ASSESSMENT OF UTILIZATION OF INFORMATION, COMMMUNICATION AND TECHNOLOGY IN TEACHING AND LEARNING IN PUBLIC SECONDARY SCHOOLS IN KAJIADO NORTH SUB-COUNTY

By

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DECLARATION

I, the undersigned hereby declare that this thesis is my original work and has not been submitted for a degree award in any other university. Information obtained from other sources has been properly acknowledged.

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DEDICATION

I dedicate this thesis to my wife Rosemary and my children Gloria, Joan and Michelle.

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I thank God for His grace which has enabled me to successfully complete this thesis. I owe a lot my parents David and Teresa who have supported me throughout my masters' study. I thank my wife and children who were denied my time because of my school engagement.

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ABSTRACT

This study assessed the utilization of ICT tools in teaching and learning in public secondary schools in Kajiado North Sub County. The study was prompted by the need to awaken learners and teachers to utilize the available ICT tools so as to promote more innovative, creative, independent and collaborative teaching and learning. This study was hinged on the presumption that there are at least few ICT tools in most schools which were not appropriately used by teachers and learners to promote learning. The study was guided by the following research questions; what ICT tools are available? How are these tools used in teaching and learning? What are the obstacles to learning and teaching through ICT? What are the benefits of teaching and learning through ICT? What are the recommendations on effective teaching and learning through ICT? The research designs used were phenomenology and cross-sectional. Ten public secondary schools were randomly sampled. Ten principals were sampled purposively. Simple random sampling technique was used to choose 104 teachers whereas stratified and simple random sampling was used to choose 150 students. Data was collected through questionnaires and interview guides. Each Quantitative and qualitative data was analyzed singly and results converged in interpretation. Quantitative data was analyzed and interpreted through statistical Package for Social Sciences (SPSS) software package version 20.0 and was summarized and presented by means that of percentages, means, tables and pie charts. Qualitative data was analyzed and presented using narrative description. The study found out that the most available ICT tools in most schools are computers and printers, that many teachers were trained on teaching through ICT and that there was limited utilization of ICT in teaching and learning among teachers and learners in most schools. Most teachers used computers and printers for filling in marks, printing exams and learning materials while most students used computers for research, typing and storing data. The findings revealed that lack of electricity or generators, inadequate tools and resources, in-adequate knowledge on teaching and learning through ICT and lack of internet connection were the main impediments to learning and teaching through ICT. The study recommended training of teachers and students on ICT, technical support and collaboration with other schools on ICT in education so as to facilitate effective teaching and learning through ICT. Based on the findings, the study recommended that education stakeholders, that is; the government, parents, teachers, local community and students should be involved in planning, training and appropriation of ICT tools and resources in schools.

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ABBREVIATIONS/ACRONYMS

ICT- Information Communication and Technology

CAL- Computer Assisted Learning

SSA- Sub Saharan Africa

PDA- Personal Digital Assistant

WAP-Wireless Application Protocol

IrDA- Infrared Data Association

MMS- Multimedia Messages

MoEST- Ministry of Education, Science and Technology

GPRS- General Packet Radio Service

GSM- Global System for Mobile Communications

PC- Personal Computer

LCD- Liquid Crystal Display

OECD- Organization for Economic Co-operation and Development

SPSS- Statistical Package for Social Science

NEPAD- New Partnership for Africa's Development

CHAPTER ONE

INTRODUCTION

1.1 Background of the Problem

Information and communication technologies (ICT) which include radio and television, mobile phones, computers and internet have been touted as potentially powerful tools in expanding world economies through prompt exchange of information. Investment in tangible assets, including ICT equipment and software are the most important source of development. The leading role of ICT investment in the acceleration of growth in the G7 economies (an informal bloc of industrialized democracies which include; the United States, Canada France, Germany, Italy, Japan, and the United Kingdom that meet annually to discuss issues such as global economic governance, international security, and energy policy) is especially pronounced in the U.S, where ICT is coming to dominate the contribution of capital input (Jorgenson & Vu 2005). The application of ICT tools and resources provide access to worldwide information and allows for collaboration between people of different continents. Greater access to information and opportunities for collaboration can create job opportunities, transfer of skills, greater efficiency and transparency in business and politics (World Bank, 2004).

ICTs have impacted positively on various life sectors including education. When used appropriately, different ICTs facilitate access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by helping to make teaching and learning into an engaging, active process connected to real life (Tinio, 2002). The use of ICT in education is critical in promoting teaching and learning by facilitating skills like creativity and independent learning which are crucial in the 21st century. To be relevant, education has to be in

line with this advancement. In order to address the question of how students can actually get prepared for the 21st century, we need additional didactics in order to motivate the new generation to invest and participate in technology, hence stimulate economies and improve infrastructures. The knowledge economy of this century cannot be attained by teaching subject matter from the shelves, learners need to learn to excavate and exploit new concepts as creative acts. Learning and teaching should become a process of developing rather than transferring knowledge. In this respect it becomes highly vital to sketch architectures for interest-based learning communities for learners (UNESCO, 2004). ICT must therefore become an integral part of an education system. Education systems that ignore information technology will fail to produce a technically literate population and hinder a country's ability to compete in the global economy (World Bank, 2004).

The only way to achieve meaningful change in the ways in which computer technologies are used in education is to strive to engineer a radical overall and wholesale restructuring of the school curricular. Rather than tinkering around the technological edges, education technologists would be best served by lobbying for radical alterations to the way we structure and organize our systems/institutions/processes of lifelong learning (Selwyn, 2007). Despite huge efforts to position computer technology as a central tenet of secondary school education, the fact that many students and teachers make only limited formal academic use of ICT during their teaching and learning is less discussed by educational technologists.

Yuen, Law and Wong (2003) conducted case studies on ICT integration in teaching and learning in 18 schools in Hong Kong. They found out that ICT innovation adopted by the schools was affected by schools' objectives, their perception of ICT's role in education, as well as their understanding of teaching and learning and the part played by teachers and students. The

leadership role of individual schools played an important part in shaping the responses to ICT innovation. Important achievements in the schools under the technological adoption model were the readiness of the technical infrastructure and also the fact that most of the teachers were trained to be technically competent. Nevertheless, the challenge to the technological adoption model schools is how to move from an engineering approach, using ICT to automate or rationalize the tasks and processes in the school, to a reengineering approach which involves the fundamental rethinking of the nature of education using ICT and possible redesign of school processes.

Schools must place learning through ICT as a matter of urgency to provide relevant education and respond to the needs of our time. Conventional teaching has emphasized content. Teachers have taught chalk and wall with learning activities designed to consolidate and rehearse the content. Contemporary settings are now favoring curricula which promote competency and performance. Curricula is starting to emphasis capabilities and to be concerned more with how the information will be used than with what the information is (Sharma, 2011). Various reasons are given for this lack of integration of ICT in teaching and learning. The main obstacle though is resistance to change to the new educational demands. Njenga and Fourie (2008) discuss this resistance;

> Although infrastructure is often believed to be the most important stumbling block in implementing e-learning, it has been proven that resistance to change is the most difficult part of implementing new technologies like e-learning. Most of the models of diffusion and adoption of innovation try to understand or explain human perceptions, behavior or reactions to innovations (p.205).

Considering the level of poverty in Sub-Sahara Africa, it is ideal to ask whether it is reasonable to invest huge amount of money in ICTs for the educational development, instead of using such resources to meet other needs of the secondary education system in the region. The

rationale for integrating ICTs in education was substantiated in a report issued by the Organization for Economic Co-operation and Development on the impact of ICT in schools(OECD, 2001). In addition, the report showed different explanation for integration of ICT in education and therefore these include: Economic explanation that features a focus on the perceived desires of the economy and the needs to satisfy the ability and learning desires of the data economy. Social explanation that focuses on facility with ICT turning into a requirement for participation in society and employment therefore creating ICT a vital life ability and a basis for maintaining employability throughout life. Pedagogic explanation that concentrates on the role of ICT in teaching and learning and therefore the ways that during which ICT will increase the breadth and richness of learning, foster motivation for learning, and support the event of higher-order thinking skills (Evoh, 2007).

Boakye and Banini (2008) measured teacher' readiness to be embraced of ICT in schools in Benin, Cameroon, Ghana and Mali with the target of deciding if the teachers were concerned within the method of integrating ICT into education in these countries. Teachers were asked regarding their skills with relation to ICT and use of ICT in their pedagogic practices. Of the lecturers questioned, 71 had never used the computers at school, 100% used it for classroom activities. About a quarter mile had never used them in preparing lesson notes whereas forty ninth did. Despite the very fact that some lecturers did not use ICT in learning often , they were in agreement that computers modified the manner students learn. Based on these findings, going forward it is important to assess the extent to which the available ICT tools are used in teaching and learning especially among teachers in public secondary schools. The end of this investigation is to elucidate the reasons for inappropriate use of these tools in most schools.

Kenya promulgated a National ICT Policy in January 2006 that aimed to enhance the livelihoods of Kenyans by guaranteeing convenience of accessible, efficient, reliable and cheap ICT services. The Ministry of Education, science and technology was tasked with the event of curriculum content to be used on the digital platform, identification of beneficiary primary schools, capability building and training for teachers and different relevant education stakeholders (ICT Authority, 2015).Teachers' personal theories and perceptions about teaching and learning processes and their level of competence with ICT play a major role in how they implement ICT and how they motivate themselves to use ICT tools in the classroom. Wanjala (2013), did a study on teachers' perception on the use of ICT in education. She found out that successful adoption of ICT depends on positive attitude of teachers. Mbaluko (2009), assessed the preparedness for implementation of ICT in learning and teaching. She found out that the role of teachers was pivotal for successful integration.

Ayere, Odera and Ogak (2010), conducted a study on e-learning; a case of NEPAD e-schools in Kenya. They found out that e-learning produces significantly better results in teaching and learning outcomes in secondary schools. The study also found out that pupils' attainment improves when using ICT because they spend more time working at or practicing the skills being studied. Furthermore, computers enhance increased practice at particular tasks which promote learning like creativity and innovation. The study recommended that every school that had ICT programme be connected to the internet and acquire e-content relevant to the curriculum taught.

Mingaine (2012), studied leadership challenges in implementing ICT in public secondary schools in Meru county. She found out that leaders supported implementation of ICT in their schools and they had put some effort to acquire ICT infrastructure. However, very few teachers, if any, use them in meaningful way due to lack of essential visions and knowledge to lead

implementation of ICT in their schools. School leaders were afraid that ICT infrastructure would be damaged by teachers and student in the process of teaching and learning. This had curtailed innovative use of the facilities by the school community.

The reviewed literature on implementation, integration, and use of ICT in teaching and learning, show that there were at least few ICT tools in most schools. These tools promote better learning by making learners more innovative, independent, participative and enhance student centered learning. The literature seldom tackles the extent to which individual teachers utilized these tools in teaching and learning and the perceptions and attitudes among teachers and learners to education through ICT. This study therefore assessed the extent to which ICT tools are utilized in public secondary schools in Kajiado North sub-county and the obstacles which hinder effective usage of ICT in teaching and learning.

