

**USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
IN SECONDARY SCHOOLS IN KENYA: A CASE OF
ISINYA DISTRICT, KAJIADO COUNTY, KENYA**

BY

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**A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILMENT
FOR THE REQUIREMENTS OF MASTERS OF ARTS DEGREE IN PROJECT
PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI**

2012

DECLARATION

This is my original work and has not been submitted for award of a degree in any other university.

Signed:*Benson*.....

Date:*15/11/2012*.....

Mwencha Benson Kimoni
L50/63965/2010

This research project report has been presented for examination with my approval as the university supervisor.

Signed:*T Maitho*.....

Date:*15/11/2012*.....

Prof. T. Maitho
Department of Public Health, Pharmacology and Toxicology

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Prof. T. Maitho

Department of Public Health, Pharmacology and Toxicology

DEDICATION

My special dedication goes to my wife Jane, my daughter Jasmine and my son Mwencha. They have been my inspiration and motivation all the time as I studied and wrote the research project report.

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My immense gratitude goes to the Almighty God for the gift of life and good health, without which I would not have reached this far.

I thank my research project supervisor Prof. T. Maitho, for the guidance and invaluable time he spent discussing with me this research project.

I also wish to thank lecturers who taught me in first year of my study.

I also take note of the contributions I got from my classmates of year 2010 taking Masters of Arts Degree in Project Planning and Management in the University of Nairobi. Thanks for the time you availed to me and the informative discussions we had during the initial stages of project proposal and undertaking the research as well writing the final research report.

I am particularly thankful to all my workmates who gave me support during the research project period.

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ABBREVIATIONS AND ACRONYMS

AT	Assistive Technology
EC	Electronic Commerce
EFA	Education for All
GOK	Government of Kenya
HR	Human Resource
ICDL	International Computer Driving Licence
IS	Information Systems
IT	Information Technology
ICT	Information and Communication Technology
KESSP	Kenya Education Sector Support Program
MDG	Millennium Development Goals
MOE	Ministry of Education
MOEST	Ministry of Education, Science and technology
PC	Personal Computer
SEN	Special Education Needs
SITE	Society for Information and teachers education
UNESCO	United Nations Educational, Scientific and Cultural Organization

ABSTRACT

There is a universal recognition of the need to use Information and Communication Technology in education in this era of globalization where the free flow of information via satellite and the internet hold sway in information dissemination. In Kenya learning and teaching in secondary schools is also under increasing pressure to integrate use of ICT in order to impart knowledge, skills and attitudes needed to survive in the global world. To attain this aspiration the Kenya government has instituted deliberate measures to facilitate the implementation of technology in schools in the most effective and efficient way to improve quality of education. This research examined how ICT and e-learning would supplement traditional methods of curriculum delivery in secondary schools and the initiatives that have been made in integrating ICT into the instructional process. This study was undertaken because there was a growing concern that a number of secondary schools in Kenya were being marginalized due to lack of accessibility to ICT infrastructure and skilled human resource to facilitate effective teaching and learning. The objectives of the study were: To establish level of access and extent of use of ICT resources; investigate level of availability of ICT facilities; establish the capacity for using ICT facilities for teaching and learning; to study the benefits of using ICT in instructional process; and to study the challenges affecting the use of ICT in secondary schools in Isinya District, Kajiado County. The researchers' aim was to develop a framework for e-learning for improved quality learning and teaching in secondary schools. A descriptive survey design was used for the study where the researcher selected 10 secondary schools from Isinya District, Kajiado County to collect data, using a sample size of 10 School Administrators, 80 teachers and 200 students during the month of May and June 2012. A self designed questionnaire and interview schedule was used to collect the data and the data collected was analyzed using Statistical package for social sciences and presented using tables, frequency counts and percentage scores.

The research report findings showed that most of the schools were not well equipped with ICT facilities, access level of ICT facilities was still very low among teachers and students, and that teachers needed training on computer application to improve their professional effectiveness. It was revealed further that a majority of the teachers and learners were positive about the use of ICT to enhance teaching and learning. The research report suggested strategies and recommendations on how to utilize ICT to improve educational outcomes and enhance quality education amongst the learners as well as give insight to educational planners and managers

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The underlying purpose of education is to prepare students for their life role in the society in order to ensure their ability for life long learning, thinking critically and for their profession growth. Oluoch, (1982) defines education as a process of acquiring and developing desired knowledge, skills and attitudes of an individual. Promoting the development of knowledge society through Information and Communication Technology is one the strategies increasingly adopted in recent times by governments around the world to encourage economic development. Today the place of ICT in education and the world in general can not be understated. According to Bandele, (2006) ICT is a revolution that involves the use of computers, internet, and other telecommunication technology in every aspect of human endeavor. Information and communication technology are a diverse set of technological tools and resources used to communicate, create, disseminate, store and manage information. Thus Information and Communication Technology can be used for a wide range of teaching and learning as well personal use, and has made a remarkable impact in enhancing the quality of education in secondary schools in Kenya.

In this chapter the focus is on the new digital ICT with emphasis on educational uses of internet and the world web, consideration is made on several important issues in respect to the use of ICTs in educational settings. What research shows about the effectiveness of ICT in education and what measures are being taken to create ICT-enabled environment and some issues facing educators and policy makers when considering implementing ICT in secondary school education.

As noted in the World Education Report (UNESCO 1998), education worldwide faces significant challenges in preparing students and teachers for knowledge-based society during a time when most teachers are not prepared to use ICT and the majority even in the most developed countries are not equipped to integrate the new information and communication.

Attempts made to measure the utilization of ICT in Africa have been hampered by insufficient empirical data to indicate any impact of ICT on sector productivity and lack of cross-country evidence. The rapid revolution of ICT and methodological challenges include a

deficiency of assessment variable and models of causality. Most of the studies undertaken have focused on information issues, while few have been undertaken to measure the extent of ICTs in Africa particularly in Kenya (Kenya school net 2003). It is widely acknowledged that ICT when used to supplement traditional teaching methods has a positive impact of the educational development of children (Passey *et al.*, 2003). Although ICT has several definitions depending on the nature of its use, for this study, ICT is used as an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems, as well as the various services and applications associated with them, such as video conferencing and distance learning. ICT therefore refers to the particular context of ICT provision, policy and teacher factors that variously support teaching, learning and a range of activities in education (Hennessy *et al.*, 2010). Modern ICT systems are made up of a complicated mix of people, networks, hardware and software (Kamani *et al.*, 2011).

Education has certainly been affected by the penetrating influence of ICT world wide and in particular developed countries; and ICT has made a very profound and remarkable impact on the quality and quantity of teaching and learning in educational institutions. This is true because its adoption by the teachers will enhance effective teaching; such as good course organization, effective class management, content creation, and self assessment. ICT also enhances collaboration learning and task oriented activities amongst the learners.

Information and Communication Technology has the potential to be used to support new pedagogical methods; as tools enabling students' learning by doing and could make it possible for teachers to engage students in constructivist learning experiences, and also test students learning in new, interactive, ways that may better assess deep understanding of content and processes. Improved assessment tools can also be developed using ICT. Such assessment could engage students in tasks that require data manipulation, simulation or other interactive acts of knowledge construction.

ICT use in education enables access to materials and human resources. Historically information resources at libraries, schools and universities have only been available within the walls of these institutions, in a wide variety of physical media, at certain times of the day and limited quantities. Because of technological advance it is no longer necessary for students and teachers to be at a certain location at specific time to acquire knowledge. The internet

represents the greatest collection of human knowledge ever assembled. The ability to access remote resources fundamentally changes the nature and potential uses of information resources available for educational purposes.

Teaching and learning has transformed beyond the teacher standing in front of a group of learners and disseminating information to them without the student adequate participation Ajayi, (2008). Ajayi notes that with the aid of ICT, the teachers can take students beyond traditional limits, ensure their adequate participation in teaching and learning process and create vital environments to experiment and explore. The new development is a strong indication that the era of teachers without ICT skills are gone. Teachers with adequate and professional skills in ICT utilization will definitely have their students perform better in classroom learning.

An analysis of secondary schools in Africa shows that for instance in a country like Nigeria there are many teachers relying much on the traditional 'chalk and talk' method of teaching rather than embracing the use of ICT. This is an indication that the students are still lagging behind in the trend of changes in the world. This presupposes that there is a tendency for the teacher and the students to be denied opportunities which ICT offers in teaching and learning activities. Thus there is need to replace the traditional pedagogical practices that still underpin the educational system, hence need for the application of ICT in secondary schools in Kenya.

1.2 Statement of the Problem

Today the education sector is faced with series of changes and reforms, and it is imperative to reflect on matters concerned with dissemination of knowledge and skills through subject content. Numerous teaching strategies have been developed which correspond to the student's diverse needs and learning methods. Thus the use of ICT in teaching is a functional way of providing education to learners that will assist in imparting them with the required knowledge and skills. ICT use in education enables information management and processing using electronic computer system and software.

Education is concerned with the imparting of information not only for the simple acquisition of declarative facts, but also procedural information such as how to do things, and how to learn. Through the use of computer technologies, access is granted to the bulk of information stored electronically, where updating, revision, and correction of information can be a continuous process (Knight and King, 2010). The application of ICT is therefore very

important as it plays an essential role in supporting high quality education for learners. ICT has emerged as an indispensable tool for teaching and learning a lever that helps to bring about change in schools (Venezky, 2002). This recognition has raised attention to the role of secondary education and its relevance to society. This paradigm calls for radical transformation in education and training systems. Education has the greatest potential in the contribution to achievement of Millennium Development Goals such as education for all (EFA) goals and expanded access to secondary education. The challenges faced by developing countries Kenya included is to increase access to post primary education, improving quality education and teacher training in modern methodologies. This calls for all the participants to strengthen the management of education in order to provide better teaching materials and increase expenditure for training and management of the teachers.

The significant of ICT is realized in many aspects such as improved access to learning (Kaino, 2007) and quality of knowledge delivery (Kaino, 2008). Through the introduction of ICT in secondary schools the acquisition of effective skills and their use, the infusion of new teaching and learning methods is emphasized.

In Kenya, various initiatives have sought to address the integration of ICTs in Education, one of them being the development of the "ICTs in Education Options Paper" for the Ministry of Education, Science, and Technology (MOEST) in Kenya of 2005. This paper made several recommendations in this regard that the Kenyan government has identified education as one of the public sector that is influenced most by technological development. (Kozma 2005). The improvement of educational system and increased educational attainment are primary to the country preparation for global technology based changes. A national ICT policy for Kenya was adopted in 2006. Waema, (2005) and Kariuki, (2009) notes that there is need to provide affordable infrastructure to facilitate dissemination of knowledge and skills through e-learning platform

Accordingly, the research examined the use of ICT for information access by secondary school learners and teachers in Kenya. It investigated various aspects of ICTs that were used in teaching and learning in secondary school education and how they contributed most to information access and thereby improved quality learning and teaching by both the students and teachers. Ultimately, the researcher aimed to develop a framework for e-Learning that

would be used to improve the quality of education of secondary school students in Kenya through the use of ICT.

1.3 Purpose of the Study

The research examined the use of Information and Communication Technology in secondary schools in Isinya District in Kajiado County. The research investigated the level of availability of ICT facilities in secondary schools, the capacity for using ICT facilities for teaching and learning, the perceived benefits of using ICT in learning and teaching, and the challenges facing the use of ICT in secondary schools. The aim was to develop a framework for improved quality education at secondary schools in Kenya.

1.4 Objectives of the Study

The General objective of the study was to examine the use of Information and Communication Technology to support quality teaching and learning in secondary schools in Kenya, and the specific objectives were;

1. To establish the extent of use of ICT in Secondary schools in Isinya District.
2. To investigate level of availability of ICT facilities in Secondary schools in Isinya District.
3. To establish the capacity for using ICT facilities for teaching and learning in Isinya District.
4. To establish the benefits of ICT in learning teaching process in Isinya District
5. To study the challenges affecting the use of ICT in Secondary schools in Isinya District.

1.5 Research Questions

The research questions for the study were,

1. What is the extent of use of ICT in Secondary schools in Isinya District?
2. To what extent are ICT facilities available for teaching and learning in Secondary schools in Isinya District?
3. What is the capacity for using ICT facilities for teaching and learning in Secondary schools in Isinya District?
4. What are the perceived benefits of ICT in Secondary education in Isinya District?

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3. What is the capacity for using ICT facilities for teaching and learning in Secondary schools in Isinya District?
4. What are the perceived benefits of ICT in Secondary education in Isinya District?

5. What are the challenges facing the adaption of ICT in Secondary schools in Isinya District?

1.6 Hypothesis for the Study Model

In order to ascertain the statistical significance of the study model as well as the usefulness of each of the independent variables (x_{1-5}), the researcher developed the following hypothesis, then the T-test was used to test the expected results.

Hypothesis for the Teachers responses

Null Hypothesis (H0): There is no significant difference between quality teaching and learning

and use of Information and Communication Technology in Secondary Schools in Isinya District.

$$H_0: \beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \beta_4 = 0, \beta_5 = 0$$

Alternative Hypothesis (H1): There is a significant difference between quality teaching and learning and use of Information and Communication

Technology in

Secondary schools in Isinya District.

$$H_1: \beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0, \beta_4 \neq 0, \beta_5 \neq 0, \beta_1 \cdot \beta_2$$

Whereby, **H0** – Implies the model is not useful and **H1**- implies that the model is useful.

Hypothesis for the students' responses

Null Hypothesis (H0): There is no significant difference between quality teaching and learning

and use of information and Communication and technology in secondary

Schools in Isinya District.

$$H_0: \beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \beta_4 = 0, \beta_5 = 0$$

Alternative Hypothesis (H1): There is significant difference between quality teaching and learning and use of Information and Communication Technology

in Secondary schools in Isinya District.

$$H_1: \beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0, \beta_4 \neq 0, \beta_5 \neq 0, \beta_i$$

Whereby, **H0** – Implies the model is not useful and **H1**- implies that the model is useful.

1.7 Significance of the Study

The motivation behind focusing on use of ICT in secondary education was three fold. First, though there were a number of researches undertaken on the use of ICT for teaching and learning in the secondary educational system, the fact that there were several schools not integrated in ICT use in learning and teaching in Kenya made this area ripe for research. The researcher also felt the need to contribute to the enhancement of quality education amongst the secondary school learners based on the knowledge that was to be acquired in the study. In addition, the researcher wanted to make a contribution to a field that needed more research, in an attempt to help narrow the gap between the ideal situation that presupposes that it was possible to provide all students with equal access to educational resources, and the reality, where secondary school students faced barriers to mainstream acquisition of knowledge and skills as a result of inability to apply ICT to improve learning outcomes and prepare the young for the information age of the 21st century.

The importance of the study would be useful to several people and organizations in various ways: Firstly, the study report highlights effective educational technologies that parents need to be aware of when making decisions about learning resources in schools. Secondly, the educators involved in curriculum development and knowledge dissemination shall understand how innovative information and communication technologies would be tailored to address the changing needs of the learner. Thirdly, academicians and researchers shall gain knowledge and experience from conducting the research. Finally, the study results will raise awareness of issues that are overlooked by policy makers that make clear the potential benefits of using ICT in secondary school education.

1.8 Limitation of the Study

There were nevertheless a number of limitations in this study, first was the number of schools to be included in the study, and second was the generalization of the findings. The study was restricted to secondary schools in Isinya District, Kajiado County. Therefore, the survey was primarily conducted through visits to schools in the area. This was due to resource limitations and the short time frame for the study, making it neither feasible nor advisable for the research team to visit all the schools in the district. This factor in itself, however, did not undermine the essence of the study's findings. Also as much as there was an attempt to improve the generalization of the results by inferring from a number of studies it was difficult to conclude from only five schools out of the many schools in the country.

However notwithstanding these limitations, the study followed the principles of interpretation research, which was not certainly to seek generalization from the setting of a population but rather to supply an understanding of the deeper structure of the phenomenon of the study.

