TO INVESTIGATE THE EFFECTS OF INTEGRATING ICT IN TEACHING OF MATHEMATICS IN PUBLIC SECONDARY SCHOOLS IN BUNGOMA NORTH DISTRICT, KENYA

BY

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RESEARCH TOPIC

To investigate the effects of integrating ICT in teaching of mathematics in Public Secondary schools in Bungoma, Kenya

DECLARATION

I declare that this is my original work and I am ready to present it for the award of BED Science in Computer Studies and Guidance & Counseling.

NAME: PETER WEKESA SOITA

Signature: ..... Date: 7/10/03

I confirm that the work reported in this report was done by the candidate under my supervision.

Name..... Date 7/10/2003

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DEDICATION

This report is dedicated to my lovely wife Theopister, my daughters Joy and Abigael secondly to my sons Sammy & Joel not forgetting my mum Dina, my nieces and nephews. To all family members and friends who stood by me with encouragement and prayer. God bless you all.

ABSTRACT

Mathematics is regarded essential and useful to most people. Its usefulness can be observed in social, aesthetic, artistic, communication and utility aspects of life. This makes it part and parcel of mans' daily life.

The social nature of mathematics deals with humankind and how he interacts with society and environment. Mathematics also provides beauty in our environment expressed in terms of such aspects as buildings, latest vehicle designs, all which incorporate shapes.

The aim of the study is to investigate the effect of integrating computer in the teaching of mathematics in public secondary schools in Bungoma North, Kenya. The literature review has been done on Computer and Information technology and mathematics. The study shows that the use of computer in teaching mathematics affects performance positively in mathematics. The research objectives will be:-

1. Find out the gender differences in the teachers' attitudes towards the use of computers in mathematics instruction.
2. Determine the computer programming skills required by the mathematics teachers.

The research question will include:-

Is the use of computers having any influence in performance?

The research design to be used here will be a survey design. The sampling procedure will be purposive random sampling which will include Ministry of Education officials, School heads, Students and University libraries.

The data shall be analyzed statistically in tables, charts and graphs. The findings will be used by the stakeholders to improve the teaching of mathematics in public schools.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Preamble

This section covers the background to the study, statement of the problem, purpose of the study and research questions that guide the study. The scope, limitations of the study, assumptions of the study is also highlighted. It also provides the theoretical framework on which the study is based and the operational terms in the study are defined.

1.2 Background of the study

Mathematics is regarded essential and useful to most people. Its usefulness can be observed in social, aesthetic, artistic, communication and utility aspects of life. This makes it part and parcel of mans' daily life.

The social nature of mathematics deals with humankind and how he interacts with society and environment. Mathematics also provides beauty in our environment expressed in terms of such aspects as buildings, latest vehicle designs, all which incorporate shapes.

Seeing mathematics in art or nature is the recognition that art and nature can be described mathematically. In ancient Egypt mathematical concepts were used in construction of pyramids. The African traditional circular huts used mathematical principles.

As a language of communication, mathematics relays information through graphs, symbols and structures. It's also a universal tool for studying other subjects like science, geography, economics and technology. Symbols like '+','-','×', ÷'are universally used. They connote same meaning whenever utilized in transactions.

It is a strategic subject in the development of science and technology. Any citizen of any country should attain a reasonable level of mathematical literacy if adequate levels of scientific and technological development are to be achieved. Owiti (2001) assert that "mathematics is the gate and key of science.....neglect of mathematics works injury of all knowledge, since he who is ignorant of it cannot view the science or things of the world. It's therefore evident that the subject provides a pivotal role in the life of man.

Mathematics is a crucial subject in the school curriculum. Cockroft (1982: iii) observes that

"Despite its importance, mathematics is viewed as a difficult subject and majority leave school without grasping the fundamental arithmetic. He adds that there are indeed many adults in Britain who have difficulty with even simple matters as adding up money or checking balance in shops. Yet these adults are not all just unintelligent or uneducated. They come from many walks of life and some are very highly educated, but they are hopeless at arithmetic and they want to do something about it."

Previous studies compared US performance with other countries like Newzealand, Netherlands, Japan, and Norway whose characteristics varied widely. According to these studies it was asserted that performance in mathematics in American high schools is poor compared to elementary schools (The National Survey of Science and Mathematics Education).

Mathematics in Kenya is a core subject and critical filter for career choices. However, its performance in KCSE has been dismal yearly. The analysis of mathematics KCSE exam results (2002-2005) indicate that the mean and standard deviation in mathematics has been on the decline for the last three years as shown in the table below (KNEC report, 2006).

Year	Paper	Candidature	Maximum mark	Mean score	Standard Deviation
	1		100	19.95	19.38
	2		100	19.51	19.25
2002	Overall	197,118	200	39.39	37.95
	1		100	17.17	16.31
	2		100	21.45	19.86
2003	Overall	205,232	200	38.62	36.17
	1		100	14.57	15.42
	2		100	22.63	20.43
2004	Overall	221,295	200	37.20	35.85
	1		100	14.87	15.73
	2		100	17.04	16.74
2005	Overall	259,280	200	31.91	31.00

The poor results have been attributed to various causes ranging from poor teaching methods to psychological factors like attitudes. Effective teaching requires that teachers apply different methods of teaching to reach students with different learning styles. Lack of learning

materials is also a common problem inherent in the subject such that performance in the subject correlates to availability of these resources. Psychological factors like attitudes have also been known to influence performance in the subject.

To redress these causes, Kenyan government and other stakeholders have embarked on various large scale capacity building seminars and workshops. They are aimed at strengthening the teaching of mathematics and sciences in Kenyan secondary schools. In 1998 SMASSE was piloted in 9 districts. In 2003 the programme was implemented nationwide with the hope of solving pedagogical issues that have contributed to poor performance in mathematics and science subjects. The government has also allocated grants to public secondary schools for purchase of basic resources like textbooks. Ministry of Education introduced use of scientific calculators for instruction and examination of candidates at KCSE (Daily Nation, Thursday 26/5/2005).This innovation is expected to yield outstanding results in the subject in terms of solving perennial problems inherent in the subject. However; the problem of poor performance still persists. The trend is adding another impediment in Kenya's effort to industrialize by year 2020.

Technology has advanced greatly in the last decade. Kenya's social economic development is pegged on education. Furthermore, with the dawn of Information Communication Technology (ICT) there's increasing concern that ICT be included in the instruction at all levels of education. Researchers have overwhelmingly indicated that computer use in mathematics instruction has considerable potential. Computers allow students to discover or construct ideas for themselves and support constructivist pedagogies. According to Makau (1990) computers have potential of making teachers work easier and efficiently. They help students become less dependent on the teacher as the source of expertise.

In Kenya, the ministry of education in an endeavor to provide learners with access to ICT came up with a vision "ICT to be a universal tool in education and training." The mission; "To integrate ICT in education and training to improve access, learning and administration". To achieve these, every education institution, teacher, learner and respective community should be equipped with appropriate ICT infrastructure and skills needed for the knowledge based economy. Teaching and learning should be transformed to incorporate new pedagogies that are appropriate for the 21st century. This was published in sessional paper No.1 2005 where ICT in education was given prominence. A comprehensive national ICT strategy for education

and training was launched in 2006.The Acting Education Minister said that the government saw ICT in three main categories: e-government, EMIS and e-learning.

In education, the Ministry of Education (M.O.E) was to play a leading role to ensure the MDG objectives are realized. In order to address new challenges of information society at national, regional and international levels, a time target was to be 2015.Specific target was to connect secondary schools and other learning institutions with ICT and adapt their curriculum to meet challenges of information society. Achievements so far include: equipping of over 450 secondary schools with computers and government providing 213 million to 142 secondary schools to purchase computers. In addition, a unit has been established at K.I.E to provide overall leadership in digital content, development and delivery. Resources are being mobilized to address digitization of the entire curriculum.

Currently there are 4000 public secondary schools in Kenya. Of this 706 are equipped with basic ICT infrastructure supported by government, development agencies and private sector for example NEPAD E-schools programs. M.O.E remains concerned with quality of secondary education that is characterized by poor performance in core subjects like mathematics and science as indicated in its strategic plan. The strategic objective of the ministry is to equip education institutions in every district with computers to stimulate integration of computers in education in the country. The minister of education in a recent forum on ICT noted that 288 rural public secondary schools will be supplied with electricity as a first step towards integration of computers in education sector. Education and Energy ministries in conjunction with the government of Finland have also embarked on a program to supply rural public secondary schools with power and internet connection (International conference on ICT development, education and training e-learning in Africa, 2007).

While developed countries have reported up to 41% of integration of computers in instruction, the proportion remains substantially low in Africa. Muriithi (2005) has argued that in Kenya like most developing countries computer usage is still limited to computer literacy training. He contents that present computer curriculum deals with teaching about computers and not how computers can be used to transform teaching and learning in schools. He argues that even in situations where teachers have been trained in use of ICT, the integration of computers in the teaching of subjects has been weak because of a number of reasons cited in the literature; lack of integration into existing curriculum and textbooks; lack of computer-based materials

that are interactive for teachers to use; absence of systematic management support and teacher overload and lack of incentives and motivation. It's against this backdrop of use of computers that the present study strives to investigate teacher related factors affecting integration of computers in mathematics instruction in Kenyan secondary schools.

1.3 Statement of the problem

Research articles have reported effectiveness of integrating computers with mathematics curriculum in the developed world. According to these studies performance in mathematics instruction can be enhanced when computers are used. Successful teaching of mathematics depends partly on appropriate methods of teaching in the classroom setting. Considering the modern instructional methods in teaching, the traditional approach to educational technology can no longer address the challenges of information age. Hence, need for the teaching and learning of mathematics to be re-examined to incorporate diversified techniques of modern instructional technology like use of computers. However most of these studies have been done in developed countries where social, political and economic conditions are different from those of developing nations.

The issue that necessitates this study arises from poor performance in K.C.S.E mathematics examinations over the years. Some of the poorly performed topics include navigation, geometry, algebra and trigonometry. Literature shows performance in these topics can be improved when computers are used in instruction. Integration of computers in education is recent in Kenya. Despite the encouraging performance elsewhere and considerable growth in the number of computers acquired by secondary schools, computer use in mathematics instruction is yet to be embraced in Kenyan secondary schools. There is, however, inadequate documented information on research conducted in Kenya on the teacher of mathematics who plays an important role in the use of computers in mathematics instruction. The purpose of this present study therefore is to investigate teacher related factors influencing the integration of computers in mathematics instruction.

1.4 Purpose of the study

The purpose of this study is to investigate teacher-related factors influencing the integration of computers in mathematics instruction in secondary schools in Bungoma North district, Kenya.

1.5 Objectives of the study

The study surveyed teacher-related factors influencing integration of computers in mathematics instruction. In particular the study sought out:

1) To find out the gender differences in the teachers' attitudes towards the use of computers in mathematics instruction.
2) To determine the computer programming skills required by the mathematics teachers.
3) To examine the degree of accessibility and usage of computers by mathematics teachers.

1.6 Research questions

The following are research questions that guided this study;

1 What are the gender differences in the teachers' attitudes towards use of computers in mathematics instruction?

2 What are computer programming skills required by mathematics teachers that will help in use of computers in mathematics instruction?

3 How accessible are mathematics teachers to the computers in the schools and to what extend are computers used in mathematics instruction?

1.7 Significance of the study

1. The mathematics teachers, teacher trainers and students will benefit from the findings of this study by contributing towards great realization of the potential of computers as a teaching and learning resource in mathematics instruction hence improve performance of the subject in the national examinations.
2. To the ministry of education officials, mathematics teachers, teacher trainers and the entire stakeholders in education sector will find the findings of the study useful since integration of computers in mathematics will improve pedagogical practices of teachers promoting creativity and self-pacing in the subject which will in turn improve performance in mathematics in the Kenyan secondary schools.
3. Findings and recommendations of this study will give guidelines for curriculum developers (K.I.E) to establish how mathematics curriculum can be structured to incorporate computer to facilitate better learning and understanding of mathematical concepts.
4. The book publishers/authors will also find these findings helpful in giving guidelines to include work in their texts that calls for computer use to enrich students' experiences while using those textbooks.

1.8 Scope and limitations of the study

The study will be limited to mathematics teachers in Bungoma North district in western province of Kenya. The study will confine itself to teacher-related factors influencing integration of computers in teaching and learning of mathematics. These include gender differences in the teachers' attitudes towards use of computers in mathematics instruction, the computer programming skills they require, accessibility and usage of computers to mathematics teachers. The findings would therefore be generalized to teachers in Bungoma North District.

1.9. Assumptions of the study

The following are assumptions of this study;

1. Teacher's willingness to integrate computers in mathematics instruction is related to their attitudes about their use.
2. Teachers shall be honest to provide personal experiences in use of computers.

