AN INVESTIGATION INTO SOME OF THE FACTORS WHICH
INFLUENCE STUDENTS’ PERFORMANCE IN MATHEMATICS IN
PUBLIC SECONDARY SCHOOLS IN EMBU WEST DISTRICT,
EMBU COUNTY, KENYA

BY
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A THESIS SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL
COMMUNICATION AND TECHNOLOGY, IN THE SCHOOL OF EDUCATION
OF KENYATTA UNIVERSITY

AUGUST, 2013
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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We confirm that the work reported in this thesis was carried out by the candidate under our supervision

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To the Almighty God for His grace and favour upon me; to my dear husband, Harrison Njiru Mbaka who encouraged me and supported me financially.
ACKNOWLEDGEMENTS

First, I wish to thank most sincerely my academic supervisors at Kenyatta University, Dr. Miheko M. K-O’Connor and Dr. Maundu J. N., for their professional guidance, devotion and commitment to ensure that I succeed in completing the study.

I am greatly indebted to the entire staff of Educational Communication and Technology department. Specifically, I wish to thank Dr. Rukangu, Prof. Ayot, Dr. Khatete, Dr. Gitau, Dr. Kimui., Dr. Ondigi., under whose guidance I gained much knowledge in research methodology. I sincerely thank Mr Antony D. Bojana for editing the final work.

I am also grateful to the principals, teachers and students who in one way or another aided in giving data. I also sincerely appreciate and thank my husband for his understanding and the encouragement he accorded me during the study period.

Thanks and God bless you all.
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<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>ATS</td>
<td>Approved Teachers Status</td>
</tr>
<tr>
<td>B.ED</td>
<td>Bachelor of Education</td>
</tr>
<tr>
<td>CEE</td>
<td>Common Evaluation Examination</td>
</tr>
<tr>
<td>COS</td>
<td>Classroom Observation Schedule</td>
</tr>
<tr>
<td>DAS</td>
<td>Document Analysis Schedule</td>
</tr>
<tr>
<td>DEO</td>
<td>District Education Officer</td>
</tr>
<tr>
<td>KCPE</td>
<td>Kenya Certificate of Primary Education</td>
</tr>
<tr>
<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
</tr>
<tr>
<td>KIE</td>
<td>Keya Institute of education</td>
</tr>
<tr>
<td>LSD</td>
<td>Least Square Difference</td>
</tr>
<tr>
<td>KNEC</td>
<td>Kenya National Examinations Council</td>
</tr>
<tr>
<td>MoEST</td>
<td>Ministry of Education, Science and Technology</td>
</tr>
<tr>
<td>MTQ</td>
<td>Mathematics Teachers’ Questionnaire</td>
</tr>
<tr>
<td>NCTM</td>
<td>National Council of Teacher of Mathematics</td>
</tr>
<tr>
<td>PGDE</td>
<td>Post-Graduate Diploma in Education</td>
</tr>
<tr>
<td>SMASSE</td>
<td>Strengthening Mathematics and Sciences in Secondary Education</td>
</tr>
<tr>
<td>UT</td>
<td>Untrained Teacher</td>
</tr>
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Abstract

The research addressed the factors that could influence performance in Mathematics in public secondary schools in Embu West District. It aimed at determining the teacher, student and school-related factors that influence performance in mathematics in the district. The study adopted descriptive research design. The target population was mathematics teachers and Form Three students. Stratified sampling technique was used to select fourteen (14) public secondary schools: 4 for boys, 4 for girls and 6 for mixed from 44 public secondary schools in Embu West District, Embu County, Kenya. The study used a sample of four hundred and nineteen (419) Form Three students from the fourteen stratified and randomly selected secondary schools. Twenty-seven Mathematics Teachers teaching the study classes were purposively sampled. Simple random sampling was used to select one stream from each category where there were more than one stream, otherwise the stream was purposively selected. This study was carried out in Embu West District, Embu County, Kenya. The factors considered in this study include: the students’ gender, class size, teaching methods and availability of teaching/learning resources. These are the independent variables and the dependent variable is students’ performance. The objective of the study was to find out whether these factors influence the students achievement in mathematics significantly or not. A pilot study was conducted to test the reliability of the measuring instruments. Questionnaires, classroom observation schedules and achievement test were used to collect data. The data collected, was coded and analyzed using the SPSS package. One-way analysis of variance (ANOVA) technique was used to test the effect of the factors on students performance. The study revealed that students’ performance is influenced by teaching method. The student-centred method was found to be superior to teacher-centred method of teaching. Class size was found to have a significant influence on students’ performance: large and medium classes were found to perform significantly better than small classes. However, the small classes were found in mixed day secondary schools where the KCPE mean entry score was very low(177.7) as compared to 338.75 and 333.25 for boys and girls boarding schools respectively which had large and medium classes. The study also revealed that the availability of textbooks influence students’ performance, although, the influence was not statistically significant. Gender differences were noted in performance where on average male students performed better than female students, however, the difference was not statistically significant. It was recommended that heuristic approaches to teaching should be integrated with expository approaches to enhance teaching and learning. Cooperative learning should be emphasized among teacher-students and students-students and students should be exposed to problem-solving situations to help them develop critical thinking skills.
CHAPTER ONE
INTRODUCTION

1.0 Introduction

This chapter discusses the background information to the study, the statement of the problem, study objectives and purpose of the study. It also highlights the basic assumptions of the study, research questions, scope and limitations of the study, theoretical framework, operational framework of factors influencing students’ performance in mathematics as well as definition of some terms that were used in the study.

1.1 Background Information

Mathematics is an important subject in secondary schools and other tertiary institutions in Kenya and other parts of the World. This is so because mathematics provides a highly effective means of conveying information in a concise and precise form (Mutunga & Breakel, 1992). In addition, mathematics is applicable in every day life for example, it is required in family budgeting, in farming, small scale and large business firms. Rukangu (2000), observes that Mathematics is seen as a subject which helps people to think logically and carry out their work systematically and with precision. Miheso (2002), observes that the importance of mathematics is further emphasized when the future employment of the child is being considered because it is used as a filter more than any other subject in various fields.
Mathematics is viewed as a subject which equips learners with knowledge and skills for problem solving. Much effort has been put by many science and mathematics teachers, but the performance continues to be poor. In a Paper presented at the Annual Conference of the American Educational Research Association, Seattle, Washington, April 10-14, 2001, it was noted that there is widespread interest among industrialized countries in improving the levels of mathematics achievement in schools. Apart from the economic benefits it is argued this would bring much improvement by better preparing young people for the numeracy demands of modern workplaces, and raising the overall skill levels of the workforce, there are also social benefits tied to improving access for larger numbers of young people to post-school education and training opportunities and laying stronger foundations to skills for lifelong learning.

Advancement in science and technology requires pupils to have a sound foundation in mathematical knowledge. Hence the learning of the science subjects requires a thorough grounding in mathematics. The United States, National Councils of Teachers of Mathematics (NCTM, 1992), argue that a high quality mathematics education is one that develops mathematical power for all students. It defines mathematical power as the ability to conjecture, explore, and reason logically to communicate about and through mathematics for problem solving to solve problems including those that are technology-based. Mwangi (2004) observes that inadequate scientific and technological capacity is one of the
reasons for Africa’s under development. Mathematics is a key tool in national development.

Eshiwani (1980) argues that in mathematics education both content and methodology emphasize understanding of concepts, developing enquiring minds and problem solving ability. The key objective is to produce a person who is numerate, orderly and precise in thought (Mwoma, 2005). Basic understanding of mathematical concepts is a pre requisite for employment in the Kenyan job market. Almost every other course offered in tertiary colleges and universities use the grades obtained in mathematics by applicants as a basis for selection. Many apply for the few available vacancies but only those that have qualified and achieved good grades in mathematics are usually selected.

A Ministry of Education Inspectorate report (1988) on improving science teaching in schools and colleges cites the following as the main causes of poor performance in the sciences and mathematics: teachers’ attitude towards mathematics, teacher performance, teacher training programme, institutional administration among others. Griffins (1983), observes that school administration determines the performance of the school because the administrators may play a role in coordinating, directing and facilitating the learning process. He asserts that poor management has brought down schools. In an in-service training seminar for science and mathematics teachers held at Embu West district headquarters (April, 2004), it was observed that parents, government and other
stakeholders continue to emphasize on good performance in science and mathematics every year. The immediate output is good performance in examinations which opens doors for gainful employment. Studies carried out attribute poor performance in science and mathematics to factors such as poor teaching methods, lack of teaching resources and students’ attitude towards the subject among others (Thuo, 1985; Shiundu, (1987); Eshiwani, (1983); Kathuri, (1986) & Maundu, (1986). However, the extent to which teaching methods and availability of teaching resources influence students’ performance has not been given serious consideration. This was the focus of this study.

Students’ performance in the subject is very low in most of the Kenyan secondary schools as reflected in Kenya National Examinations Council (KNEC) reports over the years in the Kenya Certificate of Secondary Education (KCSE) students’ performance. The Kenya National Examinations Council (2001), Mathematics analysis for Kenya Certificate of Secondary Education (KCSE) indicates that 5.8% of boys scored grades A-B while 68.4% scored grades D-E. In the same year, 2.4% of the girls scored grades A-B and 72% scored below grade D. This shows that boys performed better than girls. In the KNEC report of 2005 KCSE Mathematics performance, it was observed that the average score for boys was 18.49% while that of girls was 12.97%. This was a decline in performance as compared to the year 2004 KCSE in which boys scored 21.34% while girls had 15.39%. This shows that gender disparity still dominates in performance in
Mathematics. This study sought to establish whether there is significant difference between performance by gender in mathematics.