1.9 Delimitation of the Study

The research focused on the various information and communication technologies resources used in teaching and learning in secondary schools in Isinya District, Kajiado County. The school environment was presented as the main context within which the student developed and where these technologies were generally used. A larger number of schools as well as those which provided Computer Studies as a learning subject and examined by Kenya National Examination Council provided more in-depth insights. Thus, further research would include more categorizations and schools.

1.10 Basic assumptions of the Study

The results of this survey would be inferred to represent the state of ICT use in secondary education in Kenya. The outcome of the study was expected to provide ways of teaching and learning using ICT to assist in mainstreaming of Information and Communication Technology in secondary education curriculum. Differences and similarities that would exist between the results of this study and those generated in other countries where similar research has been conducted. It was also assumed that respondents provided accurate information enabled analysis and interpretation of data.

1.11 Definition of Significant Terms

Access is defined as “the presence of a robust system through which information is made available to citizens and others”. Such a system has physical, intellectual, and social elements. Thus, information access is a combination of intellectual, physical, and social elements that affect the availability of information to individuals. Jaeger and Burnett, (2005)

Communication refers to the process of sharing ideas and information.

It is a process that is essential, and many say innate, for all human beings.

Distance Education refers to all education activities of an organization that are supported and carried out while the learners and teachers are separated from each other for much of the time.

E-Learning refers to using the Internet as a communications medium such that the teacher and the students can be separated by physical distance (Cooper, 1999). E-Learning expands the learning opportunities of students who are time limited, live in remote communities, and/or have work or family commitments or other barriers that prevent them from attending a traditional classroom learning environment. Common eLearning tools include discussion boards, email, chat rooms, video streaming, document transfer, and other technologies to facilitate the educational process.

Inclusive Education is a process of strengthening the capacity of the education system to reach out to all learners and can thus be understood as a key strategy to achieve Education for All (EFA). As an overall principle, it should guide all education policies and practices, starting from the fact that education is a basic human right and the foundation for a more just and equal society (Watkins, Tokareva, and Turner, 2011).

Information Society is a society in which the creation, distribution and treatment of information have become the most significant economic and cultural activities... The information Society is considered as a necessary previous step to build Knowledge Societies.' (UNESCO/IFAP, 2009)

Multimedia is defined as "the integration of video, audio, graphics, and data within a single computer workstation", Bates, Harrington, Gilmore, and van Soest, (1992).

Technological Pedagogical Content Knowledge It is a complex , dynamic form of situated knowledge developed by teachers as they integrate new technology into their pedagogy for transforming subject knowledge into teaching, Mishra and Koehlers,(2006).

1.12 Organization of the study

Chapter one gives a background of Information and Communication Technology, secondary school education and how implementation of ICT impacts information access and learning by learners in secondary schools. It provides the policy status of ICT use in education in Kenya, giving reasons for the adoption of ICT in the education sector. Also included is an outline of the research problem of the study as well as the general and specific objectives that are to

guide the researcher in undertaking the research. In addition the researcher provided an elaborate explanation of the purpose of the study and how the research findings could be useful to several people and organizations.

Chapter two contains an extensive review of the relevant literature which forms the theoretical basis for this study, including the theory of technological determinism. The literature review starts with a brief introduction of the current perspective of ICT in the world and in Kenya. Further analysis of ICT and secondary school education has been extensively dealt with as well as a literature review of the school learning environment. The chapter also contains an empirical review of informative surveys done on ICT use in education.

In chapter three the research methodology is discussed and includes the research design which was used in carrying the study and the target population that the researcher had selected for the research. The chapter also gives the various data collection techniques which were used in carrying out the study, data analysis and operationalization of variables.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers the following sections; the global perspective of ICT, regional perspective, Kenyan situation on ICT use in education, and the current state of ICT integration in schools. In the chapter the theoretical orientation of the various models used for explaining ICT and education for learners was reviewed, as well as an empirical review of various literatures on ICT and education for secondary schools. The purpose of the review was to give cognizance to research done by other scholars in this field and contextualize it to the present research study. Also included was a detailed analysis of the conceptualization of the subject matter from which the conceptual framework was developed. The chapter finally ends with the operationalization framework of the various variables of the study.

The use of Information and Communication Technology is becoming an integral part of education in many parts of the world. Kenya is not left behind as ICT gradually finds its way into the educational system despite challenges brought about by its' economic disadvantage. In order to achieve the purpose of education, which is the process which seeks to change the behavior of the learner, ICT is one of the essential ingredients that could help bring gains and benefits to the fore according to Gbamanja (1997). Realistically, several researchers admit that ICT has an impact in learning and teaching in secondary schools.

2.2 Global perspective of ICT

Globalization and technological change over the last few years have created a new global economy powered by technology and driven by knowledge. ICT has become a principal driver of economic and social change worldwide. Globally policy makers have been putting efforts into crafting policies to enable countries to cope with this demands that harness their effects to support economic growth. As Kozma (2005) ascertains policy makers globally agree that education is among the public sectors that most affects by these development. Further the improvement of educational system and increased educational attainment are seen as primary ways that countries can prepare for these global technology based changes. And within education, ICT is seen as away to improve the skills of learners and prepare them for global economy and information society. It is thus not surprising to find increasing interest, attention, and investment being put into use of ICT in education all over the world (Wong, et.

al, 2003). The desire of countries to be globally competitive, grow economically and improve social conditions is often used to put up arguments for increased investment in educational improvement and the application of ICT in learning institutions.

At the global level the Millennium Development Goals (MDG's) which have been adapted by the United Nations as the key development target of the 21st century, mentions achievement of basic education as one of the major goals. This goal builds on Education for All (EFA) initiative. UNESCO (2000) argues that ICT must be harnessed to support EFA goals. These technologies have great potential for knowledge dissemination, effective learning and the development of more efficient education services. To be effective especially in developing countries, ICTs should be combined with more traditional technologies such as books and be more extensively applied to the training of teachers.

The emergence of this new global economy has serious implications for the nature and purpose of education. As access to information continues to grow exponentially, schools can not remain mere venues for the transmission of prescribed set of information from teachers to students over a fixed set of time. Rather schools must promote acquisition of knowledge and skills that make possible continue learning over the life time.

The experience of introducing ICT in the schools all over the world over the last decade suggests that the full realization of the potential educational benefits of ICT is not automatic. According to researchers, ICTs in an educational context refers to a set of combined technologies that enable not only information processing but also transmission for purposes of learning and educational development. Karsenti and Lorose (2005), states that the pedagogical integration of ICT into schools mean the appropriate, habitual and sufficiently regular use of ICT that produce beneficial changes in educational practices and improves students learning. The use ICT must therefore be understood as integration such that students learns and socializes through a multitude of interactive and communication channels.

Educators have argued that the knowledge domain relevant to learning activities must be considered in the integrations of ICT in schools. It goes further to state that the appropriate use of ICT by students can assist teachers in determining and catering for the prior knowledge of students. It is further stated that ICT can assist students in engaging cognitively to a greater depth with knowledge domains that is students' supported in employing the full

range of thinking skills within authentic context as discussed by cognitive taxonomies' provided by Bloom(1964).

2.3 Regional Perspective of ICT in Education

In Africa, we find multidimensional use of ICT, from primary schools to higher education. ICTs are increasingly used in primary schools including the pre-school and elementary levels. Besides entertainment value, the greatest benefit of ICTs at this level is the liberation of the student's ideas and aspirations, ICT also provide valuable and varying support for child learning as it fosters emotional and social development, language acquisition, general knowledge and cognitive skills.

ICT utilization appears to be more wide spread in African secondary schools where teachers and students use it to teach and learn subjects. Accordingly, ICT integration into learning activities in secondary schools would seem to be more important since it goes beyond interpersonal communication and integrates several dimensions such as interactive learning, collaborative learning and problem solving.

In higher education institutions, ICT integration is considered a necessity for university learning. In Africa, ICT utilization for on line learning provides a broader access to higher learning. Moreover, it holds enormous potential for adult self training and life long learning. Although ICT occupy an ever larger place in the developed countries, this is not the case with many countries in Africa which are increasingly living in a world of technological deficiency. The OECD (2006) demonstrates that this lack of basic network infrastructure is due to digital divide in the world lowest income areas.

The report from OECD suggests that if Africa aims to prepare its citizen for the challenge of the third millennium, it must foster a thorough integration of ICT into education. Within the continent, ICT appears to gain grounds with exponential speed. Moreover a study by IDRC (Karsenti et. al, 2005) showed that 75% of students in Senegal had an email account, and yet much of the country's schools had never had electricity. Despite the progress Africa has made in the last thirty years, the introduction of ICT into education system which is fundamental to the knowledge economy has been difficult struggle and far too slow.

According to Howell and Lundall (2000), the key factors blocking educational institutions from using computers as teaching and learning tools are insufficient funds, insufficient

number of computers, lack of teachers with information technology skills, teacher's inability to integrate technology into different subject areas and lack of appropriate ICT teaching programs.

2.4 Kenya's Situation on ICT and Education

Kenya has rapidly gained a reputation as one of the African forerunner in the development of ICT. Indeed, Information Technology is one of the fastest growing sectors in the country. In the recent years, there has been a considerable drop in the cost of hardware and software. Internet growth in the last ten years has also experienced phenomenal increase in usage.

2.4.1 Kenya ICT Policy and Strategy

The strategic policy focus of the Kenyan government on ICT is simultaneously targeting the development of ICT sector and to use it as a broad based enabler in the achievement of national development goals. The policy provides a basis for facilitating the social economic development of the country in an era that is dominated by information and knowledge based economies. At its basic the ICT policy is founded on two prerequisite infrastructure and education.

In developing this policy the government recognizes specific challenges as lack of regulatory framework, inadequate infrastructure and insufficient human resources. The key objective of the Kenya ICT policy is to promote the deployment and exploitation of information, knowledge and technology; develop and promote a globally competitive local ICT industry for the development, production and sale of information, knowledge and technology products and services; develop a competitive Information and communication led value added export oriented service sector, improve the human resource development capacity to meet the demands and requirements for developing the countries ICT; and modernize Kenya's educational system using ICT's to improve and expand access to education, training and research resources and facilities, as well as to improve the quality of education and training to make the educational system responsive to the needs and requirements of the economy.

2.4.2 ICT in education policy in Kenya

In Kenya the role of technology has been embraced since it is an important agent of national development as Minishi and Majanja (2007) explains. Waema (2007) also notes that the emergence and use of ICT in the country was rather hasty and haphazard and thus necessitated streaming. Jones and Kozma (2003) have stated that national ICT policies can

serve several important functions. First, ICT policies provide a rationale, a set of goals and vision of how education system work and how to integrate ICT it into teaching and learning and how they can benefit students, teachers and the general population. Secondly, ICT policies are expected to provide guidance on implementation of ICT in education.

The improvement of educational system and increased educational attainment are primary to the country preparation for global, technological based changes in all sectors, OECD (1999). Therefore the formulation of ICT policies in education, although included in the national ICT policy is seen to be crucial as ICT plays an important role in preparing individuals in school for the work place, Were, Rubagiza, Denley and Sutherland, (2007). ICT if carefully integrated in education has potential to facilitate the acquisition of relevant life skills that accelerate the development process in the prevailing economic and information order. According to Farrell and Isaac, (2007) the ICT policies stress access to ICT tools and Internet connectivity.

The Kenya National ICT policy which was adopted in 2006 aims at improving the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services as reported in the ICT in education Options Paper Kenya (MOEST, 2005). The objective regarding the use of ICT in schools, colleges, Universities and other educational institution to improve the quality of teaching and learning is explained by Farrell in the 'Survey of ICT in Africa Report (2007). One strategy outlined in this report is the promotion and development of specific e-learning resources that would address the needs of learning institutions. A significant step has been digitization of the curriculum which is ongoing at the Kenya Institute of Education (KIE) has noted by Ratemo (2009). To promote E-learning the development of ICT in teaching and learning is emphasized. Other strategies outlined in the national ICT Strategy for Education and Training, as noted in the *Kenya MOE, (2006)* includes: Promoting the development of e-learning resources in schools; facilitating public private partnership to mobilize resources in order to support e-learning initiatives in educational institutions; promote the integrated e-learning curriculum to support e-learning in education; provide affordable infrastructure to facilitate dissemination of knowledge and skills through e learning platform; promote development of content to address educational needs in schools; and finally create awareness of the opportunities offered by ICT as in the educational sector.

The development of the curriculum and training of teachers both at in-service and pre service is central to the government efforts of achieving the policy objectives. In an effort to promote the development of content to address the educational needs of learning institutions, the government came up with ways in which curriculum will be developed according to (MOEST, 2005). In order to improve the quality of education the government started by adopting the existing educational materials and the process of having schools create their own e- content and capacity building. According to Farrel (2007) this responsibility is done by Kenya Institute of Education, which is also in charge of overseeing other institutions that develop appropriate e-content. Farrell further notes that teachers must know how to exploit ICT by opening learners up to the world of knowledge. For capacity building, provision of adequate access to ICT is suggested, as well as capacity building workshops for teacher as noted in the ICT in Education Option Paper Kenya, MOEST, (2005). The paper notes that training of teachers should focus on increasing efficiency in teachers' workload and integrating ICT to improve teaching and learning objective.

There is some recognition that the mere provision of equipment is not sufficient to promote educational change, and hence there should be a nationally coordinated effort to create, disseminate and share E-learning content to improve the quality of learning and teaching in secondary schools. This should also ensure that management and maintenance of ICT infrastructure as well as use of ICT in school processes are included in the policies. Teachers are expected to be the curriculum implementers in the class room, and it is expected that their sound knowledge on ICT and how to use it in teaching and learning will not only go a long way in achieving this goal, but also improve the standard of education.

2.4.3 ICT and Secondary School education

Technology is developed to solve problems associated with human needs. Applying this principle to educational technology would mean that educators should create and adopt technologies that address educational problems of which there are many.

At the teacher level, the teacher should be satisfied with the educational opportunities offered to students in the class room and always strive to do better to develop the potential of the student and adequately prepare them for a productive life in the society. Many educational planners believe that what is offered in the classroom in developing countries is hopelessly inadequate to match the needs of our society and the needs of individual students.

At the school level the education problem question becomes whether the resources available to the school are being mostly efficiently employed to provide the most effective educational opportunities for students. Will investing in ICT provide better learning outcome than the equivalent investment in other areas. The secondary school education is central to the long term wellbeing of our society and teachers and students need all the support they can get and hence the need to consider the potential of all available technology.

Rieber and Welliver (1989) defines educational technology as a process involving , a systematic approach to identifying instructional problems and then designing, developing, implementing, and evaluating instructional solutions. They argue that in order for the full potential of educational technology to be viewed more as a process rather than just the implementation of education tools. The educational technology process begins with the identification of an educational problem not with the existence of a technology. They further argue that there is need to start with the well supported beliefs about learning and make sure that any solutions are consistent with technology. The most commonly held beliefs about learning and supported by research are those bearing the constructivism paradigm's that states that the, "contemporary view of learning is that learners construct new knowledge and understanding based on what they know and believe" There is an assumption that learning occurs within a physical and psychosocial environment usually labeled as learning environment. If a rationale for ICT is to be grounded in an understanding of the nature of learning and teaching this begins with an examination of the learning environment and the key precepts of constructivism.

2.5 Current state of ICT Integration in school education

According to Rautopuaro,(2006) and Webb,(2002) there are three aspects of ICT in school education that is, using ICT as a tool to support teaching and learning process such as the use of word processing and spread sheet in other subject areas. Learning through ICT, where the ICT facility becomes the learning environment by providing learning material such as LMS or Web based learning. And finally, learning ICT as a subject discipline; where the knowledge, concepts, skills and process of information communication technology are acquired. The use of ICT as a tool and learning offers very little opportunity for learners to learn knowledge, concepts, and skills needed to master ICT as a subject. Learning ICT is more than the ability to operate and use a computer system. Thus the acquisition of technical

skill is only part of the problem encountered in teaching and learning ICT as a subject. Indeed ICT education includes a sophisticated set of higher order skills and cognitive abilities, such as analyzing, designing, implementing, collecting and retrieving, organizing, managing, interpreting and representing, evaluating and creating information according to Drenoyianni(2004)

There are disagreements among academicians and educators about the theoretical framework of ICT in secondary education, and also divergent opinions on how to define ICT as a subject. Despite the emphasis on a set of topics the ICT subject curriculum does not suggest the competencies necessary teachers need to acquire in order to integrate it in their teaching. In addition, a major problem for the teacher is the complexity of software to use in the teaching and instructional delivery of the curriculum in the school environment. While knowledge about the principles and functionality of software is necessary for implementing ICT in teaching it is impossible for teachers to know all the specific features offered by the software package that they use, because software is continually being developed, extended and improved.