1.10 Theoretical framework

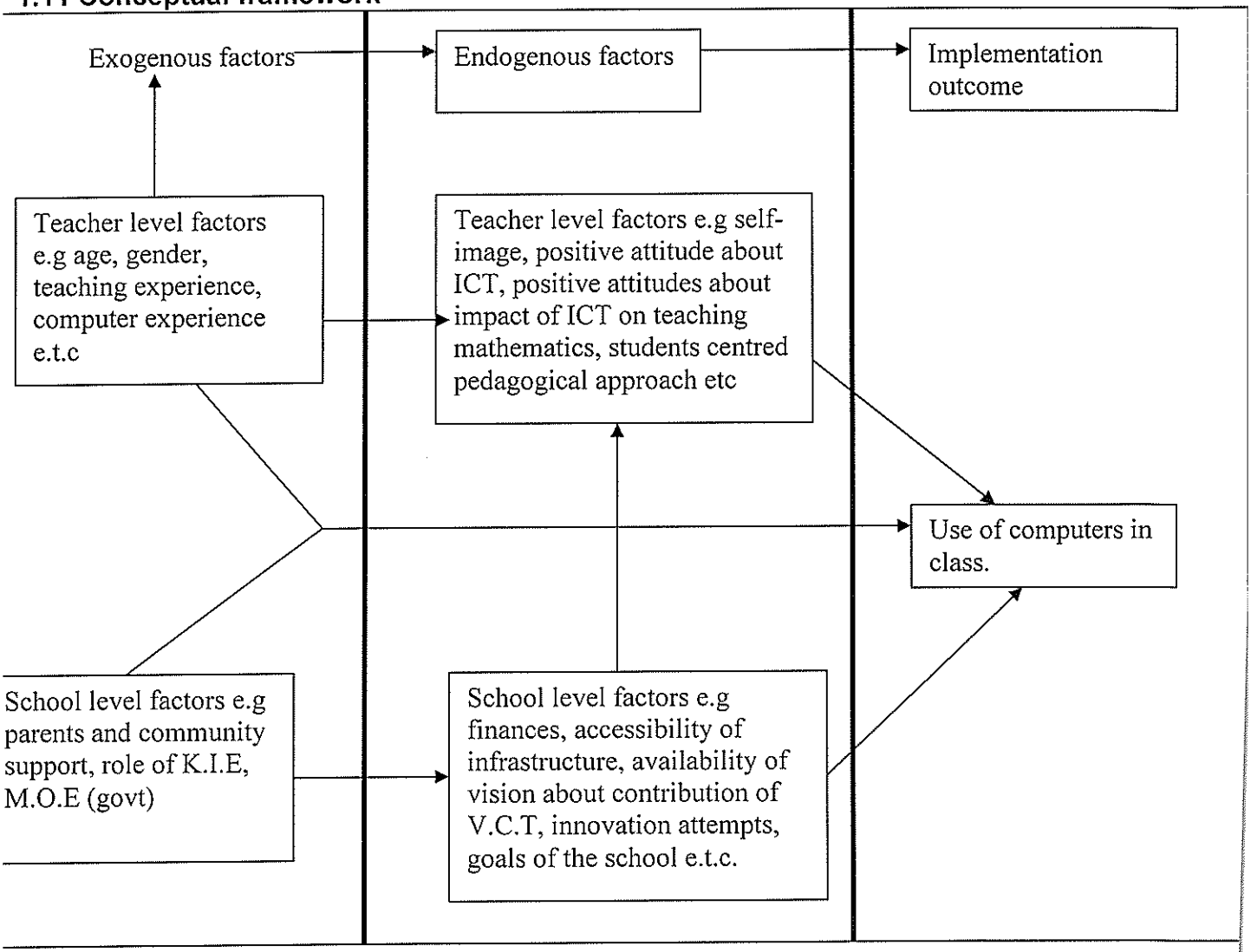
The theory of implementation of curriculum innovations will be used in this study. This theory was proposed by Gross et al (1971).By this theory the degree to which a curriculum is implemented is a function of the extent to which certain conditions are present during the process of implementation. These conditions are; the attitude of implementers, recipients and stakeholders of the new curriculum; the support provided by management staff, the availability of facilities and equipment; degree to which members of the school organization are clear about the scope and content of the curriculum; the extent to which members of the school organization possess the capabilities and competencies needed to carry out the process of curriculum implementation; existing organizational arrangement and the willingness to expend the time and effort for the implementation of the curriculum.

However, the researcher is only interested in the following conditions: implementers' attitude, availability of facilities and equipment and the extent to which members of the school organization possess the capabilities and competences needed to carry out the process of curriculum implementation. The implementers' attitude will be useful to the researcher when he will be investigating teachers' attitude towards use of computers in mathematics instruction. Since teachers are responsible for implementing the innovation in teaching, their

attitude will determine the success or failure of the implementation process. The theory will also help researcher to find out whether computers available are accessible to mathematics teachers since in order for an innovation to' take off 'necessary technology should be available and accessible to mathematics teachers in order for them to use in mathematics instruction. The theory will also be crucial to the researcher investigating the computer programming skills required by the teachers. For them to implement innovation with confidence, effectively and appropriately computer skills will be a key prerequisite.

Therefore the researcher will utilize the ideas of these scholars to find out the teacher-related factors influencing integration of computers in classroom instruction.

1.11 Conceptual framework



1.11 Definition of operational terms

Attitude: Teachers' acquired internal state or feeling influencing their choice towards learning

Computer: Is an electronic information processor that is able to perform a substantial amount of work with little human intervention. It can store, retrieve, edit, print and communicate with other computers.

E-learning: E-learning is the integration of information communication technology in the teaching, learning and training. This includes use of computers, internet, and calculators among others

Constructivism: Refers to pedagogical philosophy which views learning as being effective when it involves active participation from the learner which is student-centred, process driven, active involvement, intrinsic motivation, meaningful collaborative learning.

Integration: Is the use of computer-assisted learning (CAL) to support teaching and learning in delivery of mathematical content for purposes of improving performance in the subject.

Pedagogy: This is the 'science of teaching' and concerns itself with good practice in teaching and learning. It is the process and methods of teaching and learning, including the purpose(s), values, techniques or methods used to teach, strategies for evaluating student learning

Content: This is the mathematics subject matter that is to be learned / taught. The content to be covered in high school mathematics is very different from content to be covered at any other level.

Computer competence: Knowledge of basic vocabulary of computer terms and concepts like operating systems; ability to use internet, Library databases, catalogues and search engines to locate print materials; ability to use spreadsheets, database, use of presentation software and use of graphic programmes; ability to adapt knowledge and skills to new applications.

CHAPTER TWO

2.0: LITERATURE REVIEW

2.1 Introduction

This section entails a review of the relevant literature that is related to the research topic. The study seeks to investigate teacher-related factors influencing integration of computers in mathematics instruction. The literature will address the following themes; role of technology in teaching and learning mathematics; factors influencing teachers' use of technology, justification of computer-based learning, computers in schools and mathematics; teacher attitude and use of computers; teachers' knowledge of computer skills and use of computers; teachers' accessibility and use of computers. The primary purpose of this chapter is to situate the present study within the context of other studies in the area.

2.2 Role of technology in teaching and learning mathematics

In comparable research on technology and learning, Cradler and Bridgforth (1996:5) maintain that technology is related to increase in student performance when interactivity and other significant aspects of instructional design are applied to its use. Teacher preparation, follow-up activities, staff development and technical assistance are critical prerequisites for effective technology applications. Integration of computers that directly involves teachers consistently allows teachers to engage students in meaningful educational expertise and allows more time for individualized instructional opportunities.

Kaput (1992) noted that the role of computers in mathematics education is so significant. It is difficult to describe, and the changes are so rapid that are difficult to follow.

> *"Anyone who presumes to describe the roles of technology in mathematics education faces challenges akin to describing a newly active volcano-the mathematical mountain is changing before our eyes, with myriad forces operating on it and within it simultaneously (Kaput 1992:515)"*

The purpose of using computers in teaching and learning of mathematics is for the enhancement and improvement of the conditions in which human beings learn and teach (Fourth Revolution 1972:89).In this case computers are subservient to the teaching and learning and not an end in itself. Although there is no consensus among mathematicians and mathematics educators on the merits of using computers in teaching and learning of mathematics, much empirical research strongly supports the use of computers as a catalyst

for improving and enriching the learning and teaching environment. For instance, of several thousand studies reviewed, and many meta-analyses on this issue, the results support the use of computers in the teaching and learning of mathematics (Kadiyala, Cryines, 1988).

In addition to all these benefits, it has been shown that more importantly, if used effectively, computers can be a good instrument for fostering creativity in mathematics in a more successful manner.

> *"The creative act is often portrayed as a mysterious and even mystical process, more akin to divine inspiration than to mundane thought… However, with the advent of contemporary cognitive science, psychology has come closer to appreciating the mental processes that must participate in the creative act (Simonton, 2000:152)."*

As a tool in mathematics classroom, the computer helps students understand abstract concepts by making them visual and manipulable. Students can own complex ideas by manipulating algebraic formulae and constructing geometric figures. They can study phenomena, not merely techniques. Students become active learners; they identify 'interesting' behaviors, explore the conditions under which it occurs, analyze their observations and interpret their results. Students can do mathematics and be engaged in creative problem solving (Meissner, 2000).

Technology rich curricula reduce the time students routinely devote to practicing skills and manipulating symbols out of context. With simulations and models in geometry (or for the matter in linear programming, trigonometry and navigation), students can pursue questions of why, when, how and what if? As the council of teachers of mathematics notes;

> *"The new technology has changed the very nature of problems important to mathematics and the methods mathematicians use to investigate them."*

Research has shown that:

1. Ruthven (1994) assessed impact of using graphic calculators on high school students' ability to represent graphs in algebraic symbols. He compared students using graphing calculators demonstrated better abilities to achieve the target task.
2. Computer software that encourages student exploration supports instruction that increases students understanding of mathematics principles (Henderson, R.W and Landersman, E.M.1992)

3. Students who work in small groups on geometry problems showed improvement on higher-level problem solving and applying mathematics, they also received significantly higher scores on standardized final exams (McCoy, L.P.1991)

4. Students using computers for algebra and navigation did significantly better on a test of knowledge than conventional methods. The computer group also retained more of the information and scored significantly higher on measures of transfer to other areas of mathematics (Funkhauser, C.1993; Henderson, R, W. and Landesman, E.M 1992).

5.Guttenberger,E.W.(1992) found that high school students who used computer graphing tool to learn trigonometry achieved significantly higher posttest scores than students who learned the same materials through a more traditional approach

LOGO, a computer programming language designed for learning allows the learner extremely straight forward access both to creating interesting screen effects and to the computational/mathematical ideas in a wide range of programming contexts(Papert et.al,1979;Holyes et al.,1985;Noss,1985)

From the foregoing therefore this study is aimed at enhancing achievement in mathematics that can be realized through integration of computers in instruction an objective this study seeks to put forth.

2.3 Factors influencing teachers' use of technology

There is an emerging international consensus about factors which mostly encourage computer use by teachers. Scrimshaw (2004), has divided these into school level and external enabling factors. The most significant school level factors were; a supportive principal, planning driven by a vision and informed by needs assessment and teacher professional development approaches to match the various needs of teacher, reliable technical support, and adequate access to the requisite hardware and software resources.

Factors external to the school which included: working with community to provide more authentic, student -centred uses of computer, collaboration with other schools, continuous rather than 'one off' professional development with strong teacher input into the style and content; participation in national development and electronic networks.

In an extensive survey by Becker (1998), internet user connection in the classroom was critical in increasing U.S. teachers' efficiency and productivity. The lack of such connectivity appears to be a significant reason for low use of internet by New Zealand Secondary

teachers. Teachers' with home access had strong need for internet in their teaching. Internet usage tended to be greater among those teachers with existing computer competence. Those involved in professional leadership activities were much more likely to use internet than other teachers. Those who attended staff development were more likely to use it in teaching. Informal contacts with other teachers also are important factor in frequent internet usage. Teachers' whose schools provided them with their own computer were more likely to believe that internet is essential to teaching and were more likely to use it .Teachers' who subscribed to a more constructivist pedagogical philosophy were more likely to value and use internet.

Becker's findings were supported by National Centre for Education Statistics (1999) which also found that classroom availability and professional development were key predictors of teacher use of computer in classroom teaching (Smerdon et al, 2000).Education Review Office(2000) found that those teachers who favored use of computers were most likely to have well developed computer skills and value collaborative learning and decision making by students. Teachers who had reservations about computers were likely to exercise a higher degree of directing pupils to work individually. Pressures to prepare students for external examinations or tightly prescribed internal assessments (as in case with NCES) may account for secondary mathematics teachers being under-represented in the latter group.

It is against the backdrop of use of computers by teachers, collaboration with other schools, style and content, use of internet, pedagogical philosophy and classroom availability that this study strives to fill the gap in the literature through establishing the integration of computers in teaching mathematics.

Lack of usage of technology has been the subject of study by some researchers. The following barriers have been identified. First, lack of standard of integration is a factor cited in the literature. Although technology is in schools and teachers are encouraged to integrate technology with mathematics, there is no universal definition of what integration of technology with mathematics means or what an integrated curriculum looks like. Consequently, there is a wide range of opinion on what teachers should know about technology. Willis and Mehlinger (1996) argue that this lack of universal agreement of what teacher should know is a major reason why technology is not being integrated.

Teachers' perception of nature of technology and its role in teacher's pedagogical beliefs is another hindrance to integration (Ertmer and Hruskocy, 1999). Several research findings about perceptions are; experience with integration and knowledge of integration. Teachers who grew up learning mathematics in traditional methods tend to question role of technology. They feel insecure in the integrated form of teaching (Hazzan, 2000).Teachers with positive experience in using technology tends to teach their students with technology (Slough and Chamblee, 2000). Many teachers did not grow up learning technology and have no experience become a barrier to integrating technology when teaching mathematics.

Thirdly, teachers' knowledge about technology also affects their decision to use it. Teacher awareness is highly correlated with teacher attitude about technology(Coffland 2000).However, lack of knowledge about hardware and software is a common barrier in the literature(Weber,1996).Manouchehri (1999) says that teachers report their lack of knowledge about mathematics curriculum as to why they employ little use of technology in their classrooms. Teachers perception of role of technology (what it should do) is closely related to how he or she uses technology. (Ertmer et al, 1999)

In addition, access problem include limited infrastructure (Hadley and Sheingold, 1993; OTA, 1995), lack of access to educational software (Manouchehri, 1999) and difficulties for the computer lab to fit the curriculum.

Teachers' self-efficacy is another inhibiting factor common in the literature. Teachers past experience in using technology affects their beliefs about themselves as effective teachers. The experience in both learning and teaching with technology greatly affects teacher's confidence in integrating technology in mathematics lessons (Hsiung, 2001).Many research papers recommend training in order to increase use of technology from teachers. Training of technology increase use of computers in mathematics classes (Coopers, 1998; Mathews et al, 1996). Lack of preservice (Wetzel et al, 1996) and lack of in-service support (Ertmer and Hruskocy, 1999) are two reasons why teachers don't integrate technology. Systematic training increases teacher's confidence and actual use of technology (Gilmore, 1995).

School environment and curriculum requirements sometimes discourage integration of technology (Weber, 1996).For example lack of time to accommodate heavy workload, the more classes a teacher teaches, the less likely will integrate technology in lessons. Principal's

attitude towards technology correlates with teachers attitudes towards the same. Curriculum often allows no room for technology integration (Weber, 1996).Teachers reported seeing no relevancy of technology to mathematics curriculum.

