FACTORS AFFECTING USE OF COMPUTERS IN TEACHING AND LEARNING MATHEMATICS IN SECONDARY SCHOOLS IN KISII CENTRAL DISTRICT, KISII COUNTY, KENYA

BY

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MARCH, 2013.
DECLARATION

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

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I would like to dedicate this work to my loving wife Damaris and our children, Diana, Bolton, Moraa and Omari for their moral support during the drafting and presentation of my Thesis.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title page</td>
</tr>
<tr>
<td>Declaration</td>
</tr>
<tr>
<td>Dedication</td>
</tr>
<tr>
<td>Acknowledgment</td>
</tr>
<tr>
<td>Table of Contents</td>
</tr>
<tr>
<td>List of Tables</td>
</tr>
<tr>
<td>List of Figures</td>
</tr>
<tr>
<td>Abbreviations and Acronyms</td>
</tr>
<tr>
<td>Abstract</td>
</tr>
</tbody>
</table>

## CHAPTER ONE: INTRODUCTION

1.1 Background to the Study | 1
1.2 Statement of the Problem | 4
1.3 Purpose of the Study | 5
1.4 Objectives of the Study | 5
1.5 Research Questions | 6
1.6 Significance of the Study | 6
1.7 Scope of the Study | 8
1.8 Limitations of the Study | 8
1.9 Assumptions | 8
1.10 Theoretical Framework | 8
1.11 Conceptual framework | 10
1.12 Operational Definitions of Terms | 12
1.13 Summary | 13

## CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction | 14
2.2 Computer use in teaching and learning mathematics in secondary schools | 14
2.3 Trends of using Computer in teaching and learning mathematics in other countries | 18
2.4 Computer Programs that Support the Teaching and Learning of Mathematics | 23
2.5 Potential Benefits of using Computer (CAI) in teaching and learning mathematics--24
2.6 Summary-----------------------------------------------------------------------------------------25

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction-----------------------------------------------------------------------------------------27
3.2 Research Design------------------------------------------------------------------------------------27
3.3 Study Variables-------------------------------------------------------------------------------------28
3.4 Study Location---------------------------------------------------------------------------------------29
3.5 Target Population------------------------------------------------------------------------------------30
3.6 Sampling Techniques----------------------------------------------------------------------------------30
  3.6.1 Sample Size---------------------------------------------------------------------------------------30
3.7 Study Instruments------------------------------------------------------------------------------------32
3.8 Pilot Study------------------------------------------------------------------------------------------33
  3.8.1 Reliability----------------------------------------------------------------------------------------34
  3.8.2 Validity-------------------------------------------------------------------------------------------34
3.9 Data Collection--------------------------------------------------------------------------------------35
3.10 Data Analysis---------------------------------------------------------------------------------------35
3.11 Ethical Considerations-----------------------------------------------------------------------------35
3.12 Summary-------------------------------------------------------------------------------------------36

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction----------------------------------------------------------------------------------------37
4.2 Background information of respondents------------------------------------------------------------37
  4.2.1 Students’ background information---------------------------------------------------------------37
  4.2.2 Teachers background information----------------------------------------------------------------39
  4.2.3 Principals background information----------------------------------------------------------------42
4.3 To find out the current status of computer infrastructure and mathematics computer software resources-----------------------------------------------44
  4.3.1 Computer laboratory--------------------------------------------------------------------------------44
  4.3.2 Mathematics software-----------------------------------------------------------------------------45
  4.3.3 Computer printers-----------------------------------------------------------------------------------46
4.4 To establish the difficulties teachers face from using computers in teaching and learning mathematics-----------------------------------------------47
4.5 To establish the challenges students face from using computers in learning mathematics----------------------53
4.6 Principals’ Interview Schedule------------------------------------------57

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction----------------------------------------------------------62
5.2 Summary of findings-------------------------------------------------62
5.2.1 Summary of findings on background information---------------------62
5.2.2 Summary of findings on current status of computer models and
Mathematics software---------------------------------------------------63
5.2.3. Summary of findings on challenges students’ face when using computers------63
5.2.4. Summary of findings on difficulties teachers’ face when using computers------64
5.3 Conclusions of the study---------------------------------------------65
5.4 Recommendations-----------------------------------------------------66
5.5 Recommendations for further research---------------------------------66

References---------------------------------------------------------------68
Appendix A---Principal’s Interview schedule------------------------------72
Appendix B---Mathematics Teacher’s Questionnaire------------------------76
Appendix C---Student’s Questionnaire------------------------------------79
Appendix D---Observation Schedule---------------------------------------81
Appendix E---Budget Proposal---------------------------------------------82
Appendix F---Time Schedule / Work Plan----------------------------------83
Appendix G---Research Permit--------------------------------------------84
List of Tables

Table 3.1: Sampling Grid-----------------------------34
Table 4.1 Teachers’ Level of Education-------------------------39
Table 4.2 Principals’ level of Education------------------------42
Table 4.3 Computer Laboratory Equipment------------------------44
Table 4.4 Computer Models Available---------------------------45
Table 4.5 Computer Projector-----------------------------------46
Table 4.6 Difficulties Mathematics teachers face in teaching Mathematics using Computers-----------------------------------47
Table 4.7 Frequency of computer use----------------------------49
Table 4.8 We use computers for Mathematics activities----------------53
Table 4.9 We have access to mathematics software-----------------54
Table 4.10 Principals Response---------------------------------58
List of Figures

Figure 1: The Conceptual Framework-----------------------------------------------10
Figure 3.4 Kisii Central District Base Maps----------------------------------------31
Figure 4.1 Students’ Gender-------------------------------------------------------38
Figure 4.2 Students’ Age-----------------------------------------------------------38
Figure 4.3 Teachers’ Gender---------------------------------------------------------39
Figure 4.4 Teachers’ computer literacy---------------------------------------------40
Figure 4.5 Teachers’ Responsibilities----------------------------------------------40
Figure 4.6 Mathematics Teachers’ second subject-----------------------------------41
Figure 4.7 Principals’ Gender------------------------------------------------------42
Figure 4.8 Principals’ Computer Literacy-------------------------------------------43
Figure 4.9 Types of Schools--------------------------------------------------------43
Figure 4.10 Computer Books--------------------------------------------------------45
Figure 4.11 Computer Furniture-----------------------------------------------------46
Figure 4.12 Do you use computers to teach mathematics?------------------------------48
Figure 4.13 Are you involved in budgeting------------------------------------------49
Figure 4.14 I am Comfortable Using Computers---------------------------------------54
Figure 4.15 Frequency of use of computers------------------------------------------55
Figure 4.16 Do your Computer/Math teachers use computers--------------------------59
Figure 4.17 Kioge Girls high school computer laboratory-------------------------------61
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAI</td>
<td>Computer Assisted Instruction.</td>
</tr>
<tr>
<td>CAL</td>
<td>Computer Assisted Learning.</td>
</tr>
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<td>CBIS</td>
<td>Computer-Based Instructional System</td>
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<tr>
<td>CD-ROM</td>
<td>Compact Disk-Read On Memory</td>
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<tr>
<td>CT</td>
<td>Computer Technology.</td>
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<td>FPE</td>
<td>Free Primary Education</td>
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<td>FSE</td>
<td>Free Secondary Education</td>
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<td>HOD</td>
<td>Head of Department</td>
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<td>IBM</td>
<td>International Business Machines Corporation</td>
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<td>ICT</td>
<td>Information Communications and Technology.</td>
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<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
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<td>KIE</td>
<td>Kenya Institute of Education.</td>
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<tr>
<td>Ksh</td>
<td>Kenya shillings.</td>
</tr>
<tr>
<td>MOE</td>
<td>Ministry Of Education</td>
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<td>MOEST</td>
<td>Ministry of Education Science and Technology</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisations.</td>
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<td>PLATO</td>
<td>Programmed Logic for Automatic Teaching operations.</td>
</tr>
<tr>
<td>PTA</td>
<td>Parents Teachers Association.</td>
</tr>
<tr>
<td>RCA</td>
<td>Radio Corporation of America</td>
</tr>
<tr>
<td>SMASSE</td>
<td>Strengthening of Mathematics and Science in Secondary Education.</td>
</tr>
<tr>
<td>TICCIT</td>
<td>Time-shared Interactive Computer-Controlled Information Television</td>
</tr>
<tr>
<td>TSC</td>
<td>Teachers Service Commission.</td>
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<tr>
<td>UPS</td>
<td>Uninterruptible Power Supplyor Uninterruptible Power Source</td>
</tr>
</tbody>
</table>
Abstract

The study investigated factors affecting the use of computers in teaching and learning of Mathematics in secondary schools of Kisii central district, Kisii County, Kenya. Previous empirical studies have underscored the important roles of instructional materials in the classroom setup. Studies the world over have also highlighted the roles of computer as an instructional material in the classroom particularly in regard to assisting in enriching the teaching learning experience of perceived difficult subjects such as Mathematics. It is therefore surprising that most schools in the country are yet to integrate its use in teaching and learning of such subjects even though the Government and its development partners have invested colossal amounts of scarce resource in stocking schools with computer hardware and software. A descriptive survey study was employed to obtain both qualitative and quantitative data on factors that affect the use of computers in teaching and learning of Mathematics in the district. Stratified random sampling was used to select 323 form three students and 32 Mathematics teachers. All the Principals of the participating schools were also requested to participate in the study. Data was collected using interview schedule for principals (Appendix A), questionnaires; one for mathematics teachers (Appendix B) and one for students (Appendix C). An Observation schedule was also used by the researcher (Appendix D). The instruments were piloted to enhance their validity and reliability. Data was analysed by the use of the statistical package for social sciences (SPSS) to investigate factors affecting use of Computer in teaching and learning Mathematics. They were presented in, frequencies, means, percentages, pie charts and bar graphs. The study findings indicated that there was minimal use of computers in teaching and learning of Mathematics due to lack of Mathematics software, fewer computers per school, lack of computer skills by teachers and students, power blackouts and inadequate computer laboratory space to accommodate mathematics students. It is recommended that mathematics teachers be trained on computer skills; various stakeholders, school PTA, the government and sponsors put in place mechanisms that will ensure computers, power generator, mathematics software and computer laboratories are available in all secondary schools for computer integration in the teaching and learning of not only Mathematics but other subjects as well.
CHAPTER ONE

INTRODUCTION

1.1 Background to the Study.

Educational technology is an interdisciplinary field which is comprised of a diverse set of disciplines and knowledge domains (Bhagwan, 2005). It is mainly concerned with the use of various forms of instructional modes that aids in simplifying abstract concepts during the teaching and learning process. Computer Assisted Learning (CAL) refers to the use of a computer as an instructional material in the teaching learning process. In the process, the teacher gives learners computer directions in a programming language, use the computer as a tool using in-built software such as word processors and spread sheets or as a tutor the learners take drills, practice, tutorial, use exploration tools or simulation, and at times test using the computer (Deepark & Turner, 2006).

Audio-visual education a branch of education technology emerged as a discipline in the 1920s, when film technology was developing rapidly (Hughes, 1962). A visual instruction movement arose, which encouraged the use of visual materials to make abstract ideas more comprehensible to students. As sound technology improved, the movement became known as audio-visual instruction. Educators at that time viewed audio-visuals only as aids to teachers. Not until World War II, when the armed services used audio-visual materials to train large numbers of persons in short periods of time, did the potential of these devices as primary sources of instruction become apparent (Blomeyer and Martin (1991). In the 1950s and '60s, developments in communications theory and systems concepts led to studies of the educational process, its elements, and their interrelationships (Hughes, 1962). Among these elements are the teacher, the teaching methods, the information conveyed, the materials used, the student, and the student's responses. As a result of these studies, the field of audio-visuals shifted its emphasis from devices and materials to the examination of the teaching-learning
process. The field was now known as audio-visual communications and educational
technology, and audio-visual materials were viewed as an integral part of the educational
system (Laswell, & Dwight, 1948).

As the technology improved, educational capabilities increased correspondingly. According
to Deepark and Turner (2006), the emergence of inexpensive computer technology and mass
storage media, including optical videodiscs and compact disks, has given instructional
technologists better tools with which to work. Compact disks (the CD-ROM and CD-I) are
used to store large amounts of data, such as encyclopaedias or motion pictures. In the new
interactive delivery stations with computers and CD-ROM, CD-I, or videodiscs, a student
who is interested in a particular topic can first scan an electronic encyclopaedia, then view a
film on the subject or look at related topics at the touch of a button (Garrison & Anderson,
2003). These teaching stations combine the advantages of reference materials, still pictures,
motion pictures, television, and computer-aided instruction. With even newer technologies
now being developed, such learning stations are now commonplace in homes for both
entertainment and educational purposes. According to Nievergelt (1986) in Hung and Khine
(2006); the appearance of microcomputers has initiated graphic animation and
implementation of an increased variety of instructional strategies, such as simulation and
modelling. Significant CAL projects emerging from these efforts in the early 1970’s included
the Programmed Logic for Automatic Teaching operations (Sherwin, 1978).