Although performance by boys seems to be relatively higher than that of girls in mathematics, the general performance in the subject is still very low. In the years, 2006, 2007 and 2008 the percentage of students who scored quality grades (A-B) were 6.57%, 7.0% and 10.07% respectively while those who scored grades D-E were 73.77%, 66.32% and 69% respectively. This reveals that about two-thirds of the students perform poorly in mathematics across the years. Table 1.1 shows the performance in mathematics at KCSE from 2005 to 2008.

**Table 1.1 KCSE Results in Mathematics from 2005 to 2008.**

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidature</td>
<td>259280</td>
<td>238684</td>
<td>273504</td>
<td>304891</td>
</tr>
<tr>
<td>Average mean score out of 12</td>
<td>2.78</td>
<td>3.03</td>
<td>3.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Mean grade</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>


Table 1.1 shows that number of students increased every year with an exception of year 2006 when the candidature dropped to 238,684 from 259,280 the previous year yet the mean score remained very low. The continued poor performance in Mathematics at KCSE has remained a major concern to all stakeholders in education in Kenya. When performance in mathematics is compared with that of science subjects, it is relatively low as shown in table 1.2.
Table 1.2: Kenya Certificate of Secondary Education Performance in Mathematics and Sciences from 2005 to 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Subject/code</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics (121)</td>
<td>2.78</td>
<td>3.03</td>
<td>3.0</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Biology (231)</td>
<td>4.85</td>
<td>4.45</td>
<td>5.2</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>Physics (233)</td>
<td>5.32</td>
<td>5.35</td>
<td>5.5</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Chemistry (233)</td>
<td>4.01</td>
<td>3.84</td>
<td>4.0</td>
<td>3.8</td>
</tr>
</tbody>
</table>

NB: Maximum mean score - 12 Grade - A


Table 1.2 reveals that the mean score for mathematics has remained lower than for the other science subjects and hence it can be concluded that there exists a problem in Mathematics performance. Even with the establishment of SMASSE (Strengthening of Mathematics and Science in Secondary Education) project 1998, little improvement in students’ achievement in mathematics has been realized. The feedback from the formal examinations and observations made by stakeholders in education constantly indicates that students’ performance in mathematics performance is poor.
Table 1.3: Embu West District Common Evaluation Mathematics Examination Results

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Mathematics mean score</th>
<th>Mean grade</th>
<th>Maximum mean score</th>
<th>Maximum mean grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>2.64</td>
<td>D</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>2007</td>
<td>2.81</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>2.75</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>3.34</td>
<td>D</td>
<td></td>
<td></td>
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</tbody>
</table>

Source: District Education Officer’s Office: Embu West.

Table 1.3 shows the students’ performance in Mathematics in Embu West District Common Evaluation Examination for the last four years. It is in the light of this low performance therefore, that studies need to be carried out concerning the teaching and learning of the subject and establish the relationship between these factors and students’ performance in mathematics across Kenyan secondary schools. This study was intended to establish the extent to which teaching methods, class size, gender and availability of teaching and learning resources influence performance in mathematics in Embu West District.

1.2 Statement of the Problem

Poor performance in mathematics in Kenya has been an area of concern to stakeholders in the field of education. The government of Kenya, in partnership
with JICA (Japanese International Corporation Agency), introduced SMASSE (Strengthening Mathematics and Sciences in Secondary Education) project in July 1998 and later launched it in the whole country in May, 2003 with the aim of improving students’ performance in mathematics and sciences. In spite of this effort, no significant improvement has been realized in students’ performance in mathematics. Studies carried out attribute poor performance in mathematics to factors such as lack of resources, poor teaching methods and students’ attitudes among others (Eshiwani, 1983; Thuo, 1985; Shiundu, 1987; Kathuri, 1986). However, the extent to which these factors influence performance has not been taken into serious and systematic consideration. It is in view of this gap that this study was carried out.

1.3 Purpose of the Study

The purpose of this study was to find out whether there is a perceived significant relationship between learners, school and non-school related factors, namely availability of resources, gender, students, class size, teaching methods and students’ achievement in mathematics in Kenyan secondary schools. The study sought to establish whether these factors significantly influence students’ performance in mathematics.
1.4 Objectives of the Study

The objectives of the were to:

i. Establish the relationship between class size, teaching methods, students’ gender and instructional resources and students’ performance in mathematics.

ii. Determine whether there are other factors that teachers and students perceive could influence students’ performance in mathematics.

1.5 Research Questions

The research was guided by the following questions:

i) Is performance in mathematics related to class size of the students?

ii) Is performance in mathematics influenced by availability of teaching and learning resources?

iii) Is there relationship between the teaching methods and students’ performance in mathematics?

iv) Does the students’ gender influence performance in mathematics?

1.6 Scope and Limitations of the Study

Factors that influence students’ performance are diverse. The study was limited to factors in a classroom set up which have been pre-determined by the researcher, thus leaving out equally important variables like self-concept, interest, intelligence due to limited time for the study. The data for this study were collected from Form 3 mathematics teachers and their students in stratified
randomly selected schools in Embu West District, Kenya. The researcher looked at factors which influence students’ performance in mathematics in Embu West District, Kenya which may not have been a representative of all the secondary schools in Kenya. Form Three students were considered and hence might not serve as a representative for all students in all secondary schools in Kenya. Distance, time and accessibility to all the schools were limiting factors to the study.

1.7 Basic Assumptions of the Study

The study assumed the following:

i. The respondents would provide honest responses and to the best of their knowledge on the questionnaire and produce all the information deemed necessary by the researcher.

ii. Mathematics teachers follow the same prescribed syllabus by KIE and the content is the same in all schools

iii. Reading and comprehension abilities of the students are approximately the same

iv. The factors under study were assumed to be the key factors that influence students performance.
1.8 Theoretical Framework

The purpose of this study was to establish factors that influence students’ performance in mathematics. This study was based on “Systems approach to teaching and learning” theory developed by Ayot (1987). He argued that teaching and learning is a dynamic process which fits in a process part of a system model. He pointed out that the technological model of a simple system consists of three basic elements: input, process and output. In education, learners are the input who are put in educational system and processed at different levels of education and coming out as educated individuals. In the classroom context, the content, which is presented to the students by the teacher is the input, teaching and learning activities constitute the process which takes place in the classroom where the students interact with their environment in order to acquire knowledge. Feedback from assessment and examinations shows the output. Ayot (1987) summarizes the teaching and learning process as shown in figure 1.1.

Figure 1.1: Theoretical Framework

Adapted from Ayot (1987: 40)
1.9 Conceptual Framework of Factors Influencing Students’ Performance in Mathematics

The conceptual model for this study is concerned with communication of mathematical concepts to the students in class applying mathematical language. The teacher is the main element being the main implementer of the mathematics curriculum and the classroom is the main area of focus. Various classroom factors interact and in turn influence students’ performance. Recent study by TIMSS (Third international mathematics and science study) to look at student, school and classroom factors influencing mathematics achievement in the US and Australia has shown that classroom differences account for about one-third of the variation in student’s achievement in the US and over one-quarter in Australia.

The variables of interest for this study are gender, instructional resources, class size and teaching methods. Grouws and Koechler, (1988), observed that instructional method, availability of resources and class size play a major role in determining the achievement by students. This study focused on determining the extent to which these factors influence students’ performance. The arrows in the figure 1.2 show the direction of expected effects. Text books, class size and gender require intervention process represented by teaching method and this determines the quality of learning which leads to improved performance.
Thus, teacher and student – related factors affect teaching and learning process (Grouwns and Koechler, 1988). For instance, teacher-related factors are influenced by his knowledge of: mathematics content, how students learn and teaching techniques of the particular content. Students related factors are influenced by their attitudes, beliefs about mathematics, their confidence in their ability to learn mathematics, their gender and their feelings about their ability to discover problem solving strategies in mathematics within a supportive learning environment. There are some teaching methods that are popular with female
students like those that promote student interaction while there are methods that are popular with male students, hence the two way relationship between the teaching method and gender. The content is as stipulated in the KIE syllabus. The class size, gender and instructional resources (Textbooks, teaching aids) require the intervention of the teaching method to produce the required outcome. This, in turn, influences the quality of learning and consequently students’ performance. Using a variety of pedagogical strategies that address different learning styles within instructional environments has been shown to encourage student achievement in mathematics classrooms, particularly among females. For instance, strategies such as collaborative learning, instruction in small-group settings, inquiry-based approaches, and hands-on activities have been shown to be effective in teaching math and science and benefits female as well as male students (Clewell, Anderson, & Thorpe, 1992).
1.10 Operational Definition of Terms

The following terms were used in this study as defined below:

**Boarding school** - School where students attend classes without going home after the end of a days’ learning.

**Boys’ school** – School with male students only.

**Day school** – Where students learn and go back home after a days’ learning.

**Gender** - Refers to male and female students.

**Girls’ school** – School with female students only.

**Large class size** – 40 students and above.

**Medium class size** – 30 – 39 students.

**Mixed school** – School where both boys and girls learn. It could be either boarding or day.

**Performance** – Measure of students’ performance by score attained in a test.

**Small class size** – Below 30.

**Teaching method** – Is a body of skills or techniques which a teacher involves his/her students during the teaching and learning process.
1.11 Organization of the Study

This study has been organized in five chapters. In chapter one, the background and the statement of the problem are discussed. Purpose, objectives and limitations of the study are indicated. In chapter two, review of relevant literature with regard to the study is discussed while chapter three covers the research methodology which includes research design, data collection and research instruments. The data analysis, presentation and interpretation of results are discussed in chapter four while summary, recommendations and conclusions which were drawn from the findings of the study are discussed in chapter five. It also gives usefulness of the research, suggestions for further research and recommendations to policy makers and education stakeholders. References and appendices are presented at the end of this thesis.
CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter is devoted to reviewing literature that is relevant to the study. It will be discussed under the following sub-sections: teaching methods, class size, gender and availability of text books with respect to public secondary schools in Embu West District, Kenya.