2.6 Theoretical Review

The theoretical review of the study is made up of three broad theories: 1. Theory of Learning; 2. Constructivist Theory 3. Transformational leadership Theory.

2.6.1 Theory of Learning

Human learning is the combination of processes whereby whole persons construct experiences of situation and transform them into knowledge, skills, attitudes, values, emotions and the senses, and integrate the outcomes into their own biographies. Clark (1983) has claimed that technologies are merely vehicles that deliver instruction, but do not influence student achievement. As Clark notes, meta-analysis studies on media research have shown that students gain significant learning benefits when learning from audio-visual or computer media, as opposed to conventional instruction; however, the same studies suggest that the reason for those benefits is not the medium of instruction, but the instructional strategies built into the learning materials.

Consequently, an understanding of the technological background of the intended students is crucial, including their expectations, financial and other resources, access to the Web or other online networks, band width limitations, and any other pertinent information about their

preparedness and ability to participate equally and fully in their learning experience (Davis, 2004).

2.6.2 Transformational Leadership Theory

Transformational leadership theory, first described by Burns (1978) and Bass (1985), and later elaborated on by Leithwood and colleagues (Leithwood and Riel, 2003; Leithwood and Jantzi, 2005; Silins and Mulford, 2002), lends itself to describing and understanding the processes involved in the implementation of educational technologies in e-learning environments. Leadership is a central factor in the successful use of education technologies (Creighton, 2003; Coleman, (2003); Davidson, (2003). Transformational leadership in this context is about deploying technologies to accomplish core organizational goals in attaining a shared vision. This means implementing educational technologies requires us to resolve significant instructional, pedagogical, and technological issues, all of which need to be balanced against the purposes of learning.

This kind of change management requires leadership. Transformational leadership theory can offer insight into fundamental assumptions about change, control, order, organizations, and people, and provide a more useful base from which to examine leadership and e-learning program adoption. Sound leadership and change management skills are key to implementing the use of new educational technologies to support e-learning programs and foster transformation. Research suggests that educational technologies can have a positive impact on teaching and learning, but only if leadership and vision bring focus to using technology to support core learning goals (Bennett et al, 2000). In regards to supportive leadership activities, Owen and Demb (2004) recommend: encouraging innovation, providing development incentives, recognizing projects, establishing mentor programs, creating peer pressure, and publicizing efforts. Jacobsen summarizes, that the transformation of classroom technology from hardware, software, and network connections into thinking tools for teaching and learning requires effective and enabling leadership by visionary and knowledgeable school administrators and boards, and effective ongoing professional development and support from teachers (Jacobsen, 2001).

2.6.3 Constructivist Theory

Constructivism is a general term for the view that the world is often too complex for general principles to be useful in teaching, and that the best learning results when the learner

processes and integrates new experiences into his or her existing constructs (Coleman, Perry, and Schwen, 1997). The Constructivist pedagogical approach builds on a genuine framework of understanding on what actually the learner is doing, placing the learner and teaching activities at the heart of the process to judge whether learning and teaching processes adopted really achieve the intended learning outcomes. E-learning is based on the assumption about achieving the learning outcomes.

Constructivist teaching tends to be more holistic, collaborative in method, and accepting of learner initiatives, including greater freedom and variety in assignments and assessments (Henriques, 1997). Entrenched in learning theories advanced by Piaget (1972), Vygotsky (1978) and Bruner (1990), constructivism learning theory is defined as active construction of new knowledge based on a learner's prior experience. He further explains that the mind of the student mediates input from the outside world to determine what the student will learn. Learning is active mental work, not passive reception of teaching. McClintock (1992) also states that in a constructivist-learning environment, technology plays an acknowledged and purposeful role in the day-to-day activities, but does not become the object of instruction.

When used in a constructivist manner, students utilize technologies to manipulate data, explore relationships, intentionally and actively process information, construct personal and socially shared meaning and reflect on the learning process (Jonassen, Peck and Wilson, 1999). Technological applications which support learning in such ways are often described as cognitive tools (Lajoie and Derry, 1993). Cognitive tools describe such applications as calculators, databases, spreadsheets, communications software, and semantic network tools. The critical attribute of cognitive tools is not in the information and knowledge that they carry, but the forms of learner activity and engagement that they support and encourage. Cognitive tools still need the informed teacher to design and supervise the learning activity, but they act to amplify and distribute the cognitive tasks through their design and application (Koc, 2005).

2.7 Empirical Review

In the 21st century, there has been considerable international attention given to the role that ICT can play in economic, social and educational change. In *The International Handbook on Information Technology in Education*, The OECD, (2006) emphasizes the economic importance and impact of ICT in developed countries and points out the need for these

countries to develop a work force with skills to use ICT to increase productivity, as well as the young people to develop ICT skills in preparation of adult life. In the same Handbook, The United Nations, (2005) notes the potential of ICT to expand access to quality education, boost literacy and provide universal education in developing countries.

In developing countries the interest in use of ICTs in education appears to be growing, even in the most challenging environments (Trucano, 2005). Several studies have looked at the issue of ICT and education. For instance, Hennesy and Onguko (2010) coordinated a review entitled "*Developing use of ICT to enhance teaching and learning in East African schools: a review of the literature*", which draws heavily on the series of informative surveys of ICT use in African countries carried out by Farrell (2007), Isaacs (2007), Hare (2007) and colleagues, and updated the information by using some more recent material too. Berg (2003) writes about how effective computer-based learning environments should be designed, while Trucano (2005) outlines what is known and what isn't about the use of information and communication technology in education. According to him, there is widespread belief that ICTs can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student-centered, and that this transformation will result in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking skills. However, there are currently very limited, unequivocally compelling data to support this belief (Trucano, 2005).

2.7.1 Measuring Impact of ICT on Education

The use of ICT in education has been a key priority in most European countries during the last decade; though progress has been uneven. Most countries have embedded ICT into the curriculum and demonstrated high level of effective and appropriate ICT use to support teaching and learning across a wide range of subject areas. Studies undertaken indicate statistical evidence that ICT can enhance attainment in various subjects. According to UK's largest impact study shows there was a raise in subject performance through ICT use in English, science and design, and technology. The study showed that specific ICT uses, such as interactive whiteboards had a positive effect on pupil's performance in literacy, mathematics and science tests compared to students in other schools. They especially

improved the performance of low achieving pupils in English and impact was greatest on writing.

On an international level, the analysis of the OECD PISA results indicated that longer use of computers by students is related to better results in mathematics. Two other UK studies done showed that ICT can make a difference as regards to better results in national tests. Broadband access in classrooms is one necessary condition to benefit from new technologies for learning, and it resulted in significant improvements in pupil's performance in national tests taken at age 16. Overall, evidence from the studies reviewed shows that attainment improves as a result of embedding ICT into teaching and learning. Schools with higher levels of e-learning demonstrated a more rapid increase in performance scores than those with lower levels.

Other various initiatives to measure the impact of ICT on Education have been initiated in other countries. For example, the Government of Western Australia (GoWA), Department of Education and Training (2009) developed the *School ICT Capacity measuring tool* used to survey ICT-Capacity of Western Australian schools. The survey asked students to rate the availability, use and ease of access of different ICT hardware resources at their school (such as Printers; Laptops/ Notebooks for teachers program; Digital cameras; Digital projectors/ interactive whiteboards; Desktop computers for student use in classroom; Desktop computers for student use elsewhere at school such as computer laboratories; and Laptop computers for student use. Students were also asked about their level of use of the eight commonly used software applications such as Application Software, e-Learning software; Personal Email Account; Spreadsheets; Word processing; Presentation packages; Databases; and SIS Curriculum Manager. The NFER Annual Survey for 2000 looked at the role of ICT in the primary school, focusing specifically on its use for curriculum, administration and professional development

Researchers have developed a battery of instruments over the years to measure technology use. These have ranged from primarily demographic type surveys that report on the amount of computers available to students and the classroom time devoted to their use, to surveys focused on the educator's attitude and readiness to embrace technology, and finally surveys that examine the extent to which available technology is being used to deepen the cognitive processing of students.

2.7.2 Benefits of ICT in education

Many writers and studies have extolled the benefits of using ICT in a learning environment in education. Branford et al. (2000) explains that there are several studies done on ICT and learning showing that it has great potential to enhance student's achievement and learning. Wong et.al (2006) further explains that technology plays apart in supporting face to face teaching and learning in the classroom. Researchers are of the view that the use of technology can help students to become knowledgeable, reduce the amount of direct instruction given to them and give teachers' an opportunity to help those students with particular needs. It is also argued that new technology can help teachers enhance their pedagogical practice. This is evident from Grabe and Grabe (2007) that technology can play a role in student skills, motivation and knowledge; they explain that ICT can be used to present information to students and help complete learning tasks.

In another argument Kashorda and Waema (2007) explains that the use of ICT has the potential to enhance the quality of teaching and learning; increasing the productivity of teachers and students and enhance the management of schools. Florian (2004) has also summarized the uses of ICT as facilitating tutor programmes; improving exploratory learning; helping in communication and assessment purposes. In one of the most elaborate education costing studies by the US-based Pew Foundation's Program on Course Redesign, ICT benefits were expressed in terms of higher grades; better performance on tests of content knowledge and understanding; reduced drop-out, failure and withdrawal rates, and Significant movement form active to passive learner-centered pedagogy (Twiggs, 2003). According to Trucano (2005), ICT use greatly contributes to student motivation for learning. Ally (2004), further concludes that specialized delivery technologies can provide efficient and timely access to learning materials and can form a useful communication medium between people with different sensory abilities.

2.7.3 Criticisms of the impact ICT on Education

Although there is a huge positive gain from ICT, it is not a solution to all problems. There is a need for more research and development to turn potential into reality. Anecdotal evidence suggests that many teachers do not have a good understanding or awareness of technical solutions and that this is the key limitation to realizing current possibilities. Some unintended consequences of ICT-use in schools can already be seen; setting up and using ICT is time consuming and expensive. The costs mean that even if ICT can add value and improve quality in some respects, it may also reduce quality in others, this includes when investment

in ICT takes money away from other things that schools need such as textbooks. The handling of technology consumes time intended for the learning process itself (Pedersen, 2001). Furthermore, Trucano (2005) states that the positive impacts of ICT use in education have not been proven. According to him despite thousands of impact studies, the impact of ICT use on student achievement remains difficult to measure and open to much reasonable debate.

The utilization of ICT in Africa has been hampered by insufficient empirical data, the rapid revolution of ICTs and the methodological challenges that include a deficiency of assessment variables and models of causality. It is evident that most of the studies undertaken have focused on information infrastructure issues, while few have been undertaken to measure the extent of ICT use in enhancing quality teaching and learning in schools (Kenya School Net, 2003). Another challenge is access to ICT facilities. Research shows that there is a ratio of one computer to 150 students in developing countries as compared to the ratio of 1: 15 students in developed countries. In Kenya the ratio access at the primary level is much more limited at 1: 250 (MOE Kenya, 2006). Another survey by Education Management Information System (EMIS, 2004) indicated that over 70% of the secondary schools in Kenya required functional telephones. In addition such schools needed to establish local area Network (LANs) in order to improve sharing of learning resources.

Research done by Makau and IDRC (1991) on the use of ICT in secondary schools and other educational institutions consistently showed significant differences in the quality and use of ICT in these institutions. Its finding showed that most computer assisted lessons were observed in mathematics and sciences. It was also found that in the majority of computers lessons teachers tended to be passive, thus leaving students on whatever they chose. It further reported that some students regarded both formal and informal session on the computer as time for relaxation as opposed to serious learning. These research found that computer studies as a lesson were conducted in the computer laboratory thus they seemed to have priority over computer- assisted lessons in other subjects.

In a research carried out by the Kenya School Net (2003) to investigate availability and access to internet revealed that e-mail was rarely used as a tool for collaboration among students and teachers. The research further showed that, the little time internet was used and available was for purposes of administrative use. The study further revealed that almost 70% of the schools surveyed had less than ten computers, and were therefore inadequate for

teaching and learning. The survey went further to note that only a third of the schools had computer laboratories.

In another survey by Kozma et al (2004) for The World Links School Program done in 1998 to 1999, it was indicated that lack of time available in class and in the planning schedules as well as lack of national policy on use of computers in schools were cited as biggest barrier to the use of ICT by the teachers. Other studies done using conceptual models to explain the extent of ICT use showed that there was limited information available on the experiences of learners, teachers and school administrators on the use of ICTs in secondary schools, the nature and extent of government involvement of parents and the role of the private sector. Often overlooked was the usage of such technologies that were likely to play a major role in determining the benefit and impact of ICT use in education.

Despite the apparent benefits of the use of ICT for educational purposes, studies have shown that teachers are still not fully ICT literate and do not use ICT in their teaching. A study to investigate teacher's readiness for ICT generally suggests that there is still a long way to go before schools in the region will be able to take full advantage of the opportunities provided by the 21st century technology. Barak (2006) revealed that teachers are cautious about integrating advanced technologies in schools; and that they do not think that ICT is preferable for class- based instruction for promoting cooperation and reflection in learning.

Tella et. al. (2007) in a research to investigate the factors hindering teachers readiness and confidence in using ICTs, found that inadequate knowledge to evaluate the role of ICT in teaching and learning, lack of skills in the use of ICT equipment and soft ware had resulted in a lack of confidence in utilizing ICT tools.

A research to investigate the impact of teachers' ability to use ICT reported in The International Journal of Computing (2008), Slaouti and Barton (2007) indicated that access to equipment, time pressure, lack of mentor and opportunities or apprenticeship were the main obstacles which impacted on the teachers' ability to use ICT. Finally Guha (2000) found that teacher's workload and time management to be hindering the implementation of computer instructions in the class room.

In conclusion, a lot of work needs to be done in this area if ICTs are to become effective and integral tools in education, and if impact is to be demonstrated to donors and communities

financing ICT-related initiatives in education. ICT use is detrimentally affected by lack of sustainability of funding for equipment and the available technology changes so rapidly that it is difficult to keep up to date and purchase new reliable hardware and software. According to them, sustainable funding for technical support and ongoing staff training is crucial for long term positive impact.

2.7.4 Research Model

The framework for this study was based on the self-developed model by the researcher which identified a set of five key constructs or independent variables (Hardware, Software, Internet Access, ICT Skills, Technology Competent Teachers) that served as the building blocks upon which the quality of information access (dependent variable) for learning and teaching could be improved, as well as sustained. The framework was designed for schools that addressed needs at school level to make decisions for implementing educational initiatives that made use of ICT. The researcher subsequently developed indicators that accompanied the model.

While theoretical argument could be put forward to provide a strong rationale for use of ICT, the only rationale was based on where, in practice, it has a positive impact on learning, the curriculum, teacher, and the school.

2.8 Conceptualization of the Study

The conceptualization of this study was based on the following model by the researcher which includes five key constructs or independent variables and dependent variables. These variables are:

2.8.1 Hardware

Computer hardware is grouped in two main categories, that is, computers and network devices. A computer is an electronic data processing device that is capable of receiving data and instructions and storing them, processing the data using the instructions and storing the results of intermediate and final processing and producing the results at high speed and accuracy.

The devices used in education of learners show variations according to their functions and technological infrastructures. Computers can be connected to three different types of devices, which is Input device which are used to get data into the computer such as keyboard, digital cameras and microphones. Storage devices are used to store data once it has been put into the

computer such as floppy disk drives, hard disks and CD's; and lastly the Output devices used to display data that is in the computer this include the monitor, printers and speakers.

