers seldom realize that how they teach, how they behave and how they interact with
students can be more paramount than what they teach. In a nutshell, teachers' attitudes directly affect students' attitudes.

Chako (1981), in a study of teacher and student characteristics as they correlate to learning outcomes in Mathematics, found that teachers' attitude towards teaching significantly predict students attitude as well as achievement in Mathematics. Also, Ogunniyi (2000), found significant causal relationship between the teachers' attitude and students' achievement in integrated science.

2.4 Organizational and Social Climate Factors

Organizational structure and social climate of the school have a profound effect on students performance in Mathematics. A study conducted by Sullivan, Toblas and McDonough, (2006) of University of Otago in Sydney on; “who a student sits near to in Mathematics”: Tension between social and mathematical identities, recommends that students need to be surrounded by others whose behavior does not disrupt or distract them, and who they like and feel comfortable with. The study suggests that adolescent students do not have the power or control to stop other people’s behavior affecting them, nor do they have the power to sit where they want to ensure their academic identities are being fulfilled. By instituting seating plans Mathematics teachers can ensure students academic and social needs are met therefore improving students learning through positive discussion and help-seeking.

Social environment is likely, however, to be particularly important to young adolescents of 13-15 years. Not only do they have increasingly strong social needs (Ryan, 2001), but they are also self conscious and sensitive as “more so than at other ages, young adolescents doubt their abilities to succeed, question the value of doing their school work, and decrease their effort towards
academics" (Ryan and Patrick, 2001:439) Relationship between students impact on the adolescent social environment

The relationships between students in particular, are a resource and accessing this resource can lead to better mathematical learning through Mathematics discussion, emotional support and the sharing of Knowledge and skills. To harness this resource and to account for the students' powerlessness to control can ensure the conditions for positive seating arrangements are met every day through sensitive seating plans. Teachers might do this by getting to know the students better in terms of both their social and mathematical identities and the students could be seated in pairs with the pairs ready to turn to form a larger Cooperative learning group. The mathematics teacher needs to give explicit messages regarding as: students are valuable resources to work to increase learning; and a students' behavior affects others (Sullivan and McDonough, 2007).

A study conducted by Parsons and Harding (2009), suggests that effective schools are led by wise principals who build and support teacher leadership. When offered opportunities teachers build good learning environments. Teachers can also be instrumental in identifying key problems and when empowered and supported by principal, make significant to improve the lives of children. The researcher further found that good schools were “positive” places- they largely exorcise negativity. Teachers work hard; and are willing to work harder; and, are even energized by hard work. What brings teachers to their knees is negativity- whether introduced from the outside (where all manner of negative influence weigh upon teachers) or form wide-ranging internal criticism that cause teachers to dwell on failures, self-critiques and difficulties.

The study further found that relationships are the key to every positive action within the school. Relationships are everywhere-between teachers and students; between students and students; between teacher and teachers; between teachers and principals and between teachers and
principals and parents. When relationships are smooth schools are smooth and teaching-learning also becomes smooth.

In my view the study is applicable to the teaching-learning of Mathematics. The mathematics teachers have to ensure good relationships with the learners he/she teaches for maximum enhancements in learning Mathematics. With the cordial relationships the students will freely communicate their mathematical difficulties to the mathematics teacher who in response will give direction on their solution. Also, according to Parsons and Harding (2009), principals who believe that teachers would do a good job and gave them space to do it are always successful. Therefore, principals should assume the best from their teachers and principals should give teachers freedom to take innovative tasks in teaching-learning Mathematics. By so doing, barriers such as students feeling shy, some not ready to communicate their Mathematics difficulties will be done away with.

2.5 Learners’ Attitudes Towards Mathematics

Two contrasting beliefs are often found. Some parents, teachers and students believe that everyone can develop their ability to learn Mathematics. Others believe that Mathematics is an innate skill or trait that some people are “good at Mathematics” and other people are not. Asian countries tend to subscribe to the former belief, whereas in the United States, parents and teachers are often willing to accept that a student is innately “not good at Mathematics”. Consequently students labeled as not good often do not try, since they feel their efforts will be futile (Stevenson and Stigler, 1992).

A simple, but effective intervention taught students that the brain was like a “muscle” and if they exercised it in Mathematics, it would get stronger. Thorndike (1921), connectionist theory of
learning-law of use agrees with these. US students who were told this analogy did better than students who were not told (Blackwell, Trzesniewski and Dweck, 2007).

Negative effects on motivation and expectations can occur through “stereotype threats”. For example, the stereotype, that men are better in Mathematics than women. Research has failed to show any difference between men and women in mathematical ability. However women are too ready to admit inadequacy and say-, “I just can’t do Mathematics”. Stereotype threats occur when a group that is often stereotyped as poor in Mathematics is reminded of this stereotype (Cohen, Garcia, Apfel and Master, 2006). Spillane (2002) found that many teachers have a “deficiency” view of their “disadvantaged” students. Whether the negative belief systems are about race or gender, teachers belief systems are about race or gender, teachers need to be challenged typically through professional development. Parental beliefs and home support for Mathematics performance also relate to student success (Cooper and Robinson 1991), so outreach efforts to help parents understand what they do at home is important for Mathematics learning as well.

Mathematics has been registering dismal performance over the years in Kenya and the trend might continue so long as the negative mind-set towards the subject is not corrected. Some students hold teachers accountable for poor performance and the general public believes that Mathematics is an abstract subject meant for the intelligently-gifted ones (Kenya Times, 15 August 2006).

According to McGraw-Hill (2005), there are many myths about Mathematics. The myths dictate the student attitudes towards Mathematics. Some of the myths are: Mathematics requires a memory; Mathematics is not creative; there is a best way to do Mathematics problems and some people have a “mathematics minds” and some don’t. To dispute the above myths, Mathematics
problems may be solved by a variety of methods which express individuality and originality— but
there is no best way. New and interesting techniques of doing Mathematics are discovered by
students every day. Creativity is also central to Mathematics as it is to art, literature and music.

Belief in myths about how Mathematics is done leads to a complete lack of self-confidence. But
it is a self-confidence that is one of the most important determining factors in mathematical
performance. For many decades, poor results in Mathematics have been associated with the
cognitive than with the affective domain. A number of research studies conducted on students’
poor performance in Mathematics is not attributable to inherent characteristics of students’
populations.

As Tyler (1985) has pointed out, attitudes towards Mathematics are significant outcome of
Mathematics teaching and relevant variable in student cognitive learning of Mathematics. Little
has been made towards satisfying and determining the conditions that affect their dynamics and
influence their development. A study conducted by Schibeci and Sorenson (1983), reveal that
lack of engagement in Sciences and Mathematics has been associated with low interest levels in
those subjects and negative attitudes developed quite early in life. Understanding student’s
perceptions or stereotypes of Mathematics and Sciences may assist in designing programs that
aid students in developing more positive perceptions.

Thomas, Rendersen and Finson (2001) show that pre-service Science teachers hold similar
stereotypical views of Science, scientist and teaching Sciences as their students. It appears that
there are multiple dimensions inherent in the development of these attitudinal images that
involves both students and their teachers. Given this information, it would seem fitting that
knowing students’ and teachers’ perceptions of Mathematics and Mathematics teaching may be
critically important if educators are to effectively and positively impact students through instruction.

Parental stereotyping of careers affects girls’ perceptions of the usefulness of Mathematics and Science. Parents may have lower expectations for daughters than sons and attribute their daughter’s success in Mathematics and Science more to effort than ability (Chapman, Brush, and Wilson 1985). In addition, some girls have shied away from Mathematics and Science as counselors sometimes discourage girls from selecting courses that may require Mathematics or Science knowledge because they believe that quantitative fields of study are male-oriented. O’Brien, Kopala, and Martinez-Pons (1999) link self-efficacy in certain academic discipline to the probability of an individual choosing that career, and Zeldin and Pajares (2000) reports similar findings for females. Teachers’ perceptions and beliefs can affect students’ goals and perceptions of their own abilities and teacher encouragement has shown to be a positive influence on female’s Mathematics participation. Yet, teachers tend to treat boys and girls differently, often to the detriment of girls’ achievement (Fennema and Leder 1990). The researcher of the study will investigate students’ attitudes towards Mathematics and explore whether these are barriers to the teaching-learning process.