2.1 Class Size and Performance

The number of pupils per class should be small enough to be handled by one teacher in a given lesson. Eshiwani (1983), argues that teacher-pupil ratio is often considered as an important indicator of the quality of education. The basic assumption is that a low ratio means small classes enabling teachers to pay more attention to individual pupils. According to the Encyclopedia of Education (1971), studies have shown that pupils and teachers prefer small classes. Students feel that teaching is more effective in small classes, because teachers give attention to individual students and grades are more valid. Teachers feel that the teaching is more effective and they are able to give students more personal attention (Grouwns & Koechler, 1988). Eshiwani (1983), observes that a major contribution to poor performance in national examinations especially in teaching of mathematics is congested classrooms. In this kind of environment, pupils retain very little in mathematics.
Robinson and Wittebols (1986), in their research observed that very few studies favoured either smaller or larger class sizes and many showed no significant difference in performance between small and large class sizes in secondary schools. Sidhu (1982), argues that large class size is a problem since no individual attention can be paid and it becomes difficult for the teacher to establish class contacts with the students. The teacher cannot easily judge the capacities of the individuals. On the other hand, small classes are manageable and the teacher can be able to give attention to individual differences in academic ability (Grouwns & Koechler, 1985). Nyambura (2004), observes that small class size makes teacher’s work less strenuous and effective as opposed to large class size which may limit the teacher’s ability to cater for individual differences as well as proper class management. There is no clear association between class size and students’ performance in mathematics since the level of performance in any one given school varies despite the fact that the class size remains relatively constant (Miheso, 2002). Variation in performance is influenced by many factors. The researcher intended to find out whether class sizes could be used to explain variations in mathematics performance among secondary school students.

2.2 Teaching Methods and Achievement

Teaching styles including teaching in contexts that might be personally meaningful to the students, class discussions, small group collaboration and valuing meaningful activity over correct answers enhance effective learning.
A variety of teaching methods and techniques can be used by teachers of mathematics to make their lessons easy to understand. Different teaching methods assist pupils to understand the content of the subject easily. The education commission reports by Gachathi (1976) and Mackay (1981), suggest that teaching should be learner centered in order to make learning more relevant to the learner; and to make students self-reliant. Thus the teacher’s role is to offer opportunities that will lead to student centered activities in class, which could lead to improved performance in Mathematics. Watson (1976) noted that:

Mathematics teaching and learning must involve students active participation. This could be achieved by using varied strategies including problem solving. He observes that when the lesson is teacher, dominated, the teacher largely uses expository method instead of both expository and heuristic. Expository method does not involve the learners’ participation, whereas mathematics requires a lot of calculations, participation, motivation and practice. Hence suitable teaching method is of utmost importance in teaching and learning of mathematics.

Aduda, (2001), notes that half of the Form Four candidates failed in KCSE mathematics every year. This was attributed to negative attitude and poor teaching methods. It was observed that candidates fail in items that they were able to do while in primary schools, a clear show that something is amiss in the teaching of mathematics at secondary school level. The purpose of this study was to find out
if there is significant relationship between teaching methods and students’ performance in mathematics.

Sidhu, (1982), argues that discovery method involves finding out by the pupil. The teacher assists the pupils to solve problems by themselves. According to the report of 1972 UNESCO publication, there is evidence, that discovery or inquiry oriented teaching techniques are successful if the learner is allowed to speculate, make errors, learn from contradictions or inconsistencies and produce and experience growth of mathematical ideas in a first hand fashion as opposed to lecture method which is bound to be guided by the teacher. Scopes, (1973), defines lecture method as an expository method which transmits information in one direction only, which is from the teachers to the students through speech. Teacher defines terms, expressions or symbols, breaks them into simple components which are explained and finally summarizes. Sidhu, (1982), argues that lecture method suits neither the subject nor the learners. There is no student participation in the learning process. The purpose of this study was to establish whether teaching method influences students’ performance significantly.

Mukuni, (1980), argues that in discussions the participants contribute information and ideas without filtering them through the leader of the group every time. The discussion is limited to time available and ideally the size of the group should be about 5 or 6 pupils. The role of the teacher is to help in setting and directing this situation so that the discussion does not become a one-sided affair. Students work
in groups to explore, discover, test rules and patterns from problems presented to them by the teacher. They also learn from the process of trying to put their ideas into words in order to allow someone else to understand them. Cohen (1976), recommends the use of small groups. He stresses that collaborative efforts by students allow problem solving to continue when an individual member might have encountered a difficult situation. However, the extent to which group discussion influences students’ performance has not been put into serious consideration. This study was focused on establishing whether teaching method used influences students’ performance significantly or not.

2.3 Teaching and Learning Resources

Sidhu (1991), observed that majority of students hold Mathematics as a “dry” and difficult subject full of abstract concepts. This results to students taking little interest in it, and hence the use of appropriate aids at every step is very crucial. Use of resources gives rise to certain discourses that enhance students’ participation in the teaching and learning process. Cockcroft (1982), observes that in secondary schools, mathematics should be taught in suitably equipped specialist rooms and that their provision makes it easier for good practice to develop.

Instructional materials aid in teaching and learning because they increase learner interest. Mutunga & Breakell (1992), observes that to create interest and motivation on the part of the pupils, teachers of mathematics will have to
constantly consider the use of sensory aids in the teaching of mathematics. Such resources include textbooks, measuring instruments, charts and models. The teacher will need to select and use a wide variety of resources in teaching to take care of individual differences in class (Twoli, Maundu, Kiio, Muindi and Kithinji, 2007). Mwiria (1990), observes that the availability and use teaching aids and resources in schools were ranked among the most influential factors which affect examination performance in secondary schools. Wanjohi (2006) observed that the teaching resources enhanced retention of about 80% of what has been learnt. This indicates that the teaching resources facilitates child centered learning through discovery method. The strategy followed by KNEC when they publish KCSE examination results, students who are from schools with differing resources as was the context of this study are compared as though they had equal opportunities.

Farrant (1980), observes that in the expanding scope of knowledge in many areas of education, it is important for the teacher to be aware of the increasing types of teaching resources available for use, as well as those that the teacher can prepare locally. For the instructional resources to be effective in the teaching and learning process, they must be relevant and appropriately used. Use of teaching aids stimulates learners and arouses curiosity and interest. They also make the students not only to explain the problem but also to make connections used (NCTM, 1992). Learner interaction is enhanced and a conducive environment is created. A
pupils’ conducive learning environment keeps the pupils actively motivated and
the teacher’s competence highly upheld for critical and productive thinking
(Rukang, 2000). Since the materials are public, they can be shared by all
students in the class. This results in students observing the same features and the
language used in the classroom is about the same things. The communication
among the students and teachers is enhanced because all participants can focus on
the same entities and relationships. Availability of instruction resources determine
the level of teacher to student and student to student interactions and thus enhance
learning (Nyambura, 2004). There is, therefore, need to identify the missing link
in the teaching and learning process which causes students to attain low scores in
mathematics. Munguti (1984), observes that learning resources and facilities
affect the teaching and learning of mathematics and hence affects performance in
the subject. This study determined whether there is a significant relationship
between instructional resources and students’ performance in mathematics in
public secondary schools in Embu West District, Kenya.

2.4 Gender and Performance

Gender refers to socio-cultural classification of human beings into two basic
groups comprising women and girls on one hand and men and boys on the other
hand. Female students tend to take fewer advanced mathematical courses thus
leading them to be ill-equipped to pursue these courses in higher education
(Chapman, Amanda, 2008). Orton (1991), observes that more boys than girls
succeed in public examinations taken around the age of sixteen (16). More boys
than girls choose mathematics as their specialist subject. Miheso (2002) observes that gender differences have been noted in students’ performance over the years in KCSE mathematics examinations. Rukangu (2000), rightly states that negative talks about girls and mathematical achievement by peers, parents, teachers and the society in general caused them to withdraw from developing their mathematical ability. He argues that the difference in performance between girls and boys in mathematics is due to external situations which could be created and could professionally, psychologically and socially controlled.

According to Meinholdt & Murray (1999), females have demonstrated that they are equally capable of learning and mastering mathematical concepts and knowledge as their male counterparts. In addition, males and females are completing a roughly equal number of average credits in mathematics by the time of high school graduation (Dalton, Ingels, Downing & Bozick, 2007). However, results of standardized assessments measuring mathematics performance by gender are mixed. In some specific mathematical content areas males outperform female peers (Mullis, Martin, & Foy, 2008). In other instances, females complete comparable levels of mathematics coursework as their male peers (Ingels & Dalton, 2008) and attain degrees in mathematics at rates similar to males. Further insights are provided by examining statistical trends related to gender differences in math performance in relation to studies that identify environmental factors that influence the motivation and performance of females related to mathematics achievement (Kiefer & Sekaquaptewa, 2007; Thompson & Dinnel, 2007). This
study was focused in finding out whether there are gender differences in performance in mathematics in Embu West District public secondary schools.