In Kenya limitations to use of computers cited in the literature is poor infrastructure (Adhola, 2004 and Sanya, 2001) Provision of telephone facilities still remain far below current demand. Many of the lines that exist are either out of date or dysfunctional, interrupting connections to the information superhighway. Use of electricity is limited mainly to urban centres.The infrastructure expansion and human resource implications of the free primary education policy are immense.

Educators and curriculum planners at K.I.E have been compelled to go to the drawing board to reexamine the national goals and objectives of education. Such re-thinking will ensure that products of system are adequately prepared for challenges that await them in the world of work both within and outside Kenya. (Sanya, 2001). Therefore few rural schools are able to incorporate the use of computers in the learning process. Very few schools can afford computers to help make students technologically literate if anything, Kenya still finds it difficult to provide just enough textbooks for their overcrowded classrooms (Omari and Mosha, 1987).In addition, the NEPAD E-schools are only six in total and all are situated in the rural area.

The country doesn't have adequately trained personnel to make this dream a reality across the educational spectrum. Besides; there are no resources available to in-service teachers in order for them to cope with these new demands. Matters are worsened by the fact that Kenya still has high level of illiteracy. Although the World Bank and other donors have already made commitment towards its support, resource mobilization (including teacher training) by the Kenya government remains a challenge (Otieno, 2003).

Lack of time on the side of teachers to gain confidence and experience with technology, limited access to reliable resources, a mathematics curriculum overloaded with content, assessment that requires using technology and lack of subject specific guidance for computer to support learning hinder integration. Central to all these processes, therefore critical role of the teacher should be acknowledged. (Futurelab, 2003).

The solution to the problem of lack of integration of computers in mathematics is complex. The present study seeks to find out gender differences in the teachers attitudes towards use of computers in mathematics instruction. Establish computer programming skills required by the teachers. Determine accessibility and usage of the computers in the teaching of mathematics in a Kenyan context characterized by lack of hardware, software and personnel equipped to deal with this issue. It is against the backdrop of lack of universal curriculum, overloaded curriculum, how teachers perceive computers and its role in pedagogy, and lack of knowledge about hardware and software that the present study seeks to fill the gap in the literature through integration of computers in mathematics instruction.

2.4 Justification of computer- based learning

There are several justifications for introduction of computers in education in third world countries.Hawkridge, Jaworski and McMahon (1990) and Van Marseven (1992) have identified the following broad categories of reasons. The first justification is social. This is based on the premise that computers are pervading society; therefore learners must be introduced to computers. There is enhancement of awareness of the technological nature of the modern society so as to fit in the 'global village.'

The second reason is vocational. Computer education should be related to future jobs, therefore learners must be taught computer studies in preparation for careers in the world of work. The student is given such specific training like computer programming and hardware maintenance.

The third reason is pedagogical. Computers can improve teaching and learning. Makau (1990) asserts that computers have the potential of making teachers work easier and efficient. However this third reason is the most problematic justification. Teachers normally operate under great pressure from communities in which their schools are based. It is common for parents in some parts of Kenya to lock out a head teacher whose school does not perform well in national exams. Against this backdrop, it's found that majority of teachers would use what has passed the test of time in achieving the results than encounter problems when using 'unfamiliar technology.' For a practice to be accepted, there must be seen as consistent with teacher's personality and way of doing things. That is what works regardless of the ethics. Secondly, an innovation that originates from within and is conceived to produce

good results for students is likely to be accepted than if it's coming from above. Computers may act as catalysts and bring about a desired change in education. Use of computers is hoped to trigger off another innovation for example learner centered curriculum. Teachers tend to cope with new technologies using familiar well proven routines and responses. If they happen to accept technology they may be doing so only to avoid losing their most cherished position as controllers of learning by appearing not to be old fashioned (Oslon, 1988)

It's important to examine justification for introduction of computers in secondary schools of Bungoma North so as to understand why computers are used the way they are. This will help in the understanding of nature of problems that influence teachers when using computers in the teaching of mathematics in the schools.

2.5 Computers in schools and mathematics

Since the late 1970's one of the most significant features of the education system in the developed world has been the large scale introduction of computers in schools. In these countries introduction of computers into the school system originated from outside educational system. Computerization of schools stemmed from technological advances in micro-electronics. This led to manufacture of increasingly cheaper but smaller and more powerful computers (Friend, 1987).This development resulted in the emergence of personal computers (micro-computers). Capitalizing on the lower prizes, the government funded programs, local initiatives involving teachers and user groups (Sowell and Rotteray, 1987).Pressure from manufacturers of computers who have frequently offered attractive discounts to educational purchasers have ensured that computers are provided to schools in increasing numbers. The advent of personal computers in the homes, wide spread use of and Turner in management of public affairs, in business and industry also have exerted pressure on school systems to incorporate technology into curricula (Becker, 1984, Inderson, 1985, Wangburg 1985, Naiman 1987).

The new ICT has influenced formal education in two major ways; as a vehicle for improving existing school curricula, instruction and school management processes. Education researchers and performers who find fault with the existing traditional curricula and practices in education have turned onto ICT for a solution. To them it's a tool that has the potential for effecting fundamental changes in perception and approaches to learning.

The entry of computers into the education system of developing nations mirror development in the west in two important ways. Pressure for computerization being exerted from outside the education system. Second, computerization of schools is being advocated at a time when fundamental thinking about curricula and role of formal education in the wider society is taking place (Chan 1996,Oteiza 1987,Nissan 1988,Camara 1989,Chaundry et al,1989). Like in industrialized countries, they regard computerization of schools as an essential element in the wider effort to gear mode technology to national development. This will increase the country's competitiveness in the international market (Akinlade 1986, Ramiszowki 1986, Oteiza1987).Great hopes for rapid economic development is being pinned on the adaptation and adoption of modern technology including computers. Educational institutions are being prompted to play a role in this process. Many developing countries are in the process of reforming school curricula and education systems inherited from former imperial powers. The effort aim at making educational processes relevant to overall development of society. Among aspects receiving prominence is need for education that emphasizes practical approaches using both indigenous and imported technology .Also, practical experiences through active participation in learning activities help learners to acquire attitudes and skills necessary for which educational priorities in Africa are discussed, (Fransman and King, 1984).

Although ICT in education in Kenya is a relatively new area of research, some useful publications are available, dating back to an evaluation of one of the earliest computer deployment projects in the country, the Computers in Education Project in Kenya (CEPAK). The latter project was launched as long ago as April 1985 but its evaluation in 1990 is particularly relevant to the present research. The major goal of CEPAK was to help teachers in their teaching practice and computer awareness courses for students. This project was initiated because a section of Kenyan community was keen in devising a role of computers in some public secondary schools. It had very ambitious targets; was expected that teachers across the curriculum would be trained and become self-reliant in their use of computers by end of two years (Makau and Wray, 1987) However, time was too short for them to consider integrating computers in the normal teaching and adopt changes in their teaching approaches as suggested by software and project staff.However,the project faced various challenges; lack of qualification of subject teachers who were helping with introduction of computers; cost of setting up project, computer labs and purchase of software and hardware was high; imported coursewares were inadequate to support the teaching and learning using existing syllabi.Consequently,implementers saw the need of designing local courseware for the

project schools, Results from the trial, showed that the use of locally designed courseware improved students academic gains significantly(Wray and Makau,1987).There was need for more training of teachers in programming in order to enable them design and develop relevant courseware for existing curriculum. At its pilot phase, with funding from the Aga Khan Foundation, a small number of computers were introduced into one secondary school in Nairobi. Starehe Boys Centre was the first secondary school to introduce computers in education in 1980(Friend land, 1985 and Turner 1986).The aim of the centre for introducing computers was to train boys for jobs. In the succeeding two years CEPAK was subjected to both in-house and external evaluations. As a consequence, additional funding was obtained from Apple Inc., the International Development Research Centre (IDRC) and the Rockefeller Foundation, and in mid 1986 a three-year Phase II was launched. Five more secondary schools, which included private and public schools distributed throughout Kenya were brought into the project and each received computers, software and teacher training. During the three year period of Phase II, this innovative project was studied and evaluated by an independent research team (Makau, 1990). Three educational researchers carried out this study, using a variety of research methods; these included examination of school records on the use of computers within the six participating schools, observation of classes (91 were observed, 65 of which were computer-assisted), and interviews with teachers. Two sets of written questionnaires were administered to teachers in 1986 (baseline year) and in 1988. In total, 170 teachers responded to these questionnaires in 1986 and 110 in 1988.Thus, this represented a large-scale study of the use of computers in secondary schools in Kenya.

The CEPAK evaluation found that most computer-assisted lessons were observed to be in mathematics and the sciences. However; this evaluation also found that in the majority of computer-assisted lessons teachers tended to be passive, thus leaving students to do whatever they chose. This approach to computer-assisted lessons was explained as being a result of the perception of the computer as object of study, as more exciting and potentially more rewarding than integration of the technology into the existing curriculum (ibid: 90).

The research also found that computer studies lessons were conducted in the computer laboratory, thus they seemed to have priority over computer-assisted lessons in other subjects. It would appear that, both practically and symbolically, computer science was receiving more emphasis than integration of the technology into the rest of the curriculum.

A second research project (KenyaSchoolNet, 2003) conducted in November 2002 was based on the findings of a questionnaire to which 69 secondary schools responded, coming from all provinces and 46 districts. This research reported that only 46.4% of the sampled schools had computers although there did appear to be a high level of awareness of the benefits of computers in schools(ibid:11).The research also reported internet was rare in the schools(ibid:10).Only one school had a website and only two reported having networked all their computers to the internet(ibid:20).It went on to assert that in those schools, access to the internet was severely limited and when available was only for administrative use(ibid:20).

The Kenya SchoolNet found that almost 40% of the schools had less than 10 computers, and therefore inadequate numbers for teaching and learning. More than 20% had less than 5 computers, indicating that the computers were largely for administrative purposes (ibid: 10).Only one third of the schools surveyed had dedicated computer laboratories. The research also found that some schools heavily relied on the donation of computers as opposed to sourcing locally.

Again, mirroring closely the findings of the evaluation of CEPAK, the Kenya SchoolNet survey found that there was a close association between mathematics and computer usage given that many computer teachers were themselves teachers of mathematics. This tendency created a perception that computer courses were closely linked to mathematics.

A third research study (Ndiku,2003) conducted more recently based on the experience of managers and computer teachers in eight schools in Uasin Gishu District, western Kenya, focused on the problems encountered in the implementation of educational ICT projects. The research identified the following as the most important factors in inhibiting the success of computer deployment projects; insufficient numbers of computers and peripheral devices; teachers' lack of knowledge; inadequate software for instruction and inadequate technical assistance(ibid:81)Computer teachers themselves were found to have the additional problems of integrating computer usage into school curriculum(ibid:81)

Computers are crucial medium for curriculum delivery and desire to adopt a new technology are part of new ideas that are important attributes that have necessitated the integration of computers in instruction and delivery in mathematics teaching. A consideration that will drive

the present study in focusing on computer use in mathematics instruction and not merely computer literacy.

2.6 Teachers' attitude and use of computers

Confidence in ones ability to use computers and being at ease using them are keys to teachers' technology use (Gorald, Slewyn and Furlong 2004, Spencht et al 2002).As teachers gain confidence; they challenge themselves to develop and apply new skills. They become less concerned about potential problems and more convinced that they can handle problems that arise. Teachers who are comfortable using computers put children at ease about computer use. With confidence and security, teachers involve children in finding and creating new ways to learn using computers.

Teachers' instructional beliefs have become a central issue in education. It has been argued that those beliefs have a strong impact on teaching and learning (Handal, Bobis and Grimison, 2001; Lovat and Smith, 1995).Teachers' instructional beliefs reflect personal theories of knowledge and knowing such nature has been seen as influencing teachers' curriculum decisions. Teachers' beliefs have been conceptualized as a set of assumptions that teachers' hold on various educational processes such as curriculum, schooling, students, teaching and learning and knowledge (Lovat and Smith, 1995). According to Lovat and Smith (1995) these beliefs also act as mental models driving teachers practice and processing of new information. These instructional beliefs are seen to act as mediators between curriculum goals and the actual implementation since teachers are to make curriculum decisions based on their own affective and cognitive schemes.

Lack of implementation of instructional technology can be as a result of teachers' instructional beliefs not matching the original goals of a particular innovation. (Haynes, 1996; Koehler, 1992). If teachers' beliefs do not match these goals it is likely that resistance will be generated resulting in a low take-up (Burkhardt etal,1990).Conversely, if teachers' beliefs are more compatible with educational reform, it is probably that new ideas will be accepted and adopted in the classroom. Teachers' therefore can be obstacles or conveyances of change (Prawat, 1990). Consequently, it is very important that prior to any educational innovation, teachers' instructional beliefs are explored, identified and dealt with to determine whether they are appropriate or not (Handal and Herrington, in press, a) In Cuban's words I1993, p.256):"The knowledge, beliefs and attitudes that teachers have ... shape what they choose

to do in their classroom and explain the core of instructional practices that have endured over time."

In the last decade, there has been increasing interest for the study of teachers' instructional beliefs and their influence on curriculum implementation. The low degree of success in many educational reforms has been seen as a major reason why teachers' instructional beliefs need to be considered (Fullan, 1993). It is improbable that teachers can amend their own instructional practice if their belief on teaching and learning remain unexamined. There is more than just transferring resources to schools if educational change is to be attained. Teachers' instructional beliefs need to be confronted and appraised in terms of beliefs and principles underpinning innovations. Otherwise changes will only be "cosmetics" or a "travesty" of the original innovation goals as it has happened in the past with a large number of large scale innovations. (Burkhardt etal, 1990).