2.6. Pedagogical Approach Factors

Siegel (2004), in a research from the international comparative literature highlights pedagogical differences that seem to impact student’s mathematical learning. For example, teachers in Asian countries tend to assign students to do rich mathematical tasks. In Japan, lessons follow a structure where: students try something out; a teacher provides direct instruction on that challenge; the students work on the problem again (often as a whole class) and finally the lesson ends with a review of the concepts covered. In this structure, Asian teachers have the opportunity
to explicitly point students to critical concepts, use students errors to better explain mathematics reasoning (Stevenson and Stigler, 1992), and require students to grapple with concepts, and articulate mathematical ideas.

(Stevenson and Stigler, 1992), note that the way lessons are presented in the US, offers less rich mathematical experiences, for example, students are not given time to think or articulate about Mathematics since teachers typically ask “Yes/No” questions and emphasize procedural accuracy e.g. “the right way” to solve a problem. Because the lessons offer students limited responsibilities, they do not get the opportunity to reason through the concepts themselves. Related to the importance of thinking and reasoning about Mathematics is making students’ thinking visible, a critical component of the learning process. Chapin, O’cannor and Anderson (2003), argue that when students explain their thinking they are required to organize thoughts clearly in order to communicate them to others.

In a synthesis of effective instructional strategies, Baker, Gersten and Lee (2002) recommend that segments of mathematics instruction should target teaching students to generate explanations of mathematics concepts in their own words and to justify the methods they use to solve problems. From both the US and international research, it is clear that quality of instruction affects students’ academic achievement in mathematics (Fuller, Hau and Snyder, 1994). According to Slavin, (1990a) and Marzano, Norford, Paynter, Pickering and Gaddy (2001), using instructional approaches that emphasize group work can help support learning in Mathematics better than traditional instructional methods.
2.6.1 Small-Group Instruction

This is a teaching method where students work together in groups of various sizes with or without supervisor or the teacher. This enables students to express their view, find out what others think and clarify ones' point of view. As a result students gain a feeling of acceptance and belonging. This facilitates mastery of mathematics concepts, skills and principles.

Peterson, Wilkinson, Spinell and Swing (1984), found that small- group learning and cooperative learning are an effective to the whole class instruction. Positive effects on mathematics achievements seem to stem from the task-related interaction that occurs in small-groups. Peterson’s findings indicate that students learn by explaining why the answer is incorrect and help the other students to see the correct answer. The recipient may benefit by understanding the explanation that describes the kind of strategy and processes that a student should use to solve a problem.

According to Peterson et al (1984), small group instruction is important in the following ways: it gives students the opportunity to become interactive during the lesson and increase participation; helps students develop effective way of interacting and sharing ideas and skills learned with others. However, motivational activities during small group work are necessary and forming the groups is challenging to teachers.

2.6.2 Cooperative Learning

Cooperative learning is defined as students working together “to attain group goals that cannot be obtained by working alone or competitively” (Johnson, Johnson and Holubec, 1986). The main purpose of cooperative learning is to actively involve students in the learning process; a level of students empowerment which is not possible in a lecture format. The process requires
knowledge to be discovered by students and transformed into concepts to which the students can relate. The knowledge is then reconstructed and expanded through new learning experiences. Learning takes place through dialogue among students in social setting.

Kagan (1990), describes cooperative learning as methodology that employs a variety of learning activities to improve students understanding of a subject by using a structured approach which involves a series of steps, required students to create, analyze and apply concepts. Cooperative learning utilizes ideas of Vygostky, Piaget and Kohlberg in that both individual and the social setting are active dynamics in the learning process as students attempt to imitate real-life learning. By Combining teamwork and individual accountability students work toward acquiring both knowledge and social skills.

It is a teaching strategy which allows students to work together in small groups with individuals of various talents, abilities and backgrounds to accomplish a common goal. Each individual team member is responsible for learning the material and also for helping the other members of the team learn. Students work until each group member successfully understands and completes the assignment, thus creating an atmosphere of achievement (Panitz, 1996).

The use of this method of learning overcomes all of the barriers that are hindering the learning environment such as poor attendance, classroom disruptions and diversity among students. According to McBrien and Brandt (1997), schools utilizing this strategy report an increase in students attendance because students feel that they are valuable and necessary part of their groups. Students are more likely to stay on task and are less likely to be disruptive (Stah and Vansickle, 1992). Cooperative learning reduces class disruptions because students are allowed to socialize during the learning process students need peer interaction and without the integration of interaction among students, learning achievements may be minimal.
2.6.3 Formative Assessment

Formative assessment is another key pedagogical strategy to use in order to promote understanding and correct misconceptions more quickly. According to Black and William (1998) formative assessment helps reduce the learning gap between struggling and positive achieving students and raises overall achievement levels. Using formative assessment instructional practice can be challenging for mathematics teachers. Teachers need to learn to create assessment that aligns with learning goals and activities; then they have to interpret the results of the assessment; and finally they must be able to make changes to instruction based on these results in a timely fashion of affect students learning. Formative Assessment can be used in teaching-learning of Mathematics because it helps mathematics teachers indentify learners' difficulties.

These approaches require patience on the part of the teacher and student, but a complete conceptual understanding cannot be obtained without experience. In other cases, technology-based representations can directly link graphs, technology-based representations and animations providing another way for students to work with the concepts and connect mathematical abstractions to familiar situations (Roschelle, Kaput and Stroup, 2000).

2.7 Other Barriers to the Teaching-Learning of Mathematics

There are other critical barriers to teaching and learning of Mathematics in Secondary Schools. Which are now discussed as below:

2.7.1 Mathematics Vocabulary

Mathematics vocabulary can be a barrier to the teaching-learning of Mathematics. Biemiller (2001) has indicated that vocabulary knowledge is strongly related to overall academic achievement in school. The relationship between vocabulary mastery and Scholastic
Johnson and Johnson (1990), asserts cooperative learning helps to reduce violence. If enforced correctly, cooperative activities model non-violent resolutions to problems. Because group consensus is promoted, blame is eliminated and honor, friendliness and quality are promoted. Cooperative learning also builds diversity awareness among students. It encourages students to use their differences to help each other. Because students are placed in a situation where they are able to interact with peers that they otherwise may never socialize with, behaviors which might appear odd in other settings become understandable when students are given the opportunity to explain and defend their reasoning. In a traditional classroom there is very little opportunity for students to defend their perspectives. As students share each other’s reasoning, there is more room to understand and appreciate their differences. Cooperative methods are flexible and can easily be adapted for students with special needs. Slavin (1990) reports this type of learning environment allows for improved social acceptance of mainstreamed students with learning disabilities.

Corno and Snow (1986) argue that this strategy of learning can be applied successfully in the learning of Mathematics in secondary schools. This is because the mathematics classroom comprises both high and low ability students. Corno and Snow (1986) in their summary on the effects of cooperative learning state that “low ability students performed better in cooperative learning and high achievers also benefit from this form of instruction.” However, cooperative learning suffers from a number of drawbacks; Mathematics teachers who are unfamiliar with the strategy may not initially accept this style of learning; they may resist using the cooperative learning technique in their classroom because they are afraid they may lose control of their teaching routine; depending on age level, students may resist using cooperative learning in their mathematics classroom.
performance is particularly true in the area of Mathematics. It has been shown that students must understand Mathematics vocabulary if they are to master content and be able to apply it in future situations (Thompson and Rubenstein 2000). Thus teaching vocabulary in the Mathematics content area is a critical element of effective instruction.

Snow (2002), claimed that vocabulary instruction is one of the essential elements of a students’ academic development. Although commonly associated with language arts, vocabulary proficiency is a significant contributing factor in learning and mastering mathematical concepts. Assisted by classroom instruction, vocabulary grows rapidly. Anglin (2000) stated that, during grades one through five, the recognition vocabulary growth rate averages twenty words per day. He further argues that students lacking a firm foundation of vocabulary knowledge have more difficulty obtaining meaning while reading. This difficulty leads to reading less and, as a result, less exposure to new vocabulary words. This pattern of reading less leads to a persistent, widening gap of vocabulary proficiency compared to students with strong vocabularies who read more frequently, thereby expanding their understanding through new vocabulary and continually improve their skills. Walberg and Tsai (1983) termed this the “Matthew effect”: the students with rich vocabulary skills continually enhance their vocabulary knowledge while the vocabulary of students with poor vocabulary skills ebbs.