In a study carried out in the United States and Australia on factors affecting students’ achievement, it was observed that the differences between males and females were greater in the United States than in Australia; in the United States, gender differences had both a direct effect on achievement and a transmitted effect through its influence on attitudes to mathematics. Studies carried out in England and Wales in the years 1977 to 1979 on pupils’ grades obtained in mathematics revealed that more girls than boys passed in mathematics and more girls than boys attained grades D and below as shown in table 2.1.

Table 2.1: O level grades in mathematics: as percentages of all leavers in England and Wales

<table>
<thead>
<tr>
<th>Year of completion</th>
<th>Boys (%)</th>
<th>Girls (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pass</td>
<td>Fail</td>
</tr>
<tr>
<td>1977</td>
<td>22.8</td>
<td>9.1</td>
</tr>
<tr>
<td>1978</td>
<td>23.7</td>
<td>9.2</td>
</tr>
<tr>
<td>1979</td>
<td>24.5</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Source: Cockcroft W.H (1982:249)

In 1977, 22.8% of boys passed, 9.1% failed and 16.1 of girls passed while 9.8% failed. In 1978, 23.7% of boys and 16.7% of girls passed while 9.2% of boys and
10.2% of girls failed. In 1979, 24.5% of boys and 9.7% of girls passed while 9.7% of boys and 10.1% of girls failed. This shows that the boys performed better than girls in the three years.

Litcht & Dwek (1983), observe that female students are more likely than their male counterparts to display “learned helplessness”. Male students attribute their success to ability and failure to lack of effort while female students tend to relate their success to effort and failure to lack of ability. Female students tend to relate their success with ‘luck’ which is an unstable factor. This study attempted to establish if there are variations in students’ performance in mathematics by gender in Embu West District public secondary schools.

2.5 Summary
This study focused on students in their natural environment. This was to help the researcher establish whether gender, class size, teaching methods and instructional resources influence student performance in mathematics significantly. The aim was to identify the learning gap to help the teachers, education stakeholders and policy-makers to make informed decisions relating to teaching and learning process. The researcher thus conducted a study into some of these factors that affect the teaching and learning of mathematics in public secondary schools in Embu West District to find out whether they influence students’ performance significantly or not.
CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter mainly focused on the methodology used in the study. This includes; research design, location of the study, target population, sample and the sampling procedures, research instruments, data collection procedures and methods used in analysis and presentation of data.

3.1 Research Design

This study used descriptive survey. Descriptive survey seeks to establish factors associated with types of behaviour. It is useful in obtaining quantitative data regarding learning environment. This method involved observing teachers and students in their actual teaching and learning environment. The independent variables were gender, class size, teaching method and instructional resources and the dependent variable was student achievement in mathematics.

3.1.1 Study Process

The study was carried out in four stages as follows:

Stage one included the preparation of the proposal and development of research instruments. Stage two included piloting of the research instruments to improve and validate them.

Stage three involved the actual data collection from the sampled secondary schools in Embu West District using the validated instruments. The last stage
involved analysis of data collected from which conclusions and recommendations were made.

This is summarized in figure 3.1

**Figure 3.1: Study Process**

![Study Process Diagram]

**Source:** Adapted from Cohen & Manion (1994:89).
3.2 Variables

The variables were in two categories: dependent and independent variables. Independent variables as per the study comprise availability of teaching and learning resources, class size, teaching methods and gender. Dependent variable is the student performance.

3.3 Location of Study

This study was carried out in Embu West District in Embu County, Eastern Province, Kenya. Embu West District is on the Southern slope of Mt. Kenya. It was purposively selected because the researcher has advance knowledge on the area which would make data collection easier and more efficient. The public secondary schools were of three types: Mixed Day, Girls Boarding and Boys Boarding and are well-distributed within the district. This made it suitable for the study.

3.4 Target Population

The target population was Mathematics teachers and students in Embu West District. The mathematics teachers were involved in the study since they are the implementers of the secondary school mathematics curriculum. There are forty-four (44) public secondary schools in Embu West District with about 120 mathematics teachers and about 7,040 students.
3.5 The Sample and Sampling Procedure

To ensure that various types of the public secondary schools were represented in the sample, the researcher used stratified random sampling technique from the list of public secondary schools in Embu West District. The main sources of information for this study were:

i. Achievement tests done by sampled Form Three students in Embu West District public secondary schools.

ii. Questionnaires completed by mathematics teachers in the randomly sampled schools.

iii. Class registers to confirm class size and class observation schedule were used to get information during the teaching and learning process. Table 3.1 shows the sample size grid of schools by type.

Table 3.1: Sample size grid of schools by type in Embu West District

<table>
<thead>
<tr>
<th>Type of School</th>
<th>No. of Schools in the District</th>
<th>No. of schools selected</th>
<th>Population size</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Students</td>
</tr>
<tr>
<td>Boys Boarding</td>
<td>7</td>
<td>4 (57%)</td>
<td>1120</td>
<td>128</td>
</tr>
<tr>
<td>Girls Boarding</td>
<td>6</td>
<td>4 (67%)</td>
<td>960</td>
<td>132</td>
</tr>
<tr>
<td>Mixed Day</td>
<td>31</td>
<td>6 (19%)</td>
<td>4960</td>
<td>159</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>14 (32%)</td>
<td>7040</td>
<td>419</td>
</tr>
</tbody>
</table>

Key: LO – Lesson Observation

Source: District Education Office: Embu West
From the type of schools listed in table 3.1 above, 14 public secondary schools were selected. This was 32% of the total population of the public secondary schools in Embu West District. Ary, Jacob, and Lazavico, (1972) rightly argues that in descriptive research, 10-20% of the population is acceptable. Wiersma (1995), states that a sample whose proportion is at least 20% of the total population is acceptable in a descriptive research. The researcher used stratified sampling technique to select four boys boarding, four girls boarding and six mixed day secondary schools using “lucky dip” type of simple random technique. This technique ensures that every individual school has equal probability of being selected, thus ensuring a representative sample (Gay, 1992). From each of these schools, one Form 3 class and mathematics teachers teaching those classes were purposively sampled. For schools which had more than one stream, simple random sampling was applied to select one Form Three from each of the fourteen (14) sampled schools; otherwise the stream was purposively selected.

3.6 Research Instruments

The research instruments that were used in this study were: questionnaires for mathematics teachers; achievement test results and class observation schedule.

3.6.1 Questionnaire for Mathematics Teachers (MTQ) (Appendix I)

A questionnaire is widely used in research because it is possible to give similar or standardized questions to the respondents (Kerlinger, 1973). This makes it possible to compare responses from different respondents on the same questions.
The questionnaire for the mathematics teachers was used to find the factors which the teachers perceive to influence students’ performance in mathematics. It was also used to provide more information about the teacher and his or her curriculum characteristics. Part one sought general information about the teacher such as teacher’s teaching experience, age, academic/professional qualification. Part two sought information about availability of teaching resources, teaching aids, teachers’ workload per week, class size.

3.6.2 Achievement Test (Appendix II)
This was used to collect information on students’ performance. A pre-test and a post-test were administered to the sampled Form Three students in Embu West District.

3.6.3 Classroom Observation Schedule (Appendix III)
This instrument was used to observe the behaviour and characteristics of the learners as different teaching methods are used by the teachers. Characteristic such as interest of the learners and involvement of the learners were observed. The role of the teacher was also observed and recorded using this instrument.

3.7 Pilot Study
The pilot study was used for validation and testing the reliability of the research instruments that were used. Kombo and Tromp (2006) observes that a pilot study of the questionnaire and other field procedures is the only way the researcher can find out if everything “works” particularly the research instruments.
Two schools, one boys and one girls school were purposively sampled for pilot study. These were not included in the final research study sample. The pilot study took a period of four weeks. The researcher visited different classes occasionally and made observations on the behaviour of the learners as well as the role of the teacher when different teaching methods were used. All the three instruments were tested to ascertain their validity and reliability during this period. The test – retest method was used to assess the reliability of the achievement test. Pearson correlation coefficient was used to test for correlation between the two tests that were administered.

\[
r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2} \sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}
\]

Where

\(X_i\) = Individual score in pre-test

\(\bar{X}\) = Mean of all scores of the pre-test

\(Y_i\) = Individual score in post-test

\(\bar{Y}\) = Mean of all scores in post-test

There was a strong correlation between pre-test and the post-test with a Pearson correlation of 0.711(p<0.05 at 95% confidence level). Content and construct
validity was done at the design stage. The pilot study was done to check the appropriateness of the language used in the questionnaires. Some of the items adapted for this thesis have been used before by Miheso (2002), Rukangu (2000) and Nyambura (2004).

The reliability of the class observation schedule was tested using the following Scott’s formula:

\[ N = \frac{P_0 - P_e}{100 - P_e} \]

Where \( N \) is the inter-observer reliability index.

\( P_e \) is proportion of agreement by chance.

\( P_0 \) is proportion of agreement which is determined by subtracting the total percentage of the agreement from hundred (100).

A reliability index of 0.81 was obtained which showed a high degree of agreement between the data obtained during the first lesson observation and those obtained during the second lesson observation. The results obtained from the pilot study were used to make appropriate modifications on the three research instruments: questionnaires, lesson observation schedule and achievement test.