Various authors document the immense benefits that these materials bring to the classroom.
that calculus students who used mathematica (a Mathematics software) were better able to
make connections between numerical, graphical and symbolic representations than students
learning via traditional methods such as lecture method, historical method, book and pencil
exercises and teacher-centred teaching. The assertion is supported by Roddick, (1995) in
Hung and Khine (2006) who found that engineering mechanics students who used mathematica solved problems requiring calculus more conceptually when compared to students learning via traditional methods such as lecture method, historical method, book and pencil exercises and teacher-centred teaching focusing only on the procedures.

Snir (1996) in Hung and Khine (2006) argues that computers can make a unique contribution to the clarification and correction of commonly held misconceptions of phenomenon by visualizing those ideas. For instance, he suggests that the computer can be used to form a representation for the phenomenon in which all the relational and Mathematical wave equations (trigonometry iii) are embedded within the program code and reflected on the screen by the use of graphics and visuals. Such use, according to Anderson, Boyle and Yost, (1986) in Hung and Khine (2006) makes the computer an efficient tool to clarify scientific understanding of waves and other Mathematical topics.

Although there are numerous research on the positive impacts of computer-Assisted Learning (CAL) in foreign countries and higher institutions of learning including institutes of technology, polytechnics and universities in Kenya, the high school Mathematics teachers have done very little to introduce the same in their classroom teaching and learning process. With the Free Day Secondary Education (FDSE) provided by the Kenya Government, secondary schools are increasingly acquiring computers for computer science subject which is an optional subject, thereby ensuring that the infrastructure is put in place awaiting implementation (MOEST, 2003-2004).

It is common knowledge that Mathematics and Sciences subjects (Biology, Chemistry and Physics) are a thorn in the ‘flesh’ of most high school students in Kenya (Chiriswa, 2002; Kwaka, 2003). This fact is illustrated by the persistent poor performance by most of the students in the subjects. The dismal performance, according to most researchers could be
attributed to teacher factors, student factors and inadequate access to or use of instructional materials among others (Ogembo, 2012).

B.F. Skinner’s (1950) concept of programmed instruction emphasized the need for total educational plan involving, identifying objectives; arranging subject matter into logical sequences; preparing and testing instructional programs; and then implementing, testing, and revising them. Skinner shifted the emphasis in education away from the teacher's presentation of information and toward the learner's behaviour and, especially, reinforcement of that behaviour. His teaching machines provided programmed instruction, which allowed students to proceed through lessons by small steps, at their own pace, following an orderly sequence, and receiving immediate reinforcement for every correct response. Skinner's work emphasized the use of audio-visuals, which are well-illustrated in facilitating individualized learning. This is the concept that computer use in the teaching and learning of Mathematics was hoped, would bring to the Kenyan classroom sessions.

1.2 Statement of the Problem
Mathematics has been recognized worldwide over the ages of civilization as a vital tool for survival particularly in areas of science and technology. Mathematics education therefore has increasingly become science and technological oriented. The 21st century has witnessed an advanced development in information communication and technology (ICT) through the introduction of undersea fibre optic cables which link the whole world through the computer (internet), making the world a global village (Deepark and Turner, 2006). Further to these, there has been an increase in access to computers due to tremendous advancement witnessed in computer hardware and software engineering which has resulted in the lowering of the prices of desktop and laptop computers (Garrison and Anderson, 2003).
Due to the initiative of the Government of Kenya through the Ministry of Education and other stakeholders, there has been massive rollout of computer hardware and software to learning institutions (MOEST, 2003-2004). This rollout, it was hoped would enable the learners in using the computers during their learning sessions be at par with the rest of the world. Education sector professionals were particularly keen to adopting the technology of using computers in teaching and learning particularly of Mathematics and Sciences due to insight on its benefits in educational media instructions. Empirical data from researchers such as, Nievergelt (1986) in Hung and Khine (2006) and Bollinger (1986) have documented many potential benefits of using computers in Mathematics education, an area that has presented a lot of challenges to learners particularly at the secondary school level. However, information obtained from most learners and their teachers in secondary schools particularly in Kisii central district indicate that most schools are yet to integrate the use of computers in teaching and learning of Mathematics. This study therefore sought to investigate the factors affecting use of computers in teaching and learning of Mathematics in secondary schools in Kisii central district, Kisii County, Kenya to document the challenges that might still be prevailing in our learning institutions.

1.3 Purpose of the Study

The aim of this study was to contribute to an improved Mathematics teaching and learning environment at secondary school level. The main purpose of this study was to investigate the factors affecting use of computers in teaching and learning of Mathematics in secondary schools in Kisii central district, Kisii County, Kenya.

1.4 Objectives of the Study.

The overall objective of this study was to investigate the factors affecting use of computers in teaching and learning mathematics in secondary schools in Kisii central district, Kisii County, Kenya.
The study was guided by the following specific objectives.

i. To find out the current status of computer models and mathematics computer software resources.

ii. To establish the difficulties teachers face when using computers in teaching and learning mathematics.

iii. To establish the challenges students face when using computers in learning mathematics.

iv. To give recommendations on using computers in teaching and learning mathematics.

1.5 Research Questions

i. What models of computers and mathematics computer software are available for use in schools?

ii. What difficulties do teachers face when using computers in teaching and learning mathematics?

iii. What challenges do students face when using computers in learning mathematics?

iv. What recommendations may be given on the usage of computers in teaching and learning mathematics?

1.6 Significance of the Study.

The study will be useful and will make a major contribution in providing information on the factors that affect the use of computers in teaching and learning mathematics in secondary schools. First and foremost, as the implementers of all research inputs related to academic excellence in schools, Mathematics teachers will find much assistance in the findings. The findings will provide the teachers with appropriate information on using computers in teaching and learning Mathematics in secondary schools in order to enhance the performance of their students in the subject.
Secondly, students of Mathematics have a responsibility of responding to the learning activities and utilization of time for proper guidance. The findings will increase students’ awareness of the use of computers as a medium of teaching and learning mathematics which will lead to improved learning strategies with modern technology and achievement in mathematics.

Thirdly, policy makers will use the findings to review the existing policies especially on teacher training on computer skills with a view of guiding them on using computers as a medium of teaching and learning. The findings will also assist in formulation of policy guidelines on using computers as a medium of teaching and learning in all secondary schools of not only Mathematics but other subjects as well.

Fourthly, educational administrators are charged with the responsibility of monitoring learning programmes in schools. The findings will help them to ensure appropriate and meaningful computer instructions in Mathematics and other subjects as used in secondary schools. The results will also help the Government to identify and plan administrative issues related to imports, marketing and access to computers and computer software in order to enable students’ access quality education.

Lastly, the study will provide an insight into the Kenya’s perspective of B.F. Skinner’s programmed instruction with reference to the factors affecting the use of computers as a medium of teaching and learning in the Kenyan education system. In addition, the study will contribute to the body of knowledge in the field of instructional technology and help stimulate further research in computer applications and other related fields.
1.7 Scope of the Study

The study was limited to a sample of schools in Kisii central district, Kisii County, Kenya because it offered a variety of schools: district schools both mixed and single (boys and girls), private schools, provincial and National schools for the study to be carried. The study focused on Mathematics teachers, principals and Mathematics students. The researcher was also familiar with the locality.

1.8 Limitations of the Study

The limitations of the study included the ever changing technology on computer hardware and software resources, inadequate literature addressing use of computers in teaching and learning of Mathematics in secondary schools in Kenya and insufficient funds. The study only took place in Kisii Central district, Kisii County due to time and money constraints. Sample size was nineteen schools to represent the whole district.

1.9 Assumptions of the Study.

The study was based on the following assumptions.

i. All respondents were co-operative and provided reliable responses.

ii. All respondents were aware of the computers and computer software materials that were necessary in secondary schools

iii. All respondents were computer literate.

1.10 Theoretical framework.

The conceptual framework (Figure 1) of the study was based on B.F. Skinner’s ‘black box’ theory and programmed instruction. B.F. Skinner’s viewpoint is based on a definition of learning as an observable change in behaviour (Skinner, 1950). The potential of the computer as a teaching aid promises increasing design sophistication. Computers can be programmed
to judge student input and to tailor lessons to each individual's level of mastery. In a tutorial mode, computers can present instructional input and require mastery of each step in ways that were not possible with the early machines. The sensitivity of the instructional designer to alternative patterns of student learning is the necessary key to full use of a computer capacity. Simulation—using the computer to model a real situation—enables even greater sophistication, allowing realistic reactions to student input. Well-designed intellectual games can provide pertinent environments in which to practice important problem-solving skills.

The relevance of this theory is that the learning process is based on the principle of reinforcement and that the stimulus-response schema is based on the operant conditioning whereby an entirely new behaviour is learnt to a familiar stimulus that is, computer instruction is equated to the conditioning of a desired behaviour. The classroom is equated to the ‘black box’, with the computer as the device to be clicked by the student to give desired behaviour of positive results from the learning process. This means that computer assisted instruction (CAI), has to present a stimulus, give feedback to the student’s response (to the stimulus) and reinforces desired responses.

The behaviour to be learnt has to be split up in small components (computer tasks) which are presented to the student. The desired behaviour is reinforced through repetitions by the computer since it can go over and over a given concept several times based on the student’s responses.

This theoretical framework is therefore acting as a point of reference in establishing the factors affecting the use of computers as a medium of teaching and learning Mathematics education in Kenya.
1.11 Conceptual Framework.

Figure 1 Conceptual Framework.

Computer models & Infrastructure in school.

Mathematics Curriculum / syllabus

Modes of Mathematics Teaching, Whole class (Mass) or Individualized.

Independent variables

Positive Reinforcement

- Good performance in mathematics
- Good mathematical computations.
- Computer skill development
- Good analytical skill

COMPUTER USE BY STUDENT

 COMPUTER USE BY STUDENT

Computer models & Infrastructure in school.

Mathematics Curriculum / syllabus

Modes of Mathematics Teaching, Whole class (Mass) or Individualized.

Independent variables

- Frequency of computer use
- Teachers’ computer knowledge
- Students’ interest in computers, age and gender

Dependent variables

- Poor performance in mathematics
- Poor mathematical computation
- Poor computer skill development
- Withdrawal

Intervening variables

Source: Designed by Researcher (2012)

Computer infrastructure in school affects the learner’s choice of using or not using a computer to learn mathematics. Mathematics curriculum must be integrated to use computers in teaching and learning of Mathematics. This will be achieved by use of good Mathematics computer software. Hence mathematics teachers must integrate their teaching using
computers. Frequency of computer use by both learners and teachers will improve the teaching and learning of mathematics. The Modes of instruction, mass (use of projector) or individualized may encourage or discourage learners from using computers.

The intervening variables include teachers’ computer skills, learners’ interest in using computers, age and gender, reinforcement, and frequency of computer use. With proper reinforcement and regular use of computers, the learner is able to use computers in the learning of mathematics and hence resulting to good performance in mathematics and good Computer skill development. However with negative reinforcement the learner withdraws from using computers in learning mathematics resulting to poor performance and poor computer skill development.
1.12 Operational Definitions of Terms

AIRTEMP - Mathematics software that draws bar graphs, charts and line graphs.

Audio-Visual Communication- is the conveyance of ideas and information in forms that can be heard, read or looked upon.

Audio-Visual Education- Is instruction where particular attention is paid to the audio and visual presentation of the material with the goal of improving comprehension and retention.

Audio-Visual Instruction- The use of teaching materials and techniques that does not depend mainly upon the printed word to convey meaning and works through sight and sound.

BLOCKS - Mathematics software explaining about arithmetic and the dice.

BUILD - Mathematics software that enables the user to draw a picture composed of cubes.

CALDRAW - Mathematics software with all geometrical objects.

COMPUTER- A machine that performs tasks such as calculations or electronic communication under a set of instructions (program).

DIAGONAL - Mathematics software that explores the diagonals of rectangles.

LOCUS - Mathematics software that draws loci and geometrical constructions.

MATHEMATICA - Mathematics software that explains differentiation and integration

MATHLAP - Mathematics software that draws pictures.

MATH TREK - Mathematics software that offers mathematical games of numbers

Negative Reinforcement- The taking away of an unpleasant stimulus to increase certain behavior or response.

SINCOS- Mathematics software that provides a model that explains the meaning of sines and cosines of all angles, positive and negative.