1.2 Statement of the Problem

According to the Ministry of education, there is limited capability for effective use and maintenance of ICT infrastructure in educational institutions. Most schools use less than 40% of the available ICT infrastructure and therefore there is need to ensure optimum use of ICT resources by students, teachers and administrators in order to exploit the educational potential of technology. Furthermore, very few schools were using ICT as an alternative method for the delivery of the education curriculum (MoEST, 2006). According to the District Education Officer in Kajiado North sub-county, each head teacher is tasked with the responsibility of promoting effective and adequate use of ICT in learning. This is in response to the government directive on digitization and computer literacy; to emphasizing integration of ICTs in teaching curriculum at all levels of education; establishing educational networks for sharing educational resources and promoting e-learning at all levels. Evaluation reports from school principals on the implementation, use and impact of ICT in teaching and learning, shows that not many teachers adequately used ICT in teaching and learning (Karanja, personal communication, January, 2017)

The Ministry of education provided some ICT tools in many public secondary schools in the year 2013. School heads were tasked with the responsibility of ensuring implementation and integration of ICT in learning. However many school principals had not facilitated a spirited integration of those tools in learning. Some of ICT tools were kept in the head teachers' offices which implied lack of goodwill from many principals in Kajiado North sub-county to lead a full and effective utilization of ICT in teaching and learning. Teachers who get trained on instruction through ICT end up not using their knowledge in class due to lack of support from head teachers, or sometimes individual perceptions (J. Wakhu, personal communication, 2017). There was need

therefore to find out the extent to which teachers were utilizing the available ICT tools in learning and teaching in Kajiado North sub-county.

Tanui, (2013) studied principals' role in integrating ICT in learning and found out that though there are ICT software available in most schools, there is no requirement in the roles of principals which expected them to effectively implement utilization of the available ICT resources. Mbaluko, (2009) discussed the challenges facing teachers in integration and use of ICT in teaching and learning. He found out that most ICT teachers were illiterate or have little knowledge on teaching through ICT. Majority of schools had computers and printers to type and print examinations and official documents (Wahome, 2011). Kessy, Kaemba, and Gachoka, (2006) discussed several reasons for under-use of ICT in education in the African context. They found out that the cost of adopting ICT including, acquiring hardware and software, setting up telecommunication networks, and the maintenance and repair of facilities is often prohibitive for developing nations.

From the reviewed studies, it was evident that most schools had a number of ICT tools though not sufficient. However the studies scarcely discussed how these tools are used in teaching and learning and the obstacles that prohibited optimum utilization of these tools teaching and learning. Therefore this study assessed the extent to which these tools are used in teaching and learning through classroom delivery, communication with other learners, research and innovative learning in Kajiado North Sub-County.

1.3 Research Questions

This study was guided by the following research questions;

i. What ICT tools are available in most secondary schools in Kajiado North sub-county?
ii. How do teachers and students use ICT tools in teaching and learning in Kajiado North sub-county?
iii. What are the benefits of teaching and learning through ICT in Kajiado North sub-county?
iv. What obstacles hinder effective teaching and learning through ICT in Kajiado North sub-county?
v. What are the recommendations and policy frameworks on effective teaching and learning through ICT in Kajiado North sub-county?

1.4 Significance of the study

This study was motivated by the fact that the resourcefulness and effectiveness of ICT in promoting educational skills such as problem solving, high thinking order and independence of learners had not been explored by teachers. The study is aimed at calling on teachers to use the available tools appropriately to promote teaching and learning; the available tools start with their mobile phones to other ICT tools available to them.

The study is also intended to inform the school community like teachers, parents, learners and other educational officials in the county on the need to prioritize the appropriation of the ICT tools in schools. Education officials and school managers were to be informed on the need to facilitate more synergy on provision of ICT tools, organizing short courses and workshops for teachers on learning through ICTs and the need to offer technical support to teachers and learners

for learning through ICTs. The study will also be significant to teachers and other curriculum developers to plan for continuous evaluation of learning through ICTs in schools by pointing out the impediments to effective education through ICTs.

1.5 Theoretical Framework

This study was guided by the Diffusion of Innovation theory. Diffusion of innovations theory seeks to elucidate how, why, and at what rate new concepts and technology unfold through cultures. Everett Rogers, a professor of communication studies, popularized the idea in his book Diffusion of Innovations. Rogers argued that diffusion is the process by which an innovation is communicated through sure channels over time among the participants during a social structure. The origins of the diffusion of innovations theory are varied and span multiple disciplines. Rogers proposed that four main parts influence the spread of a brand new idea: the innovation itself, communication channels, time, and a social structure. This method depends heavily on human capital. The innovation should be more adopted so as to self-sustain. Among the rate of adoption, there's some extent at that an innovation reaches crucial mass (Rogers, 2010).

Diffusion scholars believe any population or social network can be broken down into five segments, for any given innovation: Innovators, Early adopters, early majority, late majority and laggards Innovation process begins with a tiny number of visionary, imaginative innovators. They often lavish great time, energy and creativity on developing new ideas and gadgets. The group of early adopters is always on the lookout for a strategic leap forward in their lives or businesses and is quick to make connections between clever innovations and their personal needs. Early majorities are pragmatists, comfortable with moderately progressive ideas, but will

not act without solid proof of benefits. The late majority are conservative pragmatists who hate risk and are uncomfortable with new idea. Lastly, laggards hold out to the bitter end. They are people who see a high risk in adopting a particular product or behavior (Robbinson, 2009).

1.5.1 Strengths of the Theory

The positive impact of innovation theory is embedded on its contribution to adoption process. First it brings the notion that the innovation itself is important. Apart from re-emphasizing communication channels and their influence, and the nature of the social system in which the potential adopters are embedded, it adds the extent of change agents' promotion efforts as a contextual factor (Botha & Atkins, 2005).

Pro- innovation theory is in tandem with the global call of digitization. ICT responds to this urge of becoming a global village of networking, researching and innovating. The government of Kenya supports this through e-Government Strategy, which was adopted in 2004, emphasizes transformation of Government services from manual to digital-based operations. The Government's specific objectives embrace improved coordination of state agencies to reduce duplication of efforts and to boost efficiency in utilization of resources, to enhance the competitive position of the country through provision of timely information and delivery of services. Other objectives are to cut back transaction costs, and to interact citizens and also the non-public sector through digital and on-line service provision (MoEST, 2006).

Innovation theory supports the fact that agents of communication (teachers in this case) play an enormous role in implementing the use of new technologies in learning. They belong to the category of early adopters who accept new innovations for their personal use and pass it to the learners. Teachers see ICT as kindling students' interest and learning in the subject. ICT

promotes a positive attitude towards information technology as an essential part of a lifelong interest in learning. Teachers also perceive the use of ICT as enhancing recall of previous learning, providing new stimuli, activating the learner's response, and providing systematic and steady feedback (Hennessy, Harrison & Wamatoke, 2009).

1.5.2 Weaknesses of the Theory

Diffusion is troublesome to quantify as a result of humans and human networks being complicated. It's very tough to measure what precisely causes adoption of an innovation. Diffusion theories will never account for all variables like the perceptions and attitudes which hinder utilization of ICT and so may miss vital predictors of adoption. The theory does not consider the possibility that people will reject an innovation even if they fully understand it. Insufficient consideration is given to innovation characteristics and how these change over time. It is technology driven because of its pro-innovation bias.

Pro-innovation bias implies that all members of a social system should adopt innovations and adoption should happen more quickly. It does not take into account the fact that diffusion and adoption may fail because it was a bad idea to begin with and it focuses on the individual adopter and thereby ignoring social structures. (Botha & Atkins, 2005). Lastly the nature of the utilization of knowledge in diffusion of innovations is further complicated by contrasting straightforward adoption (replication) versus re-invention (adaptation).

The study mitigates the pro-innovation bias of this theory by going beyond the stages of innovation to various social and individual perceptions on utilization of technology. The social perceptions include; the view that technology is a bad influence to character development of children and it is expensive to apply technology in learning. This is not the case as there are

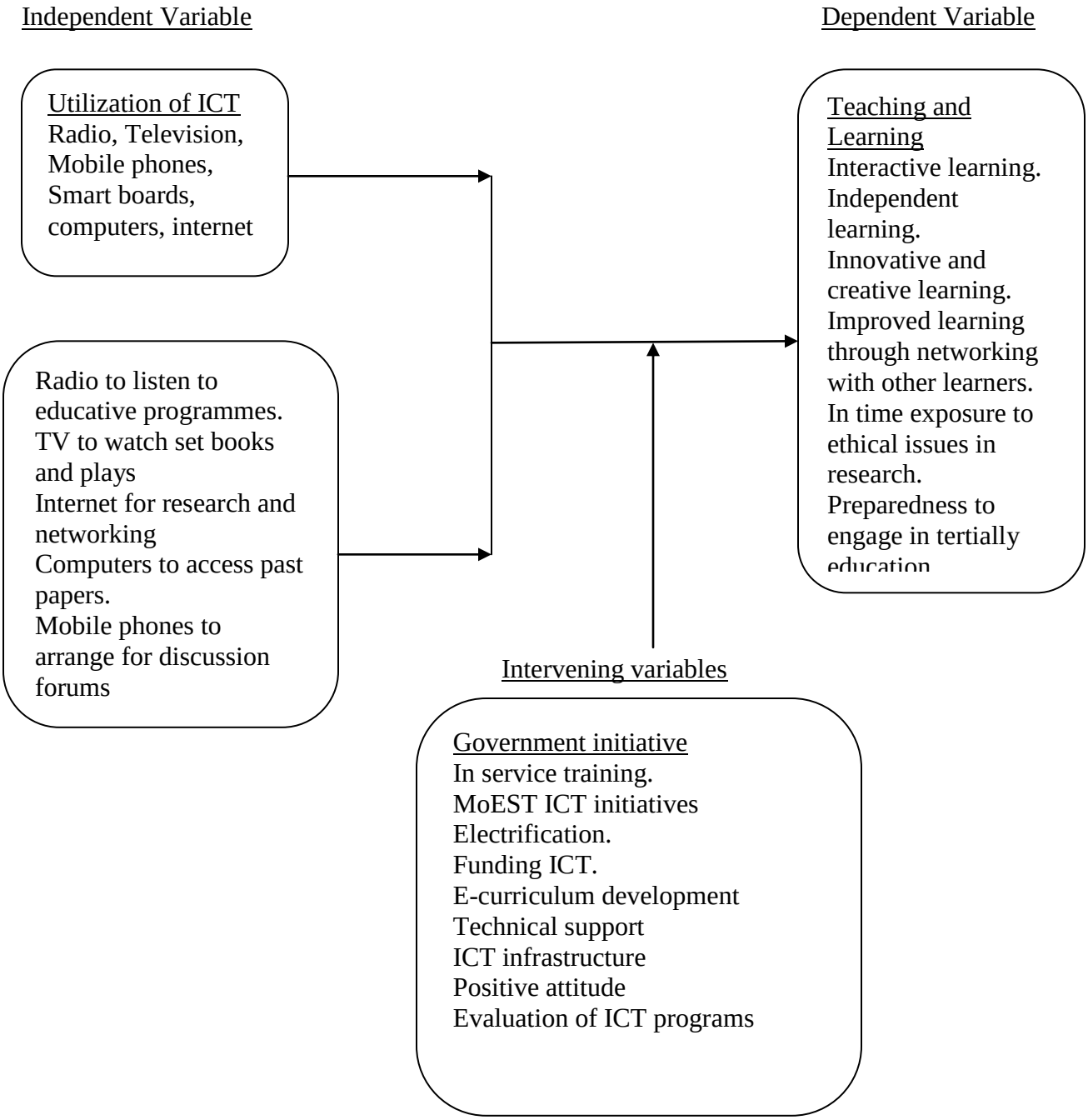
many benefits of learning through technology as discussed in this study. The individual attitudes to the use of ICTs in education range from incompetence on teaching through ICTs to viewing ICTs as added workload.