### 3.8 Data Collection Procedure

The data were collected from the sampled schools. The researcher visited each of the selected schools three times for familiarization with the respondents and establishment of a good rapport with the authorities. This helped the researcher to
minimize the Hawthorne effect. During the second visit, the researcher administered the questionnaires to the mathematics teachers and explained to the respondents the purpose for the study and the instructions to be followed when filling the questionnaires. After the questionnaires were filled, they were collected for processing. The respondents were also given the achievement test to administer to the students on the topic “Quadratic Equations and Expressions (2)”. During the study period, the researcher visited various classes to observe the behaviour of the learners as well as the role of the teachers and the teaching method used during instruction. The class size was also noted. The researcher entered the class with the teacher and sat at the back to avoid any interruption. These data were recorded in the class observation schedule. Achievement test results, recorded on class lists, were collected from the different (selected) schools.

3.9 Data Analysis and Presentation

The data collected were organized and coded using SPSS. In descriptive analysis, the data obtained from the questionnaires and class observation schedules were grouped, organized and summarized in frequency distribution tables, charts and diagrams. The data obtained from achievement test were analyzed, using means and one way ANOVA was used to find out whether there was significant difference between the students’ performance by gender. The data were used to
find out whether class size, teaching method, gender and teaching resources influence performance significantly or not.

3.10 Ethical considerations

The researcher sought permission to carry out the research in schools in Embu West district from the Ministry of Higher Education Science and Technology. The researcher then reported to the District Education Officer (DEO) Embu West and thereafter visited the sampled schools. The researcher then sought permission from the school heads to carry out the research in their respective schools. A meeting was then held for the mathematics teachers where the researcher explained the basic issues about the research and its benefits. The respondents were assured that the information supplied through the questionnaires would be treated with utmost confidentiality.

3.11 Chapter Summary

The chapter has described the descriptive survey design and the methods used in the study. Three research instruments (mathematics teachers questionnaire, lesson observation schedule and achievement test) were used to collect data. The findings of the study are presented, analyzed and interpreted in the next chapter.
CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.0 Introduction

This chapter presents, analyses and interprets the findings regarding the factors which influence the performance in mathematics in public secondary schools. The descriptive and inferential statistics were used to analyze the data. Various aspects on the teaching and learning of mathematics were revealed from the mathematics teachers’ questionnaires. The responses from the questionnaires gave the following results:

4.1 School category

On the category of the school, the results were as shown in table 4.1

Table 4.1 Percentage of Schools by Category

<table>
<thead>
<tr>
<th>Category of school</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed day</td>
<td>50.7</td>
</tr>
<tr>
<td>Girls boarding</td>
<td>25.3</td>
</tr>
<tr>
<td>Boys boarding</td>
<td>24.0</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4.1 shows the type of sampled school by category; mixed day had the highest percentage of respondents (50.7%), girls boarding had 25.3% and boys boarding had a percentage of 24.0%. This shows that mixed day secondary
38

schools were the majority in the district. This could be due to the introduction of free secondary education.

4.2 Teacher characteristics

4.2.1 Teachers’ age bracket

The age bracket of the teachers teaching in the sampled schools was as shown in figure 4.1.

Figure 4. 1 Age of teachers

![Bar Chart: Age of Teachers]

Figure 4.1 reveals that most of the teachers (59.3%) are between the age brackets of 30-39 years followed by those between the age bracket of 40-49 years (25.9%). The brackets that had the least percentage were 20-29 years and 50 years and above having 11.1% and 3.7% respectively. This indicates that most of the teachers (85.2%) are 30 to 49 years.
4.2.2 Distribution of Mathematics Teachers by Gender

The gender of the sampled mathematics teachers was analyzed and figure 4.2 reveals that 74.1% were males while 25.9% of them were females.

Figure 4.2 Distribution of sample teachers by gender

The results indicate that mathematics teaching in Embu West public secondary schools is done mainly by male teachers. This situation can be used to explain why boys seem to perform better than girls.

4.2.3: Teachers Professional Qualifications

Professional qualification is one of the factors that determine teachers’ effectiveness in teaching mathematics. This information is summarized and presented in table 4.2.
Table 4.2: Distribution of Mathematics Teachers by Professional Qualification

<table>
<thead>
<tr>
<th>Professional Qualifications</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.ED</td>
<td>66.7</td>
</tr>
<tr>
<td>DIP.ED</td>
<td>14.8</td>
</tr>
<tr>
<td>PGDE</td>
<td>10.4</td>
</tr>
<tr>
<td>UT</td>
<td>3.7</td>
</tr>
<tr>
<td>M.Ed</td>
<td>4.4</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.2 reveals that all teachers sampled for the study were trained with the highest professional qualification being Bachelor of Education (66.7%) and the lowest being Masters in education (M.Ed) holders (3.7%). It was observed that Untrained (UT) Graduates were 14.8% while Postgraduate Diploma in Education (PGDE) were 7.4%. Thus all teachers were highly qualified and hence were well-equipped with skills and desirable standards in teaching. Gitonga (1990), observes that the potential of an educational system is directly related to the ability of its teachers. Hence the more qualified and better trained teachers are, the easier it is to effect curriculum implementation. No matter how distinguished the members of a project team are, how carefully structured a new course is, how brilliantly the various educational media have been exploited, the success or failure of any
innovation ultimately lies on the receptiveness and flexibility of the classroom teacher.

This was in agreement with the findings of Sidhu, (1991) who observed that, high qualification of the teacher develops self-confidence in the teacher and equips him to attain desirable standards in teaching. Thus, the trained teachers are likely to use teaching styles that are student-centred since they are exposed to a variety of teaching techniques.

4.2.4 Teaching Experience of the Sample Teachers

The years that the teacher has taught mathematics reveals content mastery and variation in teaching styles.

Figure 4. 3: Teaching experience of mathematics teachers
The teaching experience of the sampled mathematics as shown in figure 4.3 reflects the number of years the teachers had been teaching the students. Most (70.3%) of the teachers had taught for five years and above. Those who had taught for less than five years were 29.6%. This implies that most mathematics teachers had adequate experience that could help them manage classroom teaching and learning effectively.

4.2.5 Attendance of SMASSE and Inservice Training/ Seminars

Concerning attending SMASSE and other inservice training or seminars the results were as indicated in table 4.3.

Table 4.3: Attendance of SMASSE and in-service training/ seminars

<table>
<thead>
<tr>
<th>Attended</th>
<th>SMASSE (%)</th>
<th>Inservice Training/Seminar (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>85.2</td>
<td>66.7</td>
</tr>
<tr>
<td>No</td>
<td>14.8</td>
<td>33.3</td>
</tr>
</tbody>
</table>

From the results of table 4.3, it is seen that most teachers had attended SMASSE (85.2%) or any in-service seminar (66.7%) respectively. This indicates that most were well equipped with current treads in teaching and learning of mathematics. Further analysis shows that all the mathematics teachers had attended the in-service seminars at least once as indicated in figure 4.4.
Figure 4.4: Number of times attended in-service seminars

4.2.6 Mathematics Lessons Taught in a Week

Figure 4.5 below shows the number of mathematics lessons the sampled mathematics teachers taught in a week.

Figure 4.5: Number of mathematics lessons taught in a week
Figure 4.5 reveals that majority of the mathematics teachers (55.6%) had 19 mathematics lessons and below. Those who taught twenty (20) lessons and above were 44.4%. Further analysis revealed that 11.1% of the mathematics teachers had a total teaching workload of less than 20 lessons while most (59.3%) of the mathematics teachers had a total teaching workload ranging between twenty-one and twenty-six (21-26) lessons per week as shown in figure 4.6. A large proportion of teachers (29.6%) had 27 lessons and above. This indicates that most of the mathematics teachers have very high workload per week and this would make them less effective in classroom teaching and learning.

**Figure 4.6: Total teaching workload per week**

![Bar chart showing percentage of teachers with different teaching workloads per week](image)
4.3 Whether Time Allocated for Mathematics Lesson is Adequate

The mathematics teachers were required to state whether the time allocated for mathematics lessons was adequate. The results were presented in the figure 4.7.

Figure 4.7: Adequacy of time allocated for mathematics

The figure above reveals that majority (65%) indicated yes while 35% indicated no. This could be due to the high teaching workload which would cause the teacher to be less effective in the classroom teaching and learning.

4.4 Ratio of Textbook(s): Student(s)

The research question under investigation was ‘Is achievement in mathematics influenced by availability of teaching and learning resources?’

Table 4.4 shows that, the mean score was highest (8.3064) for students with high text book/student(s) ratio (1:1) with a standard deviation of 4.195, followed by mean of 7.0002 for textbook/student(s) ratio of 1:2 with a standard deviation of
2.498 and the lowest mean (5.4153) was attained by students with textbook/students ratio of 1:3 with a standard deviation of 1.990. The overall mean was 6.734 with a standard deviation of 2.566.

Table 4.4: Performance based on textbook/student ratio

<table>
<thead>
<tr>
<th>Text book: student ratio</th>
<th>Number of schools</th>
<th>Mean score for achievement test out of 20</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:3</td>
<td>4</td>
<td>5.4153</td>
<td>1.98982</td>
</tr>
<tr>
<td>1:2</td>
<td>8</td>
<td>7.0002</td>
<td>2.49804</td>
</tr>
<tr>
<td>1:1</td>
<td>2</td>
<td>8.3064</td>
<td>4.19507</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>6.7340</td>
<td>2.56643</td>
</tr>
</tbody>
</table>

One way analysis of variance (ANOVA) indicated no significant influence of teaching resources on the achievement by the student at 95% confidence level.

\[ F(2,11)=0.937 < F_{(crit)}=3.9823; \quad p > 0.05. \]

Hence there was no significant difference in performance by textbook/student ratio.