A number of studies show that the current nature of teachers' beliefs are not favorable to adopting technology. Nowhouse (1998) surveyed 60 Australian teachers and found that even, when they had technical skills, teachers were reluctant to implement technology in the classroom. Mathematics teachers were not convinced about the benefit of computers in mathematics instruction. Factors for such resistance were preference for traditional methods of instruction. Likewise Becker (2000) investigated beliefs and instructional practices of 4083 middle and high school teachers and found that teachers with a higher constructivist inclination towards teaching and learning were more likely to use technology in the classroom. Similar findings were obtained by Fulton and Turney-Purta (2000). Many teachers dislike using technology in instruction because there are not enough numbers of computers in school, and problem of maintenance(Andrews,1995;Erickson,1993).Bobis and Cusworth (1994:14) stated that 'female (preservice teachers) are more likely to display negative attitudes to teaching mathematics when calculators and computers are involved.

Medcalf-Davenport (1998:1) argues that there has not been a major change in teachers' attitude towards technology in education. "The computer is still viewed as curriculum rather than as a tool for teaching the classroom." There is resistance and fear in the integration of anything new into the classroom and mathematics teachers do not recognize usefulness of necessity of using technology for teaching and learning.

2.7 Teachers' knowledge of computer skills and use of computers

Relevant technology knowledge and skills are prerequisite for teachers' effective use of computers in the classroom. (International Society for Technology in Education, 2002).In U.S. 1/3 of teachers in 1999 reported feeling "well prepared" to use computers for class instruction with less experienced teachers feeling better prepared. Interestingly, the main form of professional development reported by teachers was "independent learning"(93%).Most reported availability of training in computer with high levels of participation(80%)but reported lack of follow up and lack of advanced training, Smeldon et al,(2000). Mathematics teacher training programs lead to enhancement of teachers' capacity in use of computer and these in turn will result into improved quality of teaching and learning in schools. Effective educational uses of educational technology need more than simply presence of these technologies. To have impact, introduction of computers into secondary schools need to be accompanied by effective professional development in terms of content and delivery (McKenzie 1998a, International society for technology in education, 1999).In New Zealand Education Review Office (2000) reported that "schools are continuing to give priority to computer professional development. In addition to teachers attending programs funded by Ministry of Education 76% of schools have committed their own resources to computer professional development. In 80% of schools teachers have opportunity to develop skills and knowledge through access to computers and internet (Education Review Office, 2000:2).

Most scholars working in this area agree that traditional methods of technology training for teachers-mainly workshops and courses, are ill-suited to produce the "deep understanding" that can assist teachers in becoming intelligent users of technology for pedagogy(Brand,1997;Milken Exchange on Education Technology,1999;U.S. Department of Education,1999).A survey by Milken Family Foundation and ISTE found that teacher-training programs, in general, do not provide future teachers with kinds of experiences necessary to prepare them to use technology effectively in their classrooms. Specifically, they found that formal stand-alone IT coursework does not correlate well with technology skills and the ability to integrate technology into teaching.

It is argued that knowledge of technology cannot be treated as content-free, and that good teaching requires an understanding of how technology relates to pedagogy and content(Hughes,2005;Keating and Evans,2001;Lunderberg et al,2003;Margerum-Leys et al,2002)In this view technology is treated as a knowledge system, that is neither neutral nor unbiased(Hickman,1990).Rather, technology has its own propensities, biases, and inherent

attributes, Bromley(1998),Thus, technology cannot be treated as a knowledge base unrelated and separate from knowledge about teaching tasks and contexts-its not what technology can do but what technology can do for them as teachers.

It is recognized in Education Policy Framework that there is limited technical expertise for transformation of national curricula to digital education curriculum. This limited and uncoordinated supply of teachers in specified subject areas with appropriate skills and competencies continue to be a major barrier in integration of computers in most parts of Africa including Kenya. From the foregoing therefore this study is aimed at establishing appropriate skills and competences required in relation to mathematical pedagogy and content. This is seen to enhance achievement in mathematics that can be realized through integration of computers in mathematics an objective this present study seeks to put forth.

2.8 Teachers' accessibility and usage of computers

In order to discuss problem and possibilities of computer integration in mathematics it is important to establish the degree to which mathematics teacher currently has access to computers. In 2000 almost all public secondary schools in U.S had access to internet (98% from 35% in 1994). In U.S teacher use of internet or computers was high but intensive use was far less with 19% using them to gather information for mathematics lesson plans and 9% reported access in research. The NCES study found that computer teachers were largest users. This was followed by high school teachers of academic subjects like English, Social studies and Science. Mathematics teachers were sharply lower in their usage. Overwhelmingly, high users group were made up of teachers with fewer years of experience, (Smeldon et al, 2000) .Such figures underscore importance of classroom based computers in the infusion into teaching and learning. In Newzealand, classroom access in secondary schools report up to 79 % up from 60% in 1998. 54% of secondary schools reported such access in 1%-25% of their classroom's access figures is critical in determining mathematics teachers' access to the technologies. Ratio of computers to students is now 1:4 secondary students. Most secondary schools are networked (i.e. above 80%of their classrooms are linked).

Despite there being internet access in most schools in Newzealand, classrooms do not have access. This lack of connectivity is even more pronounced in secondary schools. Related issues of lack of access also include computers in dedicated suites (as opposed to classroom

based computers), lack of access to reliable equipment and technical support. This is a barrier to integration of computers into learning especially in secondary schools. Computers and internet connection within classrooms are a major prediction of infusion of computers into learning. In schools where computers were available 99% of public secondary teachers reported using them.

Studies have shown that ratio of computers to students in Kenyan secondary school stands at 1.150.Besides, research also found that computer studies lessons were conducted in the computer laboratory, thus seemed to have priority over use in other subjects. With respect to greater concern of digital divide, it's noted that access to computer facilities is presently one of the major challenges in Africa including Kenya. This is one of the crucial factors hindering integration of computers in teaching mathematics. In addition to this, ratio problem there are a number of challenges facing access and use of computers in Kenya. These are high level of poverty hindering access to computer; limited rural electrification and frequent power disruptions. Where there is electricity, high costs of internet provisions, cost of hardware and software, inadequate infrastructure and support hinder application of computers. In Kenya another challenge is limited access to dedicated phone lines and high speed systems or connectivity and access email/internet. Furthermore, very few schools in rural areas use wireless technology such as VSAT to access internet and email resources. All the six NEPAD E-schools are in rural areas. This limited access is a common barrier cited as among challenges the ministry of education is likely to face in its endeavor to meet the set objectives in the strategic plan. It is against this backdrop of limited accessibility that these present study strives to fill the gap through integration of computers in mathematics instruction.

2.9 Gap in the literature

According to studies in the literature teachers have been trained in general information technology workshops and courses which may not provide them with experiences necessary to prepare them to use computers effectively in their classrooms (Milken Exchange on Education Technology, 1999; U.S. Department of Education, 1999). However, there is need for more training of mathematics teachers in programming in order to enable them design and develop relevant courseware for mathematics curriculum. This aspect has not been covered in the literature. It is against this backdrop that the present study strives to fill the gap by establishing appropriate computer skills required that will correlate with their ability to integrate computers in teaching.

Studies have also shown that although computers are in schools and teachers are being encouraged to integrate computers with mathematics curriculum, teachers do not know what an integrated curriculum looks like (Willis and Mehlinger, 1996). K.I.E the curriculum developer has no curriculum in place that guides teachers in the use of computers in mathematics instruction (Muriithi, 2005). This aspect may be the reason why computers are not being used. Hence the present study seeks to fill the gap by establishing integration of computers with mathematics curriculum.

Studies in the literature also indicate there is limited technical expertise for transformation of the national curricula to digital educational curriculum (Ndiku, 2003:81). The aspect of teachers with appropriate skills and competencies has been overlooked (Otieno, 2003). This present study strives to fill the gap by establishing the appropriate computer programming skills required to help teachers use computers in mathematics instruction.

Studies have reported computers in dedicated suites as opposed to classroom based computers. This lack of access to reliable equipment in the specific classes is a barrier common in the literature (Hadley and Sheingold, 1993; OTA, 1995; Manouchehri, 1999). This is an aspect that the present study seeks to fill the gap by finding out teachers' accessibility to the computers in the schools that will necessitate integration of computers in mathematics instruction.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This section entails description of the area of study, study population, sample and sampling techniques, research design, research instruments, piloting, data collection and analysis procedures.

3.2 The study area

The study was conducted in public secondary schools in Bungoma North district. Bungoma North district is located in western province of the republic of Kenya. Bungoma North District is found appropriate for this study partly because of students' poor performance in mathematics in Kenya national examinations for secondary schools (K.C.S.E). Also some schools have computers which could be used to teach mathematics.

3.3 The study population

The district has 50 public secondary schools with a total of 128 mathematics teachers. Out of these schools the study targeted 10 secondary schools that have computers and teaching computer studies with a total population of 90 mathematics teachers. Half of the mathematics teachers (50%) in the sampled schools were used in the study.

3.4 Sample and Sampling techniques

Purposeful sampling was used to focus on schools with computers and teaching computer studies. Systematic random sampling was then used to select the representative sample of the mathematics teachers in every school. This enabled me to pick 50% of the total number of mathematics teachers in every school to be visited. The total sample size comprised 10 heads of departments and 35 mathematics classroom teachers.

3.5 Research design

A descriptive survey design was adopted for this study. This enabled the gathering, summary presentation and interpretation of information from the population chosen. Descriptive survey design was intended to produce statistical information about aspects of education that interests policy makers and educators (Borg and Gall, 1985:5). It is a method of collecting information to a sample of individuals (Orodho, 2003) Kerlinger(1969) points out that descriptive studies involve fact findings and formulation of important principles of knowledge

and solution to significant problems. They involve measurement, classification, analysis, comparison and interpretation of data.

3.6 Research instruments

The researcher used questionnaires, checklist and interview schedules to collect data on attitude of teachers', computer skills and examined degree of accessibility and usage of computers in mathematics instruction. The questionnaire adopted the five point Likert Scale with elements ranging from Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. Scores were awarded from 5 to 1 for each respective element for positive attitude and this will be reversed for negative attitudes. Categorical scales were also employed. The researcher also adopted open-ended and closed –ended questions. Questionnaires were used since they give unbiased responses. Respondents answer the questions without undue influence and helps gather data over a large sample (Kombo and Tromp, 2006).Checklist were used to collect data on computer programming skills. The interview schedules were used to collect qualitative in-depth data that may not be captured in a questionnaire.

3.7 Piloting

A pilot study was carried out in two secondary schools with computers in Bungoma North district. These schools were not used in the actual study. The purpose of the study was to provide a check on the research instruments to ensure they are appropriate for the study. From this study, it was possible to determine whether the research instruments were to elicit the information required from respondents and whether they relayed the intended message. Instruments were pre-tested before administration to determine their effectiveness, revise ambiguous items and determine time for administration. The results were analyzed to test face and content validity. Reliability of the research tools was established by split-half method during the piloting. A correlation was to be established between the scores on the items. Spearman's Rank correlation coefficient (rho) was used for this purpose.

3.8 Data collection procedures

Permission was sought from the pertinent offices to conduct research in the selected schools. A pilot was done ahead of the actual study. Personal researcher initiative was used in arranging, administering and collecting questionnaires and interviewing respondents. All the teachers sampled completed the questionnaires. In addition to filling questionnares, heads of

department were interviewed. The questionnaires were administered on individual basis. These ensured independent responses.

3.9 Data analysis procedures

Descriptive statistics was used to analyze data collected. To facilitate the analysis, the raw data from the attitudes, computer skills and accessibility and usage of computers in mathematics was coded. Ms Excel spreadsheet was then used to compute percentages and frequencies which was then used by the researcher to make interpretations, conclusions and subsequent recommendations.

CHAPTER FOUR

4.0 Introduction

This chapter deals with data analysis, by use of charts, graphs, tables and Spearman Rank correlation in determining the correlation of variables. It seeks to clarify the accessibility of teachers to computers, programming skills they poses and gender factors if any, in terms of computer knowledge in relation to mathematics teachers statistically.

4.1 Research Area

The research was done in 15 schools namely:

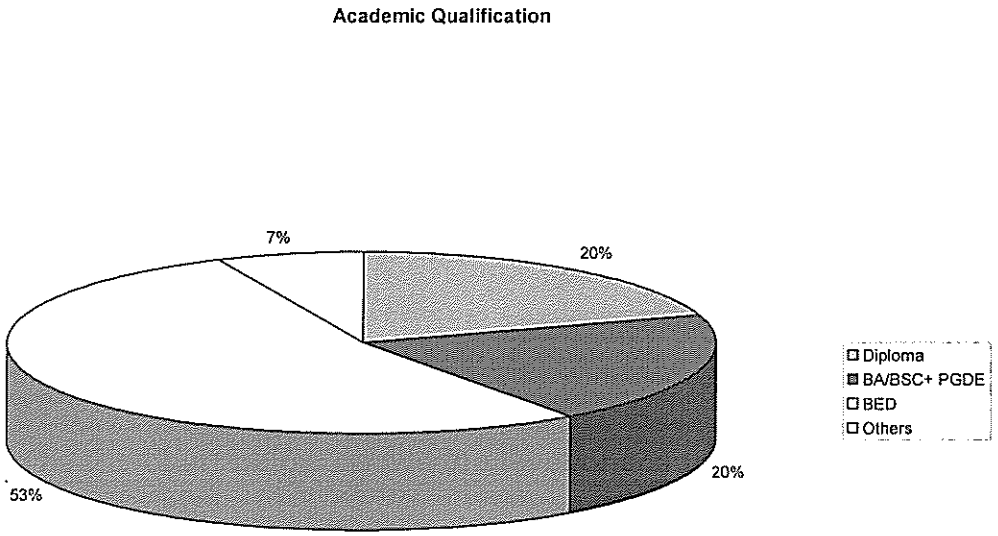
1. Kimilili Boys High Schhol
2. Kamusinga Girls
3. St Patrick's Miruri
4. Kamusinga Boys High School
5. Chesamis Boys High School
6. Chesamis Girls
7. St Mary's Sosio
8. Nakalira Mixed
9. Kamukuywa Girls
10. Maliki Sec School
11. Sikhendu Sec School
12. Friends School Milima
13. Naitiri High
14. Sirakaru Sec School
15. Ndivisi Sec School

4.1.1 Professional/academic qualification of mathematics teachers.

The research targeted Diploma, BED, BA, BSC + PGDE and other qualifications as tabulated under.