Computers have evolved since the first generation of 1940 where there were mere vacuum tubes used for magnetic drum for memory to the present generation. Computers can be classified on the basis of various characteristics such as type of data which can be manipulated. In this category we have examples of digital and analogue computers. Another classification is according to their capacity, price and performance. Under this category there are examples as super computers, mainframe, mini computer and micro computers. Micro computers are the most common form of computers in offices today, and it includes, desktops, and personal or stand alone systems. Micro computers can be used for a variety of applications such as computer literacy and word processing. Other notable examples of computer are; notebooks and smaller laptops. Technological improvement has introduced mobile phones, video cameras and Personal Digital Assistants., iPods and e-Readers which are innovative technologies but remain expensive to most developing countries and are at very early stages with regard to their use in education in developing countries.

2.8.2 Software

Software, by definition, is the collection of computer programs, procedures and documentation that performs different tasks on a computer system. According to the Computer Dictionary, two main types of software are system software (operating systems), which controls the workings of the computer, and applications, such as word processing programs, spreadsheets, and spreadsheets which perform the tasks for which people use computers. Two additional categories, which are neither system nor application software but contain elements of both, are network software, which enable groups of computers to communicate and language software, which provides programmers with the tools they need to write programs (Computer Dictionary, 1997). In the educational field, software products for e-learning are rapidly evolving, while they become more efficient, sophisticated and appealing for the majority of the students, the ability of some categories of learners to effectively use them becomes more critical (Benigno *et al.*, 2008). New barriers for people with disabilities are also created by some of the newest software products in that they rely more and more on images, motion, voice, special effects, three-dimensionality, leaving aside the basic principles of Universal Design.

2.8.3 Internet Access

The internet has been described as “the most pervasive and educationally far-reaching innovation in ICT” (Hegarty, 2004). It has now become so ubiquitous that many organizations are trying to make their web sites accessible to educational systems. One of the most important strengths of the Internet for this group of individuals is its ability to provide increased opportunities for both accessing information and interacting with peers. Physical constraints can be eliminated, which may once have prohibited an individual from being able to communicate with peers, gather information, participate in lectures or debates, or communicate with family and friends. As the capacity of the Internet evolves and expands, the potential for online teaching and learning also evolves and expands (Delich, Kelly and McIntosh, 2008). Much of the early work on the instructional use of the Internet assumed that asynchronous text-based interaction defined the medium. Techniques were developed to maximize interaction using this relatively lean medium. We are now entering an era where streaming video, video and audio conferencing and virtual worlds are readily available for educational use.

Thus, online learning theory needs to help educators to decide which of the many technological options is best suited for their application (Anderson, 2004). Educational material is placed on internet in most cases to allow easy access. Streaming of captioned video and books over the Internet means that students can themselves connect and read the relevant books independently.

The increasing number of new technology tools and expanding bandwidth are changing all facets of online activity, including e-learning. As technologies become more sophisticated and as they begin to converge (for example, cell phones becoming multimedia-capable and Internet-connected), educators will have more options for creating innovative practices in education (Delich, Kelly and McIntosh, 2008).

Broadband internet is a key element of contemporary ICT and includes numerous applications built around the TCP/IP protocol, ranging from typical desktop applications to instant messaging tools as well as a vast set of applications directly accessed from the desktop. It can be fixed-line or wireless (ASM *et al.*, 2008). A good example is in the U.S., where developments in on-line teaching and learning strategies, as well as improvements in technology, have made on-line learning a more interactive and dynamic learning process than

ever before. Access to high-speed Internet and visual technologies have also provided more opportunities for both instructors and learners to use face-to-face communication.

2.8.4 ICT Skills

The pace of change and the unpredictable nature of ICT mean that to remain a competent ICT user requires continuous effort to maintain skills and knowledge. Familiarity with and the ability to effectively use ICT for a range of purposes remains an objective for many groups of disadvantaged learners, including many people with disabilities (Watkins, Tokareva, and Turner, 2011). ICT skills may not be part of the formal school curriculum and may not be assessed by national examinations. However, there are several commonly used indicators of technology skills. UNESCO lists indicators that include: number of learners that demonstrate only basic ICT skills, number that demonstrate advanced skills, and the purposes for which they use ICT. The International Computer Driver's License (ICDL) and variations of information technology identify and measure skills related to basic computer concepts, using the computer, managing files, and using word-processing, spreadsheets, database, presentation, and communication software. The advantage of the ICDL is that it is a standard curriculum and assessment of ICT skills that leads to an internationally recognized certificate. This assessment is useful to evaluators as an indication of program success related ICT learning, and it provides the participants with a credential that is recognized by employers. However, the assessment is expensive, and is limited in its scope to skills in using ICT tools.

2.8.5 ICT-Competent Teachers

In order to make sure that the secondary school students do not fall behind in their education, well-trained teachers are needed in addition to well-trained technicians. Teachers are crucial players in the successful use of ICT in education. However, simply making ICTs available to them does not guarantee their effective use. Teachers require education/training in the following areas: Education and pedagogy; Working in inclusive education settings and supporting learners with a range of diverse needs; Using ICT in education; and Using ICT for learners with disabilities and special needs (Watkins, Tokareva, and Turner, 2011).

Teacher education should provide information that makes clear the theory and rationale for using ICTs to support learning in classroom learning environments as well as practical experiences in implementing ICT tools and approaches. This means all teachers should be prepared to use ICTs to support learners needs in their initial training and then have access to

further, in-service training later in their careers in order to develop the knowledge and skills to enhance their practice in this area (Watkins, Tokareva, and Turner, 2011). ICTs are swiftly evolving technologies, however, and so even the most ICT fluent teachers need to continuously upgrade their skills and keep abreast of the latest developments and best practices.

In this regard, many governments are using the introduction of ICT as a way of providing teachers with new skills and introducing new pedagogy into the classroom. For example, teachers participating in the Enlaces programmes in Chile receive two years of face-to-face training consisting of at least 100 hours. As a result, teachers acquire familiarity with computers and use them regularly for tasks that are professional, managerial such as student marks and parental reports, as well as searching for educational content on the web and lesson planning. Hepp, et. al.(2004).

2.9 Outcome for School ICT Capacity

Schools provide ICT capacity in order to ensure that all teachers and students have access to all ICT equipment required to support the curriculum.

Independent variables will be measured as follows:-

Table 2.1: Outcome for school ICT capacity

Component	Elaboration	Indicators
Enabling environment	A wide range of applications is available to students and teachers, where the applications are designed to match user characteristics and the requirements of curriculum tasks.	School has licenses for students and teachers to access a range of appropriate software as required. Students and teachers are able to readily access this software when required.
Access and use of ICT facilities	Students and teachers have access to computer processing and adequate use of required software applications and digital resource materials. Students and teachers have access to peripheral devices suited to	Extensive variety of peripheral technologies for different curriculum needs in all learning areas. Students have unlimited access to select and use learning technologies. A planned and dynamic hardware repair and replacement program is in

	user characteristics and the requirements of curriculum tasks.	place. Effective policies and procedures for the management of hardware resources are evident.
Internet Connectivity	Students and teachers have access to networking, including the internet, which provides high quality access to online services.	Extensive range of online services available throughout the school such as email, access from home, shared curriculum resources, intranet, video-conferencing facilities. A school wide network that includes curriculum and administration with excellent Internet access.
Technical Support	Technical support and maintenance is available to teachers and students when and where required.	Technical support and maintenance is well managed by skilled experts from a technical support contract or school appointed technician. Students and teachers are not stopped from using a learning technology due to technical failure.
Digital Resource Materials	Teachers and students readily select and access digital resource materials appropriate to their needs.	Planned approach to management and use of digital resource materials. Selection of digital resource materials is coordinated throughout the school and strongly linked to the curriculum needs of students and staff for all learning areas. There is management and coordination of all digital resource materials.

29.1 Operational Framework of School Environment

The operational framework of the school environment was described in terms of the ideal situation with a set of indicators that schools would then use to identify areas for concern and strategies. The evaluation of the outcomes was measured using the following variables:

1. Computing devices available for learning at school
2. Mobile devices available for learning for learning at school.
3. Multi-media devices available for learning
4. Operating systems that support learning.
5. Application software that support learning
6. Availability of fixed line internet.
7. Students hardware skills
8. Students soft ware skills.
9. Perceived software competency of teachers at their school.
10. Perceived hardware competency of the teachers.

The variable indicators were measured by respondent's agreement with relevant rating using a summated five-point scale where 1 represents Strongly Disagree and 5 represent Strongly Agree. These were illustrated in figure 2, Operational framework of school environment.

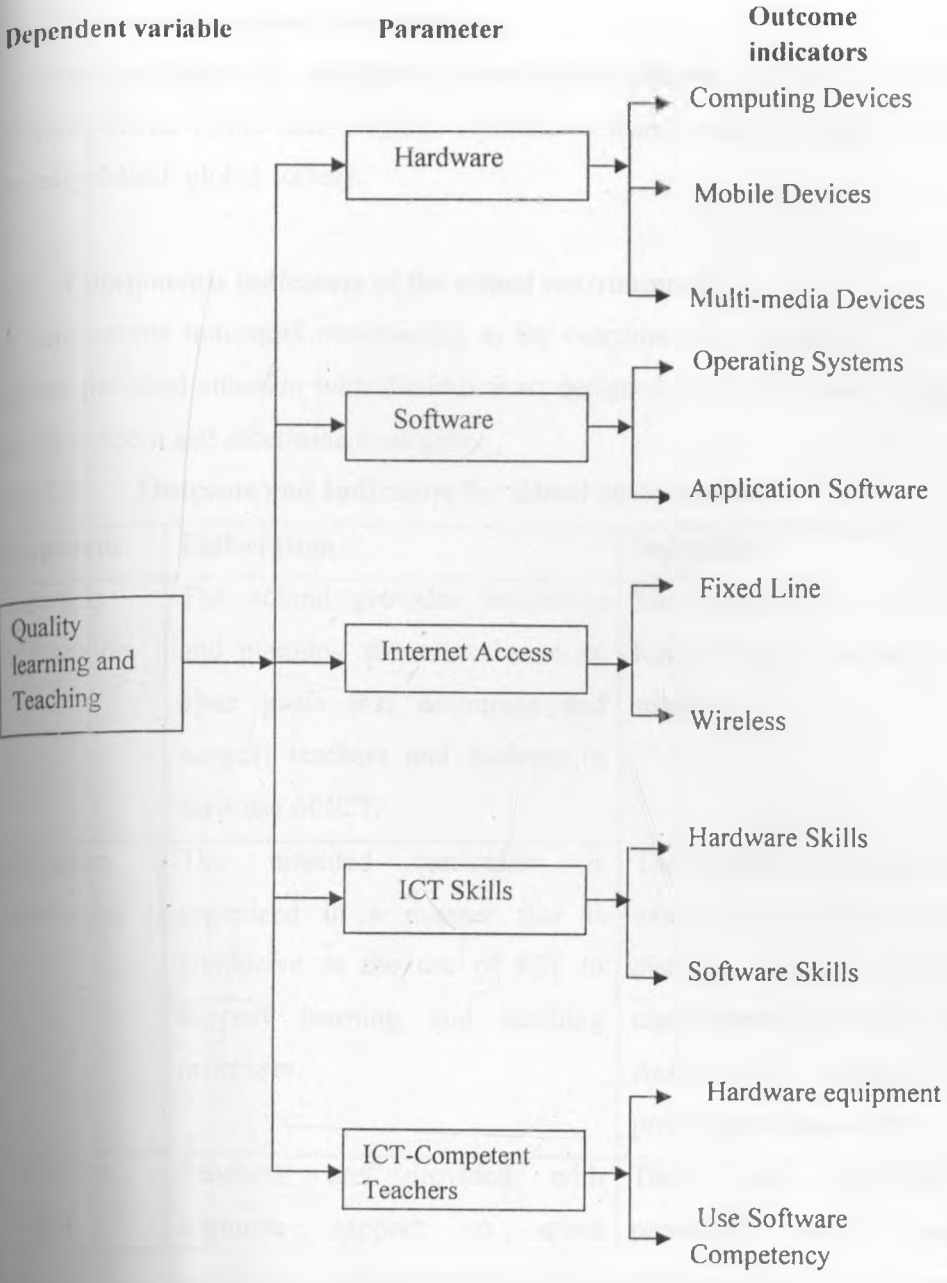


Figure 1: Operational framework of school environment

2.9.2 Outcome for School Environment

The school environment is supportive of teachers and students' use of ICT built on a shared, community-based vision that prepares students to learn, work and live successfully in a knowledge-based, global society.

2.9.3 Components indicators of the school environment

Five components indicators contributing to the outcome were identified. The elaboration describes the ideal situation with the indicators designed to assist schools to identify major areas for concern and determine strategies.

Table 2.2 Outcome and Indicators for school environment

Component	Elaboration	Indicators
Leadership and Planning	The school provides leadership and planning structures based on clear goals that encourage and support teachers and students in their use of ICT.	The school has a comprehensive long-term plan for the use of ICT in schools.
Curriculum Organisation	The intended curriculum is organized in a manner that is conducive to the use of ICT to support learning and teaching processes.	The curriculum encourages student work that addresses issues that have meaning, reaching out beyond the classroom to real-world practice. Assessment processes do not preclude the use of ICT.
Curriculum Support	Teachers are provided with adequate support to select appropriate applications of ICT to address the requirements of the intended curriculum.	There are curriculum support personnel, readily available to teachers, with expert experience in the integration of ICT in learning and teaching processes. Teachers have access to a range of curriculum support materials targeted at the use of ICT to support learning.
Community Connections	The school recognizes local and global communities as critical	There is a statement of vision that identifies and builds upon the

	partners and stakeholders in the learning and teaching process.	potential mutual benefits from community linkages for learners and the community. Formal technology-related structures and processes engage parents, community members, school staff, and learners in meaningful exchanges, interactions, and partnerships that advance the use of ICT in schools.
Accountability	The school has adequate systems to ensure accountability in the use of ICT.	The school has established the metrics and benchmarks for effective use of ICT at the student, teacher, and systems levels. The school collects and analyses data to track progress in the use of ICT and correlate findings.

2.10 Conceptual Framework

The conceptual framework, Figure 2 illustrates how a group of key ICT factors facilitate information access for students learning. The dependent variables were; access and extent of use of ICT facilities, availability of ICT facilities such as software, the capacity for using facilities which includes ICT skills and competencies, benefits of ICT as well challenges affecting the use of ICT in education. Students' perception of ICT is a useful in-class tool based on the estimated improvement in access to classroom content, participation, performance, learning experience and feeling of inclusion as a result of ICT use in comparison to the situation prior to ICT implementation. The independent variable was improved quality learning and teaching.