1.5.3 Application and Justification of the Theory

This study was guided by this theory because implementation of anything new largely depends on powerful communication agents; a role which is largely entrusted to teachers. The stages of adoption provide a procedural approach to teacher initiative in integration of ICTs in education. The knowledge and persuasion stages can be interpreted to the level where teachers get to acquire some of the ICT tools like a computer and learn how to use them in instruction. Knowledge on how to type, print, tabulate marks by use of excel, use internet for research and engaging other learning communities is acquired.

On the decision stage, the benefits of ICTs in education are spelt out by formative and summative evaluations on the progress of the learners towards achievement of the learning objectives. The ethical considerations based on the class and age of learners is looked at. The implementation stage follows where the use of ICTs in education is the main focus. As in the diffusion of innovation theory, individual teachers assess themselves whether they are researching more on the content and teaching in general, can they type, print, use PowerPoint for presentation in class, e-mail and use internet to network with other learning communities. Finally on confirmation, there should be continued update on better ways of integrating ICTs in education. Innovation skills are acquired by exposing learners to wide perspectives of knowledge and training on the ability to critique the existing ideas. ICTs promote this because of the knowledge network through internet and independent learning.

1.6 Conceptual Framework



Source: Synthesis from reviewed literature and research questions.

Independent variable is what can be manipulated to produce some results. It points to the resources educationists put in place to adequately utilize ICTs in teaching and learning. Some of the resources available include; radio, television, computers, Internet, projectors and in few cases smart boards.

Intervening variable refers to the measures put in place for successful learning through ICT. These are strategies put in place for the easy manipulation of the independent variable. It involves the government initiatives in supporting learning through ICTs by training, funding, infrastructural development like electrification and curriculum development. It also implies the change of attitude from the view that it is an added workload and an affront to the teacher's competence to better utilization of technology for improved learning. Teachers' initiative to be competent users of technology is also a controlling variable for better utilization of ICTs in learning.

Dependent variable is the product or outcome of teaching through ICTs like making learners independent by enabling them to possess the learning materials, enhancing creativity and innovation through research, interactive learning through more frequent use of learning sites like linked-in and collaboration with other learning communities, early exposure to principles of research and more specifically the ethical issues guiding research and scholarship and lastly good preparation to tertially education of research and scholarship.

1.7 Scope and Delimitation of the Study

The study was confined to public secondary schools sampled from Kajiado North sub-county because of the funding they receive. The sub-county has 28 public secondary schools categorized into sub-county, county schools and national schools. Kajiado North sub-county was

chosen because of its rural and urban coverage which yielded representative educational findings applicable to other public secondary schools in Kenya. The study was limited to utilization of the available tools in schools and among teachers. The extent to which these tools are put into good use was the main focus of the study.

The target groups were principals, teachers and students in these schools. The Ministry of education representatives at the sub-county level was also targeted to provide data on the resources available for the acquisition of ICT tools and the evaluation reports on the effects of learning through ICT.

1.8 Operational Definition of terms

Learning: Is the individual process of constructing understanding based on experience from a wide range of sources.

Asynchronous Learning: Learning at different times through the use of use technologies such as email blogs, wikis, and discussion boards, as well as web-supported text.

Perception: Understanding and interpretation of innovation with regard to individual and community concerns.

Blogs: Is a discussion or informational site published on the World Wide Web consisting of discrete entries or posts typically displayed in reverse chronological.

E-learning: Refers to the use of electronic media and information and communication technologies (ICT) in education, web-based training (WBT) and online education.

G-7 economies: The G7, or G-7, is a group consisting of the finance ministers of seven developed nations: the U.S., Japan, France, Germany, Italy, U.K. and Canada.

PC software applications: The term software refers to the set of electronic program instructions or data a computer processor reads in order to perform a task or operation.

Synchronous Learning: Involves the exchange of ideas and information with one or more participants during the same period of time.

ICT: These are the Information and Communication Technologies taken as tools and resources.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This section reviews the related literature on learning through ICTs. The review follows a global, regional and local presentation. The subsections are derived from the research questions. The subsections were; The rationale of ICT in education, learning through ICTs in Kenya: government policy, using ICT tools in teaching and learning, obstacles to effective learning through ICT, mitigation of obstacles to effective teaching and learning through ICT and benefits of teaching and learning through ICT. The chapter ends with a demonstration of the research gap.

2.1.1 Review of Related Theories

The study reviews two major theories of learning, namely; behaviorism and constructivism. Skinner and Watson, the two major proponents of behaviourism found out that learning is full of changes within the environment. Through their studies, they proved that behavior can be foretold and controlled. Piaget and Vygotsky were robust proponents of constructivism who viewed learning as a pursuit for meaning and represented components that helped predict what students perceive at totally different stages of development. Behaviorists believed that only evident, measurable, outward behavior is ought to have scientific inquiry. Hence, their focus was on learning as full of changes in behavior. They concluded that given the proper environmental influences, all learners acquire identical understanding which all students will learn. In contrast to the beliefs of behaviorists, the constructivists viewed learning as a research for meaning. They believed that information is built by the learner which the learner develops her/his own understanding through experience. Whereas a behaviorist would still cross-

check the content to be learned and also the influence of the atmosphere upon that learning, a constructivist would be more interested in knowing how the learner is making an attempt to construct meaning (Nawaz & Kundi, 2010).

Constructivism advocates that reality does not exist out there objectively rather it is constructed by the human beings subjectively. It is not predictable in total rather most of it depends on the human interaction with the situation resulting into human perception (giving meaning), which in turn draws the picture/image of reality. The constructivist theories of learning dominate today and propagate that learning is achieved by the active construction of knowledge supported by various perspectives within meaningful contexts and social interactions (Oliver, 2002). These environments create engaging and content-relevant experiences by utilizing ICT tools and resources to support unique learning goals and knowledge construction. The constructivists believe that there is no single version of reality, rather a multitude of realities situated within each learner. The strengths of constructivism lie in its emphasis on learning as a process of personal understanding and the development of meaning where learning is viewed as the construction of meaning rather than as the memorization of facts. Learning approaches using contemporary ICTs provide many opportunities for constructivist learning through their student centered environments based on their context (Nawaz & Kundi, 2010).

Two perspectives of constructivism should be taken into account; cognitive and social constructivism. While cognitive constructivists believe that learning takes place through interaction with environmental stimuli alone, social constructivists argue that culture also influences the design and development of the learning models. It is necessary to move education through ICT beyond learning management systems and engage students in an active use of the

web as a resource for their self-governed, problem-based and collaborative activities like using social software (Dalsgaard, 2006).

Along the continuum of objectivist/realist to constructivist modes of pedagogy, learners find changing learning environments. Under behaviorist model, students have to depend on teachers only. There is one-way communication and actions of teachers rather than their interaction with the students. On the other extreme of social constructivist learning environments, learners follow self-designed, self-controlled and socially collaborative learning-tracks. The middle stages of this continuum are characterized by a mix of both the absolute positions. Teachers still plays the dominant role but student is given the liberty of apply his/her cognitive powers to construct knowledge along with learning from teacher (Nawaz & Kundi, 2010).

Social constructivism emphasizes collective learning where the role of teachers, parents, peers and other community members in helping learners becomes distinguished. Social constructivists emphasize that learning is active, contextual and social, therefore the best method is group-learning where teacher is a facilitator and guide (Tinio, 2002). Social constructivists explain the technology adoption as a process of involving social groups into the innovation process where learning takes place on the learners' experiences, knowledge, habits and preferences. In contrast to traditional classrooms where teachers used a linear model and one-way communication, the modern learning is becoming more personalized, student-centric, non-linear and learner-directed (Nawaz & Kundi, 2010). The cognitive and social constructivism tenets guided this study so as to assess the importance of utilizing ICT tools in learning and teaching.

2.2 ICT Tools Available in Schools

There are various technologies employed in education through ICTs. The most common one is the use of computer in learning. Through the use of the different software applications, computers are necessary tools which facilitate learning. According to Rallis (2000), facilitators and learners can use computers in teaching in the following ways; Instead of writing on the board, teachers or students take notes on the computer and projects this onto the screen so the whole class can see this. The notes can then be saved as a record of class (summary of class discussion or group work) then e-mailed to the whole class or posted on the course web page.

Power Point slides are another way through which computers can be used in teaching and learning. Pre-prepared overhead transparencies or video are used to create own presentations for class and uploading these to course web page. Power point is also used in the following way; presentations that come on CD with textbook where students give presentations in class present assignments. On the same note, internet is used to read specific web pages as assignments. In this, student research for sites on specific topics as teacher integrates web sites into teaching of lesson (projecting sites on to the screen), having students use specific sites during class, either working in groups, using their laptops, or in computer lab, with one or two students per computer. An online discussion forum is another way ICT is used in teaching and learning. Here students continue class discussions outside class and outside 'speakers' can join in class discussions online using folders within the discussion forum. Students can "meet" online to do group projects. Student can also create web pages where they engage in an on-line portfolios of their work, on particular tasks or topics and as means of them sharing their work with peers (for group assignments) or with their teacher. Computers too are used for e-mail; this helps the teacher to provide updates and reminders to students and to e-mail students copies of work

developed in class. For example instead of writing on the board, teachers or students take notes summarizing class discussion or group work, and then this is e-mailed to the whole class (Rallis, 2008).

Other mobile devises are used in education through ICTs. This is famously referred to as m-learning which is an element of eLearning. This can be achieved by the utilization of mobile and moveable devices like personal digital assistant, cell phones, portable computers and tablet. For these tools to be integrated properly in teaching and learning, they need to have the power to attach to different laptop devices, bring out instructional information exchange information between the students and also the teacher. The main types of mobile devices used in the education process as noted by Georgiev, Georgieva, and Smrikarov (2004) are: Note-Book computers which have such abilities as desktop personal computer but are small in sizes and support wireless communications. Tablet PC; they have full range of abilities as personal computers. The main difference is that some of them don't have a keyboard but have software to recognize handwritten text. Personal Digital Assistant (PDA); they are in small sizes but have significant processor power. New models of PDA support more than 65000 colors, recognize handwritten text and can play different types of multimedia files. Cellular phones; good cellular phones of higher class can be used for internet access through WAP or GPRS technologies. They also can be used to send and receive the multimedia messages (MMS).Smart Phones; they are hybrid devices which combine the abilities of cellular phones and PDA. They are relatively small in sizes than PDA and bigger than cellular phones. They do not have full sized keyboard and can recognize handwritten text.

The mobile devises use various technologies like: Global System for Mobile Communications (GSM) which provides integrated voice mail, high-speed data, fax, paging and

short message services capabilities, as well as secure communications. Wireless Application Protocol (WAP) which is a free unlicensed protocol for wireless communications. WAP makes possible creation of better communications services and access to Internet pages from a phone. General Packet Radio Service (GPRS); it enables high-speed wireless Internet and other data communications. GPRS provides about four times greater speed than conventional GSM systems. Bluetooth wireless technology; is a short-range radio technology. Bluetooth makes it possible to transmit signals over short distances between telephones, computers and other devices and thereby simplify communication and synchronization between devices. IEEE 802.11; is a type of radio technology used for wireless local area networks (WLANs). Infrared Data Association (IrDA); it makes it possible to exchange data between two devices, up to 1 or 2 meters apart (20 to 30 cm for low-power devices). Smart phones, many PDAs, printers and laptop computers use IrDA protocols (Georgiev, Georgieva, and Smrikarov 2004).

Tools that support education through ICT cover a good range of applications. They embrace discussion forums, chat, file sharing, video conferences, shared whiteboards, e-portfolios, weblogs and wikis. Such tools are often used to support completely different activities concerned within the learning method. The question of organizing ICT tools involves the problem of integration versus separation. On the one hand, it's attainable to integrate different tools in a one complete system, a learning management system, also referred to as virtual learning environments or e-learning systems (such systems include chalkboard, WebCT, Moodle). On the other hand, ICT tools are often separated in a variety of distributed and freelance applications used for various purposes (Rallis, 2008).