TOPGRADES - Mathematics software for teaching elementary mathematics.

‘Top-Down’ Approach- is essentially the breaking down of a system (big picture) to gain insight into its compositional sub-systems (smaller segments).
1.13. Summary.

This chapter looked at the research problem and highlighted on the background to the study. It also looked at the scope of the study and the significance of the study to the teachers, students, educational stakeholders and policy makers of this country. It also looked into B.F. Skinner’s programmed learning theory (1950). The conceptual framework demonstrates the independent, intervening and the dependent variables with possible outcomes. It was therefore necessary to ensure that a study was carried out to find out the factors that affect the use of computers in teaching and learning mathematics in secondary schools in Kisii County.
CHAPTER TWO:

LITERATURE REVIEW

2.1 Introduction

Computer technology has been in use since 1970s and many countries have adopted this technology as a medium of instruction in primary schools, secondary schools, colleges and universities. In Kenya many private and public schools have adopted this computer technology as a medium of instruction in computer science. However computer technology has not been integrated in the mathematics classrooms in secondary schools. For the purpose of this study, the literature was viewed under the factors affecting the use of computers in teaching and learning mathematics in secondary schools in Kenya under the following sub-headings;

i. Computer use in teaching and learning mathematics in secondary schools.

ii. Trends of computer use in teaching and learning mathematics in other countries.

iii. Computer Programs that Support the Teaching and Learning of Mathematics.

iv. Potential benefits of using computer assisted instruction (CAI) in teaching and learning Mathematics.

v. Summary

2.2 Computer use in teaching and learning mathematics in secondary schools

According to Dwyer and Margot (1975) in a report about ‘project solo’ – a project about people involved in computer learning carried out between 1970 and 1977, elaborate experimentation with various modes of using computers in high schools was carried out and computer-related curriculum modules for secondary schools developed. The project which was jointly supported by the National Science Foundation and the University of Pittsburgh focused upon computer-augmented learning in secondary schools, engineering and other fields. The primary objective of the project was to stimulate students to analyse, synthesize,
evaluate and apply Mathematics on their own by using algorithmic problem solving and student-controlled computing as catalysts (Scardamalia, 2004). The more than 100 computer-augmented, curriculum modules produced by the project are designed to help high school students use a computer as a tool in exploring concepts and principles from topics in high school Mathematics (Hung and Khine, 2006).

A computer resource book for algebra, which was authored by Dwyer, who was the director of project solo and Margot a researcher with the project, illustrates how the ideas for teaching and learning Mathematics emanating from project solo can be used in high schools in Kenya that have access to computers (Hung and Khine, 2006). Many current students lack investigation and exploration skills (Oduor, 2009). The capabilities of computers to assist students discover and conjecture is obvious (Bhagwan, 2005). Computers provide instant calculations and rapidly generate graphics with which students can make and test conjectures. Many Mathematical software packages are open-ended tools, adaptable to a range of learning and teaching needs and objectives (Hung and Khine, 2006).

Software are available that can solve most of the exercises in today’s Mathematics textbooks (Bhagwan, 2005). The widespread availability and use of Mathematical manipulation software has resulted in significant changes in emphasis and paradigms used in school Mathematics. Bollinger (1986) concluded that 75% of all problems in high school algebra could be solved completely or partially by symbolic manipulation software. In his research findings, he asserts that students learn more Mathematics in less time with broader conceptual understanding using symbolic-manipulation software than from traditional instruction. Proper use of symbolic manipulation software with application problems would change the focus of instruction and assist students through a conceptual and applied understanding of real-world mathematics (Garrison and Anderson, 2003).
According to Deepark and Turner (2006), teachers must feel comfortable using computer technology and have an awareness of applications and how computers can be effectively integrated into learning situations. The use of computer technology in Mathematics teaching and learning, they suggest, should be a commonplace to teachers as using the chalkboard and overhead projector. This is due to the fact that technological aids allow greater realism in classroom, which in turn calls for re-examining the content of teaching and learning of Mathematics. Further, according to Nievergelt, (1986) in Hung and Khine (2006); the appearance of microcomputers has initiated graphic animation and implementation of an increased variety of instructional strategies, such as simulation and modelling. Significant CAL projects emerging from these efforts in the early 1970’s included the PLATO III and IV (Programmed Logic for Automatic Teaching operations).

Eshiwani (1981) list the aims of school Mathematics for East African countries as:

i. To develop Mathematical skills and understanding of number patterns shapes, together with social, domestic and commercial applications.

ii. To instil into the students deductive and critical methods of thinking that lead to intellectual independence.

iii. To train students in generalization.

iv. To lead to an improved and more accurate way of communication both in language of instruction together with scientific terminologies.

However in elaborating on mechanisms of achieving the aims, he falls short of pointing out how accurate communication both in language of instruction together with scientific terminologies would be achieved. It is the contention of other scholars that these aims are progressively acquired and it is only through positive reinforcements by using computers in Mathematics teaching/learning among other instructional tools that the teacher can confirm
success in his/her instruction (Omwenga, 2005). This link would be achieved probably better with the use of computers as a medium of teaching and learning mathematics.

Kwaka (2003) in his research findings on the influence of teachers’ assessment in enhancing improved performance in Mathematics among secondary school students’ in Mombasa District, noted that student’s response to the tasks is subjected to specific prescribed objectives. The student’s response to the tasks is subjected to a scoring or classificatory procedure by the assessor and hence makes a reference about the pupil. He further explains that when appropriate feedback is given, assessment should provide learners, assessors and educators with insights about themselves. However, Kwaka does not point out the appropriate feedback for better assessment. A computer in its operations gives accurate, instant, visual and audio congratulatory feedback to the learner enabling the learners, assessors and educators to have a clear insight about them when used.

Still on assessment and reinforcement, Bloomfield (1975) describes continuous assessment as a systematic collection of marks over a period of time and their aggregation into a final grade. In this mode, marks are awarded for class work, homework, practical work, oral or/and project work. However all the marks awarded are kept by the teacher for end term analysis. In contrast, instant feedback for every activity done by the student makes meaningful reinforcement. With computers in place, all assessments would be instantly awarded, stored, and retrieved by the student for instant motivation. Kieren (1973) records evidence reported from scores of studies designed to examine the effectiveness of computer-augmented teaching and learning. The data indicates that computers can be used very effectively to enhance the learning since its readily retrievable data is a major source of reinforcement.

Ayot (1984) in, Language For Learning; which stated that, out of all that we hear and see, we learn only 10% through the senses of hearing and 80% or more through the sense of sight; we
retain 20% of all that we hear and 50% of what we see and learn. Therefore; the use of computers in mathematics classrooms will ensure that students will be able to learn more through observing the computer screen and retain more from what they will learn since the visual stimulus has a more lasting impact particularly in learning. This is in line with a common proverb today which says that “What I hear I forget, What I see I remember and What I do I know”.

Esmond (2011), in his publication in the daily Nation asserts that, one way of instilling computer skills are to adopt basic computer education in schools; teaching of computer skills in schools allows youngsters to come to terms with the use of ICTs in modern life. An enlightened young generation can put its technical skills and talents in transforming the way we apply ICT. Esmond (2011) further continues to inform that in a bid to set the pace for young people’s initiation into the digital world, the government of Kenya allocated Ksh 680 million in 2011 budget for the purchase of computers for schools. Finance minister’s allocation of Ksh 680 million for schools was a good start in scaling the needs for ICT in primary and secondary schools as recommended by SMASSE which is a national programme for secondary schools mandated to strengthen mathematics and science subjects with emphasis in the use of computer technology (Esmond, 2011).

2.3 Trends of using Computer in teaching and learning mathematics in other countries.

Audio-Visuals (A-V) are aids that demand the use of touching, listening or sight. Results from empirical study show that people learn, 83% through sight, 11% through sound, 3.5% through smell, 1.5% through touch and 1% through taste (Mondoh, 2005). The use of computers in Mathematics instruction therefore combines sight, sound and touch components totalling to 88% giving the learner an upper hand.
In the mid-1950s and early 1960s collaboration between educators at Stanford University in California and International Business Machines Corporation (IBM) introduced CAI into select elementary schools in USA (Smith, Stanley, Sherwood and Bruce, 1976). Initially, CAI programs were a linear presentation of information with drill and practice sessions. The early CAI systems were limited by the expense and the difficulty of obtaining, maintaining, and using the computers that were available at that time. Programmed Logic for Automatic Teaching Operations (PLATO) system, another early CAI system initiated at the University of Illinois in the early 1960s and developed by Control Data Corporation, was used for higher learning (Sherwin, 1978). It consisted of a mainframe computer that supported up to 1000 terminals for use by individual students. According to Sherwin (1978), it was estimated that over 100 PLATO systems would be operating in the United States by 1985.

PLATO also introduced a communication system between students that was a forerunner of modern electronic mail (messages electronically passed from computer to computer). The Time-shared Interactive Computer-Controlled Information Television (TICCIT) system was a CAI project developed by Mitre Corporation and Brigham Young University in Utah (Smith et al, 1976). Based on personal computer and television technology, TICCIT was used in the early 1970s to teach freshman-level mathematics and English courses. With the advent of cheaper and more powerful personal computers in the 1980s, use of CAI increased dramatically. In 1980 only 5% of elementary school and 20% of secondary schools in the United States had computers for assisting instruction (Small, David & Sandy, 1984). Three years later, both numbers had roughly quadrupled, and by the end of the decade, nearly all schools in the United States, and most industrialized countries, were equipped with teaching computers.

A recent development with far ranging implications for CAI is the vast expansion of the Internet, a consortium of interlinked computers (Deepark and Turner, 2006). By connecting
millions of computers worldwide, these networks enable students to access huge stores of information, which greatly enhances their research capabilities (Bhagwan, 2005). Schools are also working to incorporate computers into classrooms. The need for computer literacy in the 21st century has put an additional strain on school budgets and local resources (Deepark and Turner, 2006). Schools have struggled to catch up by providing computer equipment and instruction and by making Internet connections available. Apple Computer, Inc. in the USA has provided computer equipment to help schools meet their students’ computer-education needs.

New York City school system in the USA initiated the first full-scale operational computer-system designed by Radio Corporation of America (RCA) to teach large numbers of pupils on a simultaneous and individual basis (NCTM, 2000). The computer-based instructional system (CBIS) is capable of teaching and reading Mathematics at elementary school level. Using the system, as many as 192 students may proceed with their computer lessons simultaneously. In the initial stages, approximately 6,000 children in 16 schools were involved in the project. Located within each school is a communications unit that connects with an RCA Spectra 70-45 computer situated in Manhattan, USA. The student identifies himself to the computer by typing his name on the terminal keyboard. He then receives anywhere from 5 to 20 minutes of instruction (Carrington, 1993; NCTM, 2000). The computer acts as a private tutor, giving immediate reinforcement of correct responses and rejecting all mistakes. Statistics regarding each student's progress are compiled on a battery of magnetic tapes that are automatically updated to include the latest student-computer interchange. The teacher may then ask the computer for reports on his students.

An increasing number of school libraries have computer labs with computer workstations, software, and Internet connections (Mahapatra, 2005). Because school libraries often emphasize the variety of media in their collections, they are sometimes referred to as library
media centers. Most school libraries further enhance their collections by becoming members of school library networks; this allows them to share resources with libraries in other schools (Crook, 2005).

As part of the mathematics reforms of the National Council of Teachers of Mathematics (NCTM) of North America and the Advisory Task Force of the Caribbean Community (Caricom), it is required that students be able to learn and use Computer Technology (CT) as an integral part of the learning of mathematics (Carrington, 1993; NCTM, 2000). Some countries or islands in the Caribbean such as Cuba, Jamaica, Haiti and the Bahamas have been providing their teachers with computer literacy skills and integrating CT in various subject areas (Carrington, 1993; Miller, 1996). However, this innovation is not common in mathematics classrooms.

According to (Clarke, 2007), integration of Computer Technology (CT) in the Caribbean countries of Cuba, Jamaica, Haiti and the Bahamas had to be strategic and practical because of its economic situation. Mathematics computer software programs, the graphing calculator (GC) and the internet were becoming more commonly used among different Caribbean countries of Cuba, Jamaica, Haiti and the Bahamas (Arnold, 2007). In some Caribbean contexts, however, these tools were not frequently used or were not always accessible to teachers and students in Mathematics classrooms (NCTM, 1991). Selecting computer Mathematics software such as Math Trek was important in that it had to be interactive and motivating towards learning mathematics (Pokay & Tayeh, 1997). This phenomenon was common for all software programs within learning environments.