The effect of poor vocabulary skills are compounded in the mathematics domain if students do not possess the prerequisite vocabulary to understand word problems, verbally express mathematical concepts and formulate solution approaches to problems. Mathematics vocabulary instruction is needed to help these students build the critical background knowledge that students who have been exposed to a wide range of vocabulary through reading have attained.
Although Mathematics is described visually through symbols and numbers, the symbols have associated words and meaning. More importantly mathematics problems are often expressed in words for example words like trapezoidal, denominator, slope, conjugate, dependent and independent variable. The student needs to understand the meaning of each of these words. Thus, vocabulary is essential to achieve mathematics proficiency. Marzano (2004) found that teaching academic vocabulary could positively influence standardized test scores by as much as 33%, similarly, Gifford and Gore (2008) found that under performing mathematics students who received vocabulary instruction showed standardized test gains as high as 93%, supporting Marzano’s findings.

Most states publish a list of words by subject that students may expect to see on achievement test. For example, the Colorado Department of Education (2007) and the Montana Office of Public Instruction (2006), like many state department of education offices, offer a list of essential mathematics vocabulary test terms. Additionally some governments publish mathematics vocabulary list such as the Department of children, schools and families in the United Kingdom. The Kenyan Mathematics curriculum has not done much in this area, this could be the cause of low achievement in Mathematics. Classroom instruction should include the words in those essential vocabulary lists when they appear in textbook passages or in curriculum activities.

Stahl and Fairbanks (1986) indicate that students must be exposed to words at least seven times over spaced interval in order for retention to occur. Repetition is critical for the retention of new vocabulary. Learners will have increased retention of vocabulary words when they manipulate them in a variety of ways (Miller, 2007), Bradley’s (2003) study that looked at the impact of teaching and testing mathematics vocabulary terms to third grade students on a regular basis indicated that students retained mathematics vocabulary longer when the words were
manipulated and emphasized in the curriculum. Incorporating vocabulary on multiple occasions and utilizing varied instructional methods may increase the likelihood of learners’ retention.

2.7.2 Language

'Reading Mathematics and understanding the language of mathematics vocabulary is challenging. Some words are used only in Mathematical English and are therefore unfamiliar until children have been taught them (for example, words like hypotenuse, parallelogram, surd), while some other words are used confusingly with different meanings in Mathematical English and ordinary English (e.g., mean, product, odd).

2.7.3 Syntax

Syntax is the study of the principles and processes by which sentences are constructed in particular languages. It is the arrangement of words in a sentence. The syntax is challenging, it is not just the vocabulary of mathematics that causes difficulty. The syntax in which mathematical ideas are expressed is often more complex than children are accustomed to in other areas of the curriculum. Examples include the use of the passive voice (as in each side of the equation is divided by 3) and conditional clauses (as in if…… then) (Shuard and Rothery, 1984).

Burwell and D’Sena (1998), advocated that teachers use the following checklist when communicating about Mathematics to children whether in written or spoken form. Teachers should make sure that they use simple sentence structures; present no more than one fact per sentence; check that any extra information that is given is useful; split questions into sections where possible and appropriate and every question tests mathematical skills of the child not their English comprehension.
Burwell and D'sena (1998) further propose the following hypotheses for low achievement in Mathematics:

(i) Students do not fully read the instructions before tackling a problem or they do not act on what they read.
(ii) They do not take time to understand the problem before starting to work on it.
(iii) They adopt ineffective strategies when attempting a new task.
(iv) They employ unsystematic problem solving strategies when tackling a task or frequently change their approach without allowing time for one strategy to bear fruit. They stick to a single strategy and do not try a different approach when it is unsuccessful.
(v) They do not seek help appropriately when faced with a difficulty.
(vi) They work at very slow pace losing track of what they are doing.
(vii) They race through their work making many careless mistakes without noticing that there are errors.
(viii) They are frequently off task and take avoidance action such as making frequent trips to the toilet or interfering with other children.
(ix) When working with others on a joint task, they adopt a passive role, contribute little to any discussion or wait for others to take the initiative and then follow.
(x) They adopt a defeatist or hostile attitude when working in Mathematics.

2.7.4 Summary

The literature reviewed both international and local generally revealed gaps to be filled in the teaching-learning of Mathematics in Secondary Schools. The following gaps were identified:

- Need for better methods of teaching Mathematics.
- Challenging mathematical vocabulary to learners.
- Deficiencies in mathematical knowledge amongst teachers.
- Low teacher expectations on their learners.

Most studies done in Kenya were on reasons for poor performance in Mathematics, no studies had been conducted on barriers to teaching-learning of Mathematics. Thus, the study was specifically meant to bring to board barriers to teaching-learning of Mathematics in secondary schools in Masaba South district, Kisii County.
3.0 CHAPTER THREE

RESEARCH METHODOLOGY AND DESIGN

3.1 Introduction

This chapter discusses the location, design, population, sampling, research instruments, piloting, validity, reliability, data collection, data analysis and ethical issues on research.

3.2 Research Design

Orodho (2009), defines research design as all the procedures selected by a researcher for studying a particular set of questions or hypotheses. In a wider sense it is a programme to guide the researcher in collecting, analyzing and interpreting observed facts. The study employed a descriptive survey design to collect information of the perceived barriers to teaching-learning of Mathematics from the sampled population. Rosier (1980), observed that the descriptive survey research involves the collection of information from members of a group of students, teachers or other persons associated with the educational process. Thus, my target respondents were principals of schools, Mathematics teachers and students. Survey method was preferred for the study because it is the most frequently used method for collecting information about people’s attitudes, opinions, habits or any of the variety of education or social issues.

3.3 Location of the Study

The Study was conducted in Masaba South District, Kisii County. The choice of the area was based on the fact that the district comprised schools which performed poorly in Mathematics examinations as shown in Masaba District Joint Evaluation Test, 2009. Also the researcher had professional interest in the development of quality education in Masaba South because most of
the schools were newly established through community development initiatives. The schools had a socioeconomic mix of students, with very few students from working class parents of which majority were teachers. Most of the students hailed from poor families with parents of very limited education background and incomes below the poverty line. Masaba South is purely a rural setting with small scale farming as a main economic activity.

3.4 Population

Orodho (2009), defines population as including all people or items with the characteristics one wishes to understand. Thus, principals, Mathematics teachers and form three students were chosen as respondents to the study on barriers to teaching-learning of Mathematics in secondary schools in Masaba South. The district comprised 39 secondary schools, 39 principals, 67 Mathematics teachers and 2400 form three students.

3.5 Sampling

Sampling is the process of selecting a sub-set of cases in order to draw conclusions about the entire set (Orodho, 2009). The study used simple random sampling to determine the sample schools and teachers to be included in the study. Simple random sampling is the process of selection from a population that provides every sample of a given size an equal opportunity of being selected. The lottery technique was used to determine the form three students to be included in the study. Simple random sampling was preferred for the study because it permits the researcher to apply inferential statistics to the data. Inferential statistics enable the researcher to make inferences about population based on the obtained sample values. According to Ader, Mellenbergh and Hand, (2008) the researcher rarely surveys the entire population for two reasons: the cost is too high and the population is dynamic in that individuals making up the population may change over time. The two main advantages of sampling are: (a) data collection
data is categorized into related topics, major themes identified and a summary report developed using the major themes and associations between them.

3.10 Ethical Issues on Research

Ethical issues on research such as confidentiality, anonymity and informed consent were addressed before conducting the study. The participants were assured that information was to be kept confidential and used only for the purposes of research and no undesirable persons were to access the data collected. This was to protect the participants from victimization or public embarrassment of identifying with the information given to the researcher. To address the issue of anonymity, the researcher ensured that participants would not reveal their identity on the research instruments. Informed consent was achieved by providing respondents with explanations of the study, and an opportunity to terminate their participation at any time with no penalty. Finally, respondents were not coerced into participating in the study.
4.0 CHAPTER FOUR

DATA ANALYSIS, PRESENTATION OF FINDINGS AND DISCUSSION

4.1 Introduction

The purpose of the study was to examine barriers to the teaching-learning of Mathematics in Secondary Schools in Masaba South district Kisii County. This chapter presents the results of the study and discussions of the study findings on the basis of objectives and research questions. Descriptive statistics were used for the analysis of the data collected. Findings were presented as tables, Pie charts; bar graphs and percentages.

4.2 Background Information

This section covers the gender distribution of the respondents and type of schools studied.

4.2.1 Gender Distribution

The sample of students selected for the study, constituted 720 form three students, 360 (50%) male and 360 (50%) female. The population of female students almost tallied with that of male students. This scenario must have been like so due to the influence of UNESCO on Education For All (EFA), which focuses on, achievement of gender equality in education by 2015, with emphasis on ensuring girls’ full and equal access to and achievement in basic education. This had led to an increased number of girls accessing secondary education as boys in Masaba South district as a result of subsidizing of secondary education by the government. This made it possible for girls who could otherwise drop out of school because of early pregnancies or parental biases favoring educating boys as opposed to the girl child continue schooling.
Subsidized secondary education paved way for male students to continue with secondary education successfully in Masaba south district.