The use of ICT in learning and in particular computer and networking communication to support teaching and learning include a wide range of applications, for example using a word processor to enable redrafting of an essay, running a simulation to test a prediction in science, developing cross-cultural understanding through computer conferencing and others. Learning through ICT is used to describe situations where ICT facility becomes the whole learning environment by providing learning materials and acting as assessor and tutor. A matrix produced to help schools determine the stage of development suggests that ICT evolves from being a separate subject, through integration, towards a transforming role in which ICT is accepted as a pedagogical agent in itself. In this process a suggestion that ICT as a subject no longer needs to be taught can be inferred, it should be used in learning different subject areas. To move to this phase of teaching through ICT, the school chooses to implement an ICT-curriculum that increases the use of ICT in various subject areas with specific tools and software (Unesco/IFIP, 2000 in Webb, 2002**).**

According to Gonzalez (2010), learning through ICT is resourceful in the following ways: As a source of information; in this conception the Web is mainly seen as a medium for the students to retrieve information. Teachers upload lecture notes, papers and direct students to websites for subject resources. For individual and independent self-paced learning; the Web is seen as a space that may provide the opportunity of engaging with subject analysis or subject drills that could lead to learning. For group analysis, decision making and dialogue; the Web is seen as a space in which learning relationships may be developed. It implies a more sophisticated use of the Web, which allows interaction among participants.

There are various technologies employed in education through ICTs. The most common one is the use of computer in learning. Through the use of the different software applications,

computers are necessary tools which facilitate learning. According to Rallis (2000), facilitators/ learners can use computers in teaching in the following ways; Instead of writing on the board, instructor or a student takes notes on the computer and projects this onto the screen so the whole class can see this. The notes can then be saved as a record of class (summary of class discussion or group work) then e-mailed to the whole class or posted on the course web page. Computers can be used for PowerPoint presentation, internet, online discussion forums among others uses. Other mobile devises are used in education through ICTs. This is famously referred to as m-learning which is an element of eLearning. This can be achieved by the use of mobile and portable devices such as PDA, cell phones, portable computers and Tablet PC. They must have the ability to connect to other computer devices, to present educational information and to realize bilateral information exchange between the students and the teacher.

Wastiau et.al (2013) did a survey on ICT in education in schools in Europe. They found out that; Laptop and tablet computers and mobile phones are increasingly seen as useful in education offering portability and choice as to when and where to use them. In order for a specific device to be used optimally, certain technical and organizational conditions must be fulfilled. A tablet was found to be best used together with a wireless network and a wireless data projector which enabled it to be moved around between pupils in class, something which is difficult to organize with laptops that are physically connected to an interactive whiteboard (IWB) for example. There is also a growing body of evidence on the impact of IWBs on learning. This survey was done on a totally different context from the foregoing study, the European level of digitalization is far beyond the Kenyan context. Therefore a study needed to be carried out to assess the utilization of ICT in education in Kajiado North Sub-County.

Tools used to support e-learning cover a wide range of different applications. They include discussion forums, chat, file sharing, video conferences, shared whiteboards, e-portfolios, weblogs and wikis. Such tools can be used to support different activities involved in the learning process. The question of organizing e-learning tools involves the problem of integration versus separation. On the one hand, it is possible to integrate different tools in a single stand-alone system, a learning management system, also called virtual learning environments or e-learning systems (such systems include Blackboard, WebCT, Moodle). On the other hand, tools can be separated in a number of distributed and independent applications used for different purposes. One way and probably the best way of integrating learning through ICTs is through online learning. This allows a revolution from only classroom mode of teaching to independent study, computer-based instruction, computer-assisted instruction, videoconferencing and Web-based instruction (O'Neil et al, 2004).

In a comparative study, Dabbagh and NannaRitland (2005) examined the differences between traditional and online learning environments. They found out that, traditional learning environments are bound by location and presence of instructor and student, presented in real time, controlled by an instructor and are linear in teaching methods. Using evolving information and communication technologies, asynchronous communication and real-time information, online teaching and learning environments are unbound and dynamic. Online learning environments include diverse range of pedagogical practices and are often characterized by active learning student-centered pedagogical techniques. This research focused on the advantages of ICT in education, an analysis on availability, usage and obstacles the effective usage is missing. The current study focused on these neglected areas.

As new technologies emerge, instructional designers and educators have unique opportunities to foster interaction and collaboration among learners, thus creating a true learning community. Teachers must not be left behind on this because this is a global necessity and more so an educational demand. There are several critical developments now transforming social and cultural life outside and inside institutions of learning around the globe based on new possibilities brought about by techno-instruction and cyber-instruction. These developments have enormous implications for pedagogical practice and the educational preparation of university students and their lecturers, even in Kenya. Techno-ignorance and info-shyness is converting many teachers and instructors across the world into academic and scholarly dinosaurs before their time (Amutabi, 2004).

Keengwe and Kidd (2010) analyzed an evolution of educational characteristics of online education. From 1975 to 1985 the focus was more behavioral based on programming to build tools and solve problems. This was more like local user-computer interaction. From 1983 to 1990 the focus was on computer training where there was an insistence on the use of Computer Assisted Learning models with interactive multimedia courseware. Constructivist influences begin to appear in educational software design and use. From 1990 to 1995 the concentration switched to internet-based content delivery. Active learner models were developed and constructivist perspectives were common. From 1995 to 2005 the focus shifted to internet-based flexible courseware delivery where there was an increased interactivity, online multimedia courseware, distributed constructivist and cognitive models common and remote user-user interactions. From 2005 to present the shift has gone to interactive distance courseware distributed online through learning management systems with social networking components.

Mostly in this age learning is facilitated through wireless device such as a PDA, a smart phone or a laptop and learning with portable technologies where the focus is on the mobility of the learner.

Through technology, interaction and collaboration are now attainable in either asynchronous or synchronous learning networks. The emergence of social software that enables a group of individuals to collaborate through the Internet has added a new dimension to online learning. The versatility of social software and other collaboration tools available today support constructivist environments that seek to motivate, cultivate, and meet the needs of the 21st-century learner (Beldarrain, 2006). E-Learning has enabled the curriculum of the educational institution to be more efficiently recorded and transmitted to learners in many different contexts. It has enabled every institution to become a potential distance learning provider and it has encouraged many students and teachers to change the meeting times and places that they use on a daily basis. Today students who still meet in formal classes will ask for many aspects of their course to be provided online so that they can access them while managing a complex work and study schedule (Hedberg, 2006).

Tondeur, Krug, Bill, Smulders, and Zhu (2015), conducted a research on integration of ICT in Kenyan schools. They found out that the involvement of all stakeholders was crucial for the ownership of ICT integration in education. Consequently, the process of effective technology incorporation should not be facilitated as a stand-alone event. Rather, professional development programmes should be part of a cycle of inquiry that supports teachers' learning, to try out and receive feedback. Teachers will need opportunities to share their successes and failures, face challenges and make new discoveries. To add to this, the current study went further to find out the main obstacles that hinder smooth learning through ICT.

Tanui (2013), conducted a study on ICT use in public secondary schools in Wareng sub county, Kenya. He used a mixed methods design; cross-sectional and phenomenology. He found out that majority of the school principals hardly use computers making them a bad example to other teachers. There is low IT literacy among teachers and learners, weak ICT policies in curriculum ICT implementation, technophobia and inadequate computer studies. The study did not however look at the extent to which the available tools are used in learning and the attitudes accompanying the low level of utilization. This study filled this gap by employing convergent parallel mixed methods design which analyzed qualitative and quantitative data concurrently to find a convergence between attitude and level of utilization.

2.3 Using ICT Tools in Teaching and Learning

ICT is the most significant challenge that is now confronting education at all levels. The development of modern means of communication has enabled humanity to share scientific and technological progress on a very large scale. Developments in ICT will open up new and cost effective approaches for expanding the reach of education to children, youth as well as to those who need continuing education to meet the demands of fast-changing nature of occupation and life-long education. An important focus in initial teacher education must be on quipping futures with a pedagogy, which enables them to integrate relevant technology with the process of teaching and learning. ICT is being considered as the technology of having far reaching consequences in the field of education where in the whole concept of transactional principles and the focus undergo a change in respect of centeredness of education towards child and learning principles, its effect and efficacies (Karthikeyan, 2013).

ICT not only increase opportunities for the information exchange that facilitates teaching, research, and lifelong learning, however they also cause the globalization of higher education. In most education circles, ICT are thought to be an answer for the matter of getting to try and do a lot of with less, providing access progressively to numerous demography of students and faculty and raising the standard and amount of instructional content (Adam, 2003). There has been a shift in emphasis from teaching to learning, with substantial discussion on the role of the teacher in facilitating learning, also as attention for a time on individual and independent learning. Communication and collaboration, among and between each learners and teachers could be a major concern, encompassing synchronous and asynchronous on-line facilities. Enabling and so permitting learners to set their agendas, to explore the nature of information, and the nature of knowledge are a part of the discourse. Nevertheless concerns for the professional development of teachers remain. An increasing form of national policy initiatives, programmes and projects are reported, though evaluation studies indicate that their effectiveness may be unsatisfying. However there may be little question those instructional considerations during this digital setting have broadened and gathered (Watson, 2006).

The emergence of ICT as learning technologies has coincided with a growing awareness and recognition of other theories for learning. The theories of learning that hold the greatest sway today are those based on constructivist principles. These principles posit that learning is achieved by the active construction of knowledge supported by various perspectives within meaningful contexts. In constructivist theories, social interactions are seen to play an important role within the processes of learning and knowledge. At the past, the traditional method of teaching has rotated around academics coming up with and leading students through a series of educational sequences to attain a desired learning outcome. Usually these kinds of teaching have revolved

round the planned transmission of information followed by some kinds of interaction with the content as a way to consolidate the knowledge acquisition. Up to date learning theory relies on the notion that learning is a vigorous method of constructing knowledge instead of acquiring knowledge which instruction is that the method by that this knowledge construction is supported instead of a method of data transmission (Sharma, 2011).

Research on cognitive impacts addresses the impact of ICT each on what students suppose (intellectual content) and on how students suppose (intellectual competence). Studies of the impact on intellectual content concentrate on the relative advantage of ICT within the delivery of instruction in ancient subject areas, and live the impact in terms of normal subject achievement examinations. Studies of how students think, researchers are primarily concerned with postulated side-effects of ICT on students' reasoning skills (Carnoy, 2004). Sharma (2011) points out how learning through ICTs facilitates learning; Moves from content-centered curricula to competency-based curricula are associated with moves away from teacher-centered forms of delivery to student-centered forms. Contemporary learning settings now encourage students to take responsibility for their own.

According to Kozma (2008), the common rationale in the investment on educational ICT is the role it can play in preparing future workforce and supporting economic development. Corresponding educational policies can connect the use of ICT to the development of the students' ICT skills which can be applied in the workforce to develop their capacity to use technology to solve real world problems.