Pokay & Tayeh, (1997) found Math Trek for grades 7, 8, & 9 (MT789) to be useful in motivating and engaging students in classrooms; students’ interaction has been empowering for each other and the teachers had opportunities to facilitate active learning and inquiry. The
graphing calculator (GC), a commonly used tool in secondary school Mathematics (Wilson & Krapfl, 1994), has been found to have potential benefits for students’ understanding of functions; it is further stated that the GC has the potential for influencing the way mathematics is taught and learned, which in turn would affect the students’ achievement, and their mathematical disposition.

In Hong Kong, according to Education and Manpower Bureau (EMB, 1998), the special administrative region government’s five year plan on ICT implementation in schools was launched in late 1998. EMB, (1998) adds that this five year plan is within education reforms that aim to develop students’ capacities for self-learning, problem solving, information seeking and analysis, critical thinking as well as the ability to communicate, collaborate and learn.

A survey of ICT and education in Africa, Farrell (2007) found that there was a great deal of variance in ICT policies for education among the 53 African countries surveyed. South Africa clearly is unique in terms of being able to move its ICT agenda forward. Those countries that are steadily moving to sustainable economies (Mauritius, Ghana and Botswana for example) constitute another group making remarkable progress (Karanja, 2011).

Mutula (2003) identified the ICT constraints as high cost of access to telecommunications, government policy towards ICT, underutilization of existing technologies, limited indigenous base and digital illiteracy. Checkpoint (2008) pointed out that Kenya has become the third African country to launch E-learning facilities in secondary schools after South Africa and Nigeria. In its article, Checkpoint states that the program aims to replace the blackboard with touch screen and students to send their work to teachers through wireless connectivity. However rolling of this program may not be effective in rural areas since they lack the basic infrastructure to enhance this type of learning.
2.4 Computer Programs that Support the Teaching and Learning of Mathematics.

A computer is an easy aid to use and one does not need to possess any technical expertise to use it (Ball, 1986). Computers have inbuilt well written programs that supports the user by providing information on what options are available and helps should the user go astray. Sherwin (1978) asserted that there are computer programs that can be used in connection with exposition by the teacher in the teaching and learning of Mathematics including; COUNTER - is a program which exploits one very simple idea; it counts on the computer’s screen. When it starts, COUNTER is ready to begin counting in the usual way 1, 2, 3, 4, …… and it displays each number on the screen using large characters. It has an option of listening to counting as well as watching it. AIRTEMP – is a program which is used to draw by giving a simple illustration of what the computer has to offer in terms of visual aid that can be used by a teacher to explain bar graphs and line graphs. LOCUS – is a program that draws loci and geometrical constructions.

SINCOS – Is a program providing a model that helps explain the meaning of the sines and cosines of all angles, positive and negative. When the program starts, a circle with horizontal radius is displayed. If the user enters and angle say $45^0$, the radius rotates slowly until it reaches $45^0$ (Wilson & Krapfl, 1994).

Programs that offer games or pose problems include; BLOCKS – is a program about arithmetic whereby the computer simulates the throwing of three dice, and the numbers shown on the dice are displayed at the bottom of the screen; others include MATHLAP and MATHEMATICA. Programs that support mathematical investigation include; DIAGONAL – Is a program that concerned with exploration of the diagonals of rectangles (Zammit, 1992).

Programs that draw pictures according to (Howe and Ross, 1981), include; BUILD – Enables the user to draw a picture composed of cubes, CALDRAW – Draws all geometrical objects.
Some of the Programs already in use in primary schools in Kenya include; TOPGRADES – a program designed by David Timm in the United Kingdom 15 years ago (Esmond, 2011). This program according to the author is now fully used in Kenyan primary schools such as Rusinga Schools, Makini School, Braeside School, Bahati and Mukumu primary in western Kenya (Esmond, 2011).

Karanja (2013), on using technology to support conceptual teaching and learning of mathematics and science; Kenyatta university’s department of Communications and technology flanked by Dr. Kiio et al handed over graphic calculators, science probe kits and PC tablets from Hewlett-Packard (HP) catalyst initiative Project, to Kenya High and Nairobi school mathematics and science teachers as a step to ensure use of computers in teaching and learning of Mathematics in secondary schools in Kenya.

2.5 Potential Benefits of using Computer (CAI) in teaching and learning mathematics

According to Deepark and Turner (2006), Computer Assisted Learning (CAL) can be adapted to the Mathematical abilities and preferences of the individual student and increase the amount of personalized instruction a student receives. Many students are said to benefit from the immediate responsiveness of computer interactions and appreciate the self-paced and private Mathematical learning environment (Crook, 2005). Moreover, computer-learning experiences often engage interest of students, motivating them to learn Mathematics and increasing independence and personal responsibility for education. Although it is difficult to assess the effectiveness of any educational system, researchers such as Hazewinkel & Michiel (2001), have reported that CAI is successful in raising examination scores, improving student attitudes, and lowering the amount of time required to master certain material. While study results vary greatly, there is substantial evidence that CAI can enhance learning of Mathematics at all educational levels.
Hazewinkel & Michiel (2001) further asserts that ‘The guided drill’ is a computer program that poses mathematical questions to students, returns feedback, and selects additional questions based on the students' responses. Computers also can help students visualize objects that are difficult or impossible to view. For example, computers can be used to display three dimensional objects/models, graphical presentation, histograms, pie charts and bar graphs more conceptually (Arnold, 2007). Computers can also be used in problem solving, which involves visualizing, imagining and manipulating, analyzing, abstracting and associating ideas (Siddiqui, 2004). Problem solving often requires skill in reading as well as computing and ability to state associations (Orton, 1994). The main step in problem solving is in the use of the computer as a search model to solve the problem, such as performing computations involved in completing the deductive proof, finding the solution set for the equations or inequalities, checking answers to see whether the results satisfy the conditions given and stating the complete answer to the problem (Weiss, 2006).

2.6 Summary

This chapter has discussed the use of computers as a medium of teaching and learning of Mathematics in secondary schools, trends of computer use in other countries, computer programs that support the teaching and learning of Mathematics and the potential benefits of computer use in teaching and learning mathematics. It can be observed that the USA and Western Europe have built a strong base for the use of computers in education. This largely has been attributed to developed infrastructure and large investment in computer technology. Despite the notable progress in readiness in Africa, there still exists a large digital divide between the developing and the developed countries. In Kenya, the government’s prioritization of using computers in teaching and learning mathematics is very low and there is need for a paradigm shift in matters pertaining leadership in computer technology so that the country can leap the benefits of computer technology in education.
The study aimed at investigating the factors affecting the use of computers in teaching and learning mathematics. The Kenyan government recognises the role of computer technology in helping to attain the education goals of vision 2030, which are to provide globally competitive education, training and research for development. Among the implementation strategies specified by the government is to establish a computer supply program that will equip students with modern ICT skills (Karanja, 2011). There however exists a gap in knowledge today as pertains to the factors affecting the use of computers in teaching and learning of mathematics. This study therefore aimed to fill this gap by describing the factors affecting use of computers in the teaching and learning of mathematics so as to help in achieving the education aspirations of vision 2030 which are to reduce illiteracy by increasing access to education, improve transition rate from primary to secondary and raise the quality of education and relevance of education.

The study has also shown the importance of practice and drill to encourage learning through self-reinforcement a component of computer use. It is therefore worrying for a country in its nascent state of development and targeting a leap in industrial and technological advancement that such an important tool is not a major component in the training of its future workforce. The study intends to point out the main impediments to the non-integration of computers in the teaching and learning process.
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction.

This chapter discusses the processes that were undertaken to achieve the objectives of the study by considering the design and the methods used in the study. The main sections include target population, sample and sampling techniques, research instruments and their validity and reliability, piloting and data collection, and analysis.

3.2 Research Design.

The main purpose of this study was to find out the factors affecting the use of computers as a medium of teaching and learning of Mathematics in secondary schools in Kisii Central district, Kisii County. A descriptive survey design was adapted for this study. A survey study gathers data at a particular point in time with the intention of describing the nature of the existing conditions, identifying the standards against which existing conditions can be compared as well as determining the relationship between specific events (Orodho, 2004). The survey is the most frequently used method for collecting information about peoples’ attitudes, opinions, habits or the factors affecting use of computers as a medium of teaching and learning mathematics in secondary schools and any of the variety of education or social issues. This type of design usually seeks to find answers to questions generated from the statement of the problem. Gay (1992) defines descriptive research as a process of collecting data in order to test hypothesis or to answer questions concerning the current status of the subjects in the study. A descriptive research design determines and reports the way things are (Mugenda & Mugenda, 1999).

Quantitative and qualitative methods were employed in data collection. Quantitative method had the advantage of getting responses of the same questions from a large number of people.
Their responses were quantified and conclusions drawn from them. It employs methods such as observation, interview and collection of documents, photography and video recording (Willington, 2000). Data was collected using questionnaires, interview schedules and observation schedules.

3.3 Study Variables

In research, variables are either independent or dependent. In this study therefore, the independent variables were;

i. Computer models and computer Infrastructure in school.

ii. Mathematics Curriculum/ syllabus

iii. Modes of Mathematics Teaching, Whole class (Mass) or Individualized

Dependent variables included:

i. Good performance in mathematics

ii. Good mathematical computations.

iii. Computer skill development

iv. Good analytical skill development

Intervening variables.

i. Frequency of computer use

ii. Teachers’ computer knowledge

iii. Learners’ interest in computers, age and gender.

iv. Reinforcement, expectations, beliefs, self-perception, thoughts and preferences.
3.4 Study Location.

Figure 3.4 Kisii Central District Base Maps.

Source: Ministry of Lands, Kisii County. (09 Nov.2009)

Figure 3.4 shows where research was carried out. The research was carried out in Kisii Central district, Kisii county of Nyanza Region Kenya because it offered a variety of schools; district schools both mixed and single, private schools, provincial and National schools for the study to be carried out, which were a representative sample of the whole country. The suitability of the County was due to the fact that schools with computers were found within a convenient proximity where movement between them was easy and less costly to the researcher. This in turn increased efficiency in the administration of the research instruments.
3.5 Target Population

Target population comprised of twenty (20) secondary schools in Kisii central district with computers, 1600 form three students, 40 teachers of mathematics and 20 principals. This study involved nineteen (19) secondary schools out of twenty secondary schools in Kisii Central district with computers because one school was used for pilot study. They were of two categories, public and private with the following types, Girls Boarding schools, Boys Boarding schools, Mixed Boarding schools, and Mixed Day schools.

3.6 Sampling Techniques

A sample is any number of cases less than the total number of cases in the population from which it is drawn (Ingule & Gatumu, 1996). Sampling saves time and expenses of studying an entire population (Robson, 2002). Form three students from purposively selected public and private secondary schools were considered for this study. This is due to the fact that having had a longer period of exposure to the Mathematics curriculum they were better placed to provide more concrete information required for this study.

3.6.1 Sample Size

Schools

Schools with computers were stratified into two main categories public and private with the following types, boarding schools, mixed boarding schools, mixed day schools. After stratification of the categories, purposive sampling was employed in selecting, nineteen public (19) schools of the following types, two National schools; a Girl’s National school and a Boy’s National school, four provincial schools; two boy’s provincial schools and two girl’s provincial schools, four provincial (Mixed Boarding) schools; two provincial (mixed day) schools, four district (Mixed Day) schools, and three private schools.
Respondents

The Principals’ from the sampled secondary schools were included in the study. Sixteen of the nineteen sampled representing 80% of the Principals in the schools with computers in the district honoured the interview request. Thirty two teachers of Mathematics from the forty sampled representing 80% of the teachers from the schools with computers in the district answered the questionnaires. Each sampled school provided two randomly selected Mathematics teachers.

Further, stratified random sampling was used to sample seventeen (17) form three students from each of the sampled secondary schools giving a total sample size of three hundred and twenty three (323) form three students representing 20.2% of the form three students in Kisii central district, Kisii County who were believed to have a longer experience in learning mathematics in terms of time and content coverage. They were more mature in opinion and attitude than form ones and twos. The form four students were busy preparing for the National Examinations by the time the research was conducted. The figures were sourced from the DEO’S office, Kisii Central District.

The sampled schools, principals, mathematics teachers and form three students are shown in the sampling grid 3.1.
### 3.1 Sampling grid.