Academic Qualification	No
Diploma	9
BA/BSC+ PGDE	9
BED	24
Others	3

4.1.2 The Pie chart below shows the level of academic qualification in percentages



It was observed that 20% of the mathematics teachers had diplomas while 20% had BA/BSC +PGDE, while 53% had BED qualifications, while 7% had other qualifications.

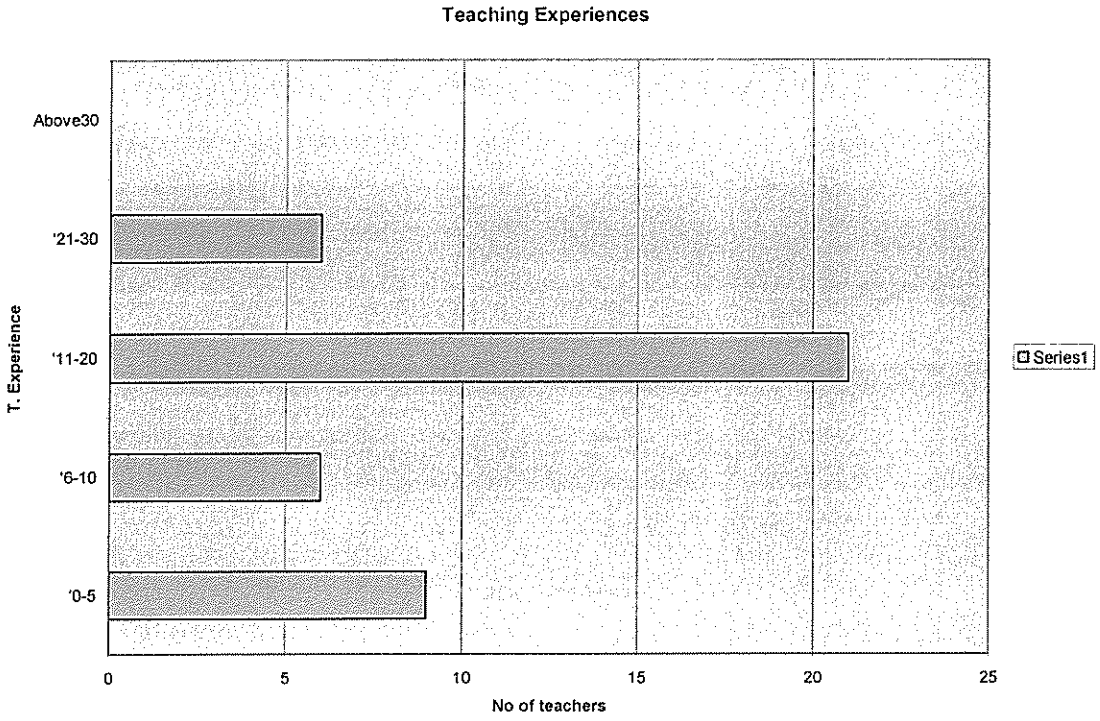
4.2 TEACHING EXPERINCE VERSES COMPUTER USE.

The following graph shows how mathematic teaching experience is related to computer use:

4.2.1 The table below shows comparison of teaching experience verses computer use

Teaching Experience	Computer Use
'0-5	9
'6-10	6
'11-20	21
'21-30	6
Above30	0

4.2.2 The teaching experience in relation to computer use can be analyzed in the bar graph below.

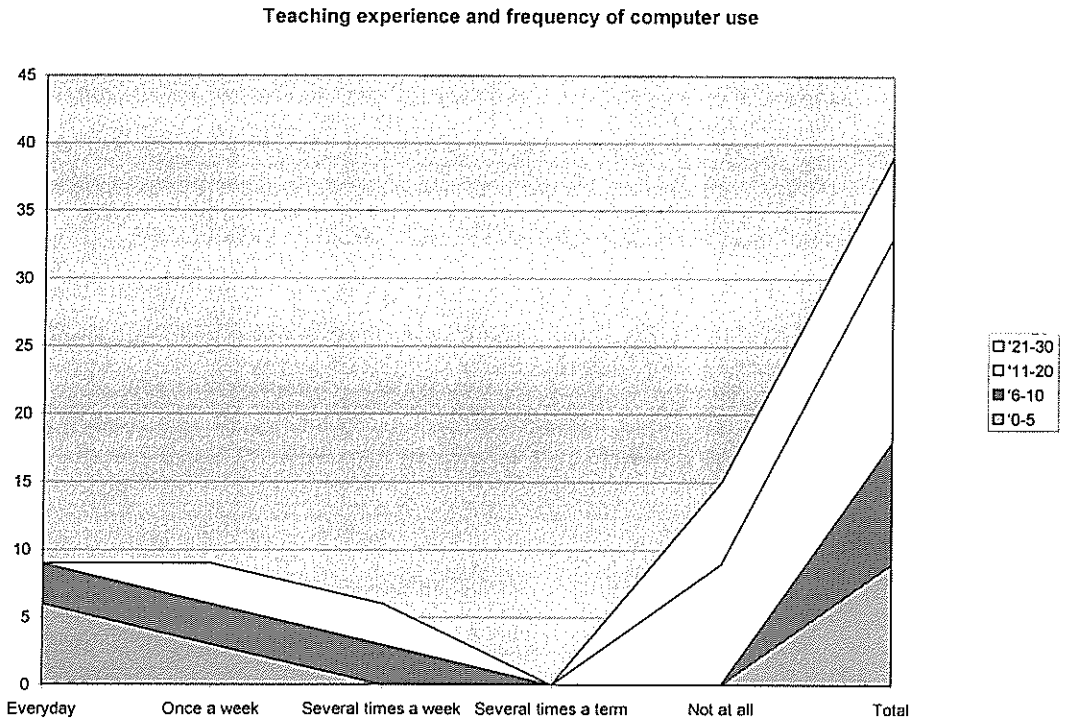


4.2.3 The frequency of computer use is categorized as shown in the classes below

Teaching experience				
	'0-5	'6-10	'11-20	'21-30
Everyday	6	3	0	0
Once a week	3	3	3	0
Several times a week	0	3	3	0
Several times a term	0	0	0	0
Not at all	0	0	9	6
Total	9	9	15	6

It was observed that the frequency of computer uses immensely correlates with that of teaching experience. And the area graph below shows the above analyzed data.

4.2.4 Frequency of Computer use and Teaching experience

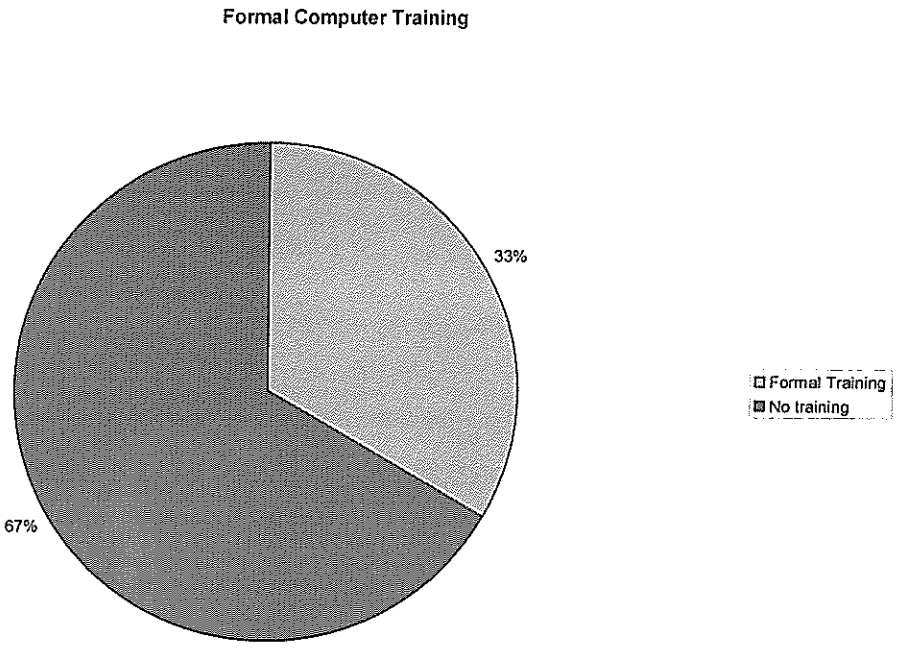


4.3 Computer knowledge through formal Training.

The table below gives data on teachers with formal training in computer.

Training	Response
Formal Training	15
No training	30

4.3.1 The pie chart below illustrates in percentage teachers with formal training in computer.



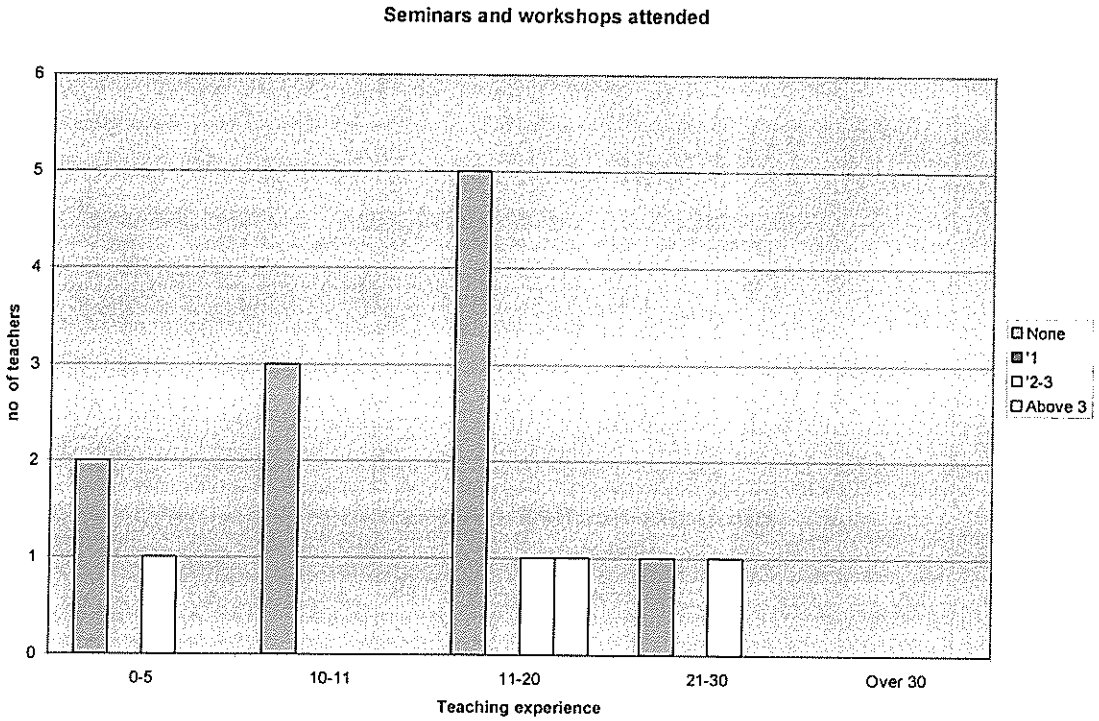
Most of the teachers interviewed had no formal training in computer knowledge as shown in the above chart above. 33% of teachers had some formal training in computer while 67% had none.

4.3.2 Seminars/workshop attended by teachers

The table below shows data on the seminars and workshops attended by mathematics teachers.

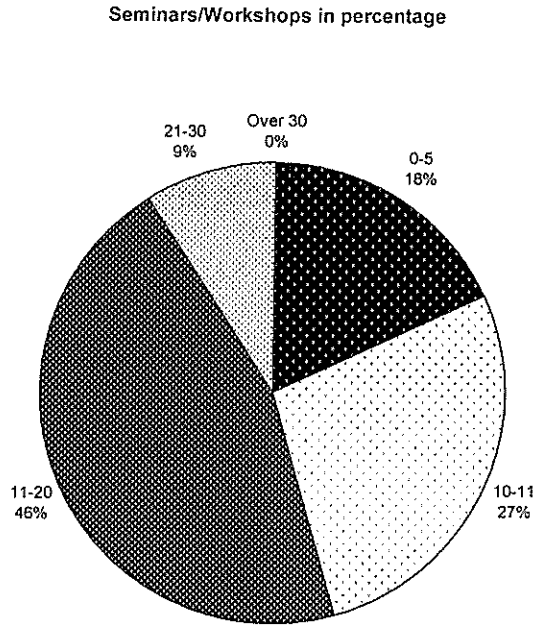
Teaching experience	None	1	2-3	Above 3
0-5	2	0	1	0
6-10	3	0	0	0
11-20	5	0	1	1
21-30	1	0	1	0
Over 30	0	0	0	0

4.3.3 Graph showing Seminars/Workshops attended



It was observed that eleven teachers had attended seminars and workshop in ICT.