Considering the extent of impoverishment in Sub-Sahara Africa, it's ideal to pose whether it's affordable to invest large amount of cash in ICT for the academic development, rather than

using such resources to fulfill other desires of the education system within the region. The explanation for integration of ICT in education was supported during a report issued by the Organization for Economic Co-operation and Development on the impact of ICT in schools (OECD, 2001).In addition, the report identified other rationale for integrating ICT in education and these include (Evoh, 2007):

- Economic rationale which has a focus on the perceived needs of the economy and the requirements to meet the skill and learning needs of the information economy;
- Social explanation that focuses on facility with ICT changing into a requirement for participation in society and employment, so that ICT competency is seen as an important life skill and a basis for maintaining employability throughout life;
- Pedagogical rationale which concentrates on the role of ICT in teaching and learning and the ways in which ICT can increase the breadth and richness of learning, foster motivation for learning, and support the development of higher-order thinking skills

To answer to the educational demands of the twenty first Century, African countries came up with an e-initiative challenging African nationalities to place ICT in education at the forefront. This can be contained within the New Partnership for Africa's Development (NEPAD) e-school initiative. NEPAD e-school initiative represents a policy network model that involves a multi-actor, multi-sector and semi-closed system operative on interlinking activities of entities aimed toward maximizing influence and resources for the common goal of education transformation in Africa (NEPAD, 2005).

The ten-year NEPAD flagship e-schools initiative involves institution of an Africa-wide satellite network which will connect schools to the web, still on points among every country from that, instructional content are going to be fed to the schools on a continual basis. In

addition, to utilize ICT instructional development it's crucial to train teachers and students, develop content and syllabus, and facilitate community involvement and participation within the implementation method. The objectives of the NEPAD e-schools initiative are in 5 folds: the first is to provide ICT skills to young Africans in primary and secondary schools to alter them operate effectively within the rising data society and information economy; to form African students health literate; to provide academics with ICT skills so as to reinforce teaching and learning; to provide school managers in Africa with ICT skills to facilitate economical management and administration in faculty's; and to ascertain "health points" in every school so as to provide health data to students, parents, health care staff and also the broader community (NEPAD,2005).

The fore going literature explains why learning through ICT is crucial especially at this age. The rationale is; meaningful learning is built around constructivism ideas (active learning where learners construct knowledge through content), to prepare learners for the job demands and respond to the emerging demands of the society (Sharma, 2011, Kozma, 2008, and NEPAD, 2005). The reviewed literature however does not present the attitudes that might hinder the teachers and learners to appreciate the compelling reasons of learning through ICT. This study tried to bring out some of the attitudes like techno-ignorance that hinder effective integration of ICT in education.

Chun, Tsai and Wu (2015) observed that in China there is a gap of ICT infrastructure and its application in middle and primary schools between urban and rural areas. Similarly, there exists a contrast between the needs of constructing ICT infrastructure and patterns of promoting ICT application in education. Most city schools offer ICT courses for all students. At least half of the classrooms are equipped with multi-media projectors to support and promote the utilization

of digital technologies for learning and teaching. County schools offer ICT courses for the third or higher grade students. The equipment for teachers to use consisted mainly of multi-media classrooms, although some teachers used them for other subjects. Few schools in the rural areas offered ICT courses, had multimedia classrooms and tended to have poor operating environment and low utilization rates. The situation in China is similar to Kenya whereby schools in urban areas tend to have more and better infrastructure facilities while those in rural areas tend to have poor and inadequate infrastructural facilities. This study was located on the Kenyan context which is geographically and economically different from China.

Infrastructural investment in schools is the bedrock of improved performance and the supporting basis for achievement educational outcomes. Asiyai (2012) investigated school facilities in public secondary schools in Delta State, Nigeria. The purpose of the study was to find out the state of the facilities, the types of maintenance carried out on the facilities by school administrators, the factors encouraging school facilities depreciation and the roles of school administrators in the management and maintenance of school facilities. The study employed the ex-post-facto research design and used questionnaires to collect data from 640 respondents who were selected through stratified sampling techniques from all the 358 public secondary schools in the state. Findings revealed that school facilities in the schools are generally in a state of disrepair. The findings further revealed that the maintenance carried out on school facilities were inadequate for majority of the facilities. The factors encouraging school facilities deprecation included excess pressure on available facilities and delayed maintenance amongst others. The study recommended that school administrators, teachers and students should develop and inculcate good maintenance culture; government should budget for facilities maintenance and allocate more funds to schools for effective management and maintenance of school facilities.

Although this study assessed the state of facilities in schools, a few gaps can be noticed; first research design used could not exhaust all the roles of school administrators in the management and maintenance of school facilities and more specifically ICT tools. More in-depth interviews would have been carried out. Thus a mixed method design seemed more appropriate. This study bridged this gap by employing a convergent parallel mixed methods design.

The use of ICT in learning and in particular computer and networking communication to support teaching and learning include a number of uses; for example using a word processor to draft an essay, running a simulation to test a prediction in science and developing cross-cultural understanding through computer conferencing. Learning through ICT is used to describe situations where ICT becomes the whole learning environment by providing learning materials and acting as assessor and tutor. A method produced to help schools determine the stage of development suggests that ICT changes from being a separate subject by integrating it in teaching and learning to transforming the role of ICT in which it is accepted as a way of teaching in itself. In this process a recommendation that ICT as a subject no longer needs to be taught can be concluded, that it should be used in teaching and learning different subjects. To move to this phase of teaching through ICT, schools should implement an ICT-curriculum that increases the use of ICT in various subject areas with specific tools and software (Unesco/IFIP, 2000 in Webb, 2002**).**

According to Gonzalez (2010), learning through ICT is useful in the following ways: As a source of information where internet is mainly seen as a medium for the students to retrieve information. Through this, teachers upload class notes or papers and direct students to websites for subject resources. For individual and independent self-paced learning in which the Web is seen as a space that may provide the opportunity of engaging with subject analysis or subject

drills that could lead to learning. For group analysis, decision making and dialogue: the Web is seen as a space in which learning relationships may be developed. It impacts on more sophisticated use of the Web thus allowing interaction among learners.

One way and probably the best way of integrating learning through ICTs is through online learning. This allows for a change from only classroom mode of teaching to independent study, computer-based instruction, computer-assisted instruction, videoconferencing and Web-based instruction. The 21st century has gone full throttle in development of virtual education, that is, distance-learning methods and new communication methods. For those who are don't want to appreciate the import and potency of these changes, the threat of being left behind is significant (O'Neil et al, 2004).

For successful learning through ICT, technologies must be used appropriately. At the tool level the technology affords much more than the elements available to the individual classroom teacher. To put it into perspective, in terms of display and representation of ideas the technology has allowed visual information display within software packages. It is now possible to collect data from the field and represent that data in a graph or animated display that explains the ideas visually and clearly (Hedberg, 2006). Online learning can take any of the following formats; Face to face with some web-based instruction, Web-based instruction with some on-site requirement/Blended Learning and Purely web-based instruction.

Face to face with some Web-based Instruction is where the web or technology is employed in on-site classrooms instruction and activities. For example learners in computerized classrooms may develop documents using word processing and desktop publishing software, conduct research through the internet, design graphics by the way of drawing software and build

a website. On some days teachers may teach using computerized slides or web-site notes as a method for students' note taking. There can be discussions or role playing activities and teaching which might take place individually, through a chat room or an electronic bulletin board. In this model, learners are encouraged to gather information from the web sites or professional groups correlated to students' major areas of study (Porter, 2004).

Blended Learning is a complimentary and enriching form of teaching and learning. The power of blending online and face to face instruction is that it respects the distinct advantages and preferences associated with face to face learning while recognizing and integrating amazing strengths of online learning to provide sustained rigorous learning outcomes Blended learning incorporates a wide array of learning environments and approaches to teaching and learning such as, asynchronous learning networks, web enhanced teaching platforms, and digital online learning tools. Three main technological components required for a hybrid content delivery include: Technology infrastructure, Instructional technology, and Technology in learning (Oliver & Trigwell, 2005).

Blended learning incorporates a big catchment of learning environments and approaches to teaching and learning such as asynchronous learning networks, web enhanced teaching platforms, and digital e-learning tools. Three main technological components required for a hybrid content delivery include: Technological infrastructure, Instructional technology, and general technology in learning. Developing and designing blended courses is an encompassing process which includes five main phases. These are; course content design, course development, course implementation, course evaluation and course revision. Findings from researched studies recommends the need for establishment of an innovative and creative balance between pedagogy

and technology that will support various departments to design, deliver, and support course design and content (Olapiriyakul & Scher, 2006).

A survey done by Wastiau et.al (2013) on students and teachers' confidence in their digital competence and frequency of ICT based learning found out that there is a relation between teachers' digital competence and their use of ICT in the classroom. Hence, participation in professional development activities can significantly influence their ICT use. Teachers prefer informal methods of training, blended training and training that relates to real classroom settings. This study however did not assess the level of utilization among teachers and students in schools. The current study assessed the level at which these tools are utilized among learners and teachers.

According to Singh (2003), blended learning combines multiple delivery methods that are designed to complement each other and promote learning and competency based behaviours and outcomes. Typically, blended learning includes face-to-face classroom teaching, live e-learning, self-regulated learning and structured off-line study including recommended readings and assignments from teachers. Blended learning was prompted by the recognition that not all learning is best achieved in an electronically facilitated environment, specifically one that deals with a classroom teacher altogether. Instead, consideration must be given to the subject matter, the learning objectives and outcomes, the characteristics of the learners and the learning context in order to arrive at the optimum mixture of teaching and delivery methods (Tinio, 2002).

In Purely Web-based Instruction, all the information is found on the course web site or through the internet. Activities like assignments, group discussions in form of chats and discussion forums are completed online and then groups communicate electronically. Online curriculum requires learners and teachers to communicate electronically, mostly by print e-mail

and bulletin board messages. Other formats, such as phone calls or faxes can be used depending on the course structure and types of communication required. Recorded chats, bulletin board forms and written documents related to the course web site or shown as full text selections are specific ways that important course content is designed online (Porter, 2004). One unique way of designing an online curriculum is through moodle. This allows one to organize a subject chronologically week by week, conceptually by topic or socially with a 'big forum' as essentially a free format structure. The features in moodle are like student peer review, self-assessment of submissions and assignments, student notes and other learning materials (Yousif, 2012).

Is this moodle, students go through the subject topics at their own pace, create their own time to do the assignments and give feedback to the learning materials. However, the success of this form of self and independent learning majorly depends on the attitude, training, competence and commitment of teachers and facilitators. The facilitators or teachers respond to the concerns of students online through collaborative learning and networking. The main advantage of this model is less emphasis upon static content and a correspondingly larger emphasis on tools for extended discursive and constructive teaching and learning. An important characteristic moodle is Open Source Software. This means that the source code is freely available to be changed by end users and there is a big educational networking community to help solve problems and implementations (Yousif, 2012).

Online learning is convenient to many learners because they are in charge of their program of study. They create time for study which is not fixed to particular times and places. The use of ICT offers powerful learning environments and can transform the learning and teaching process so that students can deal with knowledge in an active, self-directed and constructive way. At present ICT is considered as an important means to promote new methods

of instruction (teaching and learning). It should be used to develop students' skills for cooperation, communication, problem solving and lifelong learning. Through eLearning, it is possible to work with more learners, teachers, and the subject matter experts outside a student's limited geographical area. Researchers have also found that computers enhance teaching and learning by providing opportunities to practice and to analyze, offering better access to relevant articles and teaching and learning materials. Every classroom teacher should use learning technologies to enhance their students' learning in every subject because ICT can engage the thinking, decision making, problem solving and reasoning behaviors of students. Innovative use of ICT can facilitate student-centered learning, engage students in constructivist classrooms and enhance their social interaction. It has been shown to improve their cognitive development, increase creativity, and improve their problem solving skills (Khan, et al, 2012).