<table>
<thead>
<tr>
<th>Category Of Schools</th>
<th>Type Of School</th>
<th>Target Population</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students</td>
<td>Teachers</td>
<td>Principals</td>
</tr>
<tr>
<td>National</td>
<td>Boys</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mixed Boarding</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mixed Day</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mixed Day &amp; Boarding</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Provincial</td>
<td>Boys</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mixed Boarding</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mixed Day</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mixed Day &amp; Boarding</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>District</td>
<td>Boys</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mixed Boarding</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Mixed Day</td>
<td>240</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Mixed Day &amp; Boarding</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td>Private</td>
<td>Boys</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mixed Boarding</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mixed Day</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mixed Day &amp; Boarding</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>1600</td>
<td>40</td>
<td>20</td>
</tr>
</tbody>
</table>

### 3.7 Study Instruments

The major tools for the study were Interview schedule for principals’, questionnaires for both mathematics teachers and form three students and an observation schedule. Questionnaires were used for data collection because, as Orodho (2005) observes, they have a major advantage including efficient use of time, anonymity is possible and questions are standardized and everyone gets the same question. Researcher also used an observation schedule to observe the computer models and computer infrastructure in secondary schools.

i. Principals’ interview schedule. (Appendix A).

The researcher used it to collect data from the principals. Being in charge of the school management the interview schedule tried to find out the factors considered in purchasing of computers and computer software. Difficulties facing teachers and students from using computers in teaching and learning mathematics.
ii. Mathematics Teachers Questionnaire (MTQ). (Appendix B)

The purpose of this questionnaire was to establish the use of computers as a medium of teaching and learning mathematics by mathematics teachers in Kisii Central district, Kisii County. It consists two parts; teachers background knowledge on computers, that is professional and technological background as well as about the school and secondly the difficulties they face in using computers to teach and learn mathematics which was the main part of the study.

iii. Mathematics Students Questionnaire (MSQ). (Appendix C)

The purpose of this questionnaire was to establish the use of computers as a medium of teaching and learning mathematics by form three students in Kisii Central district, Kisii County. It was used because of its objectivity and its potential in providing a lot of information from respondents even in the absence of the researcher. It consists two parts; students’ background knowledge on computers such as technological background as well as about the school and secondly the challenges students face from using computers in learning mathematics which was the main part of the study.

iv. Observation Schedule. (Appendix D).

A research observation schedule was used to provide information on computer models, computer software as well as the general physical and material resources in the school.

3.8 Pilot Study.

Before the actual data collection, piloting of instruments was done in one secondary school based on convenience sampling involving one principal, two mathematics teachers and 30 students. The school did not participate in the final study. Piloting enabled the researcher to test the reliability of the instruments. The questionnaires were distributed to the two (2) mathematics teachers and thirty (30) form three students in the school at the same time of study. The researcher personally interviewed the principal of the school at his convenient time and an observation schedule was administered the same day.
The researcher used piloting to identify ambiguity such as typing question 2(b) of the students’ questionnaire as 3(a) and adjusted the same during the final data collection. The pilot study enabled the researcher to familiarize himself with the administration of the instruments.

3.8.1 Reliability.
Reliability coefficient of all instruments was determined after piloting stage using Cronbach coefficient formula. Thus;

\[ \alpha = \frac{K}{K - 1} \left( 1 - \sum_{i=1}^{K} \frac{\sigma_{Y_i}^2}{\sigma_X^2} \right) \]

Where \( \alpha \) = reliability coefficient

\( \sigma_{Y_i}^2 \) = variance of component i for current sample of persons.

\( \sigma_X^2 \) = variance in the obtained test scores

The coefficient formula is appropriate since the tools have non-dichotomous scores. A reliability coefficient of at least 0.8 was acceptable for the study. Thereafter more refinement was done to enable the researcher to determine the difficulty of the items in the instrument as swell as checking the difficulty of the language used this further enhanced the validity and reliability of the items.

3.8.2 Validity.
It was concerned with establishing whether the questionnaire content was measuring what it was supposed to measure. Construct validity was enhanced by giving operational definitions of key words used in the study. No questions or words were ambiguous during piloting hence instruments were valid.
3.9 Data Collection.

The schools were visited to notify the authorities as well as distribute the questionnaires. They were collected in the course of the same term. The questionnaires were distributed to the thirty two (32) sampled mathematics teachers and three hundred and twenty three (323) form three students in the district at the same time of study in each of the sampled school. The researcher interviewed 16 principals at their convenient time and an observation schedule was administered the same day with students’ questionnaires in each of the sampled school.

3.10 Data Analysis.

Data analysis is the process of bringing order, structure and meaning to the mass of information collected (Mugenda & Mugenda, 1999). In this study qualitative data was derived from open-ended questions in the questionnaires and the interview schedule, and was meant to supplement quantitative data availed by the questionnaire. The data from the study was analyzed qualitatively and quantitatively using percentages, means, frequency distribution with the aid of Statistical Package for Social Sciences (SPSS). Qualitative data was presented in a narrative form paying particular attention to the respondents’ comments. To facilitate quantitative analysis, questionnaire items were pre-coded. A code book was prepared. This enabled the data to be entered into the computer for the SPSS programme to analyse.

3.11. Ethical Consideration.

The researcher had a fair use of data from other researchers, sources and acknowledged them on the references list with full confidentiality of data obtained from all questionnaires. The researcher sought permission from District Education Officer (DEO) of Kisii Central District and principals of twenty sampled secondary schools with computers. The consent of the respondents was sought before they were engaged in the process.

This chapter described the rationale of the design and methods that were adopted for the study. It looked at the research instruments used and how they enhanced the acquisition of information on factors affecting use of computers in teaching and learning of Mathematics in secondary schools in Kisii central district, Kisii County.
CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.6 Introduction

The chapter presents an analysis of the data collected from a sample of 323 form three students, 32 Mathematics teachers and 16 principals of selected secondary schools of Kisii central district with computers. Data analysis and report of findings was done using descriptive statistics in the form of tables, frequencies and percentages. The findings of the study were discussed under the following research objectives:

i. To find out the current status of computer models and mathematics computer software resources.

ii. To establish the difficulties teachers face when using computers in teaching and learning mathematics.

iii. To establish the challenges students face when using computers in learning mathematics.

4.7 Background information of respondents

Respondents to the items used in this analysis included form 3 students, Mathematics teachers and school principals. A number of items that includes gender, age, and educational background were used to provide information on their background characteristics.

4.2.1 Students’ background information

Students were required to indicate their gender and age as a source of information of their background information.

The results of their responses were tabulated and represented in Figure 4.1 and Figure 4.2 respectively.
Figure 4.1 Students’ Gender, n = 343

![Pie chart showing gender distribution]

Figure 4.1 which contains a summary of students’ responses to items on their background information shows that 164 (50.8%) of the respondents were females, and 159(49.2%) were males depicting a near gender parity for sampled population of the respondents.

Figure 4.2 Students’ Age, n = 343

![Pie chart showing age distribution]

Figure 4.2 which contains a summary of students’ responses to items on their background information shows that in terms of age, 31(9.6%) of the respondents were below 15yrs, 209 (64.7%) were 15-16 yrs old, 76 (23.5%) were 17-18 yrs old while only 7(2.2%) were over
18yrs old. This shows that generally, majority of the students were of the general approved age 15 and 17 years for form three students.

4.2.2. Teachers background information

Teachers were required to indicate their gender, level of education and computer literacy among other issues as a source of information on their background information.

A summary of their responses is represented in Figure 4.3, Table 4.1, Figure 4.4, Figure 4.5 and Figure 4.6 respectively.

Figure 4.3 Teachers’ Gender, n = 32

![Pie chart showing gender distribution]

Results of the analysis on teachers’ background information in Figure 4.3 shows that 10 (31.2%) of the teachers were females, and 22(68.8%) were males indicating that most mathematics teachers were males.

Table 4.1 Teachers’ Level of Education

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma in education</td>
<td></td>
<td>9</td>
<td>28.1</td>
</tr>
<tr>
<td>B. Ed. Education</td>
<td></td>
<td>19</td>
<td>59.4</td>
</tr>
<tr>
<td>M.Ed. Education</td>
<td></td>
<td>4</td>
<td>12.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>32</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.1 Shows the teachers’ level of education, 9(28.1%) indicated that they had diploma in education qualification, 19(59.4%) scored for bachelor’s degree, while 4(12.5%) said they
had a master’s degree showing that all of the teachers sampled were trained professionals able to discharge their duties effectively.

**Figure 4.4 Teachers' computer Literacy, n = 32**

The results in Figure 4.4 further shows that most of the teachers were computer literate with 29(90.6%) of them indicating that they were computer literate while only 3(9.4%) lacked computer literacy skills implying that teachers have the skill of using computers but were not using them.

**Figure 4.5 Teachers' Responsibilities, n = 32**
Results of the analysis on teachers’ background information on responsibilities in Figure 4.5 shows that, 18(56.2%) of the respondents were class masters, 13(40.6%) indicated they were head of department (HOD) while only 1(3.1%) indicated boarding master as an additional responsibility. This could imply that each of the teachers had an additional responsibility which could affect his/her effective teaching of mathematics using computers which require an additional time for preparation.

**Figure 4.6 Mathematics Teachers’ second subject, n = 32**

Finally Figure 4.6 shows the results of the analysis on teachers’ background information on their second teaching subject, 9(28.1%) indicated that they taught science based subjects (Biology, Chemistry or Physics), 9(28.1%) scored for arts based subjects (Geography), 11(34.4%) indicated applied subjects such as Business studies, Electricity or Computer studies while 3(9.4%) did not respond to the item.

### 4.2.3 Principals background information

The principals were required to indicate their gender, level of education, computer literacy and the type of school they were heading as a source of information for their background
Information. A summary of their responses is contained in Figure 4.7, Table 4.2, Figure 4.8 and Figure 4.9 respectively.

**Figure 4.7 Principals' Gender, n = 16**

Information as obtained from the selected schools, principals’ represented in Figure 4.7 shows that 6(37.5%) of them were females while 10(62.5%) were males.

**Table 4.2 Principals’ level of Education.**

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma in education</td>
<td></td>
<td>1</td>
<td>6.2</td>
</tr>
<tr>
<td>B. Ed. Education</td>
<td></td>
<td>10</td>
<td>62.5</td>
</tr>
<tr>
<td>M.Ed. Education</td>
<td></td>
<td>5</td>
<td>31.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>16</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.2 shows principals’ level of education, 1(6.2%) indicated that he/she had diploma level of education, 10(62.5%) indicated they had a bachelor’s degree and 5(31.3%) indicated they had master’s degree indicating that they were adequately professionally empowered to discharge their duties.
Figure 4.8 Principals' computer literacy, n = 16

Figure 4.8 shows that, 12(75%) of the principals indicated that they were computer literate while 4(25%) said they lacked computer literacy skills.

Figure 4.9 Types of Schools, n = 16

Figure 4.9 shows that in terms of types of schools, 5(31.2%) indicated they headed girls boarding schools, 4(25.0%) said they were heads of boys boarding schools, 2(12.5%) pairs indicated heading mixed boarding and mixed day schools respectively, 1(6.2%) mixed day and boarding and 2(10.0%) indicated they were principals of private schools. This shows that data for analysis was fairly spread across each category of school though those from single sex schools (boys only school or girls’ only schools) had a higher representation than the other categories.
4.3 To find out the current status of computer models and mathematics computer software resources.

This item required the researcher to identify the types and quantities of computers and computer soft wares available in school for student’s use during the normal teaching and learning process particularly as regards other subjects apart from computer studies.

Information obtained from the observation schedules were as is summarised in Table 4.3, Table 4.4, Figure 4.10, Table 4.5, and Figure 4.11 respectively.

4.3.1 Computer Laboratory.

Results obtained from analysed data from observation schedules shows that all the 19 schools had a computer laboratory.

<table>
<thead>
<tr>
<th>Computer Equipment</th>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequately equipped</td>
<td>A</td>
<td>5</td>
<td>26.3</td>
</tr>
<tr>
<td>Not adequately equipped</td>
<td>B</td>
<td>14</td>
<td>73.7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.4 shows that of the 19 schools, 5(26.3%) were adequately equipped with computers, while 14(73.7%) were inadequately equipped indicating lack of equipment in schools.
Table 4.4 Computer Models Available

<table>
<thead>
<tr>
<th>Computer models</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP</td>
<td>618</td>
</tr>
<tr>
<td>COMPAQ</td>
<td>54</td>
</tr>
<tr>
<td>DELL</td>
<td>19</td>
</tr>
<tr>
<td>MECCER</td>
<td>4</td>
</tr>
<tr>
<td>ACER</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>697</strong></td>
</tr>
</tbody>
</table>

Table 4.4 shows that the most common models of computers in the sampled schools were HP with 16 out of the 19 sampled schools stocking a total of 618 desktops of the brand, Compaq brand were found in 6 schools totalling to 54 desktops, Dell in 5 schools totalling to 19 desktops, Meccer in 1 school totalling to 4 and Acer in 2 schools totalling to 22 desktops.