The study sampled 20 (30%), Mathematics teachers; 12 (60%) male and 8 (40%) female who responded to the teacher questionnaires (TQ). This is further shown in the Figure 2. The study found the percentage of female Mathematics teachers was small compared to that of male counterparts. The study revealed through interviews with principals of schools that this scenario was a consequence of stereotypical perception that Mathematics being a tough subject, was not meant for female. Thus, girls suffered more discrimination in terms of career choice as they were guided by some teachers to go for careers which did not require much of Mathematics, consequently resulting to less female teachers for Mathematics in the district as seen in Figure 2.

Figure 2: Gender Distributions of Teachers

Source: Teacher Questionnaires in the Study
The perception that boys are better than girls in Mathematics had affected teaching-learning of Mathematics in the district, resulting to low achievements of female students in the subject. These findings were similar to those of Elimu Yetu Coalition (2003), who found that women in Africa suffer discrimination in education. A study conducted by Githua (2002), in Nairobi province and three districts of rift valley province, also revealed that stereotypical perceptions make boys feel superior to girls in studying what is regarded as tough subject. Further, Lee and Lockheed (1990), who conducted a study in ninth grade, in Nigerian public schools, which measured mathematics performance and stereotypical views of Mathematics, found that, girls in single-sex schools had a less stereotypical view of Mathematics. Nwosu and Omeje (2008), reported that girls are likely to be disadvantaged in a mixed-sex school environment. Thus, in my opinion, single-sex schools were appropriate for the district, as this would improve learning atmospheres for teaching-learning Mathematics, free from discrimination and stereotypes leveled against girls. In addition, there was need for gender-sensitive curricula and pedagogies in the schools in order to achieve good-quality teaching-learning in Mathematics.

4.2.2 Types of Schools Studied

The study sampled twenty (53%) schools out of 39 schools in the district. Eighteen (90%), were mixed day schools and two (10%), were boarding schools. The boarding schools were one for boys and one for girls. These were the only boarding schools in the district. The representation is expressed further in the Figure 3.
Source: Teacher’s Questionnaires in the Study

The study found that 90% of the schools were mixed day schools. Students attending day schools were bogged down with daily chores once they arrived home and did not find regular study periods and thus had little or no time to do assignments or read Mathematics on their own. In addition day schools lacked adequate learning facilities such as Mathematics textbooks, as majority were recently established. The findings of the study agree with studies conducted by Education Insight (2005) in Kenya which revealed that inadequate learning facilities are a common feature in many secondary schools. Yeya (2002), agreed with the above studies that schools with adequate facilities perform better in national examination especially in core subject such as Mathematics. However, facilities alone cannot count, other factors such as teachers’ experience, students’ attitudes and school status matter.
improving the performance of Mathematics as girls learning styles tend to differ from those of boys. The findings agree with a study conducted by Tumbo, Martin and Maundu (1991) which revealed that those students who had attended single sex schools had a more positive attitude than those who had attended mixed schools. Similarly, studies conducted by Bosire, Mondoh and Barmao (2009), in Nakuru district Kenya revealed that streaming students based on gender improved overall student achievements in Mathematics and especially that of girls. The study found this was missing in Masaba south district as 99% percentage of the mathematics classes were streamed according to mixed gender. In such learning environments female students become more reserved especially during problem solving phase inhibiting proper teaching-learning of Mathematics. Additional approaches that may bridge the gap between the sexes in learning Mathematics may include: using cooperative learning; praising both sexes for their responses and gender responsive training for the Mathematics teachers as also recommended by Forum for African Women Educationalists (FAWE), (2001).

4.2.3 Teaching Experience of the Mathematics Teachers

The teaching experiences of the Mathematics teachers are shown in Table 4.1. As shown in the table, 55% of the Mathematics teachers had a teaching experience of between two and five years. Those with teaching experience, six to ten years, eleven to twenty years and twenty one to thirty years all equalized at ten percent (10%). However, 15% of the teachers had a teaching experience of less than one year. It was evident that majority of the Mathematics teachers (70%) had a teaching experience of less than five years. This indicated that the teachers were recently employed and this might have been the reason for low achievements in Mathematics. Thus the teachers needed INSETs in the teaching-learning of Mathematics in order to equip them with knowledge and skills about the subject.
Table 4.1: Teaching Experience of the Mathematics Teachers.

<table>
<thead>
<tr>
<th>Teaching Experience of Mathematics Teachers</th>
<th>Number of teachers</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 1 year</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>2-5 years</td>
<td>11</td>
<td>55%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>11-20 years</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>21-30 years</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>20</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Teacher’s Questionnaires in the Study

Studies conducted in Ondo State Nigeria by Adeyemi (2008) to determine the relationship between teacher experience and students’ performance in Mathematics found that teacher experience and competence were the prime predictors of students’ performance in all subjects. Ma (1999) reported teacher knowledge of Mathematics may increase student performance in the subject. Similarly Jones (1997) observed that teachers are a key input and force to reckon with in school. Sweeney (1998) made similar observation about schools in Mississipi and USA that scored better in Mathematics were taught by teachers with more years of teaching, considering the common saying that experience is the best teacher. Thus, the Mathematics teachers in Masaba south require regular in-service training in order to equip them with skills in teaching Mathematics this may enhance teaching-learning of the subject hence improved student performance.
4.2.4 Professional Qualification of Mathematics Teachers

The professional qualification of the mathematics teachers sampled is as tabulated in Table 4.2.

Table 4.2: Professional Qualification of Mathematics Teachers

<table>
<thead>
<tr>
<th>Professional qualification</th>
<th>Number of teachers</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Masters</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Bachelor of Education (B.ED)</td>
<td>15</td>
<td>75%</td>
</tr>
<tr>
<td>PGDE</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Diploma</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Untrained</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>20</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Source:** Teachers Questionnaires in the Study

The Table 4.2, shows that 15 (75%) of the Mathematics teachers sampled had bachelor of education qualification, 3 (15%) were diploma holders while two teachers comprising 10% were untrained. None had a master’s degree or a post graduate diploma in education. The fact that there were 10% untrained teachers in the district reported a problem of lack of enough qualified mathematics teachers. The shortage affected teaching-learning of the subject in the district and hence low student performance in the subject. These findings agree with studies carried out in Singapore by Kaur (2004) to determine the relationship between teacher quality and student performance in Mathematics which revealed that, there exist a strong relationship.
3.0 Barriers to the Teaching –Learning of Mathematics

The first objective of the study was to identify barriers to the teaching-learning Mathematics.

The findings from the form three students who were asked to identify barriers to the teaching-learning of Mathematics in their schools were as shown in the Figure 4 below.

Figure 4: Students’ Responses on Barriers to Teaching –Learning of Mathematics.

Source: Student Questionnaires in the Study

The Figure 4 shows that 71% of the students reported that Mathematics vocabulary was a barrier to teaching-learning of Mathematics against 29% of the students who felt this was not a barrier. A shocking figure 93%, of the student reported lack of confidence and perseverance in calculating Mathematics problems was a barrier as opposed to 7% who reported that this was not a barrier. On the other hand, 80% of the learners indicated that poor reading culture was a barrier in teaching-learning of Mathematics compared to 20% who reported that this was not a barrier. A large percentage of students 94% reported that negative attitude of the learners toward the
subject was a barrier to teaching-learning of the subject against 6% who reported that this was not a barrier. The responses of students somehow tallied with those of teachers.

The Mathematics teachers identified and reported the following barriers with percentage of teachers reporting each shown: poor pedagogy 60%, Mathematics vocabulary 80%, low teachers’ expectations and attitudes on the learner 55%, poor reading culture of the learners 50%, the mathematics teachers’ knowledge and subject competencies 45% and negative attitude of the learners towards the subject 50%. Method of teaching, teachers’ expectations and attitudes to learners, mathematics teachers’ knowledge and subject competencies and learners’ attitudes will be discussed ahead under other objectives of the study. Under this objective, mathematics vocabulary and sitting arrangements of students are discussed.