Tezci (2009), conducted a quantitative study on teacher's effect on ICT use in education in Turkey. He found out that the most common uses of ICT are the Internet, e-mail, word processing and educational CDs, though rarely used. The study also revealed that ICT use in classroom is limited, a finding which is attributed to the level of experience; and the most commonly used ICT types were determined as the Internet, e-mail, word processing, and educational CDs. According to the results of the study, most teachers know how to use the Internet, email, word processing, graphics and presentation software. The low levels of knowledge on ICT might result from the fact that these. There is a significant correlation between the levels of knowledge about ICT and the use of ICT in education. This study however has a methodological gap; a purely quantitative design neglects the personal, social-cultural and social economic factors that support or hinder education through ICT. The current study used a mixed method design to assess all these factors.

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Jimoyiannis and Komis carried out a study on teachers' attitudes towards ICT in education. A total of 1165 primary and secondary school education teachers participated in the study. The study found out that teachers have a significant influence on ICT adoption and implementation behaviors in the classroom. Teachers in general agree that computers constitute a valuable tool and they are positive about students' attainment of ICT knowledge and skills. In addition, the research also found out that even though teachers recognize the importance of introducing ICT in education, they tend to be less positive about its extensive use in the classroom and far less convinced about its potential to improve teaching thus their use of ICT

tools is limited and focused on a narrow range of applications, mainly for personal purposes. Most of them continue to use computers for low-level supplementary tasks such as word processing in lesson plans, worksheets, assessment tests and registration of grades. The study recommended more motivation strategies to teachers teaching through ICT. Although this study analyzed the role of attitudes in ICT implementation, the underlying conditions like lack of technical support, internet and/or electricity which might give rise to these attitudes were not elucidated. This study bridged this gap.

Kenya promulgated a National ICT Policy in Jan 2006 that aimed toward raising the livelihoods of Kenyans by making certain the supply of accessible, efficient, reliable and cheap ICT services. The national policy had many sections, as well as information technology, broadcasting, telecommunications, and postal services. However, it's the section on information technology that commenced the objectives and techniques touching on ICT and education. The relevant objective during this section states that government ought to encourage the utilization of ICT in schools, colleges, universities and other academic establishments within the country therefore improve the quality of teaching and learning (Farrel, 2007).

The existing education policy on ICT was embedded in 3 documents namely; e-Government Strategy, National ICT Policy and Sessional Paper No. 1 of 2005 (A Policy Framework for Education, training and Research). The vision of the MoEST was to facilitate ICT as a universal tool for education and training. So as to realize this vision in all establishments, teacher, learner and also the respective community ought to be equipped with applicable ICT infrastructure, competencies and policies for usage and progress. It entailed recognition of the very fact that ICT provides capabilities and skills required for a knowledge-based economy. It also involved remodeling teaching and learning to include new pedagogies that are applicable for the twenty

first century MoEST's mission is to facilitate effective use of ICT to enhance access, learning and administration in delivery education programmes and services (MoEST, 2006).

ICT in the education sector can broadly be categorized into: E-Government which aimed at mainstreaming ICT in all government operations and service delivery; EMIS (Education Management information Systems) that geared toward facilitating education managers and administrators with correct and timely knowledge for better and informed decision-making; and E-Learning that aimed at mainstreaming ICT within the teaching and learning process. The Ministry, sector partners and stakeholders developed this National ICT Strategy for Education and training aimed toward guiding the sector in adoption of ICT across all levels of education and training. The strategy was developed taking into thought the policy surroundings captured within the National ICT Policy of 2006 and sector policy in Sessional Paper No. 1 of 2005.

The strategy was additionally developed in line with the E-Government Strategy of 2004 and also the wider Economic Recovery Strategy Paper for Wealth and Employment Creation (ERSWEC). The strategy was supported the vision that: 'ICT could be a universal tool in education and training'. The mission statement that inspires it is; 'To integrate ICT in education and training to improve access, learning and administration'. The strategy was proposed in order to address the following challenges: The need to realize Education For All (EFA) by 2015 in line with the national and international commitment, Universal Primary Education (UPE) by 2010, and to extend transition rate from primary to secondary schools from 47% to 70%. This strategy outlined areas for integration of ICT in education in Kenya in order to address the above-mentioned challenges and to secure the position of the nation as concerns the rapidly expanding education requirements and the global economy. The areas of priority were: Establish policy framework, Digital equipment, Connectivity and network infrastructure, Technical

support, Harnessing emerging technologies, Digital content development, Integration of ICTs in education, Training (capacity building including professional development), Research and development, Partnerships and resource mobilization, Legal and regulatory framework and Monitoring and evaluation(MoEST, 2006)

The principal objective of the National ICT Policy was to facilitate sustainable economic growth and development, and poverty eradication through productive and effective technologies. The Policy was aimed toward pursuing progress towards full socio-economic inclusion of voters through universal access. Further, the Policy wanted to stimulate investment in ICT sector whereas at an equivalent time encouraging the spirit of innovation through research and development. The policy envisaged harnessing the potential of ICT and related emerging technologies to eradicate impoverishment, support universal primary education, improve maternal health, combat diseases, maximize agricultural production, guarantee food security, promote trade and industry, enhance environmental sustainability, develop world partnerships for national development, and incorporate technology in thought implementation of development policies (MoEST, 2006).

As a follow up to the commitment to make leaning virtual, the most recent efforts made by the government through the ministry of Education is governance structure for the National Digital Literacy program. The program, whose overall objective is to boost learning in Kenya education system through the employment of digital technologies, can have the Ministry of ICT providing leadership and take overall responsibility for the successful coordination of the initiative. The ICT Authority can manage any technical matters concerning style, co-creation, choice and acquisition of the suitable technology solution moreover as develop the partnerships necessary to make sure that the programme is underpinned by the establishment of a strong local

capability initiative to undertake initial line assembly of the devices and accessories. Another role will be that of developing adequate device support maintenance and assurance frameworks that guarantee adequate local participation and value for money. The Ministry of Education, science and technology, is tasked with the task of syllabus content to be used on the digital platform, identification of beneficiary primary schools, capacity building and training for teachers and other relevant education stakeholders. The ministry will convert all Kenya Institute of curriculum Development (KICD) digital content to open source format to permit for delivery across multiple technology platforms (ICT Authority, 2015).

The Ministry of Education initiative in ICT policy formulation, training of teachers, infrastructural improvement and development of e-curriculum shows the government commitment in promoting learning through ICT. The literature however seldom evaluates the extent to which the e-government has succeeded in schools; do teachers feel that the National ICT policy is successful implemented in schools through more ICT trained teachers, adequate ICT tools, technical support and rolled out e-curriculum content. This study filled this gap.

Wahome conducted a research on the extent of use of ICT in public secondary schools in Murang'a County. The research employed descriptive and naturalistic designs. The research found out that integration of ICT in education was at its infancy stage and majority of the schools were using ICT tools for basic use like typing, printing and analyzing examinations. The main challenges facing schools in using ICT are; inadequate ICT tools and resources were lack of enough trained computer teachers and inadequate funds. The study recommended that parents, Board of management and the Ministry of education should contribute to ICT infrastructure and allocate more funds on ICT resources in schools, computer studies made compulsory and ICT in service training to teachers be given priority. The study did not bring out how teachers utilize

ICT to deliver content in class and to what extent are learners involved in learning through ICT. This study assessed the utilization of ICT in learning and teaching in public secondary schools in Kajiado North Sub County. The focus was using ICT in classroom delivery, communication though discussion forums, assignment posting and other ICT learning and teaching methods.

A summary of reviewed studies analyzed how various ICT tools can be used in learning and teaching. Web is mainly seen as a medium for the students to retrieve information. Discussion forums, chat, file sharing, video conferences, shared whiteboards, e-portfolios, weblogs and wikis. Such tools can be used to support different activities involved in the learning process (Rallis, 2000, Gonzalez, 2010). The reviewed literature however does not bring out how individual teachers utilize these tools in learning and teaching to improve learning. This study filled these gaps by assessing the utilization of these tools in public secondary schools in Kajiado North sub-county.

2.4 Benefits of Teaching and Learning through ICT

The quality of school facilities have an impact on students' experiences and ultimately on their educational achievement. The research on school building conditions and student outcomes find a consistent relationship between poor facilities and poor performance. When school facilities are clean, in good repair, and designed to support high academic standards, there will be higher student achievement, independent of student socioeconomic status. The cognitive requirements for learning and teaching; motivation, energy, attention, hearing, and seeing are affected by the physical surroundings where they take place (Filardo, Vincent, Sung & Stein 2006).

Communication technologies have become one of the important characteristics of successful educators. Especially increasing interest in offering online courses, due to wide spread usage of Internet and Web technologies as well as economic reasons, has been forcing educators to use these communication technologies more than ever before (Irem, 2012). Computerization has set off new, powerful energies that have produced an explosion in the proliferation of new images, identities and subjectivities in the learning environment. It is therefore not surprising that modern curriculum, instruction and education policy thinkers and practitioners all over the world have been swept off-balance by the new technological transformations taking place around the world, where learners are more informed about the possibilities that a computer can provide more than their instructors (Amutabi, 2004).

Cellini, Ferreira and Rothstein, (2010) estimated the impact of investments in school facilities using the housing market. The study used regression discontinuity (RD) design to account for the dynamic nature of bond referenda, that is, the probability of future proposals depends on the outcomes of past elections. Using our dynamic RD estimator, the study showed that bond funds stick exclusively in the capital account, with no effect on current expenditures or other revenues. Thus the effect of referendum passage as reflected the impact of improvements in the quality of school facilities. It caused immediate, sizable increases in home prices, implying willingness to pay on the part of marginal homebuyers of $1.50 or more for each dollar per pupil of facility spending. This study is relevant to the extent to which economic welfare is significantly related to education achievement. However the study is more informative and intelligible to economists, government policy and financial planners and less to educationalists. The current study will limit itself to the benefits of optimal utilization of ICT in teaching and learning.

Jhurree (2005) points out some avenues from which school infrastructure funds can be sourced; the first place to look for funds is the school's operating budget. However, due to limitations of this fund, large purchases of technological devices are difficult. Second is Bond issues where school districts also have capital budgets apart from the operating budgets for schools usually targeted toward the funding of major projects such as the construction of a new school and other facilities. Thirdly, through collaborative efforts among schools and other organizations, educational software can also be developed or purchased. Another source is state funds or County funds. If the government has a vision of improving education and integrating computers in education and if it is committed to this vision, then the task of getting government funding should also be explored. Corporate Grants where many wealthy companies receive tax deductions, along with societal recognition and customer market, for the help, in funds or other financially quantifiable terms, they give to institutions to achieve the latter's goals. Lastly from private gifts where financial support can also be obtained from private sources such as parents teachers associations, civic groups or individuals or alumni, special fundraising events.

Unlike the classroom conventional learning which centers on information delivery, learning through ICT emphasize sharing of knowledge through communication and collaboration beyond the classroom walls. It is essentially a communication-collaboration- knowledge building conceptions. It is seen as a medium to interact in discussing, debating, developing understanding and building knowledge. As for this case, learning through ICT is planned of as an area for participating in learning tasks and activities which will result in higher-level learning experiences (Gonzalez, 2010).

ICT in education promote high order thinking skills through collaboration, research tools available through ICT and the global approach employed in study. The high order thinking is

gained from the following online activities; offering ideas or resources; inviting critique; asking challenging questions; articulating, explaining and supporting positions on issues; exploring and supporting issues by adding explanations and examples; reflecting and re-evaluating personal positions; critiquing, challenging, discussing and expanding ideas of others; negotiating interpretations, definitions and meanings; summarizing and modeling previous contributions; proposing actions based on developed ideas (Seamus & Kay, 2003).

According to Keengwe and Wachira (2008), computers can be used to support meaningful learning when technologies engage learners in five ways: knowledge construction but not reproduction; conversations not reception; articulation not repetition; collaboration not competition; and reflection not prescription. Online classes can increase participation among learners. It is difficult to lean on others because the class contribution is marked online, learners may feel more confident in an online class because of the perceived equal playing field in terms of class contributions.