The text book availability could be influencing students’ achievement indirectly through frequent use and amount of time spent with the text book in doing assignments. The findings are summarized in table 4.5.

Table 4.5: One way ANOVA for achievement levels by text book/pupil ratio

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>12.467</td>
<td>2</td>
<td>6.234</td>
<td>.937</td>
<td>.421</td>
</tr>
<tr>
<td>Within Groups</td>
<td>73.158</td>
<td>11</td>
<td>6.651</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>85.625</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4.1 Adequacy of Resources

The table 4.6 shows the adequacy of the resources and material that are available in the sampled schools; teachers reference books had an adequacy of 59.3% while those who said they are adequate were 33.3% and those who stated that the reference text books were not available were 7.4%. 66.7% suggested that student text books were available while 33.3% stated they are inadequate. On adequacy of syllabus those who stated they are adequate were 77.8% while for charts and models they were 22.2%.

<table>
<thead>
<tr>
<th></th>
<th>Adequate (%)</th>
<th>Inadequate (%)</th>
<th>Not Available (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers reference books</td>
<td>59.3</td>
<td>33.3</td>
<td>7.4</td>
</tr>
<tr>
<td>Student text books</td>
<td>66.7</td>
<td>33.3</td>
<td>-</td>
</tr>
<tr>
<td>Syllabus</td>
<td>77.8</td>
<td>22.2</td>
<td>-</td>
</tr>
<tr>
<td>Charts and Models</td>
<td>22.2</td>
<td>55.6</td>
<td>22.2</td>
</tr>
</tbody>
</table>

The results show that there were adequate resources in secondary schools to enable pupils to effectively learn mathematics. This implied that most schools were well equipped with teaching and learning resources.

The respondents were asked to rate their students’ performance in mathematics. Figure 4.8 shows the results.
Figure 4.8: Rating student’s performance in mathematics

From figure 4.8, it is observed that most (48.1%) indicated that the performance was poor as opposed to 14.8% and 7.4% who indicated that the performance was good and very good respectively. Those who noted that the performance of their students was satisfactory were 29.6%. This reveals that the general performance in mathematics is poor.

4.5 Teaching Method and Performance

The respondents were required to indicate on their questionnaires the methods they mainly used to teach mathematics during in their lessons. The results shown in Figure 4.10 reveal that lecture method was the most common having 48.15% followed by demonstrations with 37.04% and the least method that was used is group discussion having 18.52%.
The information obtained from the observed classes gave similar findings, that the teacher mainly used lecture method and was directly involved in the lesson as indicated in table 4.7. This is a clear indication that the teachers dominated the lessons always (90.91%). Thus the classroom teaching was mainly teacher-centered which implies that student-centered approach was least used. The teachers spent most of their time exposing mathematical content rather than providing students with learning situations that would enhance understanding. Muthwii (1987), investigating also noted that the teacher talk was dominant with the pupil talk taking only 16.7% of the total talk. There is need to improve opportunities for students’ participation and interaction so as to motivate and engage students in solving mathematical problems.
Table 4.7: Role of the teacher in the lesson

<table>
<thead>
<tr>
<th>Role of the teacher in the lesson</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the teacher use the straight lecture during the lesson?</td>
<td>-</td>
<td>-</td>
<td>27.27%</td>
<td>27.27%</td>
<td>45.45%</td>
</tr>
<tr>
<td>Did he/she ask learners questions during the lesson?</td>
<td>-</td>
<td>9.1%</td>
<td>36.4%</td>
<td>27.3%</td>
<td>27.3%</td>
</tr>
<tr>
<td>Did he/she encourage and give learners time to consult each other?</td>
<td>18.18%</td>
<td>27.27%</td>
<td>27.27%</td>
<td>18.18%</td>
<td>9.09%</td>
</tr>
<tr>
<td>Was the teacher directly involved in the lesson?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.09%</td>
<td>90.91%</td>
</tr>
</tbody>
</table>

(Rating Scale- 0 –not at all, 1- a little, 2-often, 3-very often, 4-always)

The analysis was done of the various teaching methods used during the observed mathematics lessons and their influence on students’ achievement. The mean score was highest (10.14) for the classes where question/answer method was used with a standard deviation of 1.96 followed by discussion method (6.48) and a standard deviation of 0.82. The mean score obtained in the classes where demonstration method was used was 5.80 with a standard deviation of 2.76 and the lowest mean (4.12) was scored by the students who were taught using lecture method was used. The table 4.8 reveals the average performance based on teaching method.
Table 4.8: Performance based on teaching method

<table>
<thead>
<tr>
<th>Teaching method</th>
<th>Performance Mean</th>
<th>N=419</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>4.12</td>
<td>248</td>
<td>0.00</td>
</tr>
<tr>
<td>Discussion</td>
<td>6.48</td>
<td>72</td>
<td>0.82</td>
</tr>
<tr>
<td>demonstration</td>
<td>5.80</td>
<td>62</td>
<td>2.76</td>
</tr>
<tr>
<td>Question/answer</td>
<td>10.14</td>
<td>37</td>
<td>1.96</td>
</tr>
</tbody>
</table>

The research question was whether there is a relationship between teaching method and students’ achievement. One-way ANOVA was run for within and between groups and the results revealed that there was a positive significant influence on students’ performance when the question/answer method of teaching was used (p<0.05 at 95% confidence level) as shown in table 4.9. The other teaching methods (lecture, demonstration, discussion) did not show a significant influence on the achievement by the student (p>0.05 at 95% confidence level). The question/answer method is mainly learner-centered, indicating a high degree of learner involvement. The other teaching methods influence students’ performance indirectly.

Table 4.9: One-way ANOVA for performance by teaching method

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>52.324</td>
<td>3</td>
<td>17.441</td>
<td>5.237</td>
<td>.020</td>
</tr>
<tr>
<td>Within Groups</td>
<td>33.302</td>
<td>10</td>
<td>3.330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>85.625</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
F test with (3,10) degrees of freedom performed on the teaching method indicated significant difference in performance when question/answer method was used. 

\[ F(3,10)=5.237>F_{\text{crit}}(3,10)=3.7083; \, p<0.05. \]

4.6 Class size and performance

Figure 4.10: Average class size

The figure 4.10 shows the average class size in the various institutions majority (40.7%) being less than or equal to 45. The class sizes of less or equal to 35 and less or equal to 55 per class were 25.9% and 3.7% respectively.

The information obtained from the observed classes revealed that most of the classes (63.64%) had students ranging from 30-39 (medium class size). The small classes (≤ 29) and large classes (≥ 40) were 18.18% each respectively as indicated in table 4.10.
Table 4.10: Performance based on class size

<table>
<thead>
<tr>
<th>Class size</th>
<th>Proportion (%)</th>
<th>Mean=6.86</th>
<th>N=419</th>
<th>Standard deviation=4.457</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>18.18</td>
<td>4.88</td>
<td>103</td>
<td>3.866</td>
</tr>
<tr>
<td>Medium</td>
<td>63.64</td>
<td>7.24</td>
<td>129</td>
<td>4.723</td>
</tr>
<tr>
<td>Large</td>
<td>18.18</td>
<td>7.68</td>
<td>187</td>
<td>4.261</td>
</tr>
</tbody>
</table>

The mean scores for small, medium and large classes were 4.88, 7.24 and 7.68 with standard deviations of 3.866, 4.723 and 4.261 respectively (see table 4.9). The overall mean and standard deviation were 6.86 and 4.457 respectively. This shows that large classes performed best followed by medium classes and the lowest performance was by small classes. These findings disagree with the findings of Eshwani G (1983), who argued that small classes should be preferred to large classes for quality education.

The research question under investigation was whether achievement in mathematics is related to class size. The one way analysis of variance (ANOVA) revealed that there was significant variation in achievement for between and within groups for textbook/student ratio (F=14.699>4.605, p<0.01). Table 4.11 summarizes these findings.
Table 4.1: One way ANOVA for achievement by class size

<table>
<thead>
<tr>
<th>source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>548.155</td>
<td>2</td>
<td>274.077</td>
<td>14.699</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>7756.537</td>
<td>416</td>
<td>18.646</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8304.692</td>
<td>418</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post hoc analysis using least square difference (LSD) at 95% confidence level revealed that there was a significant difference in achievement between small class and large class and between small class and medium class. There was no significant variation between large class and medium class.

However information on KCPE entry scores for the students in the study schools revealed that mixed day secondary schools had a KCPE mean of 177.7, boys boarding had a mean of 338.75 while girls boarding had a mean of 333.25. In mixed day secondary schools, all the classes from the sampled schools were small classes with students below 30 and a mean class size of 18.17. In boys boarding schools the mean class size was 39.5 while in girls boarding schools the mean class size was 38(see table 4.12). In this study, these were categorized as medium and large classes.
Table 4.1: KCPE Mean Scores for the Sampled Schools

<table>
<thead>
<tr>
<th>School category</th>
<th>A(mixed day sec schools)</th>
<th>B(boys boarding)</th>
<th>C(girls boarding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class size (mean class size)</td>
<td>Small class (18.17)</td>
<td>Medium or large (39.5)</td>
<td>Medium or large (38)</td>
</tr>
<tr>
<td>KCPE marks (mean score out of 500)</td>
<td>150 201</td>
<td>360 355</td>
<td>365 300</td>
</tr>
<tr>
<td></td>
<td>198 162</td>
<td>310 318</td>
<td>318 350</td>
</tr>
<tr>
<td></td>
<td>175 180</td>
<td>330</td>
<td></td>
</tr>
<tr>
<td>Overall KCPE mean score</td>
<td>177.7</td>
<td>338.75</td>
<td>333.25</td>
</tr>
</tbody>
</table>

Table 4.12 reveals that students’ performance is influenced by the entry behavior of the students in the secondary school. Thus, the performance was better in large and medium classes where the students’ KCPE entry scores were higher implying that they had a strong background in basic mathematics content, skills and abilities. This in turn promotes their capability to attain high grades in mathematics at secondary school level.