**Figure 4.10 Computer Books, n=19**

Figure 4.10 shows computer books in all the schools; however the books were found to be adequate in only 2(10.5%) schools with the rest of the schools 17(89.5%) having inadequate stock.

4.3.2 Mathematics Software

Mathematics software was also found to be inadequate in all the 19 schools sampled.
Figure 4.11 Computer Furniture, n = 19

Figure 4.11 shows that for computer furniture, 12 (63.2%) of the sampled schools were well furnished with the remaining 7 (36.8%) schools being poorly furnished.

Table 4.5 Computer Projector

<table>
<thead>
<tr>
<th>Computer projector</th>
<th>Responses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
</tr>
<tr>
<td>Available</td>
<td>18</td>
<td>94.7</td>
</tr>
<tr>
<td>Not available</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.5 shows that each of the sampled schools 18 (94.7%) had a projector each while 1 (5.3%) did not have a projector.

4.3.3 Computer Printers.

All the 19 schools had a printer each located in the computer laboratory.

The general picture was therefore of schools having computer laboratories equipped to handle minimal number of students unlike the large populations of students taking mathematics – a compulsory subject in every school. Since most of the schools were found to have large population of students per stream in each class with each class having more than one stream, it is highly probable that the computer hardwares and softwares were inadequate for their use. This research finding agrees with that of Evidence reported from scores of studies.
designed to examine the effectiveness of computer-augmented teaching and learning which indicated that computers can be used very effectively to enhance the teaching and learning of mathematics (Kieren, 1973).

4.4 To establish the difficulties teachers face from using computers in teaching and learning mathematics.

This item was intended to determine the difficulties Mathematics teachers faced in teaching mathematics using computers. The findings were as is summarised in Table 4.6

Table 4.6 Difficulties Mathematics teachers face in teaching Mathematics using Computers.

<table>
<thead>
<tr>
<th>statement</th>
<th>Highly inadequate</th>
<th>Inadequate</th>
<th>Adequate</th>
<th>Highly adequate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency(f)&amp; percentage</td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
<td>Computer laboratory</td>
<td>2</td>
<td>6.2</td>
<td>9</td>
<td>28.1</td>
<td>21</td>
</tr>
<tr>
<td>Computer furniture</td>
<td>1</td>
<td>3.1</td>
<td>5</td>
<td>15.6</td>
<td>12</td>
</tr>
<tr>
<td>Computers</td>
<td>-</td>
<td>-</td>
<td>14</td>
<td>43.8</td>
<td>11</td>
</tr>
<tr>
<td>Mathematics software</td>
<td>8</td>
<td>25.0</td>
<td>19</td>
<td>59.4</td>
<td>3</td>
</tr>
<tr>
<td>Electricity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17</td>
</tr>
<tr>
<td>Computer books</td>
<td>3</td>
<td>9.4</td>
<td>13</td>
<td>40.6</td>
<td>13</td>
</tr>
<tr>
<td>Computer accessories</td>
<td>2</td>
<td>6.2</td>
<td>15</td>
<td>46.9</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 4.6 Contains summaries of data obtained from 32 Mathematics teachers about the difficulties they faced in teaching the subject using Computers. In response to question about computer laboratory, 2(6.2%) indicated that they were highly inadequate, 9(28.1%) respondents indicated that they were inadequate whereas 21(65.6%) respondents said their schools had adequate computer laboratories. As regards computer furniture, 1(3.1%) respondent said they were highly inadequate, 5(15.6%) said they were inadequate, 12(37.5%)
scored for adequate furniture in their schools while 14(43.8%) said they were highly adequate.

Computers on the other hand were said to be inadequate in their schools by 14(43.8%) respondents, adequate by 11(34.4%) respondents and highly adequate by 7(21.9%). Mathematics computer-software were said to be highly inadequate in 8(25.0%) schools, inadequate in 19(59.4%) schools, adequate in 3(9.7%) schools and highly adequate in 2(6.2%) schools. Electricity as a source of power was adequate in 17(53.1%) schools and highly adequate in 15(46.9%) schools. Computer books on the one hand were said to be highly inadequate in 3(9.4%) schools, inadequate in 13(40.6%) schools, adequate in 13(40.6%) schools and highly adequate in 3(9.4%) schools. Computer accessories on the other hand were said to be highly inadequate in 2(6.2%) schools, inadequate in 15(46.9%) schools and adequate in 15(46.9%) schools. On budgeting for computer hardware and software, 6(18.8%) of the teachers said they were involved while 26(81.2%) of the teachers said they were not involved in budgeting. This means that by the teachers’ own admission, there are inadequate computer and computer software in almost all the sampled schools. This means inadequate facilities could therefore be one of the major problem that the Mathematics teachers face in implementation of computer based Mathematics curriculum in their schools.

Figure 4.12 Do you use Computers to teach mathematics? n = 32

Figure 4.12 shows that only 5(15.6%) of the teachers said they used computers to teach Mathematics while a majority; 27(84.4%) of the teachers did not use computers to teach Mathematics. This was attributed to lack of enough computers and Mathematics software.
Table 4.7 Frequency of computer use

<table>
<thead>
<tr>
<th>Frequency of computer use</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
</tr>
<tr>
<td>None</td>
<td>20</td>
</tr>
<tr>
<td>Rarely</td>
<td>8</td>
</tr>
<tr>
<td>Often</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

Table 4.7 shows the frequency of use of computers, a majority of the respondents, 20 (62.5%) said they do not use computers in teaching, 8(25.0%) indicated using computers rarely while only 4(12.5%) of the teachers often used computers to teach mathematics. The response paints a grim picture in which majority of the teachers either out of lack of motivation or due to disconnect are not using computers in teaching of mathematics. The findings on this item corroborates the observation made under item on observation schedule in which the resources available were found to be inadequate and depicted a scenario in which other subject teachers apart from computer studies teachers would be reluctant to use the meagre computer resources in teaching their subjects.

**Figure 4.13 Are you involved in budgeting? n = 32**

Figure 4.13 shows that 6(18.8%) teachers are involved in budgeting while 26(81.2%) are not involved showing that mathematics teachers are left out on budgeting for mathematics tools.

Qualitative data obtained from the teachers required that they give information on level of consultation by the administration in acquisition of teaching and learning materials, possible
ways of improving existing ICT facilities and factors affecting the use of Computers to teach mathematics among others. In response, 6(18.8%) teachers indicated the following as points of consultation: They are consulted on what type and quality of computer software to buy, when making requisition of computer software, textbooks and computer accessories, they are members of the tendering committee and they give estimates of the prices of computer software in the market.

6(18.8%) mathematics teachers also highlighted the following as possible ways of improving existing computers: Computers should be regularly serviced, purchasing all computer accessories, networking the existing computers, expanding the computer laboratory, use of projectors for large classes, improving on the speed of processing of the current computers by upgrading their memory, installing mathematics-computer software on the existing computers, timetabling to include all classes- time schedule to accommodate all forms, purchasing more computers, constructing power point screens in classrooms and updating the antivirus regularly.

On how teachers used computers to teach mathematics 6(18.8%) teachers listed the following topics in mathematics where they used computers: graphics for 3dimensional geometry, ICT lessons using KIE software for form one Mathematics, construction of loci and transformations in form four.

For those who were not using computers to teach mathematics, 26(81.2%) indicated the following as their reasons for not doing so; most mathematics teachers lack computer skills, lack of mathematics software, few computers, having more lessons in other subjects, and the computer laboratory is small and cannot accommodate all students in one shift.
Over and above, the respondent teachers indicated the following as factors affecting use of Computers to teach mathematics: lack of mathematics software, power blackouts, few computers for computer science students, lack of enough time to prepare for computer mathematics lessons, syllabus is not yet integrated with use of computers, lack of computer skills by mathematics teachers, all classes do not have sockets to use with computers, lack of time schedule in the laboratory for mathematics lessons, poor internet connectivity and workload- more lessons for mathematics teachers hence they are biased to the second subject.

26(81.2%) of the teachers therefore suggested the following as the possible solutions to the stated factors as a remedial mechanism: all subjects to be allocated time to use computers in the computer laboratory, all mathematics teachers to be in-serviced on ICT-Skills, improve computer infrastructure, purchase mathematics software, revise current syllabus to accommodate use of computers to teach mathematics, downloading materials for mathematics from the internet, power backup to be installed in school such as a generator and UPS(Uninterruptible Power Supply), installation of power sockets in every mathematics class, sponsorships by computer for schools by making computers affordable to more schools, employ more mathematics teachers with computer skills and the internet connectivity should be made cheap and affordable.

In summary 27(84.4%) of teachers seem not to be using computers in teaching of mathematics due to several reasons that include lack of appropriate computer skills, inadequate computer hardware and software and tendency to be doing things the usual way among others. This finding seems to be in agreement with that of Norton (1999) who in studying Brisbane teachers’ responses to and beliefs about using computers for mathematics learning found that: (i) few secondary mathematics teachers used computers at least weekly; (ii) computers were considered equally or more effective than traditional instruction for doing calculations or providing basic skills practice; few teachers considered computers useful in
developing conceptual understandings. The effective use of technology depends on the teacher. Teachers should use technology to enhance their students’ learning opportunities by selecting or creating mathematical tasks that take advantage of what technology can do efficiently and well – graphing, visualizing, and computing (NCTM, 2000).

Bringing computers into classrooms can have profound effects on teachers. In the U.S., Smerdon, et al. (2000), found in their study that only half of the public school teachers who had computers available in their schools used them for classroom teaching and learning. The teachers' perceptions of the barriers to computer and Internet use for instruction were also examined. Most frequently, the teachers reported lack of release time to learn how to use computers or the Internet (82%), lack of time in the daily schedule for students to use computers in class (80%), and insufficient numbers of computers (78%) as the major barriers, findings quite eminent in this study. Similarly Hadley and Sheingold (1993) had reported a similar, related set of barriers to computer use that teachers identified in this study. These included: lack of appropriate software or information about it; teachers' self-doubts, lack of interest or knowledge about computers; inadequate numbers of computers; and lack of maintenance, support, advice, and upkeep. In a fairly recent large Australian study, Finger et al (1999) found that most of the participating teachers had very high levels of basic computer skills, with a much lower proportion reporting advanced skills.

Although 90% of the teachers agreed that information technology was worthwhile for teaching and learning, several barriers to its effective implementation were identified including hardware and software costs, and insufficient maintenance and technical support. A large proportion of the teachers (88.5%) rated their computer skills as at least average; about 51% felt fairly competent. No teacher reported not wanting to turn the computer on. About 55% felt confident when faced with using a computer for teaching mathematics; another 39% were at least prepared to have a go. It was encouraging to see that such a high
proportion of teachers (73 out of a total of 80 teachers) reporting that they were at least prepared to have a go at using computers for teaching mathematics, findings quite similar to this study, inferring that teachers are ready and willing to use computers in teaching mathematics (Finger et al., 1999).

In summary, it can be said that the teachers were generally supportive of the idea of using computers in their mathematics teaching and that most were confident and comfortable enough to be in- serviced on Computer applications in order to at least try using computers to teach mathematics.

4.5 To establish the challenges students face from using computers in learning mathematics.

This item was intended to assess students’ views on challenges they encounter in learning Mathematics particularly as regards use of computers. They were therefore required to respond to a number of issues raised.

A summary of their responses is presented in Table 4.8, Figure 4.14, Table 4.9, and Figure 4.15, respectively.

Table 4.8 We use computers for Mathematics activities.

<table>
<thead>
<tr>
<th>We use computers for Mathematics activities.</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
</tr>
<tr>
<td>Yes</td>
<td>162</td>
</tr>
<tr>
<td>No</td>
<td>161</td>
</tr>
<tr>
<td>Total</td>
<td>323</td>
</tr>
</tbody>
</table>

Table 4.8 shows that in terms of use of computers for mathematics activities, 162 (50.2%) answered in the affirmative while the remaining 161 (49.8%) said they did not.
Figure 4.14 shows that 293 (90.7%) of the students indicated that they were comfortable using computers while the remaining 30 (9.3%) said they were not.

**Table 4.9 We have access to mathematics software.**

<table>
<thead>
<tr>
<th>We have access to mathematics software</th>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td>174</td>
<td>53.9</td>
</tr>
<tr>
<td>Rarely</td>
<td></td>
<td>143</td>
<td>44.2</td>
</tr>
<tr>
<td>Often</td>
<td></td>
<td>6</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>323</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.9 As regards mathematics software shows that 174 (53.9%) of the respondents indicated that they did not access computer software for learning of Mathematics, 143 (44.3%) said they rarely accessed the software while 6 (1.9%) said they often accessed computer software for learning mathematics.
Figure 4.15 shows the frequency of use of computers, majority of the respondents; 170 (49.5%) did not respond to the statement, 10 (3.1%) completely did not have access to the computers, 60 (18.6%) said they rarely accessed them, 50 (15.5%) indicated the frequency to be often and the remaining 43 (13.3%) accessed the computers quite often.