Online learning complements classroom conventional learning because of the independence and ownership of the content by the learner. Students gain significant learning benefits from audio visual instruction which promote high order thinking. The benefit of this model is not however based on the instructional tools but the instructional strategies employed in using these technologies. Online learning must create challenging activities that enable learners to link new information to old, acquire meaningful knowledge and use their meta-cognitive abilities. It is not computers alone that make students learn but the design to real life models and simulations, and the interaction with those models and simulations (Mohammed, 2004).

Askar, Usluel and Mumcu, (2006) examined the extent to which perceived innovation characteristics are associated with the probability of task related ICT use among secondary

school teachers. A questionnaire was completed by 416 school teachers in Turkey to see the task-related usage and therefore the perceptions of the academics in reference to ICT. The findings showed that quality or simple use was a standard perceived innovation characteristic for teaching delivery, preparation and social control tasks in schools. Since this study was conducted in a different context where technology is more advanced, this study assessed the reported benefits in a technology improving environment, Kajiado County, Kenya.

Tella, Toyobo, Adika and Adeyinka (2007) investigated 700 Nigerian secondary school teachers' uses of ICTs and implications for any development of ICT use in schools. The purpose of this study was to examine the effects of ICT in students' achievement. The findings showed that almost all teachers perceived ICT as terribly helpful and assisting teaching and learning to be easier. Generally, the expected benefits of integration ICT in secondary education in Africa are: Effective information delivery by teachers; Improved learning by raising curiosity; Technological attainment among students; increasing instructional access to remote communities that were formerly deprived of education because of distance, culture, economic needs or gender disparities; and to organize students for the globe of work (Watson, 2007

The reviewed literature focused on the positive end result of integrating ICT teaching and learning. Students gain significant learning benefits from audio visual instruction which promote high order thinking ((Mohammed, 2004). Learners may feel more confident in an online class because of the perceived equal playing field in terms of class contributions (Keengwe &Wachira 2008). The reviewed studies did not present the extent to which teachers feel that the objectives of teaching and learning through ICT are met. This study filled these research gaps by assessing the level to which teachers admit that there is a significant improvement in learning through lea

2.5 Obstacles to Effective Learning through ICT

Teachers' personal theories and perceptions about teaching and learning processes and their level of competence with ICT play a major role in how they implement ICT and how they motivate themselves to use ICT tools in the classroom. Teachers' pedagogical cultures shape their representations of ICT use in the classroom and they are likely to adopt practices with computers that reflect their beliefs about teaching and learning. It has been shown that teachers with the most constructivist teaching philosophies regarded the role of computers in their instruction as very important. Most effective teachers not only have a positive attitude towards ICT but had good ICT skills and used computers as a part of a stimulating environment favoring pupils' inquiry and collaboration (Jimoyiannis & Komis, 2007).

Teo (2008) conducted a survey on pre-service teachers' attitudes towards computer use in Singapore. A sample of 139 pre-service teachers was assessed for his or her pc attitudes using questionnaire with four factors: have an effect on (liking), perceived utility, perceived management, and behavioral intention to use the personal computers. He found that teachers were positive regarding their perspective towards computers and intention to use computer than their perceptions of the usefulness of the personal computers and their control of them. Demici (2009) conducted a similar study on teachers' attitudes towards the use of Geographic information systems (GIS) in Turkey. The study used questionnaire to gather information from seventy nine geography teachers teaching in 55 totally different high schools. The study disclosed that although barriers like lack of hardware and package existed, teacher's positive attitudes towards GIS was a very important determinant to the successful integration of GIS into geography lessons. Demici and Teo in the preceding studies did not bring out clearly the perceptions impeding proper utilization of ICT. This current research looked at this.

Khan (2012) pointed out lack of good vision in educational institutions in implementation of ICTs in education in developing countries. He used a case study of Bangladesh and describes it this way, "In Bangladesh most of the educational institutions are far away from implementing ICT into teaching and learning situations. Also, there are few educational institutions in big cities that have ICT facilities but cannot integrate it effectively due to lack of a proper vision and plan." (p.69). Yilmaz, (2011) in assessing the technology integration processes within the Turkish education system reported that in providing schools with hardware and web connections, it is very crucial to provide the schools with technical support with relevance repair and maintenance for continued use of ICT in schools. Therefore, if there is no technical support for teachers, they become pissed off leading to their disposition to use ICT altogether. Although these studies points out the main obstacles to education through ICT, they fail to give possible recommendations and policy frameworks to counter them. This study filled this gap by gathering viable recommendations and policy frameworks from the respondents on effective utilization of ICT in teaching and learning.

Most African countries have problems with school infrastructure. There are dilapidated buildings, broken chairs, and absence of good ventilation and sanitation facilities (World Bank, 2009). This is brought about by lack of investment capital, poor construction standards and inadequate maintenance of ICT tools. Inadequate hardware and software system, slow net connections, learners' procrastination, lack of technical experience among the instructors, too little orientation for learners, and an absence of enough time for instructors to develop and style their online courses are cited as the main barriers to school participation in developing and teaching online courses (Nkonge & Gueldenzoph, 2006).

Yildirim (2007) conducted a survey on factors that discourage teachers' use of computer technology in classrooms. He reported that the major use of technology by teachers was to prepare lesson notes and assessments instead of improving students' performances. The research also revealed that barriers to the use of technology include congested classes, insufficient training, inadequate technical and pedagogical support, rigid school syllabi, inadequate motivation, lack of strong leadership and inadequate cooperation among teachers. The study recommended more collaborative approach from all educational stakeholders to curb these challenges. The current study went further to highlight specific recommendations from principals, teachers and students on successful learning through ICT.

Some researches on barriers to online learning point a finger to non-commitment from members. The time and energy demanded to develop on-line courses and to find out new technologies also are causes for faculty member's withdrawal. Some teachers may resist on-line teaching because they're involved that those courses could need longer for advanced coming up with. Further, college members could also be hesitant concerning this shift because of the actual fact that they will lose autonomy and management of the course of study, lack of technical training and support, and lack of unleash time for designing (Keengwe & Kidd, 2010).

Alemneh & Hastings (2006) discussed a number of barriers to harnessing the full power of internet as a tool for learning. These include, but not limited to; inconsistent and restrictive regulations, and prohibitive policies towards information exchange and use. With Africa having the lowest per capital income in the world, the current pricing regime of high ICT tariffs and customs duties does not actively promote connectivity. Inadequate funds and lack of progressive national programs for generations; Many African governments remain unconvinced of the

importance of research and scientific innovation in creating economic growth and they pay little attention to the national need for higher education and ICT infra- structure.

Shortage of trained ICT professionals; Professionals having sensible ICT skills are leaving the continent or like to not be part of higher establishments and their libraries thanks to a mix of low remuneration edges, poor ICT infrastructure and work environments and restricted opportunities. Several of those barriers to the adoption of computers in colleges are merely specific samples of barriers to vary generally. Variety of barriers common to all or any amendment might have a specific resonance for why efforts that involve technology could also be notably tough to tug off. These embrace the very fact that information integration could be a complicated, tough to be told process; several educators feel isolated and alone; time to experiment, explore and study innovations is crucial however rare in schools (Watson, 2001).

Neyland (2011) conducted a mixed method research on factors influencing the combination of on-line learning in high colleges in Sydney. The purpose of this study was to find out the readiness of teachers in integrating ICT in teaching. The study involved twenty six computer coordinators. Most computer coordinators in schools stated that increased workload of teachers was alarming, so asking them to take on board yet other tasks in an already overcrowded curriculum and extremely busy work days is pushing many teachers to the limit and in some cases beyond. This study did not assess the role of other teachers in ensuring successful implementation of ICT in education. This current study assessed the role of different education stakeholders in facilitating effective utilization of ICT in education to fill the observed research gap.

The perception and attitude of teachers is a great hindrance to the implementation on ICTs in learning. Curriculum modification theories have usually declared that after a little cohort

of innovators emerges, their adoption of the innovation cascades through their peer group of subject teachers. Nevertheless it's clear this is often not happening with reference to ICT in schools; the innovators have remained a minority of teachers. Teachers who do use computers in their classrooms tend to be those that will clearly relate the utilization of technology to their pedagogical strategy for his or her own subject. It's the keen 'ICT for CAL' users who manage, despite sizable structure difficulties, to get access to resources and who are versatile in their approach to its use (Watson, 2002).

Above all this, these teachers who acknowledge and revel in the pedagogical potential of ICT as a result of it relates to their own philosophical underpinnings concerning teaching and therefore the nature of their subject. They're at home with CAL; they teach Geography or History or Biology with computers' rather than 'deliver ICT'. They recognize the way that ICT is actually changing the nature of the subject that they teach. But they're rare. that the success of this innovation, ICT use in schools, resides within the skilled competencies and interests of only some teachers. For them the main focus isn't a future 'information age', however the actual fact that it supports the character of the learning. Their colleagues, however, even within the same subject specific caution and articulate barriers that inhibit their involvement with IT. They realize the small politics of access too inhibiting, don't seem to be confident users of the hardware, and don't seem to be convinced of the worth. All of them state reasons that became related to failure of IT innovation; an absence of excellent computer code, or time to explore software system, negative experiences within the classroom that had 'put them off', which it's not definitely worth the quantity of additional effort needed (Watson, 2002).

In a qualitative multiple case-study research on school competency and confidence level concerning the utilization of ICT in teaching conducted in 5 European countries, Peralta and

Costa (2007) found that technical competency influenced Italian teacher's use of ICT in teaching. However, the teachers cited pedagogical and instructive competences as vital factors if effective and economical instructional interventions are likely to be enforced. Peralta and Costa (2007) conducted a connected study on twenty teachers' competences and confidence concerning the use of ICT in classrooms. They discovered that in Italy, teachers' technical competency with technology may be a factor of rising higher confidence within the use of ICT. In addition, teachers in Greece reported pedagogical and individual factors as those which mostly contribute to their confidence in ICT use. Also, innovative teachers in Portugal linked the perception of confidence in using ICT with the loss of fear of damaging the computer and at the same possessing absolute control over the computer. However, they reported plenty of available time to work and practice ICT, support of experienced teachers and training as favourable conditions for gaining confidence in ICT usage. To come up with statistical data on the level of utilization of ICT in education, the current study used a mixed method research design. Through this, the gaps in the above studies were filled.

Chitiyo, and Harmon (2009), did an analysis on the integration of instructional technology in pre-service teacher education in Zimbabwe. The study found out that the absence of resources both hardware and software and the teachers' own lack of preparedness to integrate technology are the main reasons they were not using computers for instructional or teaching purposes. The lack of readiness was further confirmed by the lecturers' lack of confidence and their uncertainty in their ability to do some critical IT integration tasks. The current study looked into the mitigating strategies to curb these obstacles.

Amutabi (2004), in his research on the use of ICTs in education, discussed a number of challenges facing Kenyan institutions in integrating the use of ICTs in education. The lack of

trained and experienced technical personnel to manage control and maintain the progressively massive numbers of those resources means their utility values, effectiveness and efficiency, cannot be determined. The shortage of theoretical information and practical management and maintenance skills of ICT teachers ends up in these units being managed, controlled and maintained on trial and error basis. A number of the technicians are untrained or semi-trained within the real sense of ICT training.