4.7 Gender and Performance

Figure 4.10 reveals that in mixed schools, male students (boys) performed better (mean=6.64) than female students (girls) (mean=5.27); while in single sex schools, female students performed better (mean=7.46) than male students (mean=7.19).

In general, the male students had a mean of 6.94 with a standard deviation of 4.67 while female students had a mean of 6.81 with a standard deviation of 4.33 as
shown in table 4.12. This indicates that male students outperformed female students.

**Figure 4.11: Performance based on gender**

![Performance based on gender](image)

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed</td>
<td>5.27</td>
<td>6.64</td>
</tr>
<tr>
<td>Not Mixed</td>
<td>7.19</td>
<td>7.46</td>
</tr>
</tbody>
</table>

**Table 4.13: students’ performance by gender**

<table>
<thead>
<tr>
<th>A</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement Test</td>
<td>Male</td>
<td>159</td>
<td>6.94</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>260</td>
<td>6.81</td>
</tr>
</tbody>
</table>

The research question under investigation was whether student’s gender influences performance significantly or not. The t-test revealed that there was no significant difference in performance based on gender as shown in table 4.13.
Table 4.14: Independent samples test of score by gender of student

<table>
<thead>
<tr>
<th>Achievement Test</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.184</td>
<td>.668</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.274</td>
<td>314.422</td>
</tr>
</tbody>
</table>

Students t-test for equality of means did not show any significant variation in achievement by gender of the student (t=0.280, p>0.05 at 95% confidence level). Levene’s test for equality of variances revealed no significant difference on variation based on gender (F=0.184, p>0.05) as shown in table 4.14. These findings agree with the findings of Rukangu (2000) that, boys tend to perform better than girls in mathematics. These findings contradict the findings by Miheso (2002), who observed that girls performed better than boys. Further these findings are in agreement with the findings of Carole La Campagne (2002). According to Carole La Campagne in her discussion paper, Panel One (Internet), gender differences in mathematics achievement over the past twenty years have been decreasing, and a greater percentage of women are taking mathematics at college level. However, a smaller number of women majoring in mathematics are interested in teaching mathematics as compared to men, so this is not equitable.
4.8 Chapter Summary

In this chapter, data collected through questionnaires, achievement test results and class observation schedules have been presented, analyzed and interpreted with reference to the research objectives. The study has shown that the dominant teaching method is lecture, that is teacher-centred. Further it has shown that class size and teaching method influence performance. It has also shown contrary to the research findings by Eshiwani (1983), Miheso (2002) that large and medium classes performed better than small classes. However students in schools with small classes had low entry behavior from primary schools as was revealed from their KCPE results. Thus the performance was poor as compared to students in the large and medium classes who had high KCPE entry scores. Availability of text books and student’s gender were found to influence students’ performance. However, the influence was not statistically significant. From the observed lessons and teachers’ responses, it was noted that students’ absenteeism was a major factor that affected performance. However the extent to which it influenced performance needs to be established and appropriate recommendations made. The discussion, conclusion and recommendations of the findings are presented in the next chapter.
CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction
This chapter discusses and presents the summary of the research findings, conclusions made from the research results, recommendations and suggestions for further research.

5.1 Summary of Research Findings
The study focused on establishing whether students’ achievement is related to class size and teaching methods, influenced by availability of teaching/learning resources and students’ gender. Descriptive and inferential statistics were used and the main findings of this study were as follows:

5.1.1 Class Size
In this study, the classes with less than or equal to 29 students were categorized as small classes, those with students ranging from forty to forty-nine (30-39) were categorized as medium while classes with 40 students and above (≥40) were categorized as large. The research question under investigation was whether class size influenced performance. The findings in this study showed that large and medium classes performed significantly better than small classes which contradicts the research findings by Sidhu (1982), Eshiwani, (1983), Grouwns & Koechler, (1985), that favoured small classes. Students in large and medium classes showed better performance than those in small classes. The variations in achievement might have been as a result of other intervening factors such as
student-centered teaching methods and/availability of appropriate teaching and learning resources. The small classes were mainly in mixed day schools whereby entry behavior of the students was low as was revealed in chapter four. The KCPE mean score for boys boarding and girls boarding schools which had medium and large classes, was almost twice that of mixed day secondary schools which had small classes. Some of the students’ learning would be disrupted because of absenteeism due to lack of school fees.

5.1.2 Gender of the Students and Performance

The research question was whether students’ gender influences performance in mathematics. The findings in this study showed that in mixed schools, boys performed better than girls while in single sex schools, girls performed better than boys. On average, the male students performed better than female students, however, the gender differences were not significant. In single sex schools which were mainly boarding, all the students had equal learning opportunities and girls showed higher achievement level than boys although the differences were not statistically significant. This indicates that given equal learning opportunities, the gender differences in achievement would be minimal.

Meinholt & Murray (1999), observe that females have demonstrated that they are equally capable of learning and mastering mathematical concepts and knowledge as their male counterparts.
5.1.3 Availability of Teaching and Learning Resources

The research question was whether achievement in mathematics is influenced by availability of teaching and learning resources. Findings in this study showed that there was a positive relationship between text book/students ratio and performance. Students who shared one text book between two (1:2) performed better than those who shared one text book between three (1:3). Similarly, students who had each a text book on their own (1:1) performed better than those who shared one between two (1:2) although the influence was not statistically significant. This agrees with the findings of Mihezo (2002), Rukangu (2000) and Nyambura (2004), who indicated a positive relationship between textbook availability and students’ performance.

The findings in this study reveal that students’ performance in mathematics can be improved through increasing number of textbooks available to the students. Thus, the students should be provided with a variety of textbooks and also the teachers should ensure they utilize them effectively to improve students’ performance.

5.1.4 Teaching method

The study focused in finding out whether there is a relationship between the teaching methods and student achievement in mathematics. The findings in this study indicated that question and answer method was superior to the other teaching methods.
Classes in which the teacher mainly used question/answer method performed significantly different from the others taught using other methods (p<0.05) at 95% confidence level. The findings in this study concur with those of Miheso (2002), Gachathi (1976) and Mackey (1981), who observed that interactive teaching approach where learners are actively involved is superior to traditional (direct) instruction. In the question/answer method of teaching, the learner participation and involvement were high. However, in most of the observed classes, the teachers dominated the lessons (chalk and talk). There is therefore need for the mathematics teachers to be conversant with different teaching strategies for different categories of students. The varied individual differences will require varied teaching approaches.

5.2 Other supplementary findings
Absenteeism was a factor noted to influence performance negatively, thus, it needs to be investigated and the extent of its influence appropriately documented. Attitude was implied in some of the situations as having a negative influence on students’ performance in mathematics.

5.3 Conclusion
From the above, the main contexts of findings are that:
The teaching methods used in most lessons were mainly teacher-centered, hence do not provide opportunities for students’ participation to enhance learning.
There was a marked use of lecture method where the teacher dominated the lessons and the students played a passive role. Thus students interaction was reduced. There is need for the teacher to use interactive teaching and learning approach to promote student-centeredness learning and thus increase student participation to improve students’ performance.

Teachers need to expose students to problem-solving situations. This will help them to improve in critical thinking.

Absenteeism should be addressed especially in mixed day schools to support teaching and learning process. Students from poor family background need to be supported financially to be in school consistently.

5.4 Recommendations

i. Policy makers should put in place policies that emphasize that:

- Teachers be encouraged to form mathematical associations where they can share their experiences in teaching strategies and learning.
- Students be maintained in school throughout the term and ensure that bursaries are given to the needy students.
- Heuristic approaches to teaching should be integrated with expository approaches to enhance teaching and learning.
- Students should be exposed to problem solving situations so as to develop critical thinking skills.
• Cooperative learning be emphasized among teacher-students and students-students.

ii. The mixed schools have been found to perform very poorly as compared to single sex schools. The study recommends that policy makers and all education stakeholders need to pay much attention to the mixed schools and provide the necessary support for effective learning.

iii. Remedial teaching in mathematics needs to be emphasized since most of the teachers indicated that students' performance in mathematics is generally poor.

iv. There is need to develop and maintain a good guidance and counseling programme for all secondary school students in Kenya where they are advised on importance of mathematics in different careers.

v. Absenteeism in school should be addressed since it was noted to influence performance.

5.5 Suggestions for further research

Research needs to be done on effective classroom practices that can assist teachers improve on their pedagogical skills which should in turn enhance students’ conceptual understanding of mathematics leading to improved students’ performance in tests and examinations.

There is need to replicate this study to include a bigger sample of schools, classes, students and teachers in public secondary schools to ratify the findings of this research.
REFERENCES


*Comparative Education Review* 31(1), 1987, 73 – 75.