Qualitative data required students to respond to open ended statements about factors that hindered their use of computers, problems arising from use of computers to learn mathematics and what they used in the absence of computers. As regards the factors that affected the use of computers in learning mathematics, 162 (50.2%) of the students highlighted the following: frequent computer breakdown, difficulty in portability of the desktops into mathematics classrooms, computers make a lot of noise causing distractions, lack of computer skills, lack of access to computers in the computer laboratory, slow and outdated models of computers, out-dated computer software, frequent power blackouts, negative students attitude towards computers, few computers are available limiting learners, lack of mathematics computer soft wares, lack of internet connection, poor motivation on the use of computers, lack of computer-mathematics teachers, lack of practice on computer use,
computers have different mathematics symbols different from those found in textbooks, use of computers requires more time and hence it wastes a lot of time and lack of guidance on the use of computers.

In terms of problems arising from using computers to learn mathematics, 162 (50.2%) of the students underscored the following: Complicated functions (formulae) in the computers, Lack of training on computer use, Computer breakdown while using them to learn mathematics, Straining eyes on bright light from computer screens, Computer ‘hang-ups’ while using them, Computer errors as a result of wrong entries, Computer viruses, Power blackouts, Slow typing speed on the computer keyboard, Computer vocabulary, Time consuming, Threats from teachers on the use of computers-take precaution because computers are expensive, Fear of computers, Lack of confidence towards computer use, Lack of enough space for all students, Lack of mathematics-computer software, Unwilling teachers to use computers, Lack of computer facilities, Lack of learning programmes whereby there is no time schedules on the use of computers, and Change of computer passwords by other students.

Finally 30(9.3%) of the students were not willing to use computers to learn Mathematics and indicated the following as alternative facilities to computers for learning of Mathematics; Scientific Calculators, Mathematics four figure tables, Geometrical set and Manual calculations.

43 (13.3%) of the students who used computers quite often indicated the following as tools in the computer they used in carrying out Mathematical operations in the absence of appropriate software; Microsoft excel, Microsoft access and Computer Calculators.

In summary, 293 (90.7%) of the students though seemingly enthusiastic about using computers for learning mathematics, they were faced with several challenges which included,
frequent power blackouts, lack of computer skills and inadequate mathematics software among others made some of them to opt for alternative instruments for learning mathematics such as the use of scientific calculators, mathematical tables and geometrical set. Students were willing to use computers to learn mathematics since 293(90.7%) of the students indicated that they were comfortable using computers while the remaining 30(9.3%) said they were not. These encouraging factors and the relative rankings are similar to those reported by computer users in Zammit's (1992) study; access to computers, the availability of software, self-motivation to stay up-to-date, the need for students to learn to use technology, and a supportive computer coordinator (teacher) were the five top-ranked (researcher-supplied) categories.

Mathematics courseware is software used in a computer lab or in a classroom that pre-tests students to determine their specific mathematics needs. It then provides customized lessons and tutorial that focus on those needs. The mathematics courseware program has resulted in important benefit, improved student self-esteem (Holland, 2002). This leads to student motivation, willingness to use computers in learning mathematics and an overall good performance in mathematics at the end of the course and further career developments.

4.6 Principals’ Interview Schedule.

Sampled school’s principals were interviewed to obtain information to corroborate those that were obtained from students’ and mathematics teachers. Of the 19 sampled schools, the researcher was able to access 16 principals or their deputies who were co-operative and responded to the items of the interview schedule. The remaining three principals were perpetually unavailable for interview and their deputies were unwilling to act on their behalf. Both qualitative and quantitative data were obtained and a summary of their findings are contained in Table 4.13, Table 4.14 and Figure 4.16.
Table 4.10 Principals’ Response

<table>
<thead>
<tr>
<th>Statement</th>
<th>Highly inadequate</th>
<th>Inadequate</th>
<th>Adequate</th>
<th>Highly Adequate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (F)&amp;percentage(%)</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Computer laboratory</td>
<td>9 56.2</td>
<td>7 43.8</td>
<td>- -</td>
<td>- -</td>
<td>16 100</td>
</tr>
<tr>
<td>Computer furniture</td>
<td>12 75.0</td>
<td>4 25.0</td>
<td>- -</td>
<td>- -</td>
<td>16 100</td>
</tr>
<tr>
<td>Computers</td>
<td>1 6.2</td>
<td>5 31.2</td>
<td>9 56.2</td>
<td>1 6.2</td>
<td>16 100</td>
</tr>
<tr>
<td>Mathematics software</td>
<td>1 6.2</td>
<td>12 75.0</td>
<td>1 6.2</td>
<td>2 12.5</td>
<td>16 100</td>
</tr>
<tr>
<td>Electricity</td>
<td>- -</td>
<td>1 6.2</td>
<td>4 25.0</td>
<td>11 68.8</td>
<td>16 100</td>
</tr>
<tr>
<td>Computer books</td>
<td>- -</td>
<td>7 43.8</td>
<td>9 56.2</td>
<td>- -</td>
<td>16 100</td>
</tr>
<tr>
<td>Computer accessories</td>
<td>1 6.2</td>
<td>12 75.0</td>
<td>3 18.8</td>
<td>- -</td>
<td>16 100</td>
</tr>
</tbody>
</table>

Table 4.10 Contains the analysed data on Principals responses to a number of issues raised during their interview. In response to issues of infrastructure, 9(56.2%) principals indicated that computer laboratory were inadequate for students’ use in their schools while 7(43.8%) others said their schools had adequate computer laboratories. In terms of computer furniture in these laboratories, 12(75.0%) of the respondent principals indicated that they were inadequate and only 4(25.0%) said they had adequate computer furniture.

As for the Computers themselves, 1(6.2%) principal indicated that the computers were highly inadequate, 5(31.2%) others said they were inadequate whereas 9(56.2%) said they had adequate computers in their schools. Mathematics computer soft wares were classified as highly inadequate by 1(6.2%) principal, inadequate by 12(75.0%) principals with only 1(6.2%) principal saying there were adequate Mathematics software in his/her school and another 2(12.5%) principals saying the soft wares were highly adequate. Electricity as a source of power to run the computer was inadequate in 1(6.2%) school, adequate in 4(25.0%) schools, and highly adequate in 11(68.8%) schools. Computer books on one hand as reference materials were said to be inadequate in 7(43.8%) schools and adequate in 9(56.2%)
others. Computer accessories on the other hand were highly inadequate in 1(6.2%) school, inadequate in 12(75.0%) schools and adequate in 3(18.8%) schools.

On whether mathematics / Art based teachers used computers to teach their various subjects, all the 16(100%) principals interviewed answered in the negative.

**Figure 4.16** Do your Computer/Math teachers use computers?, n = 16

Figure 4.16 shows on whether computer/mathematics teachers used computers to teach mathematics, only 1(6.2%) principal said they do while 15(93.8%) others said they do not use computers to teach mathematics.

Further information were obtained from the principals in form of qualitative data in which they were required to give suggestions on possible ways to increase students enrolment in IT-based classes, possible reasons why teachers were not using computers in teaching Mathematics and challenges in management of computers among others. In response, 12(75.0%) highlighted the following as possible ways of increasing students’ enrolment in ICT based classes; Purchase of more computers, Employ more mathematics/computer teachers, Enlarge the existing laboratory, Good performance in computer studies and Networking the existing computers.
In response to reasons why Mathematics teachers were not using computers in teaching Mathematics, 15(93.8%) principals confirmed the following; few computers, lack of computer skills, lack of math software and more lessons for Mathematics.

As a remedy to the above mentioned shortcomings, 15(93.8%) Principals suggested the following as possible solutions to problems; Improve computer infrastructure and add more computers, Train math teachers on use of computers, Employ more computer teachers and Networking the existing computers.

In an attempt to equip all classrooms with computers for ease of access, 9(56.2%) suggested the following as a source of funds for expansion of existing ICT facilities; CDF funding to purchase more computers, PTA Funding to purchase more computers, Funding by the government, Donors/NGO’S to support, and Computers for schools to make computers affordable.

In terms of challenges they faced in management of computers, 9(56.2%) sampled principals listed the following as the major source of challenge; power blackouts, frequent computer breakdown, high maintenance costs and computer viruses.

As a remedy to challenges highlighted, 9(56.2%) suggested the following; installation of power backup- generator, employ computer technician, install anti-virus in all computers and ensure regular servicing of computers.

With computer numbers in schools having increased over the years, it could be argued that the access difficulties identified in this study are likely to stem from a situation in which demand outstrips supply, rather than simply a shortage of hardware, although this may still be true in some settings. It should be noted that in secondary schools, the State government,
school PTA and education stakeholders should fund all schools in order to acquire more computers to enhance teaching and learning of mathematics using computers. Power backup is to be installed in all school laboratories to ensure efficient use of computers.

![Kioge Girls high school computer laboratory](image)

**Figure 4.17 Kioge Girls high school computer laboratory.**

Figure 4.17 shows a section of students in the computer laboratory in Kioge girls’ high school, Kisii central District, Kisii County taken during the data collection by the researcher in the observation schedule. Some students could share one computer (background) due to lack of enough computers. The computer laboratory however shows desktop computers, computer projector among other accessories and internet connectivity at the top, at the back of the laboratory. This clearly indicates that the hardware is in place in schools, waiting for its use by mathematics teachers.

In summary therefore, although computers are in place for mathematics teachers to use in their teaching, they are fewer for all students to use in learning mathematics. The computer laboratory on the other hand is small in size to accommodate mathematics students, hence as a remedy, it should be expanded, and more computers added.
CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the findings gathered from the analysis of the data. Conclusions have been drawn from the study and recommendations put forward that may help to understand factors affecting the use of computers in the teaching and learning of Mathematics in secondary schools in Kisii central district, Kisii County, Kenya.

5.2 Summary of findings.

The study sought to find out factors affecting the use of computers in the teaching and learning of Mathematics in secondary schools. The sample consisted of 323 form three students, 32 Mathematics teachers and 16 principals from purposively sampled schools with computers in Kisii central district, Kisii County, Kenya. The study found out that:

5.2.1 Summary of findings on background information.

The respondent students’ background information shows a condition of near gender parity for sampled population in terms of enrolment.

A majority of the sampled teachers on the one hand were found to be males indicating effects of gender stereotypes. With regard to training background, all of the teachers sampled were found to be trained professionals with most being computer literate. Most of the teachers were found to have as a second subject which was either a science or arts based subject and
indicated being overloaded with lessons, making it difficult to use computers in teaching and learning mathematics.

A Majority of the principals sampled were males. With regard to training background most principals sampled were found to be trained professionals with most being computer literate.

5.2.2 Summary of findings on current status of computer models and mathematics software.

On Computer models and infrastructure the findings shows that of the secondary schools in Kisii central district sampled in the study, 14(73.7%) schools had inadequately equipped computer laboratories and lacked Mathematics computer software for effective use of computers in teaching and learning mathematics. The computer laboratories were not accessible to all students especially those who were not taking computer studies subject, making it difficult to use computers to learn mathematics.

Further, the most common models of computers in the sampled schools were HP with 16 out of the 19 sampled schools stocking a total of 618 desktops of the brand due to its durability, Compaq brand were found in 6 schools totalling to 54 desktops, Dell in 5 schools totalling to 19 desktops, Meccer in 1 school totalling to 4 and Acer in 2 schools totalling to 22. This enabled students and teachers to select variety of models to use.

5.2.3. Summary of findings on challenges students’ face when using computers

The students, 293 (90.7%) though seemingly enthusiastic about using computers for learning mathematics, they were faced with several challenges which included frequent power blackouts, lack of computer skills and inadequate mathematics software among others made
some of them to opt for alternative instruments for learning mathematics such as the use of scientific calculators, mathematical tables and geometrical set instead of using the computer.

5.2.4. Summary of findings on difficulties teachers’ face when using computers

Mathematics teachers about the difficulties they faced in teaching the subject using Computers; though they rated their computer literacy skills highly, 29(90.6%) reported lack of Mathematics computer software, inadequately equipped computer laboratory, lack of computer skills, extra responsibilities and more work from their second teaching subject as the main hindrance to effective use of computers to teach mathematics. Hence, they suggested that Mathematics be allocated time to use computers in the laboratory, all Mathematics teachers to be in-serviced on ICT-skills, improvement of computer infrastructure in schools, purchase Mathematics computer software and revision of the current syllabus to integrate use of computers in teaching and learning of Mathematics among other remedial actions.