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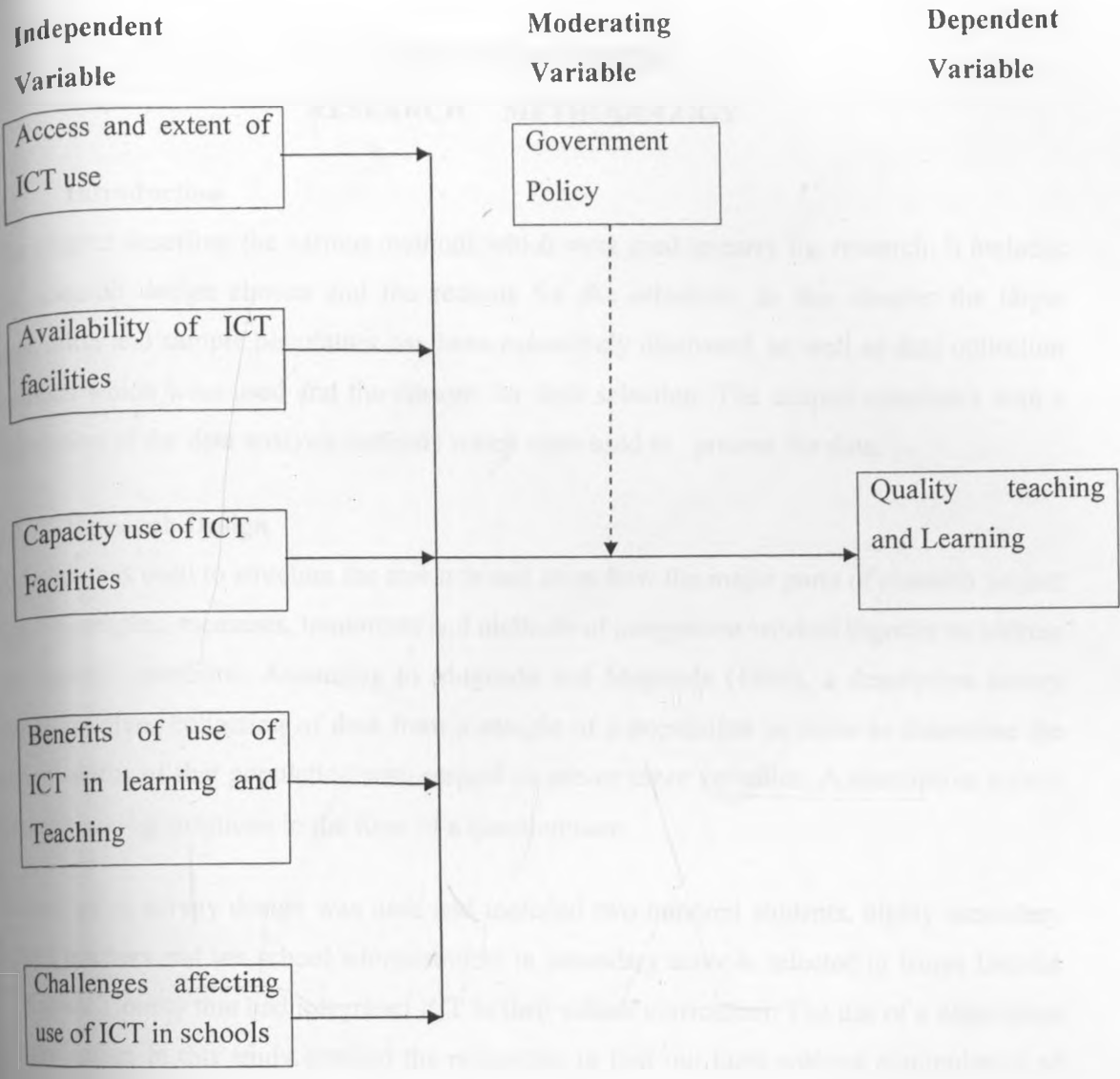


Figure 2: Conceptual framework of ICT

2.12 Chapter Summary

This chapter gives an overview of the global and regional perspective of ICT in education and the Kenyan ICT situation. An orientation of theories for explaining ICT use in education is discussed followed by an empirical review of published literature regarding the impact of ICT use on information access to enhance quality teaching and learning in secondary school education.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter describes the various methods which were used to carry the research. It includes the research design chosen and the reasons for the selection. In this chapter the target population and sample population has been extensively discussed, as well as data collection methods which were used and the reasons for their selection. The chapter concludes with a description of the data analysis methods which were used to present the data.

3.2 Research Design

A design was used to structure the research and show how the major parts of research project like the samples, measures, treatments and methods of assignment worked together to address the research questions. According to Mugenda and Mugenda (1999), a descriptive survey design involves collection of data from a sample of a population in order to determine the current status of that population with respect to one or more variables. A descriptive survey involves asking questions in the form of a questionnaire.

A descriptive survey design was used and included two hundred students, eighty secondary school teachers and ten school administrators in secondary schools selected in Isinya District in Kajiado County that had integrated ICT in their school curriculum. The use of a descriptive survey design in this study enabled the researcher to find out facts without manipulation of data, seek opinion, describe, analyze and interpret factors influencing integration of ICT in secondary school learning and teaching.

A survey of students, teachers and administrators in the selected secondary schools was carried to determine if ICTs leads to quality learning and teaching amongst learners and teachers in secondary schools in Isinya district. The survey was done in order to establish the impact of ICTs use on information access to enhance quality learning and teaching in secondary schools. Cooper and Schindler (2001), defines descriptive studies as those concerned with finding out who, what, when, where, when, or how much. This research was conducted by questioning selected respondents, and using their input to answer the research questions and analyse the data.

3.3 Sampling Procedure

Population refers to the total collection of elements about which inferences are made, according to Cooper and Schindler (2001). The population for this research covered all secondary schools in Isinya District which have integrated ICT systems in their schools. It is from this selected population that the results of the study apply, and the schools that haven't integrated ICT learning were not included in this research. The secondary schools chosen made a good target population for the study because of the government commitment in improving the quality of learning and teaching in the rural secondary school by funding computer infrastructure in schools in order to make secondary education more relevant to the needs of the country and in tandem with the latest international trend in education (MOEST, 2005).

Currently Isinya District has a total of seventeen secondary schools, five are public and twelve are private owned. Most of these schools have computers and are making efforts to establish and improve ICT capacity. The schools have an average population of 300 students, and a teaching staff of 15-30. This study covered an average population of 5000 students and 300 teachers in all the secondary schools located in Isinya district (Appendix 5).

3.3.1 Sampling frame

According to Saunders *et al.* (2003), a sampling frame refers to the complete list of all the cases in the population, from which a probability sample is drawn. The sampling frame for this study consisted of 10 secondary schools which were investigated, and analysed. The information records were sourced from Isinya District Education office. The sampling frame was important since it influenced the population covered and the actual selection process of schools sampled.

3.3.2 Sample Size

According to Kerlinger (1986) purposive sampling which is characterized by use of judgment and deliberate effort to obtain representative sample by including typical areas or groups of sample was used to come up with the sample size for the study. Mugenda and Mugenda (2003) also state that purposive sampling allows a researcher to use cases that have the required information with respect to the objectives of his or her study.

The researcher conducted a survey since the sampling frame was only ten schools which were sampled out of the possible 17 secondary schools in the District. A survey eliminated sampling error and provided data on all the individuals in the population. Finally, virtually the entire population would have to be sampled in small populations in order to achieve a desirable level of precision.

A sample of 10 secondary schools was selected from the total number of schools in Isinya District. This was 59% of the total number of schools selected on the basis of being accessible to the researcher. From each school a sample of 8 teachers, 20 students and 1 administrator was selected randomly making a total of 200 students and 80 teachers from the whole population who were given questionnaires to fill. The researcher guided the administrators to answer questions in the interview schedule

3.3.3 Sampling Technique

The researcher used the stratified sampling techniques to divide the population into homogeneous subgroups and a simple random sample was taken in each sub group. This ensured a representative sample of the overall population was selected. Stratified random sampling generally has more statistical precision, and offered the researcher and the assistant's convenience to administer the research designs. The advantage of this technique was that it assured the researcher of representation not only of the overall population but also key subgroups such as county schools via District secondary schools, mixed secondary schools, girls' schools, as well as public and private secondary schools.

3.4 Methods of Data Collection

Data collection involved collecting primary and secondary data using several procedures and instruments. Primary data for this research was collected using self-administered semi-structured questionnaires.

3.4.1 Questionnaire

A questionnaire with open-ended and closed questions was used in order to elicit both qualitative and quantitative responses. The questionnaire was organized based on the research questions and specific objectives in order to ensure relevance to the research problem. The questionnaire used for this study employed a five point Likert scale of (5 - strongly agree to 1 - strongly disagree), which allowed the respondents to rate their perception on use of ICT to

support learning and teaching. It was a rating scale that was considered approximately equal to attitude value which subjects respondents with degree of agreement or disagreement (Kerlinger (1973). The questionnaire was divided into two sections; Section A of the questionnaire described respondents background information such as age, gender, status, subjects taught, academic qualifications and length of time the respondents have used ICT. Section B comprised of possible ICT uses of learning and teaching by the respondents to help the researcher to sample data to draw inference about the population represented. The questionnaire was designed as simple as possible

The questionnaire allowed for contact with otherwise inaccessible respondents who offered data required for the research. This increased the response rate due to perceived anonymity of the respondents, and also allowed for faster data collection (Cooper and Schindler, 2001).

3.4.2 Interviews

Focus group discussion and in depth interviews were used to get information from teachers and students. The focus groups were conducted with groups of five students in three secondary schools. The students were picked on the basis of those who were available on the day of the interview. In depth interview were conducted with the school principals or Heads of academics Department, in some cases where teachers taking computer studies were available and willing to give an interview, they were included in the interview schedule. The interview technique was used in order to get more detailed information since the interviewer could control the process. Secondary data was gathered from the following sources:

3.4.3 Online Databases

The researcher searched on multiple online databases systematically; where relevant websites such as Kenya Ministry of Education, Kenya Institute of Education, United Nations, UNESCO and the World Bank and also the European Union as well as International online reports were taken into consideration. These general searches were followed with more specific citation searches. The search terms used included: 'education for secondary schools', 'ICT in education', 'inclusive education', 'and assistive technologies in education'. Findings and research from 2000 onwards were taken into account. The focus was on ICT for secondary schools, with particular emphasis on access to information and knowledge, in order to enhance quality learning and teaching.

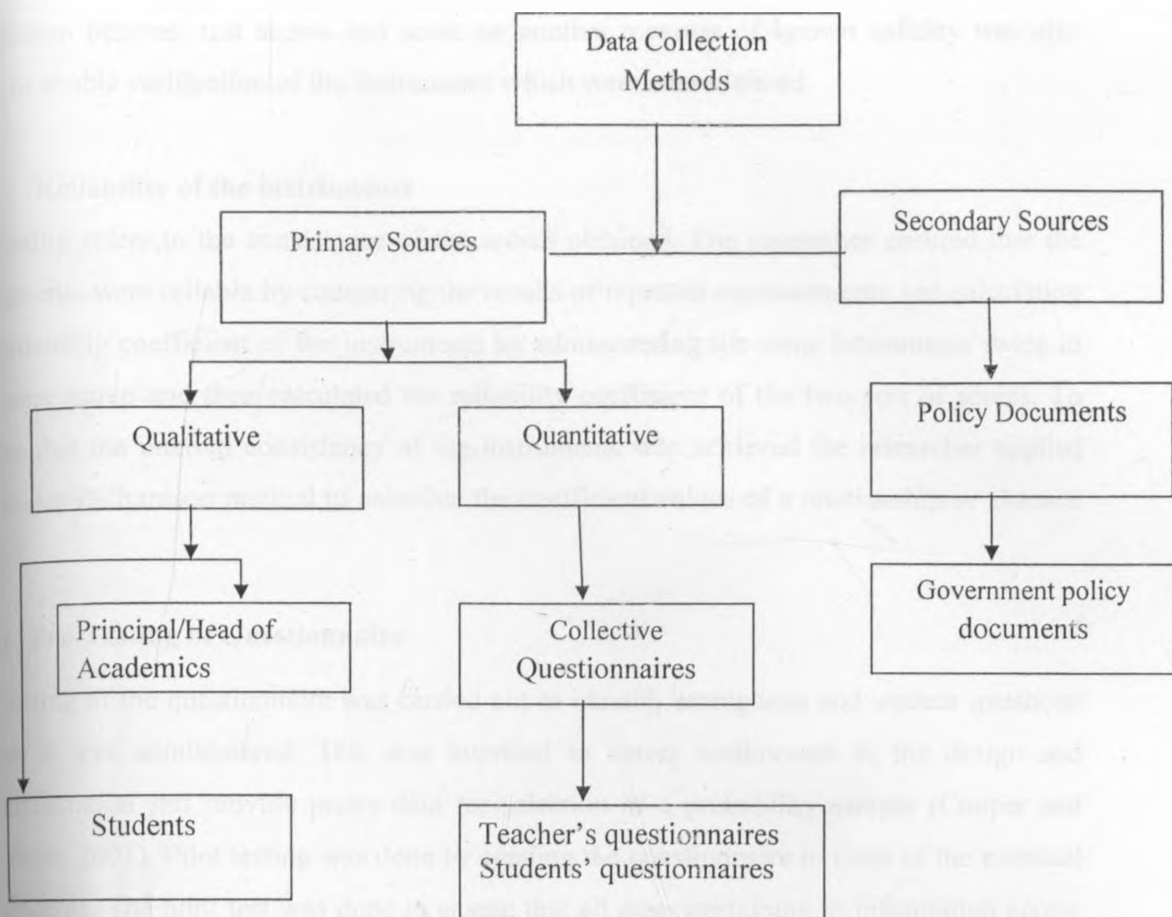


Figure 3 Summary of the study process

3.4.4 Publications

Additional secondary data was collected from an environmental scan by conducting a content analysis of documented reports and studies, books, magazines, and media reports.

3.5 Validity of the instruments

Validity refers to the appropriateness, meaningfulness and usefulness of the inferences on the collected data. This was ensured by use of different instruments in order to record the data and the quality of the instruments which were used. And this enabled the researcher draw the correct conclusions. Assessment of the instruments which were used was done so as to provide evidence to support interpretation of the analyzed data. This was done by measuring the collect variable in order to provide useful information for inferences, through ensuring that the content and format of the instruments was achieved. The researcher also ensured that the criterion related validity was measured to find the relationship between scores obtained using one or more instruments and the research instruments. Calculation of the coefficient of

correlation between test scores and score on another measure of known validity was also done to enable verification of the instruments which were administered.

3.6 Reliability of the instruments

Reliability refers to the consistence of the scores obtained. The researcher ensured that the instruments were reliable by comparing the results of repeated measurements and calculating the reliability coefficient of the instruments by administering the same instruments twice to the same group and then calculated the reliability coefficient of the two sets of scores. To ensure that the internal consistency of the instruments was achieved the researcher applied the Kuder-Richardson method to calculate the coefficient values of a relationship or absence of it.

3.6.1 Pre-Testing of Questionnaire

Pre-testing of the questionnaire was carried out to identify ambiguous and unclear questions before it was administered. This was intended to detect weaknesses in the design and instrumentation and provide proxy data for selection of a probability sample (Cooper and Schindler, 2001). Pilot testing was done by sending the questionnaire to three of the eventual respondents. The pilot test was done to ensure that all areas pertaining to information access for secondary students through ICTs are covered. A coding test was done to ensure that the required data could be analysed to give the required information. Modifications for the instruments where necessary, were done at this point.

3.6.2 Assigning of questionnaire

After the pilot testing, the questionnaires were administered using a drop-and-pick-later method, and then reminders were sent to the target respondents to ensure maximum response. The time used for this activity was a month after the pilot test. Collection of the questionnaires was done at the end of the said month.

3.7 Data Analysis

Data analysis was done qualitatively and involved synthesizing the information obtained from the various sources into a coherent description of what was discovered. Data analysis involved data conversion involving four primary methods. Kothari (2008) has given a detailed description of the processing methods. The main analysis methods included editing, coding, re-coding, tabulation and classification of data.

The data gathered was organized for manipulation through a Computer Statistical Software Views 3.1. Extensive editing of the data was done in order to remove mistakes which would influence final results negatively. Data analysis helped the researcher interpret data, draw conclusions and make decisions. Data editing ensured consistency across respondents and locate omissions as well as reducing errors in recording, improving legibility and clarify unclear and inappropriate responses according to Cooper and Schindler (2001). The researcher coded the data to reduce the responses to manageable levels for processing and reporting. The codes were based on pre-set decision rules to assist sorting, tabulating and analysing according to Cooper and Schindler (2001). Qualitative data was grouped and coded around thematic areas and presented in frequency distribution tables and pie charts.

3.8 Methods of Data collection

The study was a research survey that examined the use of ICT to support quality teaching and learning in secondary schools in Isinya District. In order to collect data respondents were asked questions and their responses were recorded for analysis. The survey method was preferred because it was more efficient, economical and appropriate moreover the respondents are uniquely qualified to provide the desired information as compared to other methods. The researcher in addition utilized face to face interview and this provided detailed and correct information especial from the school administrators and policy implementers.