4.3.4 Pie Chart showing seminars and workshops attended by teachers in percentages



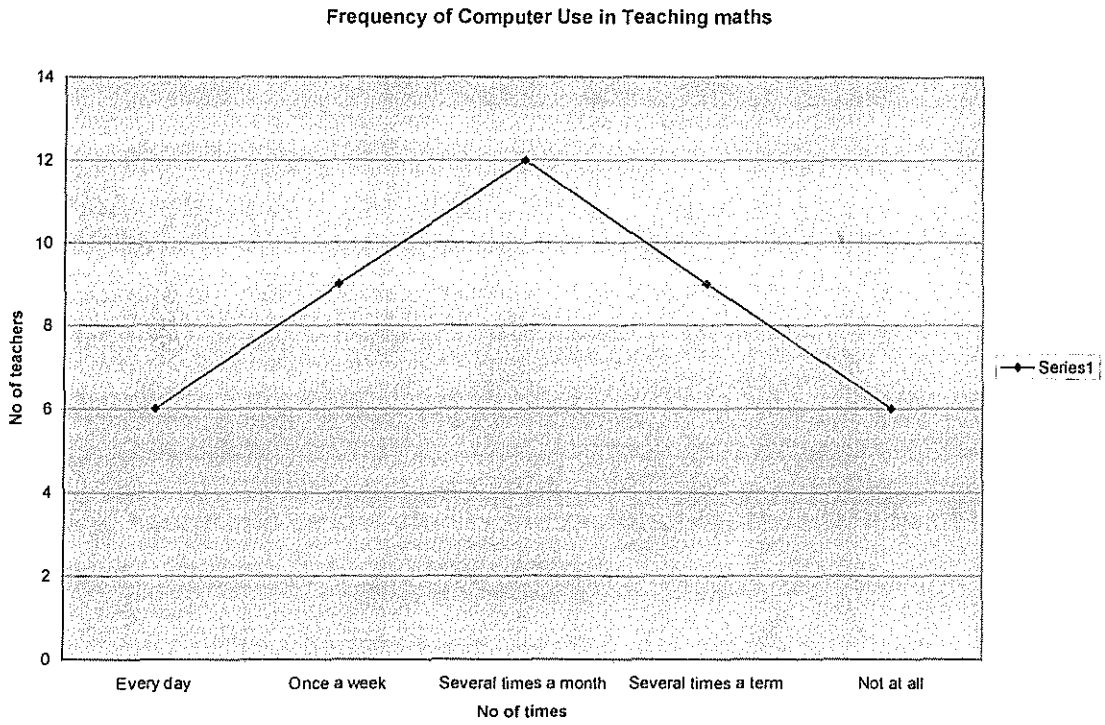
From the above observation it is observed that teachers with teaching experience of over 21-30 had no computer knowledge and had no attended any seminar or workshop in ICT, 27% had attended seminars more than three times.

4.4 Computer use in the teaching of mathematics

The frequency of computer use in teaching mathematics is tabulated below.

Frequency	Reponses
Every day	6
Once a week	9
Several times a month	12
Several times a term	9
Not at all	6

4.4.1 The line graph below shows the pictorial representation of the above data.



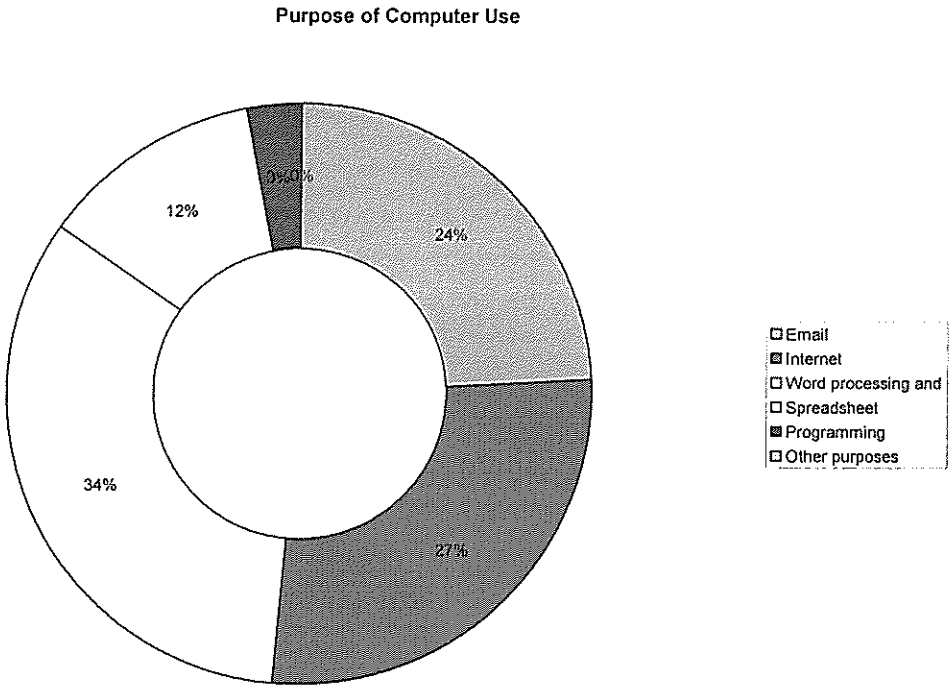
The frequency of computer use is by mathematics teachers: only 18 out of 45 use computers daily, 27 use it once a week 36 use it once a month, 27 use it once a term and 18 not at all.

4.5 Purpose of Computer use

Purpose	Frequency
Email	8
Internet	9
Word processing and	11
Spreadsheet	4
Programming	1
Other purposes	0

Most of teachers use computer for word processing and spreadsheet; only a handful use it for other researcher purpose.

4.5.1 Purpose of Computer use in percentages



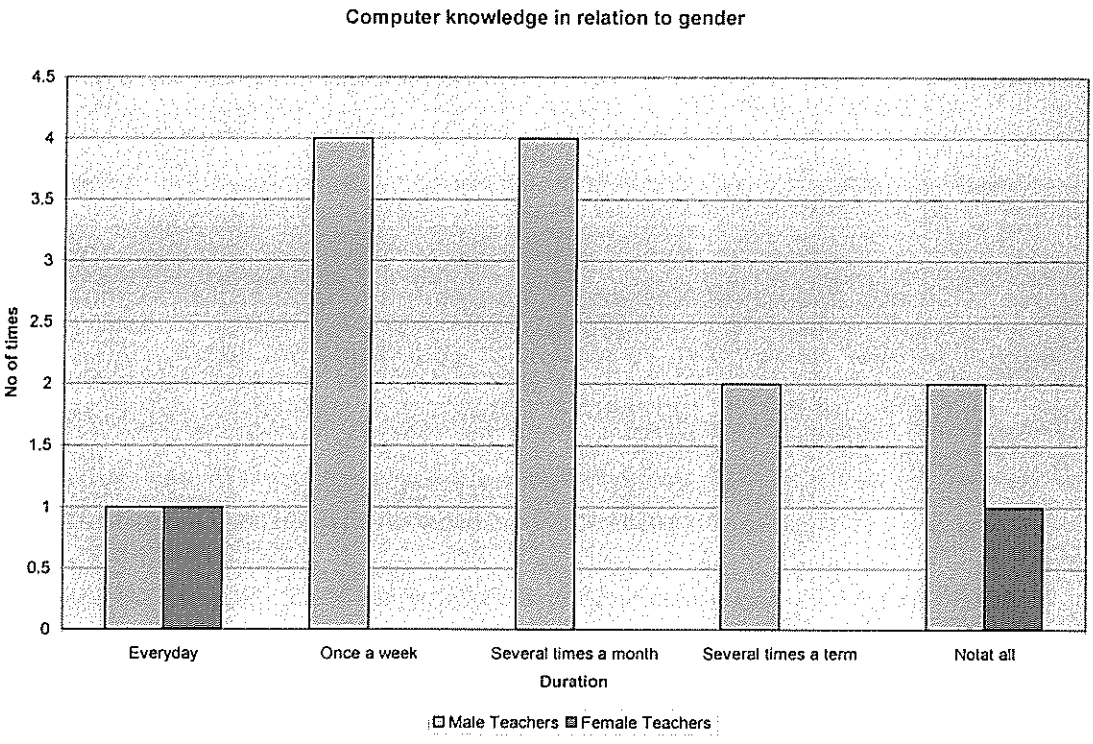
From the doughnut above it was observed that only 3% of mathematics teachers use computers for programming purposes while 24% use it for Email, 27% use it for Internet purposes while 12% use it for spreadsheets 34% for word processing and the rest for other purposes. Therefore only a small percentage of mathematics teachers have some knowledge in computer programming.

4.6 The following table shows the relationship between the computer use and gender.

Frequency	Male	Female
Everyday	3	3
Once a week	12	0
Several times amount	12	0
Several times a term	6	0
Not tat all	6	3

It was established that only 3 female and 3 male teachers uses computer everyday. Twelve of the male teachers use computers once a week, twelve use several times a month, six use computers several times a term while 6 male not all and three female.

4.6.1 Computer Knowledge in relation to gender



4.7 Correlation between teaching experience and computer knowledge

The researcher used the Spearman's Rank correlation to determine if there exists any correlation between teaching experience and computer use. The computation was done as shown below.

$$R = \frac{1 - 6\Sigma d^2}{n(n2-1)}$$

Variable	Computer knowledge	Teaching Experience
Age	6	1
Gender	7	7
Formal	1	2
Academic quality	2	5
Purpose of computer use	4	3
Computer use in Teaching mathematics	3	6
Frequency of use	5	4

	Rank in computer knowledge	Rank in teaching experience	d	d^2
A	6	1	5	25
B	7	7	0	0
C	1	2	-2	1
D	2	5	-3	9
E	4	3	1	1
F	3	6	-3	9
G	5	4	1	1

$$r = 1 - \frac{6 \times 46}{7(72-1)} = 0.18$$

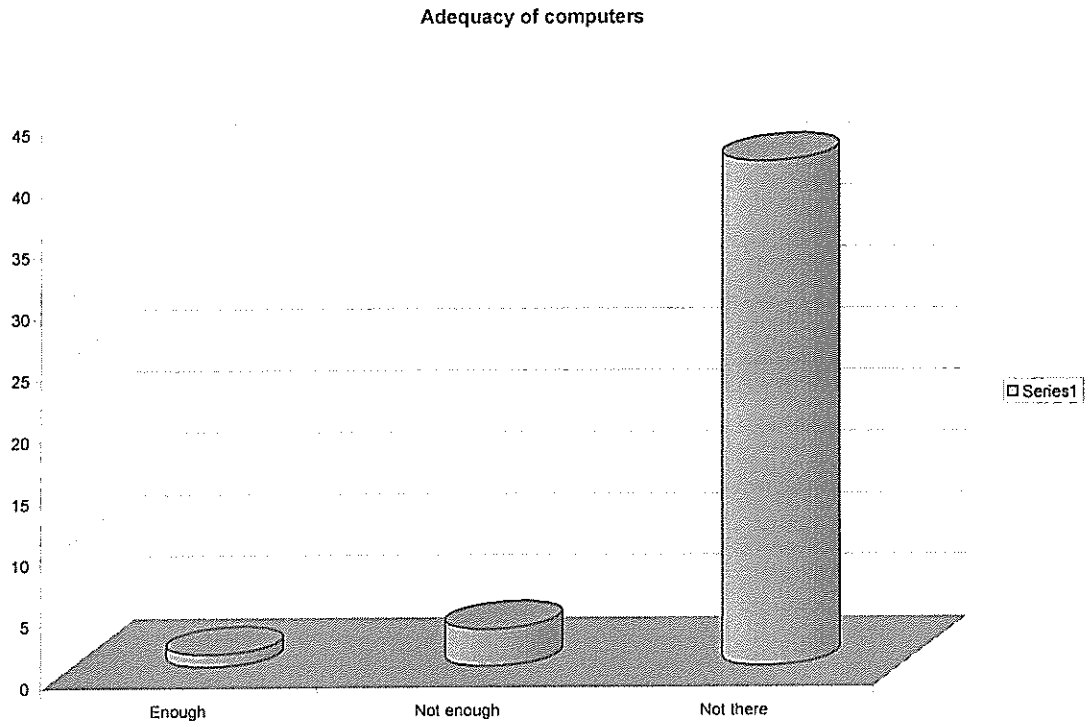
There's a perfect direct correlation in the experience and computer knowledge.

4.8 Adequacy of computer in schools

4.8.1 The following data shows if schools have enough computers teaching of mathematics

Often	0
Not often	1
Never	14

4.8.2 The cylinder below shows teachers responses in term of computer adequacy in the schools



From the above observation it was established that 41 out of 45 respondents agreed that computer in schools are not adequate only three respondents out of 45 responded by not having enough computers while one respondent responded that computers were enough. Therefore it was concluded that schools don't have adequate computers.

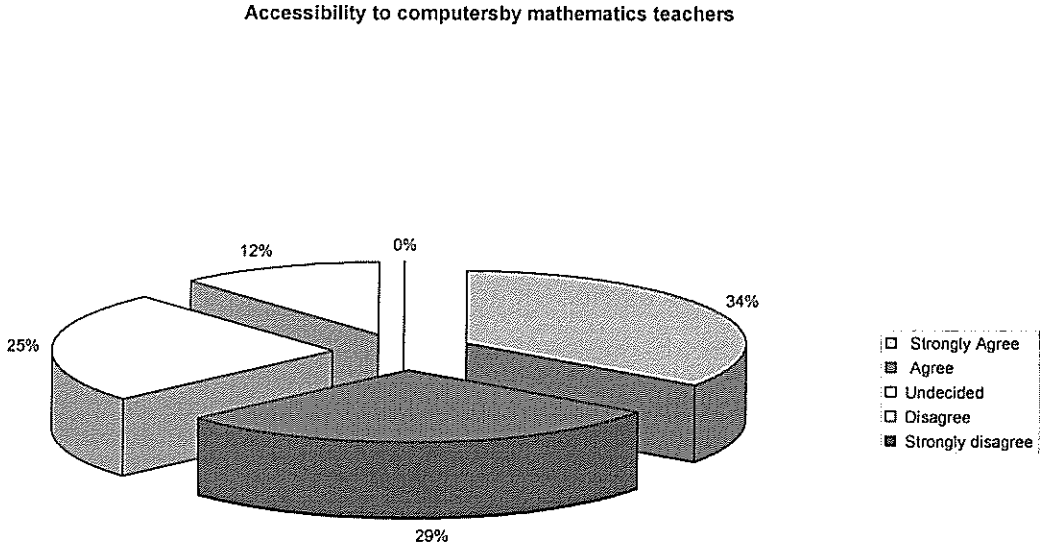
4.8.3 Lack of accessibility to computers by mathematics teachers

Data on accessibility to computers was tabulated as.

Strongly Agree	18
Agree	15
Undecided	3
Disagree	6
Strongly disagree	0

Eighteen out of the 45 respondents strongly agreed with the fact that computers are inaccessible by mathematic teachers, while fifteen out of 45 agreed three respondents were undecided while six disagreed and there was none that strongly disagreed.