4.3.1 Mathematics Vocabulary

From the findings 71% of the students reported that mathematics vocabulary was a barrier to teaching-learning of Mathematics. This was confirmed by 80% of the teachers who reported that mathematics vocabulary is a barrier to teaching-learning of Mathematics to a large extent. The students cited terms like conjugate, Mantissa and surd to be hard to comprehend thus making Mathematics difficult to learn. The study found mathematics vocabulary a barrier to teaching-learning of the subject in the district, it was possibly one of the factors contributing to low achievements in the subject. Mathematics vocabulary instruction is needed to help students build background knowledge that students need in Mathematics. The findings of the study were similar to those of Snow (2002) who reported that vocabulary instruction is one of the essential elements of a student’s academic development. Although commonly associated with language arts, vocabulary proficiency is a significant contributing factor in learning and mastering mathematical concepts. Similarly, Marzano (2004) found that teaching academic vocabulary
could positively influence standardized test scores by as much as 33%, also Gifford and Gore (2008) found that under performing Mathematics students who received vocabulary instruction showed standardized test gain as high as 93% supporting Marzano’s findings. This study proposes mathematics vocabulary instruction for school in the district for a better teaching-learning of Mathematics.

4.3.2 Sitting Arrangement of Students

On another note, 82% of the mathematics teachers acknowledged that sitting arrangement enhances the learning of Mathematics while 18% of the teachers never thought so. When asked if they mind of sitting arrangement of the students while teaching Mathematics in class the teachers responses were as shown in the Table 4.3.

Table 4.3 Teachers’ Responses on Sitting Arrangement of Students in the Mathematics Class

<table>
<thead>
<tr>
<th>Response</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>8</td>
<td>40%</td>
</tr>
<tr>
<td>Some lessons</td>
<td>6</td>
<td>30%</td>
</tr>
<tr>
<td>Most lessons</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Every lesson</td>
<td>3</td>
<td>15%</td>
</tr>
</tbody>
</table>

Source: Teacher Questionnaires in the study

From the Table 4.3, 40% of the Mathematics teachers never minded of the sitting arrangement of their student in the mathematics class and yet 82% of the teachers acknowledged that sitting arrangement of students influences the teaching-learning of Mathematics, thus it may be implied that negligence of minding about the sitting arrangement of students in mathematics class...
constitutes a barrier to teaching-learning of the subject. The responses of the Mathematics teachers were confirmed by 504 (70%) of the students who reported that the sitting arrangement in class influences how one learns Mathematics and 525 (75%) of the students reported that they decided by themselves who they sit with in the mathematics class while 175 (25%) of the students reported that the teacher decided who they sit with during the mathematics lesson. The study found that proper sitting arrangement in the Mathematics class were missing, this hindered effective teaching-learning of Mathematics in the district thus low achievements in the subject.

Sitting according to mixed ability enhance learning through group discussion and teamwork, however, it is important to realize that boys and girls have different learning needs, and teachers need to take this into account when creating learning environments in the mathematics classroom. Studies conducted by Owens and Straton (1980) found that boys prefer competition and are individualistic. They also may want to answer more mathematical questions than girls. On the other hand, girls may prefer cooperation, open-ended and organized activities. Thus, the Mathematics teacher can apply these different preferences in their teaching methods by assigning the female students to assignments that require cooperation and the male students to more individual assignments. More of this attention should prevail in mixed schools. Similarly, a study conducted by Sullivan et.al (2007) reported that by instituting seating plans, Mathematics teachers can ensure students academic and social needs are met therefore improving students learning through positive discussion and help-seeking.

4.4.0 Identification of the Main Methods of Teaching Mathematics

The second objective was to identify the main methods of teaching Mathematics. The study had the following findings; 12 (60%) of the teachers used lecture method frequently, 6 (30%) of the teachers reported that they used the lecture method sometimes and 2 (10%) of the teacher rarely
used the lecture method for instruction. On the other hand, 65% of the teachers reported that they rarely used small-group method of instruction while 20% of the teachers reported that they used it sometimes and 15% of the teachers used the method frequently.

Nine teachers, representing 45% rarely used peer-tutoring teaching strategy, only 35% of the teachers used the method sometimes and 20% of the teachers reported to be using the method frequently. Further the study, found that 10% of the teachers used co-operative learning strategy frequently, 40% of the teachers used the strategy sometimes and a large 50% of the teacher rarely used co-operative learning strategy. The findings are as illustrated in Table 4.4.

Table 4.4 Main Instructional Methods Used by Teachers

<table>
<thead>
<tr>
<th>Instructional method</th>
<th>Frequency of using the method in percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequently</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>N = 20</td>
<td></td>
</tr>
<tr>
<td>1. Lecture Method</td>
<td>12 (60%)</td>
</tr>
<tr>
<td>2. Small-group</td>
<td>3 (15%)</td>
</tr>
<tr>
<td>3. Peer-tutoring</td>
<td>4 (20%)</td>
</tr>
<tr>
<td>4. Co-operative learning</td>
<td>2 (10%)</td>
</tr>
</tbody>
</table>

Source: Teacher’s Questionnaires in the Study
The findings on the main methods of teaching Mathematics was confirmed by students through their questionnaires whereby 357 students representing 51% of the sampled population reported that the Mathematics teachers mostly used lecture method to teach Mathematics. Two hundred and seventeen students, representing 31% reported that the Mathematics teachers used group work and a meager percentage of 18%, indicated that peer tutoring strategy was used by their Mathematics teachers. The Table 4.5 below reports further on frequency of activities in the Mathematics lesson;

Table 4.5: Frequency of Activities in the Mathematics Lesson

<table>
<thead>
<tr>
<th>Frequency of activities in the Mathematics lesson</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Very often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Student assist another student in solving mathematics problems</td>
<td>72</td>
<td>454</td>
<td>137</td>
<td>58</td>
</tr>
<tr>
<td>2) A student seeks assistance from another student in solving mathematics problem</td>
<td>151</td>
<td>403</td>
<td>108</td>
<td>58</td>
</tr>
<tr>
<td>3) Student seeks assistance from another student in solving mathematics problem</td>
<td>280</td>
<td>310</td>
<td>79</td>
<td>65</td>
</tr>
<tr>
<td>4) Mathematics teacher lets a student to the blackboard to solve problem</td>
<td>274</td>
<td>295</td>
<td>94</td>
<td>58</td>
</tr>
</tbody>
</table>

Source: Student Questionnaires in the Study
From the Table 4.5, it is clearly reported that 8% of the students assisted other students in solving mathematics problems very often, 19% of the students assisted often and a large percentage 63% only assisted other students sometimes while 10% rarely assisted other students in Mathematics. Those students who sought assistance from other students very often and often were reported to be 8% and 15% respectively while 56% percent of the students sought assistance from other students sometimes and 21% of the student rarely sought assistance from other students.

Table 4.5, further show that 9% and 11% of the students did class assignments in groups very often and often respectively while 43% and 37% of the students reported to do class assignments in groups sometimes and rarely respectively. Further, 38% of the students reported that rarely did the Mathematics teacher let them go to the blackboard to solve a mathematics problem. Only 41% of the students reported that they solved problems on the blackboard sometimes, while 13% and 8% are allowed by the Mathematics teacher to solve problems on the blackboard oftenly and very oftenly respectively. All the above findings testified that the involvement of students in either assisting each other or peer teaching was low. Perhaps this was a reason for poor performance in Mathematics in the district. It was evident from the findings of this study that lecture method was the main method used by the Mathematics teachers in the district, this was assumed a barrier to the effective teaching-learning of Mathematics as lecture method is teacher centered and thus does not provide opportunities for learners to interact and exchange ideas. Lecture method also converts learners into a passive audience.

The findings of the study are similar as those of Slavin (1990) and Marzano et.al (2001), who found using instructional approaches that emphasize the use of group work can help support learning in Mathematics better than traditional instructional methods and can raise overall
achievements of learners in Mathematics. Small group instruction is important as it gives students the opportunity to interact and increase participation. The method allows students to share ideas and skills learned. Students learn by explaining why the answer is wrong and help the other students see how to get to the correct answer. Peterson et.al (1984) found that small group learning and co-operative learning are effective to the whole class instruction. Corno and snow (1986) in their study on effects of co-operative learning reported that low ability students performed better in co-operative learning and high achievers also benefits from this form of instruction. Cooperative learning reduces class disruptions as students are allowed to socialize during the learning process. The method also builds diversity awareness among students as the method encourages students to use their differences to help each other.

Peer-tutoring has advantages when used. First, learners get additional practice in the skills they have not mastered. Second, students are influenced through observational learning by what they see their peer doing. Third, learner is often less intimidated by a peer than the teacher. Finally, a peer is able to explain solutions to mathematics problems in a way that the teacher could not and that it is easier for the tutored person to understand because there are more commonalities between the tutor and the one being tutored.