Principals’ challenges in management of computers, 15(93.8%) listed the following as the major source of challenge; lack of funding, power blackouts, frequent computer breakdown, high maintenance costs, fewer computers, most mathematics teachers lack computer skills, and computer viruses making it difficult for mathematics teachers to use computers in their teaching. Hence they recommended installation of power backup-generator, employment of computer technician, installation of anti-virus in all computers, regular servicing of computers and training mathematics teachers in computer technology for them to be able to use computers in their teaching.
5.3 Conclusions of the study

Conclusions of the study findings were made based on the relationships that were established for each of the different objectives. From the foregoing summary of findings, it can be concluded that:

i. Secondary schools in Kisii central district sampled in the study lacked enough computers, power generator and lacked adequately equipped computer laboratories to ensure use of computers in teaching and learning mathematics. The computer laboratories are not big enough in size to accommodate all students, indicating that the average number of students per computer is very high for effective use of computers in teaching and learning mathematics. This was attributed to lack of funding by both the parents and the Government on computers.

ii. Lack of mathematics computer software prevented teachers’ and students from using computers in teaching and learning mathematics.

iii. The most common models of computers in the sampled schools were HP with 16 out of the 19 sampled schools stocking a total of 618 desktops of the brand.

iv. Very few mathematics teachers have acquired the requisite skills and training on computer technology to enhance effective usage of computers in teaching mathematics. Integration courses organized by MOE through SMASSE on ICT are not accessible to all mathematics teachers, making it difficult for them to use computers in teaching mathematics.

From the foregoing summary, it can be concluded that computer use in teaching and learning of Mathematics in Kisii central district is still in its early phase. Integration of computer in the teaching and learning of Mathematics in the district suffer from inadequate computer infrastructure in schools, ill equipped and overburdened teaching force and overstretched school budgets incapable of sorting out the financial challenges that the schools face relative to computer integration in the teaching and learning process. There is need to address those
factors affecting computer use in teaching and learning of Mathematics in order to integrate its use in the teaching and learning of Mathematics in schools.

5.4 Recommendations.

i. Education stakeholders in the country should finance provision of computers, power generator, mathematics computer software, and expand computer laboratories in all secondary schools. This will enhance the use of computers in the teaching and learning of mathematics.

ii. Due to varied types of computer models, it is recommended that schools should use HP models due to their durability.

iii. All mathematics teachers should be trained on using computers to teach mathematics due to lack of computer skills.

iv. The government through KIE should make curricular re-design of the Mathematics syllabus to accommodate the use of computer in the teaching and learning of Mathematics.

v. The PTA, educational stakeholders and the government through MOE who finance free secondary education should increase its allocation on tuition fees and encourage schools to have a specific vote head for computers so as to ensure reliable funding of computers by schools. However MOE should ensure use of the funds efficiently and effectively to create sustainable computer programmes in their schools.

5.5 Recommendations for further research.

i. A study to establish the impact of computer use in the teaching and learning of mathematics in secondary schools may be undertaken.
ii. A study to be carried out on the effects of on-line (internet use) teaching and learning of mathematics on the performance of mathematics.

iii. Finally a similar study should be carried out in a different location to find out whether similar results will be obtained.
REFERENCES


Esmond, S, (2011, 14th June) computers for schools a boost to ICT. Daily Nation.


APPENDIX A

Principals’ interview schedule

This research is meant for academic purpose only. Its purpose is to establish the factors inhibiting use of computers in teaching and learning mathematics in secondary schools. Responses for the questions will be treated confidentially and will be used for the study.

SECTION I:

Background information

1. Your sex: female ☐ male ☐

2. Level of education:
   M.Ed degree ☐
   Bachelor’s degree ☐
   Diploma ☐
   Computer Literate Yes ☐ No ☐

3. (a) Total number of years since started teaching-----------------------------

   (b) Total number of years as principal --------------------------------------

   (c) Period spent in the present position in this particular school---------years.

4. Type of school: Girls boarding ☐
   Boys boarding ☐
   Mixed boarding ☐
   Mixed day ☐
   Mixed day and boarding ☐
   Others specify-------------------------
SECTION II

1. Kindly rate the availability and status of the following physical facilities.

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Adequate</th>
<th>Inadequate</th>
<th>In bad shape</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer furniture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Assess the adequacy of the following in your school.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Highly Adequate</th>
<th>Adequate</th>
<th>Inadequate</th>
<th>Highly inadequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics- Computer software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Books</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>computer accessories</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION III

1. Who in the school do you make budgets with for acquisition of physical (Hardware-computers) and Material (software) resources.

   i.

   ii.

2. (a) How many students are taking computer science in your school?

<table>
<thead>
<tr>
<th>Form</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>Four</td>
<td>(4)</td>
<td></td>
</tr>
</tbody>
</table>
(b) Kindly suggest possible ways of increasing the enrolment.

i.

ii

3. (a) How many Mathematics / Arts teachers are in your school?------------------

(b) How many Mathematics’ / Computer science teachers are in your school? ---

4. (a) Do your Mathematics / Art subject teachers use computers to teach mathematics?

Yes [ ] No [ ]

(b) Why do you think that is the case?

i.

ii

(c) Kindly suggest possible solutions to that problem.

i.

ii.

5. (a) Do your computer / mathematics teachers use computers to teach mathematics in your school? Yes [ ] No. [ ]

(b) Why do you think that is the case?

i.

ii

6. What do you think can be done in order to ensure that all mathematics classrooms are provided with computers in your school?

i.

ii.

7.(a)What are some of the challenges you encounter in management of computers.
(b) What are some of the solutions in the mentioned challenges?

i.

ii.
APPENDIX B

Mathematics Teachers’ Questionnaire

This research is meant for academic purpose only. Its purpose is to establish the use of computers in teaching and learning mathematics in secondary schools. You are kindly requested to provide honest and precise responses.

Responses for the questions will be treated confidentially and will be used for the study.

Please tick (√) where applicable or fill in the required information in the spaces provided.

SECTION I:

Background information.

1. Your sex: female ☐ male ☐

2. Level of education:
   - M.Ed degree ☐
   - Bachelor’s degree ☐
   - Diploma ☐
   - Computer Literate Yes ☐ No ☐
   - Others specify-----------------------------------------------------------------------------------------------------------------

3. (a) Number of years you have worked as a teacher----------------years
   (b) Number of years you have worked in this station------------------year.

4. Current Designation:
   - Dean of students ☐
   - Head of department ☐
   - Class master ☐
SECTION II

1. Kindly rate the availability and status of the following physical facilities.

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Adequate</th>
<th>Inadequate</th>
<th>In bad shape</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer furniture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Assess the adequacy of the following in your school.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Highly Adequate</th>
<th>Adequate</th>
<th>Inadequate</th>
<th>Highly inadequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics- Computer software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Books</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>computer accessories</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION III.

Pertinent information

1. (a) Are mathematics /computer science teachers involved in making budgets for acquisition of computers and computer software?  Yes ☐  No ☐

(b) If your answer is yes briefly state how they are involved

i. 

ii
2. Suggest possible ways of improving the existing computers and computer software so as to cope with the current population.

i.

ii.

3. (a) Do you use computers to teach mathematics?  

   Yes  [ ]  No  [ ]

   (b) If your answer in 3(a) above is yes briefly state how you use it.

i.

ii.

(C) If your answer in 3(a) above is No briefly state the reasons.

i.

ii.

4. (a) How often do you use computers to teach mathematics?

   (a) Quite often  [ ]  (b) Often  [ ]

   (c) Rarely  [ ]  (d) Do not  [ ]

5. (a) What factors inhibit you from using computers in teaching and learning mathematics?

i.

ii.

iii.

(b) Suggest possible solutions to the stated factors.

i.
APPENDIX C

Students’ Questionnaire

This research is meant for academic purpose only. Its purpose is to establish the factors inhibiting use of computers in teaching and learning mathematics in secondary schools. You are kindly requested to provide honest and precise responses.

Responses for the questions will be treated confidentially and will be used for the study.

Please tick (✓) where applicable or fill in the required information in the spaces provided.

SECTION I

Background information.

1. Your sex:  
   female □  male □

2. Your age (in years)  
   Between 13-14 □  
   Between 15-16 □  
   Between 17-18 □  
   Between 19-20 □  
   Above 20 □

3. Your class:  Form three □

Pertinent information.

1. (a) Does your school have a computer room?  Yes □  No □
   (b) If yes, how many students can sit in the computer room in one shift? ---------

2. (a) Do you perform mathematical activities/ tasks/ exercises using computers?  
   Yes □  No □
   (b) If your answer in 2(a) is yes, how often do you use computers to learn mathematics?  
      Quite often □  Often □  
      Rarely □  Do not □
3. (a) Will you be comfortable using computers to solve mathematical problems?

   Yes  [ ]  No  [ ]

   (a) If your answer in 3(a) above is No, State any factors that prevent you from using computers to learn mathematics.

   i. 
   ii. 
   iii. 
   iv. 

4. State any problems you encounter as students which arise from using computers to learn mathematics.

   i. 
   ii. 
   iii. 

5. (a) Do you access mathematics-computer software in learning mathematics?

   Yes  [ ]  No.  [ ]

   (b) If your answer in 5(a) above is No, what do you use to learn mathematics in the computer?
APPENDIX D

Researcher’s Observation Schedule.

This research is meant for academic purpose only. Its purpose is to establish the factors inhibiting using computers in teaching and learning mathematics in secondary schools. You are kindly requested to provide honest and precise responses.

Responses for the questions will be treated confidentially and will be used for the study.

Responses for the questions will be treated confidentially.

1. Computer laboratory.

   (i) Availability: Available □ Not available □

   (ii) Computers: Adequately equipped □ Not adequately equipped □

   (iii) Computer models (makes)

<table>
<thead>
<tr>
<th>Model</th>
<th>HP</th>
<th>IBM</th>
<th>COMPAQ</th>
<th>DELL</th>
<th>TOSHIBA</th>
<th>OTHERS.</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk top</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Laptop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Learning resources

   (i) Computer Books

      Adequate □ Not adequate □

   ii) Mathematics-Computer Software, -Compact Disks (CDs),

      Adequate □ Not adequate □


4. Computer accessories

   i. Computer projector Available □ Not available □

   ii. Printers Available □ Not available □
APPENDIX E

Budget Proposal

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (ksh.)</th>
<th>Per month.</th>
<th>Duration</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary</td>
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<td></td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>Typing</td>
<td>20,000</td>
<td></td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>Photocopying and Binding</td>
<td>21,600</td>
<td></td>
<td></td>
<td>21,600</td>
</tr>
<tr>
<td>Two Research assistants</td>
<td>12,000 x2</td>
<td>3 months</td>
<td></td>
<td>72,000</td>
</tr>
<tr>
<td>Travel and subsistence</td>
<td>8,000</td>
<td>3 months</td>
<td></td>
<td>24,000</td>
</tr>
<tr>
<td>Computer data analysis.</td>
<td>40,000</td>
<td></td>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>197,600</td>
</tr>
</tbody>
</table>
## APPENDIX F

### Time schedule / work plan

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal writing and presentation</td>
<td>Friday, 6th April 2011</td>
</tr>
<tr>
<td>Proposal corrections</td>
<td>November 2011</td>
</tr>
<tr>
<td>Obtaining research permit</td>
<td>December, 2011</td>
</tr>
<tr>
<td>Pilot study</td>
<td>January, 2012</td>
</tr>
<tr>
<td>Adjustment of the questionnaires</td>
<td>January, 2012</td>
</tr>
<tr>
<td>Data collection</td>
<td>January 2012-March 2012</td>
</tr>
<tr>
<td>Data analysis and report writing</td>
<td>March 2012</td>
</tr>
<tr>
<td>Submission of the report and defence of thesis.</td>
<td>April 2012</td>
</tr>
</tbody>
</table>
APPENDIX G

RESEARCH PERMIT

MINISTRY OF EDUCATION

DISTRICT EDUCATION OFFICE
KISII DISTRICT

REPUBLIC OF KENYA

Our Ref: ED/K/427/VOL.III/212

DATE: 8th May 2012

TO
THE PRINCIPALS

RE: RESEARCH AUTHORIZATION MR. MONYORO WILFRED MOGIRE
REG. NO: ESS/CE/10696/08.

The above named has permission to carry out research on Factors Inhibiting use of ICT-Computers in Teaching and Learning Mathematics in Secondary Schools.


Kindly do assist him carry out the research.

NYABIBA A.O
For: DISTRICT EDUCATION OFFICER
KISII CENTRAL.