4.8.4 The above data was further analyzed using the pie chart below.



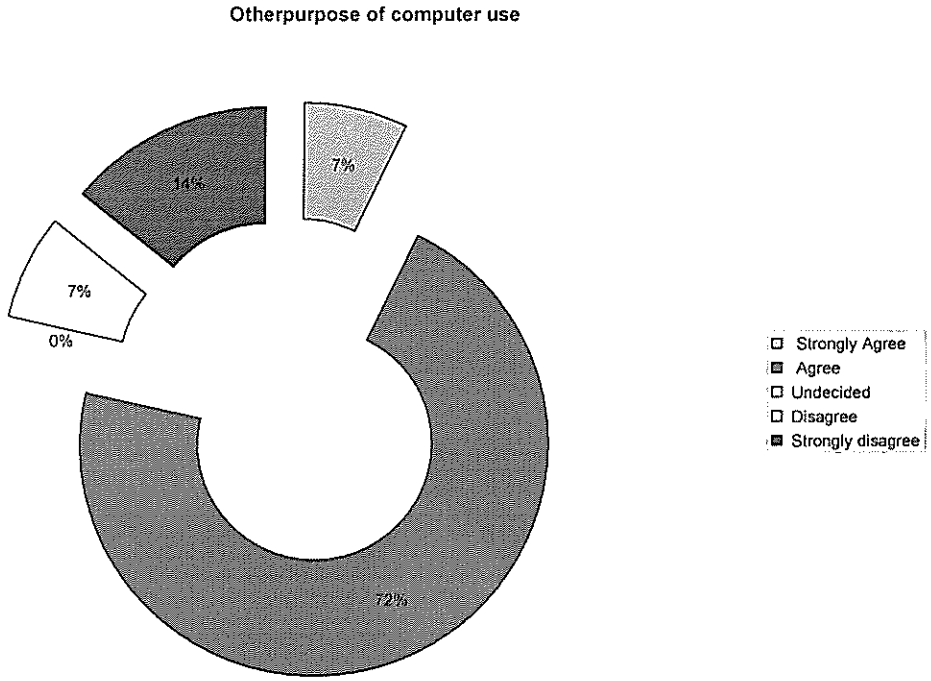
From the pie chart above the following observation can be made: 34% strongly agree that computers are inaccessible to mathematics teachers, 29% agree with the same fact, 12% were undecided, 25% disagreed while 0% strongly disagreed.

4.8.5 Computer used for other purpose other than teaching mathematics.

The table below indicates that although some schools have computers but they use them for other purpose other than teaching of math.

Strongly Agree	3
Agree	30
Undecided	0
Disagree	3
Strongly disagree	6

The pie chart below indicates that although some schools have computers but they use them for other purpose other than teaching of math.



7% of the respondents strongly agreed that though computers are there but are used for other purposes while 72% agree that computer often are used for other purposes other than teaching math, 0% undecided, 7% disagree while 14% strongly disagree.

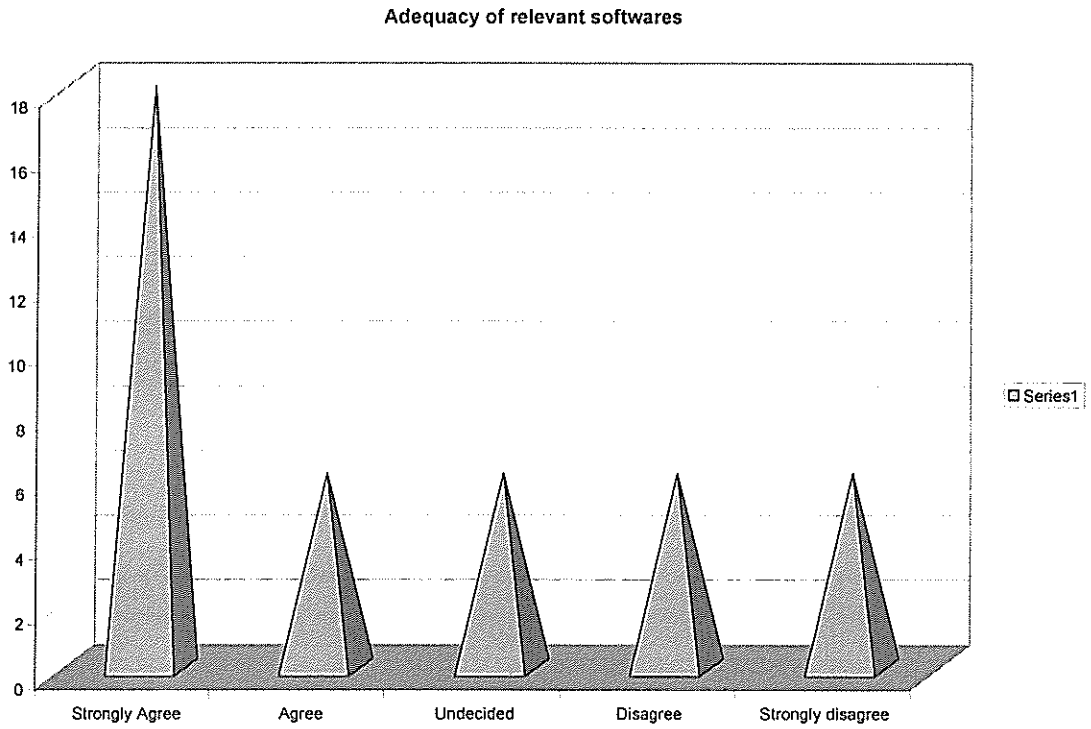
4.8.6 Inadequate software's/programs for teaching of math.

The table below tabulates the adequacy of relevant softwares/programs in the teaching of mathematics. It seeks to any the question do you agree that relevant softwares are adequate?

Strongly Agree	18
Agree	6
Undecided	6
Disagree	6
Strongly disagree	6

It was established that eighteen out of the forty five respondents strongly agree that software for teaching mathematics are inadequate while 6 agree, 6 were undecided, 6 disagree and 6 strongly disagree.

4.8.7 Graphical Analysis of adequacy of relevant softwares for teaching of mathematics

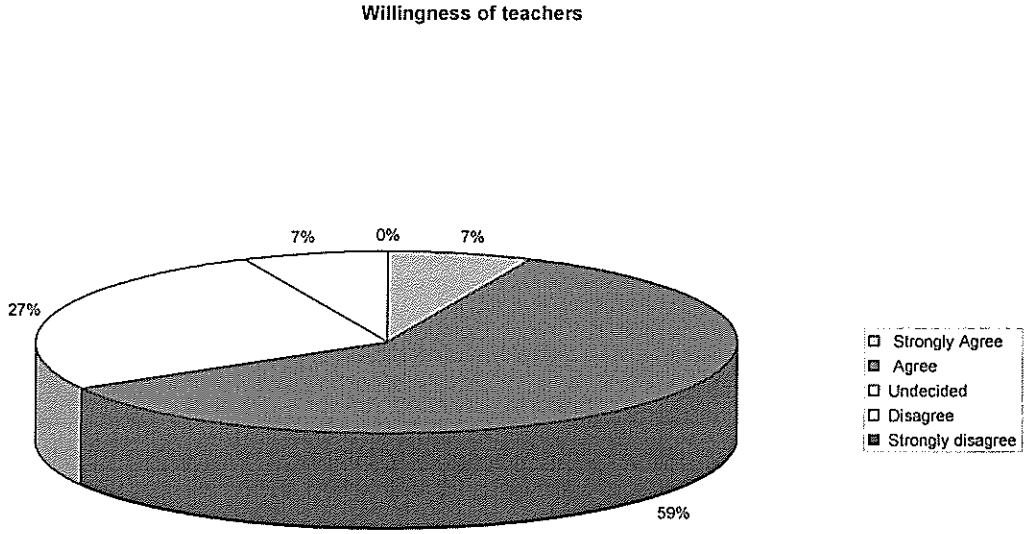


4.8.8 Are teachers willing to integrate computer in teaching mathematics.

The table below indicates the willingness of teachers in using computers to instruct mathematics

Strongly Agree	3
Agree	27
Undecided	12
Disagree	3
Strongly disagree	0

4.8.6 Pie Chart showing the willingness of teachers in integrating ICT in the teaching of mathematics



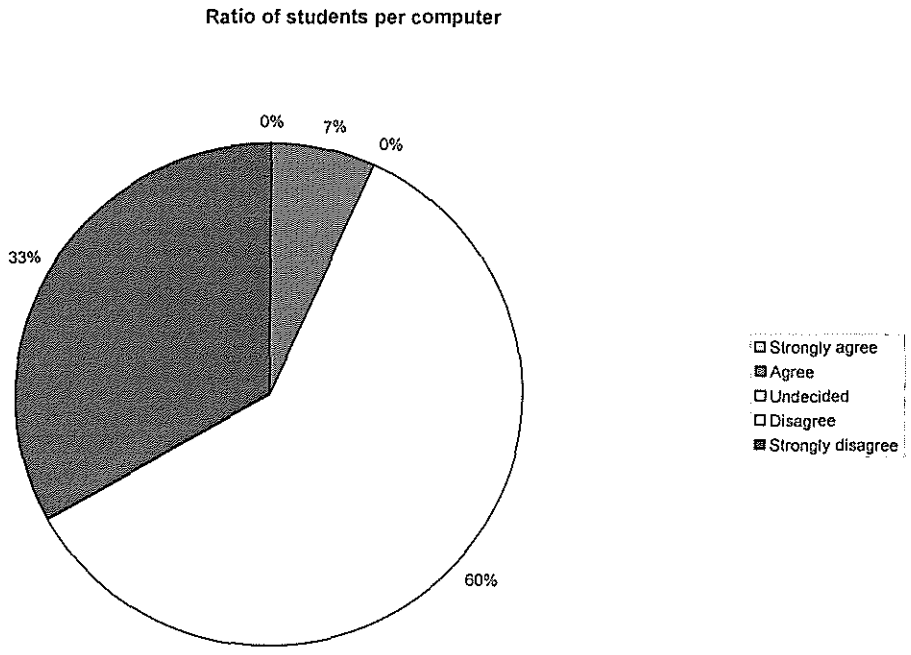
7% of the respondents strongly agree to integrate ICT in the teaching math whole 59% agree, 27% of the respondents were undecided while the remaining 7% disagree 0% strongly disagree.

4.8.9 Ratio of students per computer

The table shows the responses of teachers if the ration of students per computer is adequate in their schools.

Strongly agree	0
Agree	3
Undecided	0
Disagree	27
Strongly disagree	15

4.8.9.1 Ratio of students per computer in percentage



From the above observation 0% of the respondents strongly agree that the ratio of computers to students is adequate, 7% respondents agreed that student computer ratio was adequate 60% disagree, 33% strongly disagree while 0% were undecided.

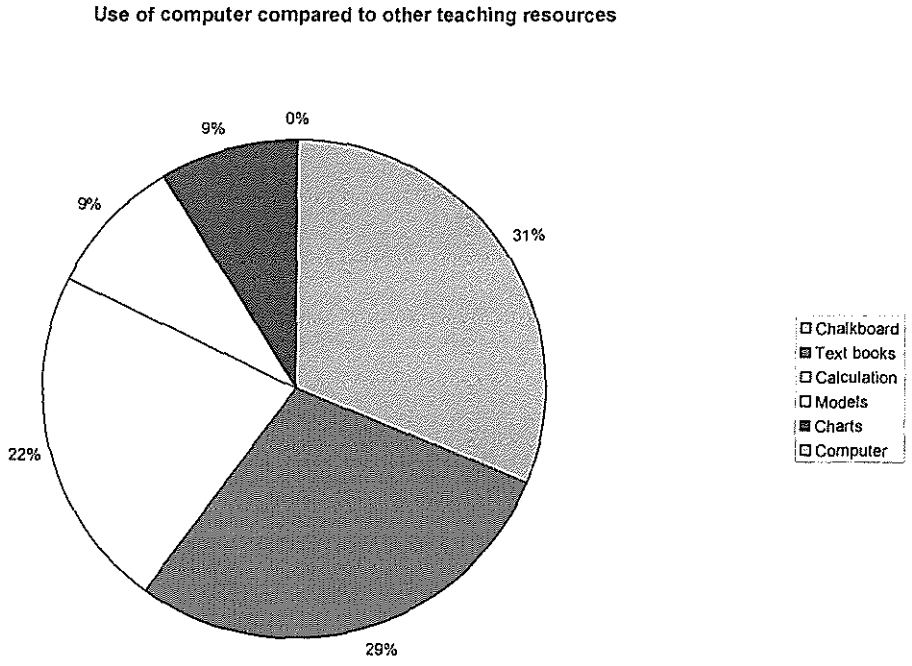
4.8.9.2 How teachers use other resources in teaching mathematics

The table below shows comparison of the use of other resources in relation to computer in teaching of mathematics.

	Often	Not often	Never
Chalkboard	42	0	0
Text books	39	3	0
Calculation	30	6	0
Models	12	30	0
Charts	12	24	0
Computer	0	6	39

From the above observation 13 respondents have never used a computer in instruction of math while two use it but often but most respondents use chalkboard, textbooks calculators, modules and charts oftenly as a means of instructing in teaching Mathematics.