Hence, group work; peer-tutoring and co-operative learning may be appropriate instructional methods for the Mathematics teachers in the district as opposed to the lecture method which they mainly used. However, the methods require motivational activities organized by the Mathematics teacher which is a challenge.
4.4.1 Students' Views about Mathematics

The third objective was to determine the students’ views about mathematics. The findings revealed, 641 (89%) of the students don’t like solving problems of Mathematics on their own whereas 77 (11%) of the students like solving problems of Mathematics on their own. When asked whether they could like to pursue a career involving Mathematics in future 662 (92%) of the students said yes and 58 (8%) of the students reported no. Further, 88% of the students reported that they don’t read Mathematics at home during their free time, only 12% of the students who reported otherwise. A large percentage, 93% of the students believed that people are not born knowing Mathematics but Mathematics is learnt. A meager, 7% of the students believed that people are born knowing Mathematics. On another note, 88% of the students reported that male students were better than female students in Mathematics only 12% of the students denied that male were better than female student in Mathematics. When asked whether a family member had ever passed in Mathematics, 14% of the students reported that no family member had ever passed in Mathematics and 96% reported that family members had passed in the subject. Similarly, 93% of the students reported lack of confidence and perseverance in calculating mathematics problems (a product of negative attitude) and 80% of the students believed that Mathematics is for the intellectually strong. The above findings revealed, even if majority of the students could like to study careers involving Mathematics in future, their reading culture was poor as they don’t solve mathematics problems on their own during their free time nor do they read Mathematics back at their homes. This indicated lack of commitment and negative attitude towards the subject. Further the study found that students suffer from stereotypical perceptions that Mathematics is meant for male not female. The reason for such gender stereotype may be, was because of lack of role models especially for girls given that the
number of male mathematics teachers was more than that of female mathematics teachers, see the Figure 2. This had an implication that quite a number of the schools didn’t have completely female mathematics teachers. This impacted negatively on the girls who had conceived a perception that Mathematics is meant for male. The study assumed that male students were more impacted by male role models whereas girls had few role models to learn from. Girls observing a female teacher demonstrating mathematical excellence help to potentially raise the girl’s self efficacy (Pajares and Miller 1994). Gender beliefs can influence a student’s identity and liking of Mathematics.

Stereotypical perception makes boys feel superior to girls in studying what is regarded as tough subject (Githua, 2002). Such a situation presupposes that the mixed-sex school environment is likely to inhibit the performance of girls in Mathematics. Perhaps this was a barrier to the teaching-learning of Mathematics in the secondary schools in the district given that almost all schools were day mixed schools except two boarding schools one for boys and another for girls (see Figure 3). Cohen et.al (2006) found that stereotypical threats lead to negative effects on motivation in a subject. Similarly, a study conducted by MCGrav-hill (2005) found that myths about Mathematics dictate the student’s attitudes towards Mathematics. Attitude towards Mathematics may be influenced by peers, parents and other members of the family or school. The study found that special interventions, like forming of the mathematics clubs in every school and creating of more single sex schools for each gender are were urgently required.

### 4.4.2 Professional and Academic Preparation of Mathematics Teachers

The fourth objective of the study was to find out the professional and academic preparation of the Mathematics teachers. Table 4.2 shows 15 (75%) of the Mathematics teachers sampled had Bachelor of Education qualifications, 3(15%) were diploma holders while two teachers.
comprising 10% were untrained. Of the teachers sampled none had a master’s degree or a post graduate diploma in education.

The findings on teaching experience of the mathematics teachers were; 15% had a teaching experience of less than one year, 55% had a teaching experience 2-5 years, 10% had an experience of 6-10 years, 11-20 years and 21-30 years respectively see Table 4.1. From the findings it was clear that although majority of the Mathematics teachers were professionally qualified they had less teaching experience in terms of years. The scenario was like this because most schools had been newly established thus attracted newly employed teachers by the TSC.

A report from 90% of the principals interviewed indicated absence of school level in-servicing of the mathematics teachers. Only 10% of the principals reported having the school level in-servicing of mathematics teachers. However, 85% of the principals reported that some mathematics teachers had been in-serviced in SMASSE in-service training organized at the district level. Eight five per cent (85%), of the mathematics teachers reported that Mathematics was their favorite teaching subject while 15% denied that Mathematics was their favorite teaching subject. When asked if they could competently teach all the topics in Mathematics, 60% of the teachers reported that they were confident in teaching all the topics in Mathematics while 40% reported that there were some topics they could not teach competently. Some of those topics include Matrices and Transformations, Probability, Loci, Rotation, Reflection and Congruence and linear programming. When asked the way forward the teachers suggested regular in-servicing of teachers on the topics in the Mathematics curriculum. Lack of regular in-service training of the Mathematics teachers was cited by 70% of the principals as a barrier to proper teaching-learning of Mathematics in their schools. The same was reported by 45% of the Mathematics teachers.
Teacher knowledge is crucial for removing teaching-learning barriers to Mathematics by improving teacher delivery in class. Lack of INSETs can inhibit teachers from making instructional changes in Mathematics. Monk (1994), asserts that mathematics teachers’ subject matter expertise increases student learning gains. He also found mathematics pedagogy courses contributed to students’ achievement as was the match of teachers’ experience to the classes they taught. Similarly studies conducted by Newmann and Associates (1996) and Secada and Adajian (1997) claim that a strong professional community of Mathematics educators provides the capacity for improving instruction and ultimately for enhancing student learning. Professional development may contribute to teachers’ knowledge, skills and dispositions. When serious professional development is based in a school, it may help establish many of the features of the professional community, including collaboration, shared values, practices and reflective discussions about student learning. Thus, profession development has potential for building a school’s capacity to create change in teaching-learning of Mathematics (Darling-Hammond and Mclaughlin, 1996; Tharp and Gallimore, 1988) Professional competence is believed to be a crucial factor in classroom and in school practices (Shulman, 1987).

A study conducted by Ma (1999) reported that professional development focused on increasing teacher knowledge of Mathematics may increase student performance in the subject. Similarly stodolsky and Grossman (2000) reported that teachers need access to new knowledge and support as they embark upon instructional practices. Also Harbison and Hanushek (1992) found that teacher subject matter competence was the best predictor of students’ mathematical achievement in rural northeast Brazil. Thus teachers’ knowledge and professional development are crucial factors for proper teaching-learning of Mathematics. Similarly, Otieno (2010), in a study looking at the effects of teaching/learning resources on academic performance in
secondary school Mathematics in Bondo district, Kenya recommends in-servicing of trained Mathematics teachers. However, good instruction, of course is not determined just by teachers’ background knowledge, professional development, beliefs and attitudes it should also be responsive to students’ needs and various student, classroom and school background factors for example class size, school status and language background. School climate, ethos and culture directly and indirectly affect student learning. From the findings adequate in-servicing of the mathematics teachers was missing and thus a barrier to proper teaching-learning of Mathematics. Mathematics teaching at any level requires that teachers have an extensive knowledge of Mathematics, including the specialized content knowledge specific to the work of teaching, as well as knowledge of the Mathematics curriculum and how students learn.

4.4.3 Mathematics Teachers' Expectations on Learners

The fifth objective was to establish the effect of teachers’ expectations and attitudes towards learners in the teaching-learning of Mathematics. Responses of the Mathematics teacher on the students’ achievements in Mathematics are as shown in the Figure 5. The study found that, 55% of the teachers reported low expectation of their learners’ achievements in Mathematics while 35% and 10% reported moderate and high expectations on their learners respectively. Many Mathematics teachers claimed to treat boys and girls equally in the mathematics classroom but in practice their attitudes often reflected subtle biases. Almost all the teacher respondents (93%) agreed that boys and girls should receive equal treatment in mathematics classrooms. However, these findings about teachers’ beliefs and expectations were not consistent with the stereotypical behavior of many who expected lower performance in Mathematics from girls than boys.
Boys generally enjoyed more challenging interactions with their Mathematics teachers, dominated classroom activities and received more attention than girls. The low expectations influence negatively the efforts the Mathematics teachers put in teaching the subject and hence poor result of the learners in the subject. A study conducted by Romberg (1984) reported teachers with low expectations of their learners’ achievement will most likely teach remedial skills and not more on advanced concepts. Similarly on the same note Zohar et.al (2001) argued only if teacher set high expectations by engaging students in challenging mathematics, can students be expected to learn more challenging mathematics. These two findings agreed with the findings of this study that majority of the Mathematics teachers’ in Masaba district had low expectations of their learners’ achievement in Mathematics thus students were not learning challenging problems in Mathematics. Low expectations had constituted a barrier to teaching-
learning of the subject—no wonder the dismal performance of the subject in the district.