Nairobi: ERAP.


http://www.edchange.org/multicultural/papers/genderbias.html


APPENDIX I

MATHEMATICS TEACHERS QUESTIONNAIRE (MTQ)

This questionnaire seeks to gather information to be used in the factors influencing teaching of mathematics. You are kindly requested to fill in the questionnaire indicating your honest response by ticking (√) against your option and filling in the blanks. Your response will be treated with confidentiality.

Please do not write your name on this questionnaire.

Part 1

Category of the school

<table>
<thead>
<tr>
<th>Day</th>
<th>Boarding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>( )</td>
</tr>
<tr>
<td>Girls</td>
<td>( )</td>
</tr>
<tr>
<td>Mixed</td>
<td>( )</td>
</tr>
</tbody>
</table>

Age _______________ 20 -29 years

( ) 30 – 39 ( ) 40 -49 ( ) 50 and above ( )

Gender

Boy ( )
Girl ( )

Professional/academic qualifications

Diploma ( ) PGDE ( ) UT Graduate ( ) ATS ( ) B.ED ( ) Masters ( )

Other specify ( ).

Teaching experience in mathematics

1 - 4 years ( ) 5 -10 ( ) 11 – 15 years ( ) above 15 ( )
Have you attended SMASSE training?

Yes (  )
No (  )

(ii) If yes, (a) Duration in years…………………………………………
(b) Focus of training ……………………………………………

Any other in-service seminar/workshop attended. Yes (  )
No (  )

If yes specify ______________________________

How many times

Once (  )
twice (  )
more than twice (  )

PART II:

a) How many maths lessons do you teach in a week? Less than 15 () 15 – 19 ()
2025 above 25

b) What is your total teaching load per week

c) Indicate the mathematics classes you teach and the number of students in each class.

<table>
<thead>
<tr>
<th>Class form</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Is the time allocated for teaching mathematics adequate to cover the syllabus?

Yes (  )
No (  )
State the students/Mathematics text book ratio in mathematics classes

1:1 ( ) 1:2 ( ) 1:3 ( ) 1:4 ( )

Other (specify)  

Rate the following facilities and resources in relation to the teaching and learning of mathematics in your school. Tick as appropriate.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Adequate</th>
<th>Inadequate</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers reference books (recommended)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students text books (recommended)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syllabus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charts and models</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. How do you rate students’ performance in mathematics in your class?

Very good ( )  Good ( )  Satisfactory ( )  Poor ( )

16. Which of the following methods do you mainly use in teaching mathematics?

Lecturing ( )  Group or class discussion ( )  Demonstration ( )

Question and answer ( )

Other, (specify) .................................................................

17. Which teaching methods do you find suitable in teaching mathematics

.....................................................................................................
18. Which of the methods in No. 16 above actively engage students in learning process?

19. What is the average class size in your school?

   \[ \leq 25 ( ) \quad \leq 35 ( ) \quad \leq 45 ( ) \quad \leq 55 ( ) \quad \text{Above 55 ( )} \]

20. Suggest the suitable class size

THANKS FOR YOUR CO-OPERATION
APPENDIX II

Achievement Test (Pre-test)

Time: 40 min Total Marks: 20

Quadratic Expressions and Equations

1. Factorise
   (i) \( x^2 - 7x + 10 \)  
   (ii) \( 9x^2 - 24x + 16 \)  
   (4marks)

2. Add the missing terms to make the following expressions perfect squares.
   (i) \( x^2 + 12x + \_ \)  
   (ii) \( 4x^2 + \_ + 36 \)  
   (4marks)

3. Solve the following by completing the square method.
   (i) \( x^2 + 8x + 7 = 0 \)  
   (3marks)
   (ii) \( 9x^2 + 24x + 12 = 0 \)  
   (3marks)

4. Given that \( 25x^2 - 20x + k + 1 \) is a perfect square, find \( k \)  
   (2marks)

5. Form a quadratic equation whose roots are -4 and 3.

6. Solve for \( x \) if \( \frac{x - 2}{1} = \frac{1}{x} \)  
   (2marks)
APPENDIX III

Achievement Test (Core-test)

Time: 40 min  Total Marks: 20

Quadratic Expressions and Equations

1. Factorise
   (i) $x^2 - 6x + 8$  (ii) $4x^2 + 12x + 9$  (4 marks)

2. Add the missing terms to make the following expressions perfect squares.
   (i) $x^2 + 4x + \quad$  (ii) $16x^2 + \quad + 36$  (4 marks)

3. Solve the following by completing the square method.
   (i) $x^2 + 5x + 1 = 0$  (2 marks)
   (ii) $4x^2 + 12x - 9 = 0$  (3 marks)

4. Given that $16x^2 - 40x + 20 + m$ is a perfect square, find $m$  (2 marks)

5. Form a quadratic equation whose roots are -2 and 3.

6. Solve for $x$ if $\frac{x - 1}{1} = \frac{1}{2x - 3}$  (2 marks)
APPENDIX IV

CLASSROOM OBSERVATION SCHEDULE FOR MATHEMATICS LESSONS IN PUBLIC SECONDARY SCHOOLS IN EMBU WEST DISTRICT

The purpose of this schedule is to find out the teaching methods used by teachers in the classroom, class size and the learner characteristics as they interact with the teachers and instructional resources.

This schedule consists of two parts:

PART A: Personal information

PART B: Assessment of classroom teaching and learning by the researcher

PART A: Personal Data

School name ................................................. Subject .........................................................
Class......................................................... Teachers teaching experience..............

Academic qualification................................. Date ............................................................

PART B: Assessment of Classroom Teaching and Learning

Indicate your assessment by placing a tick in the appropriate box.

(Rating Scale- 0 –not at all, 1- a little, 2-often, 3-very often, 4-always)

<table>
<thead>
<tr>
<th>1.</th>
<th>Role of the teacher in the lesson</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Did the teacher use the straight lecture during the lesson?</td>
<td></td>
<td></td>
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<tr>
<td>ii)</td>
<td>Did he/she ask learners questions during the</td>
<td></td>
<td></td>
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<tr>
<td>iii)</td>
<td>Did he/she encourage and give learners time to consult each other?</td>
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<td>------</td>
<td>---------------------------------------------------------------</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>iv)</td>
<td>Was the teacher directly involved in the lesson?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Rate the following methods as the mathematics teacher used in the lesson</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Lecture</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Demonstration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Group discussion/ small group activities</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question and answer</td>
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<tr>
<td></td>
<td>Any other,</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>(specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2. Number of students in the class

-------------------------------------------------------------------

Any other classroom observations made (specify)

-------------------------------------------------------------------
APPENDIX V
EMBU WEST DISTRICT PUBLIC SECONDARY SCHOOLS 2010

1. Nguviu Boys*
2. Kangaru Boys H School*
3. St Paul’s Kevote
4. Kangaru Girls
5. Kiriari Girls*
6. Itabua Mixed Day Sec
7. Kavutiri Boys H Sch
8. St Teresa’s Kithimu Girls
9. Kamama Boys*
10. Nguviu Girls*
11. St Benedict’s Kithimu Day
12. Kithegi Mixed Day
13. St Francis Ngoire Day
14. Lions Sec
15. DEB Kairuri Mixed Day
16. St Alphones Mixed Day
17. St Mary’s Kiangima Girls*
18. St Christopher Mixed Day
19. St Martha Mixed Gatoori*
20. Gatunduri Mixed Day
21. St John’s Girls Kianjuki*
22. Kiriari Mixed Day*
23. Gituri Mixed Day Sec
24. Nthambo Mixed Day
25. S A Manyatta Mixed Day
26. ACK Kamviu Day
27. Kianjokoma Mixed Day
28. All Saints Kigari Day*
29. Kirimari Boys*
30. Kimangaru Mixed Day
31. St Peter’s Kagumori
32. Kamiu Day
33. St Joseph the Worker*
34. St Michael Mixed Day Kevote
35. DEB Kavutiri
36. Rukira Day
37. ACK Kithunguriri Mixed Day*
38. ST Peter’s Kathakwa Mixed Day
39. Kirigi Mixed Day*
40. ACK Gatondo Mixed Day
41. St Benedict’s Mixed Day Sec
42. St Mary’s Mukangu Day
43. Muvandori Mixed Day Sec Sch
44. Embu County Mixed Day Sec *

Key:

* - sampled schools
APPENDIX VI

A MAP SHOWING THE LOCATION OF EMBU DISTRICT IN KENYA

Source: Encarta Library 2005
APPENDIX VII

RESEARCH PERMIT

PAGE 2

THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss/Institution
Lycia Igandu Njagi
of (Address) Kenyatta University
P.O. BOX 43644, Nairobi
has been permitted to conduct research in

Embush West
Location
Eastern
District
Province

on the topic: Factors which influence students' performance in Mathematics in public secondary schools in Embu West District, Embu County, Kenya

for a period ending 30th June 2012

PAGE 3

Research Permit No. NCST/RCD/14/012/07
Date of issue
2nd March 2012

fee received
KSHS. 1000

Applicant’s
Signature

National Council for
Science & Technology

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do so may lead to the cancellation of your permit.

2. Government Officers will not be interviewed without prior appointment.

3. No questionnaire will be used unless it has been approved.

4. Excavation, mining and collection of biological specimens are subject to further permission from the relevant Government Ministries.

5. You are required to submit at least two (2) bound copies of your final report for Kenyans and non-Kenyans respectively.

6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice.

[CONDITIONS—see back page]