3.9 Methods of Data Analysis

Data analysis involved reducing accumulated data to a manageable size, developing summaries, looking for patterns, and applying statistical techniques according to Cooper and Schindler, (2000). Statistics is a body of mathematical technique or process for gathering, organizing, analysing and interpreting numerical data. Therefore data collected was analysed using statistical methods which involved both descriptive and inferential procedures.

3.9.1 Descriptive Statistics

Descriptive statistics was used to summarize and present the analysed data which consisted of numerical and graphical summaries to enable the information to be simple and understood. The descriptive statistics included percentages and measures of central tendencies such as arithmetic mean, weighted mean and variance and standard deviation.

3.9.2 Inferential Statistics

Inferential statistics which measures relationships and differences between or among the variables was also used. Inferential statistics used included correlation, regression and analysis of variance. Hypothesis testing which included F-test and T-test was used to determine if Information and communication Technology could lead to improved quality learning and teaching in secondary schools in Isinya District in Kajiado County was used. A Computer Statistical package E-Views 3.1 software was used to analyse the data. The mean, variance, standard deviation and T-test of significance were employed to test the relationship between variables and respondents' information. A multivariate statistical technique such as multiple linear regressions to measure the impact of ICT use on quality of teaching and learning was done. Use of Frequency tables and graphs was utilized to present the data for easy deciphering. This provided the researcher with procedures of making generalizations about characteristics of population from the sample selected.

The multiple linear regression model used in the inferential statistics was as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + E_1$$

3.10 Ethical Considerations

Ethics which refers to the code of conduct or behaviour of the researcher while conducting a research was also strictly adhered. The researcher to ensure ethical principles were followed was conscious of the need for strict ethical guidelines for the research. Therefore the researcher ensured that privacy and confidentiality of the information provided was safeguarded, and that the ethical behaviour was adhered to at each step of the research process. The researcher further upheld the principles of research of using valid research design and competency in conducting the research as well as debriefing the research participants after the research study through explanation of the real purpose and use of the research.

3.11 Operationalization of variables

The operationalization for this study was based on a model whereby secondary school students and teachers were presented with five key ICT variables that were, access and extent of ICT use in schools, availability of ICT facilities in the school environment, capacity for using ICT facilities, benefit of ICT in enhancing quality of teaching and learning schools, and challenges affecting the use of ICT in secondary schools in Kenya. The respondents were asked to rate their perception of the impact of each respective factor as a means of facilitating

information access based on a scale of 1 to 5 numerical points, where 1 represents very low and 5 extremely high. For information access, a single-item numerical construct based on a 0-100% scale and expressed in percentage points in order to measure student's perception on the degree of improvement of information access due to ICT use in order to enable quality learning and teaching.

3.11.1 Operational definition of variables

The operational definition of research variables provided a relationship of the research objective, independent variables that the researcher used to measure and the tools used to analyse the collected data using the various instruments. Operational definition of variables is shown in Table 3.1.

Table 3.1 Operational definition of Variables

Objectives	Variables	Indicators	Measurement Scale	Tools of Analysis	Types of Analysis
1. To establish level of access and extend of use of ICT in secondary schools.	Independent ICT Infrastructure and access.	1. Access and use of computers 2. Number of computer connected to internet 3. Access and use of e-mail and website.	Ratio.	Mean Mode Median	Descriptive Analysis.
2. To investigate level of availability of ICT facilities in secondary schools.	ICT integration in school curriculum.	1. Number of hours used in teaching ICT lessons. 2. Presence of educational software. 3. Subjects in which ICT is integrated.	Interval.	Mean Range Standard deviation. Correlation	Descriptive Analysis
3. To study the capacity for using ICT facilities for learning and teaching in secondary schools	Teacher training and teaching.	1. Number of teachers with ICT training. 2. Level of expertise in use of ICT.	Nominal	Cross tabulation Mean	Descriptive analysis

		3. Use of internet for teaching.			
4. To establish the benefits of using ICT in Teaching and learning process.	Skills and competencies of learners.	1. Use of ICT in improving learning and attitude. 2. Change in teaching methods. 3. Use of ICT in teaching confidence.	Interval	Correlation Regression	Inferential Analysis.
5. To study the challenges affecting the use of Information and Communication technology in secondary schools.	Challenges facing use of computers.	1. Policy and strategy of government and schools 2. Budget allocation to school ICT projects	Ordinal	Rank Correlation Regression T-test	Inferential analysis
To study how Information and Communication Technology can lead to improved quality teaching and learning in secondary schools.	Dependant variable Improved quality teaching and learning.	1. Increase in learner's collaboration 2. Level of ICT usage. 3. Students performance in examinations 4. Perception and attitude of learners and teachers on changes in learning and teaching	Ratio	Mean Mode Median Correlation	Descriptive and inferential
To study how government policy influence quality learning and teaching in secondary schools.	Moderating Variable Policies and legal factors	1. Number of teachers trained 2. Integration of ICT in subjects 3. Teacher access to curriculum support materials	Ratio	Mean Correlation	Descriptive and Inferential

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter comprises data analysis after data collection using the questionnaires and secondary sources of data, presentation and interpretation. The data obtained from the research was summarized and presented using Tables and narratives.

4.2 Data Collected and Response Rate

A total of 79 students and 31 teachers and 3 administrators from Isinya District, Kajiado County returned the questionnaires which represented 39% of response rate. The rest of the respondents did not bother to return the completed questionnaires or when they did it was poorly filled, which led to its rejection. A summary of profile of gender of respondents is shown in Table 4.1

A total of 113 respondents participated and returned the questionnaires which were sent to them on five important parameters which were measured; access and extent of use Information and Communication Technology, availability and capacity of use of ICT facilities, benefits of ICT to teaching and learning and the challenges facing ICT integration in the Secondary school curriculum as well as how the use of ICT in schools support quality learning and teaching.

4.2.1 Gender of respondents

Table 4.1 Gender Profile of Respondents

Respondents	Students		Teachers	
	Frequency	Percent	Frequency	Percent
Male	43	54.4	22	71
Female	36	45.6	09	29
Total	79	100	31	100

Table 4.1 Shows Gender of respondents, and the results revealed that there were a total of 79 students and 31 teachers who participated in the study by filling the questioners correctly. In

terms of student gender, boys were 54.4% and girls were 45.6%. The teachers' were 71% males and 29% females.

4.2.2 Teachers' Age

When teachers were asked about their age, majority of the respondents were below 40 years old. A summary of the respondents' teachers' age is given in Table 4.2

Table 4.2 Teachers' Age

Teachers age	Frequency	Percent
Less than 30 years	13	42
31-40 years	8	26
41-50 years	9	29
51-60 years	1	3
Total	31	100

A majority of the teachers were below 30 years old of which comprised 42%, while those with 30 to 40 years were 26%, 41 to 50 years were 29%.

4.3 ICT Infrastructure and Access

The ICT infrastructure and access pattern among students and their experience in using ICT facilities are represented in Table 4.3.

Table 4.3 Student s' experience of using ICT

Number of years of using computer	Frequency	Percent
Not at all	0	0
Less than 1 year	31	39
2 years	13	17
3 years	7	08
4 years	28	36
Total	79	100

The results on students' experience of using ICT show that 39% of the students had less than 1 years experience of using ICT facilities like the computer and other devices, 17% had an experience of 2 years, 8% of the students indicated that they had an experience of more than 3 years while 36% indicated that they had an experience 4 years of using ICT in learning.

The teachers' experience of using ICT is shown in Table 4.4.

Table 4.4 Teachers' experience of using ICT

Number of years of using computer	Frequency	Percent
Not at all	3	9
Less than 2 years	7	23
2- 5 years	7	23
More than 5 years	14	45
Total	31	100

The results show that 9% of the teachers had no experience at all of using ICT, 23% of the teachers had an experience of less than two years, while those with an experience of 2 to 5 years were 23% , and teachers who had an experience of more than 5 years were 45%.

4.4 Level of Availability of ICT Facilities

The research also studied the level of availability of ICT facilities among the students and teachers within the school environment. The variable considered the students and teachers access hours to the computers.

4.4.1 Students accessibility to school computers

The researcher also asked the respondents to state on average the number of hours they accessed the computers at school. The results on student's hours of access to the computer at school are shown in Table 4.5.

Table 4.5 Students average access hours to Computers at school

Students access hours to computers per week	Frequency	Percent
No access	27	34
Less than 2 hours	24	31
2 - 4 Hours	16	20
4 - 6 Hours	1	1
6 -8 Hours	0	0
Above 8 Hours	11	14
Totals	79	100

The results show that 34% of the students had no access to computers at school; while those with less than 2 hours access to computers were 31%, and students who would access the computers for an average of 2 to 4 hours were 20 %.

4.4.2 Teachers' access hours to school computers

Teachers average access hours to computers at school in a week was analysed and its results reported in Table 4.6.

Table 4.6 Teachers access hours to computers

Teachers computer access hours per week	Frequency	Percent
No access	5	16
Less than 2 hours	8	26
2 - 4 Hours	4	12
4 - 6 Hours	3	10
6 - 8 Hours	3	10
Above 8 Hours	8	26
Totals	31	100

The results show teachers' average access hours to computers within the school compound per week. The teachers who had no access to computers were 16%, those who would access computers for less than 2 hours were 26%, while the teachers who had 8 hours and above access were 26%.

4.4.3 Teachers Access to the Internet

The researcher also studied the teacher's access hours to the internet per week and the results were presented in Table 4.7

Table 4.7 Teachers access hours to Internet

Hours per week the internet Is available to Teachers	Frequency	Percent
No access	16	51
Less than 2 hours	5	16
2 - 4 Hours	1	3
4 - 6 Hours	2	7
6 - 8 Hours	2	7
Above 8 Hours	5	16
Totals	31	100

The results show that almost a half of the teachers sampled from the five schools representing 51% had no access to internet at their schools, while only 16% of the teachers indicated that they would only access internet for less than 2 hours. There were 16% of the teachers who accessed the internet for an average of 8 hours and above per week at their school.

4.4.4 Location of computers in school

The responses on the location of computers in school indicated that the computer laboratory was the main location where computers could be accessed. This was rated at 76% of the total students respondents surveyed. The respondents further indicated that there were no computers at the classrooms or at the library since their rating was zero. Only 24% respondents indicated that they could access the computers at other locations in the school such as the administrator's offices.

4.4.5 Teachers Level of Access to ICT facilities

Majority of the teachers access to ICT facilities in their schools were mainly located in the school computer laboratories with 73% response rate, 3% of the respondents would only access computers in the staffroom and in their offices, 18% of the teachers had access to computers in other areas within the school possibly at the typing pool and the administration offices.

4.5 Capacity for Using ICT Facilities

4.5.1 Respondents level of expertise in use of ICT

To study the capacity for using ICT facilities for learning and teaching the students and teachers were asked to rate their level of expertise in computer use. The researcher used a five level scale rating, those with no expertise, fair, good, very good, and excellent to ascertain their capacity in the use of ICT in learning in school. The students' and teachers' level of ICT expertise were presented in Table 4.8.

Table 4.8 Respondent s' level of ICT expertise

Level of ICT Expertise	Students		Teachers	
	Frequency	Percent	Frequency	Percent
No expertise	4	5	5	16
Fair	38	48	10	32
Good	14	18	6	20
Very Good	18	23	5	16
Excellent	5	6	5	16
Total	79	100	31	100

Table 4.8 shows that majority of the students' respondents who were 48% had a fair level of expertise in computer use, 18% had a good expertise level in computer use, and 23% stated that they were very good using computers.

Among the teacher respondents 32% were fairly able to use ICT facilities in teaching, while 20 % stated that they were good in using ICT, and those who had no expertise were rated at 16%.

4.5.2 Students ICT Skills and competencies

To study the parameter of students' ICT competencies and skills in ICT respondents were asked to rate their perceived competencies and skills in basic computer applications which include Word processing, Spread sheet, Presentation tools, Database, Internet browsing. Each item was measured on a five point rating scale from 1 (None) to 5 (Proficient). The result from the research is explained in Table 4.9

Table 4.9 Student Skills and Competencies in word processing

Level of skill and competency	Frequency	Percent
None	16	21
Basic	35	44
Intermediate	20	25
Proficient	08	10
Total	79	100

Table 4.9 shows that the students level of ICT skills and competency in Word processing was 10% proficiency level, 25% had intermediate skills, 44% had basic skills, while 21% of the students reported that their had no skills at all in word processing. Word processing is the most common soft ware application that is used.

The students respondents were also asked to rate their level of skills in internet use, and results are reported in Table 4.10.

Table 4.10 Students level of skills and competencies in internet operation

Level of skill and competency	Frequency	Percent
None	16	21
Basic	20	24
Intermediate	16	21
Proficient	27	34
Total	79	100

Table 4.10 shows that 34% of the respondents were proficient in the use of internet, 21% had intermediary skills, and 24% had basic skills in internet operations while 21% of the respondents stated that they had no skills in the use and operation of internet.

4.5.3 Teachers Level of Academic Qualifications

Teachers' levels of academic qualifications are shown in Table 4.11.

Table 4.11 Teachers Academic Qualifications

Qualification	Frequency	Percent
PhD.	0	0
Masters Degree	2	6
Degree	20	65
Diploma	7	23
Certificate	0	0
Others	2	6
Total	31	100

The results show that 65% of the respondents had degrees in education, 23% had attained diplomas in education, and 6% had master's degree as their highest qualification and only 6% respondents indicating that they had other qualifications.

4.5.3 Teachers with ICT training

The respondents were also asked to state whether they trained in ICT before joining teaching profession and the following results were analyzed and reported in Table 4.12.

Table 4.12 Teachers trained in ICT

Responses	Frequency	Percent
Yes	20	64.5
NO	11	35.5
Total	31	100

The results show that majority of the teachers had received ICT training before joining teaching profession with 64.5% agreeing that they had received training, and 34.5% indicating that they did not receive any training. Nevertheless, 55% of the respondents had taken self initiative to under go ICT training and upgrading their skills over the last three years.

4.5.4 Teachers Reason for Acquiring ICT skills

The researcher asked teacher’s respondents to state the reasons that make them acquire ICT skills, and the following responses were analyzed and reported in Table 4.13.

Table 4.13 Teachers Reasons for Acquiring ICT Skills

Reasons for training	Frequency	Percent
Prestige	7	23
Change of profession	0	0
Promotion	1	3
Enhance teaching and Learning	19	61
Others	4	13
Total	31	100

The result shows that 61% of the teachers acquired more knowledge and skills in computers to enhance their teaching skills. 23 % of the respondents stated that they acquired the ICT skills for prestige while 3% acquired ICT knowledge to enable them get promotion and 13% stated that ICT skills enable them keep pace with the changing times where technology is the order of the global change and this would include activities such as communicating with their peers.

4.6 Benefits of ICT in Teaching and Learning

4.6.1 Use of ICT in improving learning attitude

The researcher asked respondents to state whether they used ICT as a learning tool and whether computer studies assisted them to learn other subjects. The results are shown in Table 4.14

Table 4.14 Use of ICT as a Learning Tool

Responses	Frequency	Percent
NO	4	05
Yes	67	85
Not Sure	8	10
Total	79	100

The results show that 85 % of the student's respondents agreed that ICT can be used as a learning tool, 5% disagreed, while 10 % were not sure whether ICT can be used as a learning tool.

4.6.2 ICT and Students Motivation

The researcher further asked the respondents to state whether using computers change their attitude towards learning and the results are reported in Table 4.15.

Table 4.15 ICT and Student Motivation

Responses	Frequency	Percent
NO	12	15
Yes	43	55
Not Sure	24	30
Total	79	100

The results show that 55 % of the students generally agreed that there is a positive change of attitude towards learning when using ICT, 30% of the respondents were not sure, while 15 % disagreed that ICT does not influence students motivation towards learning.

4.6.3 Teachers Use of ICT in Teaching

The researcher also investigated whether the teachers use ICT in teaching preparation and the results are reported in Table 4.16.