Teachers’ expectations can be raised by involving teachers in investigation of the students work and formation of Mathematics clubs in every school in which teachers will oversee the students share ideas through discussions of Mathematics problems.
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of the study was to examine the barriers to the teaching-learning of Mathematics in secondary schools in Masaba south district, Kisii County. This chapter presents a summary of the major research findings, conclusions, recommendations of the study and suggestions for further research.

5.2 Summary of the Findings

The study found out the following as barriers to teaching-learning of Mathematics:

- Poor method of teaching the Mathematics teachers used to teach the subject as this was revealed by 60% of the Mathematics teachers and confirmed by 51% of the students. The teachers in the district mainly used the lecture method in teaching Mathematics.

- Low Mathematics teachers expectations on the learners’ achievements was the other barrier found. Fifty five percent (55%) of the teachers had reported low expectations that the students would achieve high grades in Mathematics. Studies conducted revealed low expectations of the Mathematics teachers’ determine the efforts put in teaching the subject. (low expectations of teachers are equated to low achievements of learners in Mathematics)

- Lack of regular in-service training of the Mathematics teachers was found to be a barrier to proper teaching-learning of Mathematics in the district, as was reported by 90% of the principals of schools. Most schools did not have school-based in-service training for Mathematics teachers. This denied the Mathematics teachers a chance to upgrade their
skills in pedagogy and more especially in using student centered methods and gender responsive teaching methodologies.

- Negative attitudes of the learners towards Mathematics was reported by 94% of the students and confirmed by 50% of the teachers as a barrier to teaching-learning of Mathematics. It was revealed a lot of this attitude has been influenced by myths and stereotypes about Mathematics.

- The sitting arrangement of learners in the mathematics class was also revealed as a barrier to teaching-learning of Mathematics. Eight two percent (82%), of the Mathematics teachers acknowledged that sitting arrangement enhance the teaching-learning of Mathematics but never minded how their students sat in the mathematics lessons leading to less of the group work, peer tutoring and co-operative learning in the subject.

- Finally, mathematics vocabulary was found to be a barrier to teaching-learning of Mathematics. This was reported by 80% of the teachers and confirmed by 71% of the students who reported terms like conjugate, surd and mantissa to be difficult for them to comprehend. It is important to note that words like hypothesis, parallelogram surd e.t.c are only used in mathematical English whereas other words are used confusingly with different meanings in mathematical English and ordinary English (e.g, Mean, product, odd).

5.3 Conclusion

The study found that teaching-learning of Mathematics was influenced by pedagogy used to teach the subject. Poor pedagogy like lecture method could lead to poor performance of learners in the subject. Low expectations of the Mathematics teachers on their learners, lack of regular in-
service training of the Mathematics teachers, poor sitting arrangements of learners in the mathematics class and lack of mathematics vocabulary instruction all posed challenges in teaching-learning Mathematics. Mathematics is an important subject as Science and Technology depend on it. In order for our country to achieve vision 2030, any barriers to the teaching-learning of the subject should totally be eliminated if we are to raise learners’ achievements in the subject.

5.4 Recommendations

Based on the study findings from the fieldwork and theoretical literature the study presents the following main recommendations:

i. Regular in-service training of the Mathematics teachers. The in-service training to be organized by the principals of schools in their respective schools or by the Ministry of Education in various centers in the district. School level organized INSETs may give opportunities for all Mathematics teachers to attend the in-service training and share ideas based on common interests.

ii. Mathematics teachers to use student centered methods of teaching like cooperative learning and peer tutoring. In addition, teachers to monitor the sitting arrangements of the students in every lesson. The study proposes students to sit in mixed ability arrangements in order to facilitate discussions of mathematics problems. Studies reveal, sitting arrangements influence teaching-learning Mathematics.

iii. The K.I.E to develop a mathematics vocabulary instruction curriculum. This can be done through dialogue with the Mathematics teachers as it is done in other countries. In addition to this, Mathematics teachers try to simplify the Mathematics vocabulary for the learners.
Setting up "Mathematics clubs" in every secondary school so as to develop a love for Mathematics and also develop positive attitudes towards the subject.

5.5 Suggestions for Further Study
The researcher suggests studies in areas that were closely related to the study but beyond the scope of the current study. The areas are:

i. Barriers in teaching-learning of Mathematics in other districts in order to allow comparison of the findings of those districts with the findings of this study.

ii. Influence of Mathematics teachers' attitudes on teaching-learning of Mathematics.

iii. Parents' contributions in effective teaching-learning of Mathematics.


Githua, B. N. (2002). Factors related to the motivation to learn Mathematics among secondary


- 82 -


Owens, L. and Straton (1980). The Relationships between Cooperative, Competitive, and Individualized Learning Preferences and Student Perceptions of Classroom Learning


APPENDICES

Appendix A: Research Permit and Authorization Letter

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss/Institution
Victor Morara Oisebe
Of (Address) Kenyatta University
P.O BOX 43844, Nairobi

has been permitted to conduct research in

Location
District
Province

Masaba South
Nyanza

On the topic: Barriers to teaching-learning of Mathematics in secondary schools in Masaba South District, Kisii County, Kenya

Research Permit No. NCST/RRI/12/1/SS011/1
9th November, 2011
Fee received
KSHS.1,000

Applicant’s Signature

Secretary
National Council for Science and Technology
RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Barriers to the teaching-learning of Mathematics in secondary schools in Masaba South District, Kisii County, Kenya” I am pleased to inform you that you have been authorized to undertake research in Masaba South District for a period ending 31st January, 2012.

You are advised to report to the District Commissioner & the District Education Officer, Masaba South District before embarking on the research project.

On completion of the research, you are expected to submit one hard copy and one soft copy of the research report/thesis to our office.

P. N. NYAKUNDI
FOR: SECRETARY/CEO

Copy to:
The District Commissioner
Masaba South District

The District Education Officer
Masaba South District

Date: 9th November, 2011

P. N. NYAKUNDI
FOR: SECRETARY/CEO
Appendix B: Consent Letter.

Dear Respondent;

The purpose of this study is to help understand barriers to the teaching-learning of Mathematics in secondary schools in Masaba South District, Kisii County. Please answer all the questions in the study. All information you give will be useful for the purposes of the study. In the interview you will be asked to give your opinion based on the research questions. The information gained from the interview will be reported, anonymously, in the study report. Your identity will be kept confidential while reporting the results. The name of your school will not be mentioned. Do not write your name or TSC number on any instrument used by the study. Your privacy is absolutely confidential. The data collected from the interviews and questionnaires will be safely guarded and locked under lock and key.

Participation in the study is entirely voluntary. If you agree to participate in the study, you can withdraw without giving reasons, simply by letting me know your wish to withdraw. If you have any queries or would like to know the findings of this study later, please contact me using the mobile number or address provided below.

Yours faithfully,

Oisebe M. Victor

Mobile number: 0728320629

Box 3594, Kisii-Kenya
**APPENDIX C:**

**QUESTIONNAIRE FOR MATHEMATICS TEACHERS**

**SECTION A: Background Information**

Tick (✓) in the spaces provided below.

1. What is your gender?  
   - Male □  
   - Female □

2. What is your age bracket?  
   - 20-30 Yrs □  
   - 31-40 Yrs □  
   - 41-50 Yrs □  
   - Over 50 Yrs □

3. What is your professional qualification?  
   - Masters in Education □  
   - Bachelor of Education □  
   - Post Graduate Diploma in Education □  
   - Diploma in Education □  
   - Untrained □

4. What is your teaching experience in years?  
   - Below 1 Yrs □  
   - 2-5 Yrs □  
   - 6-10 Yrs □  
   - 11-20 Yrs □  
   - 21-30 Yrs □  
   - Over 30 Yrs □

5. Is your school (a) Day □ or Boarding □?  
   (b) Boys □ Girls □ Mixed □?
6. The following are the perceived barriers to the teaching-learning of Mathematics in secondary schools. Indicate with a tick (✓) the extent it is applicable to your school.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Not at all</th>
<th>Small extent</th>
<th>Large extent</th>
<th>Very large extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Negative attitudes of learners to the subject.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Mathematics vocabulary terms like conjugate, surd independent and dependent variable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Teachers' attitude towards the subject.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. Teachers' knowledge/competence in subject.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v. Teachers' expectations on the learner's achievements.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vi. Myths and stereotypes about the subject e.g. Mathematics is for those who have Mathematics mind and boys perform better in Mathematics than girls.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vii. Poor reading culture on the part of learners.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>viii. The use of scientific calculators.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ix. Poor method of teaching the Mathematics teacher uses.

x. Lack of Pre-service and In-service training on pedagogy for instruction.

xi. List any other barrier you encounter in the teaching-learning of mathematics.