4.8.9.3 Comparison of other resources used in relation to a computer



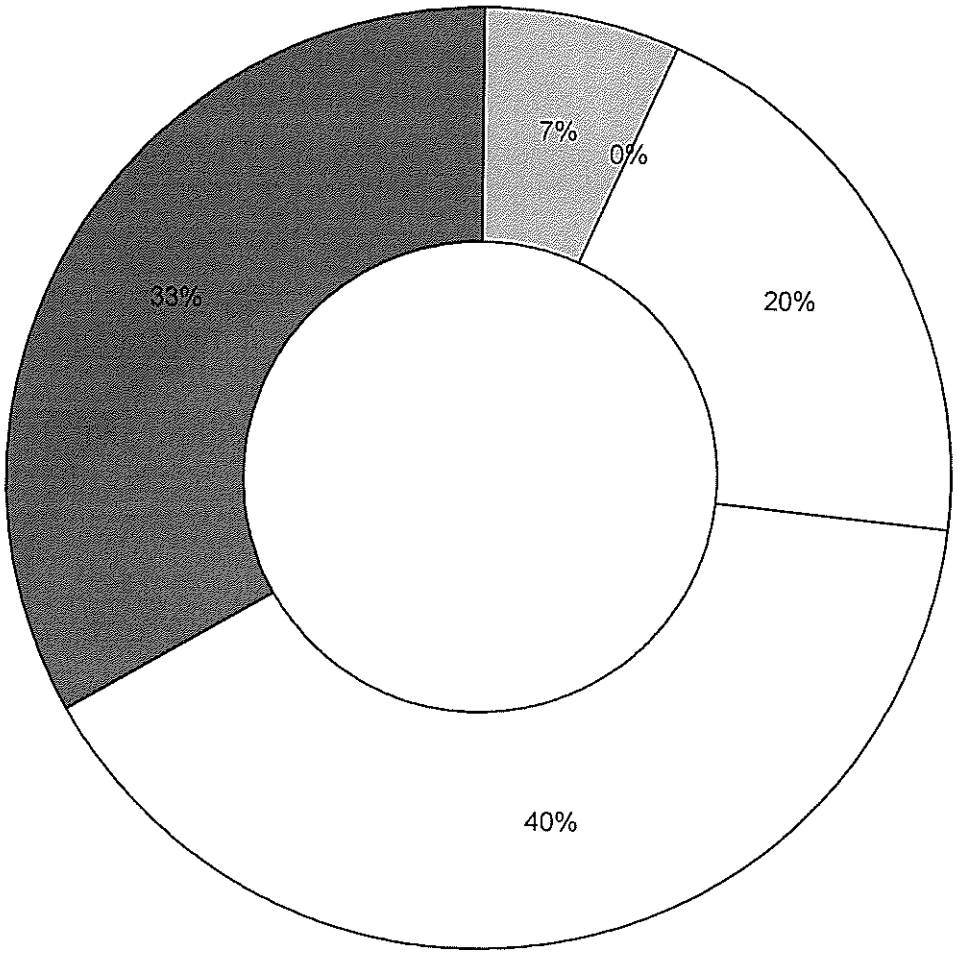
It was observed that 31% of teachers use the chalkboard as a resource in teaching math, 29% use textbooks, 22% use calculators, 9% use models, 9%use charts while 0% use computers.

4.9 Programming skills/knowledge by mathematics teachers

Level of familiarity	Frequency
Excellent	3
Good	0
Average	9
Poor	18
Very poor	15

4.9.1 Comparison of mathematics in relation to programming skills

The programming skills of mathematics teachers in percentage



The above chart illustrates the level of knowledge of programming skills of mathematics teachers. 7% of the teachers have excellent knowledge in programming, 0% in good, 20% have average knowledge, 33% are poor while the rest 40% are very poor in regard to programming. From the data analysis I conclude that there is a great need to train teachers.

CHAPTER FIVE

5.0 Conclusion

The study therefore established the need to integrate computer in the teaching of mathematics.

a) The proportion of gender differences and between female and male teachers is high. Female teachers need to be sensitized in adopting new technology.
b) Mathematics teachers need training in computer programming skills so that they can be in a position to integrate these skills in the teaching of mathematics because majority of them have poor knowledge programming.
c) The degree of accessibility & usage of computers by mathematics teachers should be increased so and mathematics teachers should be encouraged to use computers.

5.1 Recommendations

The study strongly recommends the following:

a) I recommend that the government should ensure that every school gets enough computers at a reasonable price.
b) Integrating of ICT in the teaching of mathematics has been hampered by lack of relevant software. Therefore we recommend that relevant software's should be provided.
c) The government should encourage and motivate mathematics teachers in the use of computers in teaching mathematics.
d) There is a great need of in servicing of mathematics teachers in the use of computers and learning of new skills like programming.
e) Female mathematics teachers should be encouraged to learn computer use and use these skills in the teaching of mathematics.
f) There is need to carry out a campaign on using the computer for teaching of mathematics unlike for typing and administrative functions.
g) This study recommends that integrating of ICT in the teaching of mathematics should be incorporated in the syllabus.
h) Recommends further study to be carried out in this area and other related areas.
i) This research recommends that teacher trainers should incorporate the integration of ICT in teaching mathematics while training teachers.

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APPENDICES

APPENDIX 1: MATHEMATICS TEACHER QUESTIONNARE

INSTRUCTIONS:

Please answer all the questions. You are kindly requested to spare some of your precious time to provide the information asked for as accurately as possible. Your co-operation will be highly appreciated. The information is purely for educational purpose and will be treated with utmost confidence. Please do not indicate your name anywhere in this questionnaire.

PART 1: TEACHER'S DEMOGRAPHIC CHARACTERISTICS

1. Gender: Male [ ] Female [ ]

2. **Professional/Academic qualification**

Indicate by placing a tick in the appropriate box unit what your qualification is

	Qualification
(a) Diploma	
(b) BA/BSC + PGDE	
(c B.ED	
(d) Others (specify)	

3. **Age in years** [Indicate your age range]

a) 23 years and below b) 24-30 years c) 31-40 years d) 41-50 years e) Above 50 years

4. Years of teaching experience

a) 0-5 years b) 6-10 years c) 11-20 years d) 21-30 years e) Above 30 years

5. **Frequency of computer use** (how frequent do you use computers?)

a) Everyday b) Once a week c) Several times a month d) Several times a term e) Not at all

6. **Years of computer experience** [Indicate your experience of learning about/ working with computers.]

a) Less than a year b) 1-3 years c) 4-5 years d) Above 5 years e) Not at all

7. **Purpose for computer use** (You are allowed to make more than one choice)

a) Email communication b) Internet c) Word processing and Spreadsheet d) Programming

e) Other research purposes (specify)

PART 2: INFORMATION ON TEACHER'S ATTITUDE ON USE OF COMPUTERS IN TEACHING MATHEMATICS

1. In - service course in computer by mathematics teachers is

a). Very Useful

b) Useful

c). Undecided

d) Not useful

2. In your own opinion do you think that computers can play a crucial role in the teaching and learning of mathematics?

a) Yes [ ] b) No [ ]

Each statement below expresses an opinion about teacher's attitude towards use of computers in teaching mathematics. Indicate by ticking in the relevant boxes the extent you think in your own view are true. See below for an explanation.

SA..... STRONGLY AGREE

A ..... AGREE

U..... UNDECIDED

D..... DISAGREE

SD.....STRONGLY DISAGREE

Items	SA	A	U	D	SD
Computers will make mathematics teaching enjoyable					
Mathematics teaching will be easier if computer is used to solve problems					
I have a low opinion of integrating computers in mathematics					
Use of computers will cause students to loose basic computational skills					
Computer will help me approach same topic in many different ways					
With computer it is possible to do more practical teaching					
I fear computer may take over my job					
Teaching using a computer is hard, involving and challenging					
Teaching mathematics using computers takes the time required for covering the syllabus .					
I am using computers in teaching mathematics					
Using a computer will enable me to teach better					
Use of computers is not absolutely necessary for teaching mathematics					

PART 3: INFORMATION ON TEACHER'S COMPUTER KNOWLEDGE/ SKILLS

1. Have you attended any in-service course in computer?

(a) Yes [ ] (b) No [ ]

How many computer courses, /seminars/workshops have you attended as indicated in 1 above? Place a tick against the appropriate number

a) None b) 1 C) 2-3 D) Above 3

Indicate the courses attended in the table below

NO.	DATE	ORGANIZER	THEME OF WORKSHOP[
1.			
2.			
3.			

Each statement below expresses an opinion about mathematics teacher computer skills. In your own view and experience indicate by ticking in the relevant boxes the extent to which each of the following is true.

SA-Strongly Agree A-Agree U-Undecided D-Disagree SD-Strongly Disagree

NO.	ITEMS	SA	A	U	D	SD
1	Teachers should be appropriately trained in order to use Computers in teaching mathematics					
2	It's difficult to teach geometry using a computer if you lack computer skills					
3	Training in computer increases quality of teaching mathematics					
4	Computer skills is a prerequisite in integration of Computers in teaching mathematics					
5	I lack essential computers skills / knowledge about use of computers in mathematics instruction					

PART 4: INFORMATION ABOUT TEACHER'S ACCESSIBILITY/ USAGE OF COMPUTERS IN TEACHING MATHEMATICS

1. a) Does your school have adequate materials for teaching mathematics?

Yes [ ] No [ ]

(b) How often are the following resources used in the teaching of mathematics in your school?

Place a tick in the appropriate box

Resource	Often	Not often	Never
Chalk board			
Text books			
Calculators			
Models			
Charts			
Computer			

Each statement below expresses an opinion about teachers' accessibility and usage of computers in mathematics instruction. Indicate by ticking in the relevant box the extent you think in your own opinion and experience as true

SA – Strongly Agree A – Agree U – Undecided D – Disagree SD – Strongly Disagree

No.	Item	SA	A	U	D	SD
1.	Lack of computer usage in mathematics is due to lack of accessibility					
2.	Most mathematics teachers have their own computers					
3.	Computers in my school are for clerical work					
4.	More interesting problems can be taught when I am accessible to computers					
5.	I have computers in my classroom					
6.	Lack of computers is a crucial factor affecting use of computers in teaching mathematics					
7.	Ratio of computers to students in my school is adequate					
8.	Computers are not free when I want to use them					
9.	There are no computer softwares/ programs for Mathematics instruction in my school					

APPENDIX 2: INTERVIEW SCHEDULE

Interview schedule Number.....

Interview date.....

1. Suppose computers are introduced in the teaching of mathematics how do you rate your computer Skills?

   A – Excellent

   B – Good

   C – Poor

   D – Very Poor

Why do you think so?

2. Do you anticipate any difficulties using computers if they were integrated in mathematics Syllabus? What is your view?

3. Are you willing to adopt the use of computers in mathematics instruction?

   a) Yes [ ] Give reasons

   b) No [ ] Give reasons

4. Do you think your colleagues are willing to adopt computers in Mathematics instruction?

   a) Yes [ ] Give reasons

   b) No [ ] Give reasons.

5. (i) Are you allowed access to computers in this school?

   Yes [ ] Give reasons

   No [ ] Give reasons

   (ii) If yes, do you use them for teaching mathematics?

   Yes [ ] Give reasons

   No [ ] Give reasons

6. In your own opinion what factors do you think hinder the integration of computers in teaching and learning mathematics?

   1.....

   2.....

   3.....

7. In your view what should be done to promote use of computers in mathematics instruction?

   1.....

   2.....

   3.....

APPENDIX 3: CHECKLIST FOR COMPUTER TECHNICAL SKILLS IN TEACHING MATHEMATICS

Indicate your level of familiarity with the computer technical skills in the table below. In addition indicate whether you need training /further training in the same skill (tick in the appropriate box.)

KILLS	LEVEL OF FAMILIARITY					NEED FOR TRAINING/FURTHER TRAINING
	EXCELLENT	GOOD	AVERAGE	POOR	VERY POOR	
raphic application skills g drawing graphs in near programming using computer						
ultimedia presentation ills e.g projecting athematical information ing presentation ograms like PowerPoint.						
readsheet & statistical ckages e.g using Ms cel to compute averages percentages of student ams						
ing Internet for thematical research						
rd processing skills e.g ing exams, keeping dents' records using nputer						
blem solving skills e.g ng computer calculators eaching.						
of programming guages e.g C++.						

APPENDIX 4: BUDGET ESTIMATE

No.	ITEM/ ACTIVITY	DESCRIPTION	APPROX. COST
1.	Stationery/ equipment	Computer Printer 20 reams of photocopy paper @ 400/= 2GB Flash disk	25000 5000 8000 2000
2.	Literature search	Moi University library 3 visits @ 1000/= Kenyatta University library 2 visits @ 2000/= Masinde Muliro University library 2 visits @ 500/= Internet search	3000 4000 1000 2000
3.	Travel and Subsistence	14 days @ 1000 /=	14000
4.	Emoluments for research assistants	3 research assistants @ 500/= per day for 14 days	21000
5.	Secretarial work	Photocopying Printing Binding of thesis	3000 5000 3000
6.	Research Permit		2000
7.	Miscellaneous		5000
	Total		103,000

APPENDIX 5: LETTER TO SCHOOL PRINCIPAL

Peter Wekesa Soita
P.O. Box 2162,
KITALE

THE PRINCIPAL
.....
.....
.....
Date.....

Dear Sir/Madam,

RE: REQUEST TO CARRY OUT RESEARCH IN YOUR SCHOOL

I am a student at Kampala International University pursuing Bachelors degree in BED Science Computer Studies. As part of my course, I'm required to carry out a research on teacher-related factors influencing integration of computers in mathematics instruction.

The purpose of this letter is to seek your permission to collect relevant data in your school. If allowed, I promise to abide by your school rules and regulations. Attached find copies of my research abstract, questionnaires and a letter from the University.

Thanking you in advance for your cooperation.

Yours faithfully,

Peter W. Soita

APPENDIX 6: TIME SCHEDULE

TOPIC: Teacher-related factors influencing integration of computers in mathematics instruction in secondary schools in Bungoma North District, Kenya.

Report writing	May-July 2008
Design Research instrument	August 2008
Pilot study	August 2008
Data collection	September 2008
Data analysis	September 2008
Writing of report 1st draft and 2nd draft	End of September 2008
Submission	Early October

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Institute of Open and Distance Learning
P O Box 20000 Kansanga, Kampala, Uganda
256 41 373 498/ 256 41 373 889 (Ug) 254 20246275 (Ke)
e-mail: efagbamiye@yahoo.com Tel: 0753142725

Office of the Director

24th April 2008

TO WHOM IT MAY CONCERN:

Dear Sir/Madam,

RE: INTRODUCTION LETTER FOR MS/MRS/MR. PETER W SOITA

REG. # BED 1336+/611 DE

The above named is our student in the Institute of Open and Distance Learning (IODL), pursuing a Diploma/Bachelors degree in Education.

He/she wishes to carry out a research in your Organization on:

To Investigate the effects of Integrating ICT In teaching Mathematics in public Secondary schools in Bongoma North District, Kenya.

The research is a requirement for the Award of a Diploma/Bachelors degree in Education.

Any assistance accorded to him/her regarding research will be highly appreciated.

Yours Faithfully,

MUHWEZI JOSEPH
HEAD, IN-SERVICE