Table 4.16 Use of ICT in the Scheme of Work

Teachers Responses	Frequency	Percent
Yes	6	19
No	25	81
Total	31	100

The results show that use of ICT in teaching in the schools visited was rarely used with only 19 % of the teachers agreeing that they use computers in their preparation of the schemes of work, while 81% of the respondents had never used computers in their schemes of work.

4.6.2 Students Perception of ICT integration in Schools

Majority students were positive on the integration of ICT in the school curriculum by generally agreeing that use of ICT make them more effective and organized in their studies with a response rate of 80%, while 48% of the respondents agreeing that ICT use enabled them meet their varying needs as students. 89% of the respondents agreed that with the use of internet and technology their learning is enhanced through interactive learning.

4.6.3 Teachers' Application of ICT and Impact

Preparation of class lists, keeping and accessing students' records and processing examinations was performed using the computer at least occasionally. It was also found that computers were used very rarely in the preparation of time table and students' report cards and keeping student and teachers teaching notes. The teachers noted that the internet was often used to find and access educational materials on emerging issues like drug abuse as well as for communication.

4.7 Challenges Affecting Use of ICT in Secondary schools

In this study lack of training for teachers in the schools surveyed proved to be a major drawback with 65% of the respondents having received ICT training before joining the teaching profession. Moreover 55% of the teachers who could not use computers cited training as the biggest obstacle to their inability to utilize the technology. Lack of appropriate training among respondents led to their low use of computers for instructional purposes. When respondents were asked whether the use of ICT was planned for in their scheme of work? The results of the study showed that 81% of the teachers disagreed while only 19%

agreed. This showed that ICT was rarely used for instructional purposes in school. The research further revealed that even those who stated that they planned for ICT in the scheme of work only 13 % would develop their own soft ware and 77% would not. Unavailability of computers was cited by all administrators as the main cause of low numbers of computers available to schools. The researcher found out that in almost all the schools surveyed, the number of computers which were available on average were 10 against the school enrolment of over 300 students.

4.8 Regression Analysis

4.8.1 Regression analysis for the parameters of study(Improved quality teaching and learning and ICT Infrastructure and access X1, ICT integration X2, Capacity for ICT use X3, skills and Competencies X4, Challenges affecting ICT use X5)

4.8.1.1 Teachers Regression Output

Table 4.17 represents dependent Variable Y versus Independent Variable, X1, X2, X3, X4, and X5

Table 4.17 Regression Output for Teachers

Dependent Variable: Y
 Method: Pooled Least Squares
 Date: 08/27/12 Time: 16:30
 Sample: 1 31
 Included observations: 31
 Total panel (balanced) observations 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.923659	0.824863	-2.332096	0.0280
X1	0.401628	0.103375	3.885166	0.0007
X2	0.422965	0.110775	3.818239	0.0008
X3	0.399437	0.090066	4.434930	0.0002
X4	0.430228	0.119788	3.591563	0.0014
X5	0.288222	0.088398	3.260521	0.0032
R-squared	0.680870	Mean dependent var	3.580645	
Adjusted R-squared	0.617044	S.D. dependent var	0.837623	
S.E. of regression	0.518350	Sum squared resid	6.717167	
Log likelihood	-20.28262	F-statistic	10.66761	
Durbin-Watson stat	1.983954	Prob(F-statistic)	0.000014	

Table 4.17 shows that the regression output values R- squared from the teachers' responses 0.680870 % and 0.638969 %. The values show that there were approximately 68.09% of

the variations of the teachers' responses. The mean dependent variable was 3.58064 and F-statistic given as 10.6676

The equation derived from Regression 1 is therefore given as:

$$Y = -1.923659 + 0.401628 X_1 + 0.422965 X_2 + 0.399437 X_3 + 0.430228 X_4 + 0.288222 X_5 + E_1$$

4.8.2 Hypothesis testing for the teachers' responses

In order to ascertain the statistical significance of the model as well as the usefulness of each of the independent variables (X_{1-5}), a T- test analysis was used.

Null Hypothesis **H0**: $\beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \beta_4 = 0, \beta_5 = 0$

Alternative Hypothesis **H1**: $\beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0, \beta_4 \neq 0, \beta_5 \neq 0, \beta_1 \cdot \beta$

Whereby, **H0** – Implies the model is not useful and **H0-** implies that the model is useful.

According to the Null hypothesis **H0**, if coefficient, $\beta_1 = 0$, then the distribution of the response Y does not directly depend on the input variable X_i , which can therefore be dropped from the model, Consequently, it is useful to test the hypothesis;

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$$

versus

$$H_1: \beta_1 \neq 0 \text{ for at least one } j$$

4.8.3 T- Test Calculation for the teachers responses

To establish the statistical significance of each of the independent variables (X_{1-5}) at 95% degree of confidence, the researcher conducted a T-test whereby the statistically significant

indicators were those where the $T - \text{stat} > T_{k, n-1, \alpha/2} = T_{5, (31-5-1), 0.025}$

$$T - \text{Stat} > T_{5, 26, 0.025} = 2.056$$

According to the T – test, at 95% degree of confidence, (3.885166) X_1 , (3.818239) X_2 ,

(4.434930) X_3 , (3.591563) X_4 , and (3.260521) $X_5 > T_{k, n-1, \alpha/2} = T_{5, 26, 0.025} = 2.056$.

Therefore it implies that the calculated value of T - test statistics for the teachers is greater than the table value,

Thus from the given information it can be concluded that all the variables for the model are statistically significant, and they include ICT Infrastructure and access (X_1), ICT integration

(X2), Capacity for ICT use (X3), skills and Competencies (X4), and Challenges affecting ICT use (X5).

4.8.4 Regression analysis for the students

The output Table 4.18 represents the dependent variable Y versus independent Variables, X1, X2, X3, X4, and X5

Table 4.18 Regression output for the student respondent

Dependent Variable: Y
 Method: Pooled Least Squares
 Date: 08/27/12 Time: 17:05
 Sample: 1 79
 Included observations: 79
 Total panel (balanced) observations 79

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.322286	0.481860	-4.819419	0.0000
X1	0.370480	0.067681	5.473885	0.0000
X2	0.335571	0.071717	4.679078	0.0000
X3	0.393051	0.068680	5.722906	0.0000
X4	0.285627	0.067452	4.234550	0.0001
X5	0.439250	0.057290	7.667094	0.0000
R-squared	0.638969	Mean dependent var	2.686709	
Adjusted R-squared	0.614241	S.D. dependent var	0.805100	
S.E. of regression	0.500044	Sum squared resid	18.25321	
Log likelihood	-54.22441	F-statistic	25.83973	
Durbin-Watson stat	1.861476	Prob(F-statistic)	0.000000	

Table 4.18 show that R-squared was 63.9%, the mean dependent variable was 2.6867 and the results for the F-test are given as 25.83973.

The equation derived from the regression model 2 is as follows:

$$Y = -2.322286 + 0.370480 X1 + 0.335571 X2 + 0.393051 X3 + 0.285627 X4 + 0.439250 X5 - E_i$$

4.8.5 Hypothesis testing for the students responses

In order to ascertain the statistical significance of the model as well as the usefulness of each of the independent variables (X1-5), a T- test was used.

Null Hypothesis **H0**: $\beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \beta_4 = 0, \beta_5 = 0$

Alternative Hypothesis **H1**: $\beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0, \beta_4 \neq 0, \beta_5 \neq 0, \beta_i$.

Whereby, H_0 – Implies the model is not useful and H_0 - implies that the model is useful.

4.8.6 T- Test Calculation for the student responses

To establish the statistical significance of each of the independent variables (X_{1-5}) at 95% degree of confidence, the researcher conducted a T-test whereby the statistically significant indicators are those where the $T - \text{stat} > T_{k, n-1, \alpha/2} = T_{5, (79-5-1), 0.025} = T_{5, 73, 0.025} = 1.960$

According to the T- test calculation at 95% degree of confidence, (5.473885) X_1 , (4.679078) X_2 , (5.722906) X_3 , (4.234550) X_4 , and (7.667094) $X_5 > T_{k, n-1, \alpha/2} = T_{5, 73, 0.025} = 1.960$.

Therefore it implies that all the input variables for the model are statistically significant.

4.8.7 Summary Results in Regression Analysis

The results of the regression output in Tables 4.17 and 4.18 indicate that the R-squared for the teachers' responses were 68.09% and 63.9% for students' responses of the variations of the 5 predictors. The values show that there was approximately 68.09% of the teachers' responses and 63.9% of the students' responses in rate of improvement in quality learning and teaching in relation to ICT use. The parameters measured were well explained by all the independent variables indicated by X_1 , X_2 , X_3 , X_4 , and X_5 , which are significant predictors based upon population sample (P) value. Therefore this means that the regression equation shown is statistically significant.

4.9 Descriptive Analysis

The second set of analysis was based on a set of pooled questions that evaluated respondents' perception on variables associated with teachers and students ICT utilization in learning and teaching using mean and standard deviation. These questions were designed to give information that was related to use of Information and communication and technology to improve learning and teaching in secondary schools. It was aimed at assessing teachers and students perception on the extent of ICT infrastructure and access, level of ICT integration in the curriculum, capacity for utilization of ICT resources, skills and competencies of learners and teachers as well as challenges affecting use of computers in learning and teaching

Table 4.19 shows means and standard deviation of differences between teachers and students. All the results were identical.

4.19 Means and Standard deviation of respondents

bles	Teachers		Students	
	Mean	Std. Deviation	Mean	Std. Deviation
infrastructure and	2.935484	1.066076	2.764177	0.84599
integration in	2.720323	1.022159	2.633544	0.824505
lum ty for use of ICT	2.936129	1.086762	2.789241	0.870833
and competencies	2.891935	0.87530	2.911772	0.868743
ages facing ICT use	2.62903	1.0952	2.670886	1.037397

extent and level of ICT infrastructure, the teachers had a mean = 2.935484 and a std. dev. of 1.066076 against the students mean of 2.76417 and a std. deviation of 0.84599. The study credited teachers to the effective level in which their access ICT resources. On studying respondents' perception on ICT Integration in school curriculum, the results show that teachers fairly agree that there is more integration than the students. This is shown in the means and std. deviation of teachers (mean =2.720323 and std. dev. =1.022159) against students (mean 2.633544 and std. dev. 0.824505) respectively. Where as the same was noticed on the perception of teachers and students capacity for using ICT. This is also evident in their mean and standard deviation (M= 2.936129 and SD= 1.086762) against students (M =2.789241 and SD =0.870833). On studying the variable of skills and competencies there was a deviation in the results as the mean of the teachers was lower than students (Teachers' M= 2.891935 and SD = 0.87530 against students M =2.911772

and SD = 0.868743) this indicates that the students had a more positive attitude towards the use of ICT in Improving their learning and teaching. On analyzing the challenges affecting ICT in schools the results were fairly identical between the teachers and students. The teachers' mean was 2.62903 and SD = 1.0952 against students' mean of 2.670886 and SD = 1.037397.

Based on the means and standard deviations in the Table 4.19 between the teachers and students, it can be concluded that availability and access of ICT resources is needed for teachers and students to effectively utilize ICT to support teaching and learning process.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter gives a summary of findings, discussion, conclusions and recommendations with respect to the research objectives.

5.2 Summary of Findings

The objectives of the research were to help policy makers to make well informed decisions about public policy in regards to education at the secondary school level by understanding how use of information and communication technology can support and improve teaching and learning in secondary schools. The research has shown the extent to which ICT is being utilized, the level of availability of ICT facilities and ICT integration in the school curriculum, and identifies the factors that enhances or impedes ICT utilization in schools in relation to teaching and learning.

The findings show that the use of ICTs and its integration in the teaching and learning in secondary education is getting more wide spread, more pervasive among teachers and students as a means of communication and for information searching. Access rates for teachers were observed to be much higher than those of students with assumed positive impacts. The research also revealed that there was a positive correlation between proportions of students and teachers accessing the school computers, and this was evident mostly in public secondary schools where it appeared that investments in ICT was low resulting in the disparity. Though the study focused on schools which have integrated ICT in their schools, the proportion of teachers with access to computers and internet was 84% and 49% respectively, implying that internet connectivity is still expensive, inaccessible to most schools.

The research found out that most of the schools were not well equipped with ICT facilities such as computers, and software tools as well as computer laboratories and that there were no computers available in the classrooms except in the computer laboratories.

To establish capacity for using ICT facilities for teaching and learning, the results showed that 65% of the teachers had acquired training in ICT before joining the teaching profession and only 35% had no skills. Nevertheless, it is reassuring to note that there seems to be a reversal of trends with 55% of those who had not acquired training indicating that they were trained in the past three years, with the Ministry of Education and schools supporting their training programmes.

To establish the use of ICT in schools the findings from the research showed that majority of the teachers and students were positive about the use of ICT in enhancing teaching and learning. This was supported by the teachers who agreed by 61 % that the main reason for acquiring ICT skills was to enhance their teaching learning skills and keep pace with the changing technological times. The finding revealed that in all the schools under study, word processing and basic computer operations was most pronounced with 32% of the respondents agreeing. It was further revealed that computers were used for recoding progress marks for students as well as processing of examinations, while internet browsing was very rarely used.

The result findings for the challenges facing the use of ICT in secondary schools showed that teachers' lack of technological competence was the main barrier to the adoption of ICT in secondary schools. Lack of accessibility to computers was also cited as a major challenge. The findings showed that the lack of access to ICT resources including home access discouraged teachers from integrating ICT to their teaching. Most administrators indicated that they had few numbers of computers available in their schools.

With regard to use of ICT in the school curriculum. The study showed that policy planners at the Education Ministry had not come up with a curriculum to be followed in integrating the subject syllabus with ICT. Furthermore, current changes in technology, new advances in learning require that there is need for radical changes in teaching and learning methodologies to conform with the current technological trends this calls for promoting teaching and learning methodologies different from those used in the past. This involves from moving away from a rigid prescriptive approach in classroom work.

Finally, the research findings show that using ICT in the teaching learning process would result to improved quality learning and teaching, not only because the students enjoy the

instructional activities but because they are valuable factors that enhance the skills and capability of the learners and teachers.

5.3 Discussion

To establish the level of access and extent of use of ICT in secondary schools in Isinya District. The study revealed that ICT facilities such as computers, projectors and electronic notice boards, internet were inadequate in the secondary schools in the district. The study indicated that lack of access to ICT resources including home access discouraged teachers and students from integrating technology in learning and teaching. The findings from the study showed that teachers and students had difficulty in accessing computers and the internet; this was mainly due to inadequate ICT facilities in the schools. This finding agrees with Becta (2004) who stated that inaccessibility of ICT materials was as a result of the unavailability of the hardware and software. This was as a result of inadequate funding of the schools by the government and parents. This finding has grave consequences on the resourcefulness of the teachers. Even if the teachers are willing to learn and use ICT in their teaching the inadequacy of the facilities will hinder them.

The research revealed that teachers and students were to a little extent exposed to the use of ICT. These results suggest that teachers' computer competency is possibly related to their frequent use of word processing. The results are in agreement with those of Cuckle et al (2000) and Jegede et al (2007) who found teachers were most competent in word processing compared to other applications. A high proportion of respondents perceived themselves to be good in internet and spread sheets. It is however, not surprising for teachers to be more competent as these applications are most likely used daily. The research shows that there were low levels of ICT utilization in secondary schools within Isinya District. This indicates that still most teachers use the traditional method of chalk and talk, which make them lag behind in the world of ICT.

On the extent of ICT use, the study revealed that ICT was mainly used for teaching specific subjects such as computer studies and in keeping track of student performances as well as preparing students reports. However there was positive attitude towards the use of ICT and the realization by the teachers and the students that ICT could lead to enhanced learning and teaching in particular contributing to quality improvement in student performance. This was similar to the study conducted in Malaysia on the extent of ICT adoption among secondary

school teachers by Lau and Sim (2008), the finding suggested that most of the teachers and students were positive about the role of computers and appreciate the use of ICT in enhancing teaching and learning. The study further showed that the level of ICT and competencies were high among the Teacher with 84% expert level against the students with 78%.