SECTION C: Pedagogical Factors

7. The following are some of the instructional methods used to teach Mathematics. Please indicate with a tick (✓) whether you use the methods frequently, sometimes or rarely

<table>
<thead>
<tr>
<th>Method</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Rarely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Small-group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Peer Tutoring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Cooperative learning</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. How often do you ask students to work on a problem with no obvious method?

Never [ ] Some lessons [ ] Most lessons [ ] Every lesson [ ]

9. How often do you ask students to explain reasoning behind an idea in Mathematics?

Never [ ] Some Lessons [ ] Most Lessons [ ] Every Lesson [ ]
**SECTION D: Curriculum Related Barriers**

10. The following are the perceived curriculum related barriers to the teaching-learning of Mathematics Tick (✓) if you Strongly Disagree, Disagree, Agree or Strongly Agree.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Lack of INSETs on implementation of the curriculum.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. An overloaded curriculum.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Lack of guidance on how to use Mathematics textbooks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. Teachers resistance to New Mathematics curriculum e.g. Mathematics Alternative B.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v. Lack of supplementary materials e.g. teaching aids.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vi. Lack of adequate planning for the lesson on the part of the teacher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION E: Teacher Knowledge Expectations and Attitudes**

11. Is Mathematics your favorite teaching subject? Yes ☐ No ☐

12. Are there topics in Mathematics that you don’t teach competently?

Yes ☐ No ☐
13. If Yes in number 12, list the topics below.

a. 

b. 

c. 

14. What do you propose to be done about the topics above?


15. How often do you teach the Form 4 class?

Rarely

Sometimes

Always

16. What was your KCSE mean score in Mathematics last when you taught the candidates class?

17. If you currently teach the candidates class, what is your expectation on student achievement in mathematics? Tick as appropriate.

Low

Moderate

High

18. Support your answer above


19. Does your class consist of weak students in Mathematics?

Yes

No

20. If yes in the above question, what do you do to ensure that they improve in Mathematics?


- 96 -
SECTION F: Organizational and Social Climate of the Mathematics Class

21. Do you mind of the sitting arrangement of students in the Mathematics class?
   Never □ Some lessons □ Most lessons □ Every lesson □

22. Does sitting arrangement of students in the Mathematics lesson enhance learning?
   Yes □ No □

23. Explain your answer in question (22)

24. Do your students seek help form others whenever you give a Mathematics problem to be solved in class?
   Yes □ No □

25. What should the administration (principal) do to enhance teaching–learning of Mathematics?

26. Suggest ways of raising student achievements in Mathematics?
APPENDIX D:

QUESTIONNAIRE FOR THE STUDENTS

SECTION A: Background Information

1. Write the name of your school ____________________________

2. What is your gender? Male ☐ Female ☐

3. In which class are you? ☐

SECTION B: Perceived Barriers to Learning Mathematics

4. Tick (✓) as appropriate to you in the following statements

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Mathematics vocabulary like conjugate, surd, mantissa, independent and dependent variable are hard to comprehend thus making Mathematics difficult to learn.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Lack of confidence and perseverance when solving Mathematics problems leads to low achievements in the subject.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Poor reading culture in Mathematics is a barrier to learning Mathematics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. Negative attitude towards Mathematics leads to low achievement in the subject</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Write any other barriers (obstacles) you encounter in learning Mathematics.

i. ________________________________________________

ii. ________________________________________________
6. Which method does the Mathematics teacher use mostly to teach Mathematics? Tick (√)
   
   i. Lecture method
   
   ii. Group work
   
   iii. Peer tutoring

7. In the following statements indicate the frequency by a tick (√) as appropriate to you

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. I assist another student solve Mathematical problem(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. I seek assistance from another student in solving Mathematics problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. We do class assignment as a group.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. My Mathematics teacher lets me go to the blackboard to solve a problem</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Do you complete Mathematics assignments in time? Tick (√)
   
   Yes [ ] No [ ]

9. Does the Mathematics teacher mark class Assignments? Tick (√)
   
   Yes [ ] No [ ]
10. Does the Mathematics teacher revise assignments with you? Tick (✓)

Yes [ ]  No [ ]

SECTION D: Attitudes about Mathematics

11. Do you like solving problems of Mathematics on your own? Yes [ ]  No [ ]

12. Do you wish to pursue a career involving Mathematics in future?

Yes [ ]  No [ ]

13. If Yes above, explain why:

____________________________________________________________________________________

____________________________________________________________________________________

14. Do you read Mathematics at home or during your free time?

Yes [ ]  No [ ]

If no above explain why:________________________________________________________________

____________________________________________________________________________________

15. Are you discouraged by your desk mate from solving Mathematics problems?

Yes [ ]  No [ ]

16. In the following statements, write whether it is True or False

i. Mathematics is meant for the intellectually strong

____________________

ii. Some people are born knowing Mathematics

____________________

iii. Male are better in Mathematics than Female

____________________

iv. No family member has ever succeeded in mathematics including my parents

____________________
SECTION E: Organizational and Social Climate of the Mathematics Classroom

16. Who decides who you sit with in class? Tick as appropriate.
   a) Class teacher □
   b) Parent □
   c) Myself □

17. Do you think the one you sit with influences how you learn Mathematics?
   Yes □
   No □

Explain your answer above

18. (i) Do you enjoy being taught Mathematics?
   Yes □
   No □

(ii) Explain your answer above

19. Give your own opinion on how teaching-learning Mathematics can be improved.

________________________________________________________________________

- 101 -
APPENDIX E:

PRINCIPALS’ INTERVIEW SCHEDULE

Section A: Background Information

1. Name of the school.
2. In which year was the school started?
3. What is the number of students in form I-IV?
4. How many Mathematics teachers do you have in your school?

SECTION B: Professional Qualifications of Mathematics Teachers

5. What are the professional qualifications of the Mathematics Teacher(s)?
6. Do you have school level In-servicing of Mathematics teachers?
7. Are any of your Mathematics teachers In-serviced in SMASSE INSETs?
8. Do the Mathematics teachers teach the subject competently? If not in what ways can the competencies be improved?

SECTION C: Barriers to Teaching-Learning Mathematics

9. What are the main barriers to teaching-learning Mathematics in your school?
10. Of the barriers identified which one has the greatest impact in teaching-learning of Mathematics?
11. What can be done to eliminate such barriers? Elaborate.

SECTION D: Pedagogy

12. Which methods do the Mathematics teachers commonly use to teach Mathematics?
13. Which teaching method is popular in teaching Mathematics in your school?

14. SECTION E: Attitudes about Mathematics

15. Do Mathematics teacher’s attitudes and expectations towards students influence learner’s achievement in Mathematics? Explain your answer.

16. What do you do to improve learner’s attitudes towards Mathematics?

SECTION F: Organizational and Social Climate

17. As the principal of the school, how do you support teaching-learning of Mathematics?

18. Are your students guided and counseled properly on learning Mathematics and its usefulness?

19. Do you educate the learners on how to encounter some of the barriers to teaching-learning of Mathematics?

SECTION G: General Questions

20. What was the mean in Mathematics for the last two years?

21. What affected the mean?

22. According to your opinion at one point can Mathematics top in terms of mean grade in your school?

23. What can be done to raise learner’s achievements in Mathematics?
# APPENDIX F:

## BUDGET FOR THE STUDY

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (Ksh.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling Costs in (Ksh.)</td>
<td>40,000</td>
</tr>
<tr>
<td>Typing and Printing</td>
<td>20,000</td>
</tr>
<tr>
<td>Binding</td>
<td>15,000</td>
</tr>
<tr>
<td>Photocopying</td>
<td>25,000</td>
</tr>
<tr>
<td>Packaging of Instruments (Questionnaires)</td>
<td>22,000</td>
</tr>
<tr>
<td>Miscellaneous Costs</td>
<td>18,000</td>
</tr>
<tr>
<td><strong>Total cost in Kenya Shillings.</strong></td>
<td><strong>140,000</strong></td>
</tr>
</tbody>
</table>
APPENDIX G:

TIMETABLE SCHEDULE

- Preparation of research instruments by 31\textsuperscript{st} July 2011.
- Issue of data collection instrument to schools by 12\textsuperscript{th} August 2011.
- Collection of questionnaires from schools by 19\textsuperscript{th} August 2011.
- Analysis of data, by end of 30\textsuperscript{th} December 2011.