To establish the capacity for using ICT facilities for teaching and learning in Isinya District. The study showed that in the schools covered a high proportion of the teachers and students lacked essential skills and knowledge in the application software needed for effective use of ICT to learning and teaching thus leading to limited use of computers. The teachers' lack of training reduced the integration of technology in learning and teaching. This finding agrees with the study carried by David et al (2003), on three Kenyan Secondary Schools which showed that newly recruited teachers were trained in use of ICT in word processing and internet applications. The study further identified that teachers' training on computer application and operation improves their use of ICT and professional effectiveness. The finding suggested that teachers need to undergo basic courses in using ICT in instruction to improve their teaching skills. Boakye and Banini (2008) argued that teachers need to seek and receive initial and ongoing training on how to use ICT and enhance their teaching.

Educational technological facilities may be available in schools but teachers can not use them because of lack of skills. Schools need to provide training courses for teachers to gain experience in dealing with emerging technologies. Additionally, schools must provide teachers and students with necessary ICT resources including computer hardware and software. Most of the teachers who could not use computers for teaching cited lack of skills in ICT. This is in support of the results of study conducted by Balanskat et al (2006) which showed that in Denmark many chose not to use ICT in teaching because of their lack of skills rather than for pedagogical reasons. Hence lack of teacher competence may be one of the strong barriers to low use of ICT in teaching and learning in secondary schools. From the research findings some initial training is needed for teachers to develop appropriate skills, knowledge and attitude regarding the effective use of computers to support learning and teaching.

On the study objective of the perceived benefits of use of ICT in schools. It was noted that ICT is used in schools to make teaching learning interesting, improving peer corroborative learning, helping teachers to keep pace with their work, and enhancing quality of work by

school teachers by Lau and Sim (2008), the finding suggested that most of the teachers and students were positive about the role of computers and appreciate the use of ICT in enhancing teaching and learning. The study further showed that the level of ICT and competencies were high among the Teacher with 84% expert level against the students with 78%.

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In the study objective of the perceived benefits of use of ICT in schools. It was noted that ICT is used in schools to make teaching learning interesting, improving peer corroborative learning, helping teachers to keep pace with their work, and enhancing quality of work by

both the students and the teachers. This is in agreement with the findings of Slaouti and Barton (2007) which reported that ICT can motivate students in their learning by bring variety into the lessons and at the same time sustaining their own interest. This finding agrees with Kwache (2007) who reported that the application of ICT makes Institutions more efficient and productive, enhance and facilitate pedagogical activities.

On the objective of the challenges affecting use of ICT in secondary schools ,the study revealed that inadequate ICT facilities was a major problem facing the utilization of ICT in schools in Kenya. This was attributed to the low level of funding in the school system. It was reported that if schools were well funded the school management would always make provision of purchase of ICT facilities. From the research it was found that computer purchases were not given priority in the annual school budgets and teachers were not allocated time on the school curriculum to use computers. At the same time scarcity of computer hardware and soft ware for instructional purposes and access to computers in school were some of the greatest challenges to the use of ICT in the schools surveyed. The lack of accessibility to ICT resources was closely related to several other key issues such lack of time for teachers to access the computers. The study further showed that most schools sampled lacked computer literate teachers. This finding is in agreement with Kwache (2007) who reported that lack of skilled manpower to manage available system and facilities for ICT hinders ICT use in schools in Nigeria. In his research he noted that most schools lacked computer literate teachers and ICT experts that would support and manage the application of ICT in the teaching learning process.

5.4 Conclusions

The following conclusions were made from the research. Firstly, the use of ICT and its integration in schools was getting more wide spread within the schools as access level to computers among the schools showed remarkable increase. Secondly, most schools were not well equipped with ICT facilities as there were very few ICT facilities within the schools sampled. Thirdly, there was lack of capacity for using ICT facilities for learning and teaching since only half of the teachers had acquired training in ICT skills. Fourthly, majority of teachers and students were positive on the benefit of use of ICT in enhancing teaching and learning, and finally teachers' lack of technological competence and was attributed to be the main challenge towards the adoption and use of ICT in secondary schools in Isinya District, Wajir County.

5.5 Recommendations

The report finally outlines specific recommendations for action at the national, county level as well as the school level. The recommendations made from the results of the study are.

1. There is a need for the government and school administrators to facilitate greater access to Information and communication Technology in schools.
2. Schools ought to ensure that computers for instructional use are increased in number and are accessible to teachers and students. This will facilitate greater access to ICT by students and teachers.
3. Purchase of computers and learning software should be budgeted for and acquired by schools in order to avoid reliance on donated computers and software.
4. Training of teachers in application and use of educational software programmes for schools' instruction should be undertaken by the various training institutions.
5. The Ministry of Higher Education should develop policies to guide the use of ICT in the secondary school curriculum. There is also a need to facilitate relevant content to meet the needs of students and teachers in schools in order to facilitate ICT learning.

5.6 Areas for further Research

The study has provided a starting point for further research on the impact of ICT utilization in secondary schools in Kenya. Firstly, further research should be conducted in order to obtain more concise information on the use of ICT, particularly on some indicators used in the conceptual framework of this study. Secondly, there is a need to carry out research on secondary schools which are connected and unconnected to the internet with a view of making comparative analysis of factors which determine use of ICT and student academic performance. Thirdly, it would be interesting to study the factors which determine ICT utilization in rural and urban secondary schools.

5.7 Contribution to the knowledge

The following contributions are made from the study: Firstly, the research will help policy makers understand the level of access and the extent ICT is integrated at the secondary school education in Kenya. Secondly, the study has provided an understanding of the level of availability of ICT facilities within the schools. This provides information on whether ICT is being integrated in school curriculum successful. Thirdly, the study will enable trainers and institutions of higher learning to set up policies of teacher training in order to incorporate ICT

skills and competences as findings from the research have shown that teacher training is a major impediment on the utilization of ICT in schools. Finally, the contribution of this research will offer insight on how ICT can lead to improved quality teaching.

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APPENDICES

Appendix 1: Introduction Letter to Teachers

Benson Kimoni Mwencha
OLTUROTO SEC SCHOOL
P.O. BOX 429
KITENGELA.
Kimonib916@gmail.com

Dear Sir / Madam,

RE: RESEARCH QUESTIONNAIRE

I am a Masters of Arts degree student at the University of Nairobi specializing in Project Planning and Management. I am carrying a research on the use of Information and Communication Technology to support quality learning and teaching in secondary schools in Isinya District, Kajiado County.

I have prepared a questionnaire to be filled by teachers in order to gather data for the research, and I write to kindly request your assistance in this academic endeavour by filling in the questionnaire. I would like to emphasize that your responses are extremely valuable and I would appreciate if you would answer all the questions. I assure you that that the data collected will be held in confidence.

Thank you in advance.

Yours faithfully,

Benson Kimoni Mwencha.

50/63965/2010

Appendix 2: Interview Schedule for School Principals

- 1 a) How many computers do you have in the school?
- b) How many hours would an individual teacher use computers per week?
- 2a) Do you have internet connectivity?
- b) How many hours would an individual use internet per week?
- 3 a) How many hours are the computers not in use per week?
- b) Why are the computers not in use during those hours?
4. Averagely, what is the level of expertise of the teachers and students?
5. What are some of the tasks the students and teacher use computers for?
6. Do teachers plan for the use of ICT in their scheme of work?
7. Has there been any ICT training for the teachers in the last three years?
8. What skills do you think teachers should have to enable them integrate ICT in teaching and learning?
9. According to you, why is the quantity of computers such low?
10. What are some of the policy intervention that can be used to increase the quantity of computer use?

Appendix 3 : Questionnaire for Secondary school teachers

Instructions:

Please tick in the relevant box and put the information that is appropriate in the blank spaces.

Date.....

SECTION A

1. Name of the school you teach.

.....

2. What is your gender?

Female []

Male []

3. How old are you?

Under 30 years []

30 - 40 years []

40 - 50 years []

50 - 60 years []

4. What are your qualifications? Please indicate specialization.

PhD. []

Degree []

Masters []

Certificate []

Diploma []

Others []

5. How many years have you been in teaching position?

.....

6. Which subjects do you teach?

.....

How many years have you used computers and related technology?

Less than 2 years []

More than 2 years []

More than 5 years []

Not at all []

Please indicate whether you have access to computers and internet in the follow locations.

Location	Access to computers		Access to internet	
	Yes	No	Yes	No
School				
Home				
Cyber café				
Others (Specify)				

Where do you use computers in your school? (Tick all that apply).

In my office [] Staff room [] Class room []
 Computer room [] Library [] others []

How many hours per week are the computers available to you?

How many hours per week is the internet available to you in school?

2 a) Did you receive any ICT training before joining the teaching profession?

Yes [] No []

If Yes, Where did you receive the training?

How would you rate your level of expertise in computer use? Tick that which applies.

Level of expertise	
NO Expertise - can not use computers at all.	
FAIR- able to operate basic computer functions and word processing application	

GOOD -able to operate office applications, word processing, spread sheet PDM.	
VERY GOOD - all the above and internet	
EXCELLENT- Including use of email, internet, WebPages , collaboration and on line surfing	

14. How frequently do you use ICTs for your school work related to the following purposes?

Purpose	Very often	Often	Rarely	Never
Teaching specific subjects				
Learning Specific subjects emerging professional uses				
Teaching, computer skills				
Finding and accessing educational materials				
Making presentations/ lectures				
Preparing lessons				
Communicating with students				
Communicating with other teacher				
Keeping track of students performances				
Preparing reports				
Others (State)				

5. State the subjects in which you have used ICT as a teaching / learning tool.

.....

6. Is the use of ICT in that subject planned for in the scheme of work?

Yes []

No []

17. Did you develop the tool/ support?

Yes [] No []

18. Do you think ICTs can be used for the purposes below?

	No	Yes	Not sure
Motivation/ reward students			
As a substitute for teaching			
As student Relaxation			
To impress Student and parents			

19. Did you receive any training in ICT in the last 3 years?

Yes [] No []

20. What would be your main reason for acquiring further ICT skills?

- Prestige [] Change of profession []
- Promotion [] Enhance Teaching and Learning []
- Other []

21. State two other skills apart from the above skills that you think are useful for ICT teaching learning process?

.....

.....

.....

22. State three competencies that a learner in school needs to develop.

.....

.....

.....

.....

.....

In which of the above mentioned competencies do you feel inadequate as a teacher?

.....

.....

SECTION B

1. Please indicate how applicable each of these statements is describing the importance of ICT infrastructure and access.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Disagree
The school all allows access and use of computers to teachers					
Does the number of computers influence the average hours per week computers are available to you.					
Level of access and use of e-mail and educational website enhances learning /teaching.					

2. Please indicate how applicable each of the statements is describing ICT integration in school curriculum.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Number of hours used in teaching ICT lessons is sufficient					
There is presence of educational soft ware such as Ms power point					
ICT is integrated in subjects taught in secondary schools					

3. Please indicate how applicable each of these statements is in describing the importance of ICT training and teacher experience in supporting teaching and learning.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The number of teachers with ICT training affects use of computers in learning and teaching					
The level of expertise in use of ICT directly influence quality of teaching					
There is use of internet for teaching and learning purposes in school					

4. Please indicate how applicable each of these statements is in describing the benefit of use of ICT to enhance skills and competencies of learners.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
ICT use contribute to student motivation for learning					
ICT enhances change in teaching methodology.					
Use of ICT improves teaching / learning confidence					

5. Please indicate how applicable each of these statements is in describing the challenges affecting integration of ICT use in teaching and learning in your school.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Policy and strategy of government and school enhances use of ICT in educational curriculum					
The number of computers available to the school is sufficient for implementation of ICT integration in learning and teaching.					

6. Please indicate how applicable each of these statements is in describing the use of ICT in Supporting learning and instructional activities in you school.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
There is increase in teacher/ learner collaboration					
The level of ICT usage has a direct impact on the quality of teaching and learning					
Use of ICT has a positive impact on student performance in examinations					
ICT has an effect on perception and attitude of learners and teachers on changes in learning and teaching					

Thank you for completing this questionnaire.

Appendix 4: Questionnaire for Students

Instructions;

Please tick in relevant boxes and fill appropriate information in the blank spaces.

Date _____

SECTION A

1. State the name of your school.
2. What is your gender? Female Male
3. Which year are you in?
 1 2 3..... 4
4. How many years have you been using computers and related technology?
 Less than 1 year 2 years
 3 Years 4 years and more
5. Where did you first encounter with computers?
 Primary school Secondary school
 Home Computer Cyber
6. How many hours per week are computers available to you?
7. How many hours per week is the internet available to you in school?
8. Where do you use computers in your school (Tick all that applies?)

Level of expertise	Tick the one that applies
No expertise, can not use computers at all	
FAIR able to operate basic computer functions and word processing.	
GOOD, able to use office application , word processing, spread sheet, presentation for school assignment	
VERY GOOD, able to use all the above skills including use of internet and internet resources	

If you use computers to learn other subjects state the subjects

.....

.....

Do you learn ICT in other subjects? Yes [] No []

If, Yes state some of these subjects.

.....

.....

Do you think ICTs can be used for these purposes?

Purpose	No	Yes	Not Sure
Motivate students			
As a subject for teaching			
Relaxation for students			

18. What would be your main reason for learning ICT in school? (Tick all that applies)

Prestige	
Improve students skills	
To enhance learning	
Internment	
Further Studies	
It's a requirement for job employment	
Others (State)	

ICT in secondary schools can be categorized four competencies given below.

19. Please rank the competencies in terms of the emphasis given to each in the school where you are learning.

1.- Really emphasized	1	2	1
2.- Slightly emphasized			
3 - Not emphasized			
ICT skills and concepts			
Use of ICT in learning and teaching.			
Collaboration and Networking amongst students and teachers			
School planning and recording purposes			

20. Do you think the current computer studies curriculum will prepare you adequately for further studies and job market?

.....

.....

21. If your answer in question 20 is No, What are the additional skills that you think should be included in the curriculum?

.....

.....

.....

SECTION B

1. Please indicate how applicable each of these statements is describing the importance of ICT infrastructure and access.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The school all allows access and use of computers to teachers					
Does the number of computers influence the average hours per week computers are available to you.					
Level of access and use of e-mail and educational website enhances learning /teaching.					

2. Please indicate how applicable each of the statements is describing ICT integration in school curriculum.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Number of hours used in teaching ICT lessons is sufficient					
There is presence of educational soft ware such as Ms power point					
ICT is integrated in subjects taught in secondary schools.					

Please indicate how applicable each of these statements is in describing the importance of ICT training and teacher experience to support teaching and learning.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The number of teachers with ICT training affects use of computers in learning and teaching					
The level of expertise in use of ICT directly influence quality of teaching					
There is use of internet for teaching and learning purposes in school					

4. Please indicate how applicable each of these statements is in describing the benefit of ICT use in enhancing skills and competencies of learners.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
ICT use contribute to student motivation for learning					
ICT enhances change in teaching methodology.					
Use of ICT improves teaching / learning confidence					

5. Please indicate how applicable each of these statements is in describing the challenges affecting use of ICT in your school.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Policy and strategy of government and school enhances use of ICT in educational curriculum					
The number of computers available to the school is sufficient for implementation of ICT integration in learning and teaching.					

6. Please indicate how applicable each of these statements is in describing the use of ICT in Supporting learning and instructional activities in you school.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
There is increase in teacher/ learner collaboration					
The level of ICT usage has a direct impact on the quality of teaching and learning					
Use of ICT has a positive impact on student performance in examinations					
ICT has an effect on perception and attitude of learners and teachers on changes in learning and teaching					

Thank you for answering the Questionnaire.

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Appendix 5: Secondary schools in Isinya District, Kajiado County

Number	Secondary School
1	Olturoto Secondary
2	Isinya Moi Girls
3	Kaptei Mixed.
4	Baraka Girls
5	Kings Educational School
6	Kitengela Boys
7	Gladfield School
8	Kitengela Intenational
9	Newlight High
10	Kitengela Girls
11	Norkopir Girls
12	Dawamu School
13	Maji Mazuri Sec
14	Isinya Mixed Secondary School
15	Muslim Girls
16	Vineyard Secondary