Earthman (2009) investigated the possible relationship between the attitudes teachers have about the condition of their classrooms when the classrooms were independently assessed. This study was based on previous researches that reported that teachers in unsatisfactory classrooms felt frustrated and neglected to such an extent that they sometimes reported they were willing to leave the teaching profession. Eleven high schools in which the principals stated that the buildings were in unsatisfactory condition were identified and matched with 11 schools assessed as being in satisfactory condition. The study found differences between the responses of teachers in satisfactory buildings were significantly different than those of teachers in unsatisfactory. Similar results were obtained on the attitudinal scale of the CAP. The findings clearly indicated the physical environment influences attitudes of teachers, which in turn affects their productivity. Such effects could cause morale problems in the teaching staff. The study recommended the need for school authorities to recognize the importance physical conditions have upon teachers so that negative feelings and attitudes do not pervade the learning. Going forward, this study has a research gap which needed to be filled. To make an impact on better performance, other variables needed to be incorporated; change of attitude, better maintenance of ICT tools, more funding to schools and improved infrastructure and physical facilities in schools. The current study assessed these variables.

The lack of computer culture in public institutions impedes speedy diffusion of the new technologies. Ignorance is the biggest drawback facing establishments with relation to ICT. Several faculty managers have not experienced an atmosphere where ICT is at full throttle. This makes them less appreciative of ICT. The restricted information of functions and operations of ICT as mirrored at the level of senior administrative employees of universities makes matters worse, particularly on technical problems and need to invest in ICT. This in turn produces graduate academics who are less appreciative of the advantages of teaching through ICT. Several senior and important establishment officers with positions of responsibility requiring decision-making received their education and early work experiences well before the arrival of ICT. The new issues that are closely connected with the introduction of the computer technology embrace low computer skill among employees, securing and putting in ICT resources, hiring and coaching of technical personnel, and managing, dominant, and maintaining ICT at intervals a rapidly ever-changing environment (Amutabi, 2004).

Another issue inhibiting the use of ICTs in learning is limited digital equipment at nearly all levels of education. Whereas the common access rate is one computer to fifteen students in most of the developed countries, the access rate in Kenya public schools is roughly one computer to one hundred fifty students. Additionally, it's noted within the Education Policy Framework (EPF) that there are variety of challenges regarding access and use of ICT in Kenya. These embody high levels of impoverishment that hinder access to ICT facilities, limited rural electrification and frequent power disruptions. wherever there's electricity, hindrances to application of ICT include; high prices of net provision, costs related to digital equipment, inadequate infrastructure and support. Another drawback is limited penetration of the physical telecommunication infrastructure into rural and low-income areas. This is connected to limited

access to dedicated phone lines and high-speed systems or connectivity to access e-mail and net resources (MoEST, 2006).

Mbaluko, (2009) in discussing the challenges facing teachers in integration and use of ICT in teaching and learning found out that most IT illiterate or have little knowledge on teaching through ICT. Majority of schools have computers and printers to type and print examinations and official documents (Wahome, 2011).

2.6 Mitigating Obstacles to Effective Learning through ICT

To overcome impediments to education through ICT, some strategies should be put in place. These impediments are either technological (lack of enough ICT infrastructure) or personal (individual attitudes).To gain the information necessary to implement on-line syllabus effectively, teachers should have the required training, mentoring, and support, ideally on the equipment they'll use. Tasir et al (2012) conducted a research on the relationship between instructors' level of competency on the use of ICTs and the level confidence and efficiency in Malaysian schools. The aim of the study was to find out the extent to which personal initiative and training influences utilization of ICT. They found out that teacher's competency, teacher's confidence level, and teacher's satisfaction toward ICT training programmes is a very important factor that can increase the levels of the competency and confidence. The study recommended ICT trainers to formulate strategies that not only increase teachers' satisfaction but also exceed their expectations of the acquired knowledge that they may gain at the end of the course. This research did not however assess the level at which ICT trained teachers utilize ICT tools in teaching and learning. Moreover the study belongs to a different geographical context. The

current study was carried in Kajiado North Sub-county, Kenya and sought out to find a relationship between ICT training and consequent optimum utilization.

Interaction, collaboration and socialization are necessary ingredients for a successful online curriculum. Simply dumping information on a website does not promote learning. The question centers on how best to deliver the materials and provide the experiences and interactions that promote learning and how educators can guide students throughout the learning process (Porter, 2004).Online courses should present a manageable amount of content and variety of activities specifically designed to be completed on-line. Subjects ought to be designed for college students with completely different skills and learning designs. They must be inventive and innovative.

Crampton (2009) carried out a study on financing of school infrastructure. The purpose of this study was to assess the impact of investment in human, social, and physical capital on student achievement. The study employed a multivariate statistical approach that allowed for multiple independent and dependent variables. The research relied on three national databases: United States Census Bureau, US Department of Education's National Assessment of Educational Progress test score data, and the US Department of Education's Common Core of Data. The findings showed that investment in human, social, and physical capital accounts for between 55.8 and 77.2 percent of the variation in student achievement in fourth and eighth grade Reading and Mathematics. Investment in human capital is consistently the largest influence on student achievement followed by social and physical capital. The study recommended more attention from all education stakeholders in investing in human capital. Although this study presents a thorough assessment of a researched theory through a standard statistical analysis, it fails to integrate other variables which contribute to

improvement of school infrastructure and consequent achievement of intended learning outcomes. These variables include the social-economic factors, individual perceptions, government policies, technical support, good management and maintenance strategies and political environment. These variables needed a mixed method approach where quantitative and qualitative designs are employed in the same study other than a purely quantitative method employed. The fore-going study used a convergent parallel mixed method design to find out the connection of the above factors in achievement improved school facilities (more so ICT).

Soong (2001) in FitZpatrick (2012) points out some Key Success Factors for developing an online curriculum and getting good results from it; Human issues: The teacher must be competent in motivating the students on-line and making an enthusiastic on-line environment; Technical skills: each the trainer and the student ought to possess the required skills to figure with efficiency in an internet setting; Technical support: Any sort of technical difficultly must be address so as for the total utilization of the course to be had; Collaboration: there should be collaboration and networking with other institutions on the use of ICT; Attitude: The teacher and student ought to have a positive approach towards learning on-line. Teachers need to be self-motivated, interested, and willing to integrate technology in their subjects. Technology provides opportunities to support student learning. However, to achieve the full benefits in education, technology requires strategic planning and integration of these tools into teaching that only a sense-making and skilled teacher can provide (Keengwe & Wachira, 2008).

Tondeur, Van Keer, Van Braak, & Valcke, (2008) did a study on ICT integration in classroom. The study was conducted in Ghent, Belgium. A stratified sample of sixty schools was involved in the study. Stratification variables were associated with the sort of instructional

network and also the degree of urbanization (rural/urban). At least one teacher at every grade level was asked to participate, leading to data from at least six teachers per school. The sample contained 574 teachers, of that 430 were feminine. Teacher age varied from twenty two to sixty one years, with a median age of thirty eight (SD = 10.3). The study discovered that teachers in schools with a definite ICT school policy that stresses shared goals are using ICT more often in their classroom. It ought to be stressed, however, that within the present study solely 'teachers' perceptions concerning the content of the ICT school set up' and not the actual content of the ICT plan encompasses a vital impact on category use of ICT. As a consequence, an ICT policy set up appears to be a very important incentive to foster the integration of ICT use in classroom, however only if academics are responsive to its content. In different words, successful ICT integration becomes far more possible once teachers share the values expressed inside the school policy and perceive their implications. The study did not however bring out the how teachers' perception on ICT school plan effect on under-utilization or maximum utilization of ICT in education. This study filled this gap.

Hodgson (2005) discussed some issues to consider in implementation and management of learning technologies, Students develop a strong dependence on their teachers during their primary and secondary schooling. Therefore, they cannot automatically be weaned off this habit of dependence and become self-reliant in an electronic surroundings in tertiary education. To assist students to develop from being dependent learners to independent learners, they have to be familiarized towards the teacher's expectations and be given pointers for on-line activities and their own roles within the on-line learning community. Academics got to demonstrate technical skills if activities are new to students and to take more time guiding and interacting in both face-to-face and electronic communications.

There are areas to look at if there is to be any meaningful progress in the online curriculum development in education. First the vision of the school should reflect the new needs of education as innovative- something which is necessarily achievable through the use of technology. Administrative support structures, student services, technology support, and employees training and support needs are all areas that need to be analyzed and maybe modified so as to successfully implement eLearning. By accepting a vision statement and its implications, those at the forefront of eLearning in the school acknowledge that physical, organizational, and programmatic changes will be occurring, with the inevitable shift of resources. Advanced planning and policy development are keys to a well-run distance learning program. This planning will allow money to be spent more efficiently such as buying one software package to serve multiple purposes, rather than several packages over several years. Planning will also facilitate better use of existing resources and time, for example, developing technical training programs for all departments rather than having departments contacting technical support one at a time (Levy, 2003).

Wong and Li (2008) conducted a study on factors that influenced transformational integration of ICT in eight schools in Hong Kong and Singapore. The study discovered that leadership promotion of collaboration and experimentation and teachers dedication to student targeted learning influenced effective ICT transformation. In an exceedingly quantitative study conducted by Ng (2008) on aspects of transformational leadership with eighty Singaporean secondary teachers, the study found out that a transformational leadership with qualities of distinctive and articulating a vision, promoting acceptance of group goals, providing individualized support, providing intellectual stimulation, providing associate acceptable model, making high performance expectations, and strengthening school culture may influence the

utilization of ICT in schools. Similarly, Afshari et al. (2009) distributed questionnaires to thirty heads of second-cycle establishments in Tehran. Their results revealed that there is a relationship between the head's level of computer competency and transformational leadership practices. They indicated that transformational leadership may facilitate improve the integration of ICT into teaching and learning processes. The current study analyzed the specific roles of schools principals in ensuring maximum utilization of ICT in teaching and learning.

Yuen, Law & Chan (2003) conducted case study of 18 schools in Hong Kong. They found that in catalytic integration model schools, the school principal is the key change agent, exhibiting visionary leadership, workers development and involvement whereas in cultural innovation model schools, sensible leadership is exhibited wherever the school principal is not essentially concerned in ICT leadership, and teachers are liberal to implement new ideas in certificatory and enhancing culture. Additionally studies have shown that varied levels of leadership like principal, administrative leadership and technology leadership influence successful use of ICT in schools.

Successful education through ICTs depends on the following factors; (a) Institutional: The appropriate infrastructure must be in place to enrich the successful operation of the eLearning environment; (b) Management: Managing the content, the delivery, and therefore the maintenance of the eLearning system; (c)Technological: the right hardware and package is used; (d) Pedagogical: the tactic and method of teaching must be analyzed; (e) Ethical: an outline of social, political, cultural, geographical, and legal issues must be considered; (f) Interface: the actual website style and content navigation system should be simply accessible and usable; (g) Support: each communication and resource support have to be compelled to be in place; and (h)Evaluation: This includes the analysis of the eLearning content development method, the

analysis of the eLearning program and therefore the assessment of the students' learning (Levy, 2003).

Wanjala (2013), did a study on teachers' perception on the use of ICT in education. The research used a mixed methods research; cross sectional and phenomenology. The study found out that successful adoption of ICT depends on positive attitude of teachers. Teachers need to be trained on how to teach using ICT. Even though teachers were willing to fully embrace ICT in teaching, its use was limited to few administrative tasks due to inadequacy of the tools. The study however did not clearly point out the particular attitudes and perceptions that might hinder effective and maximum utilization of ICT in teaching and learning, for example added workload, computer illiteracy, and technophobia. This study filled these gaps by assessing the individual, social and cultural impediments to full utilization of ICT in education. Mbaluko (2009) conducted a study close to Wanjala. He assessed the preparedness for integration of ICT in learning and teaching. She found out that the role of teachers is pivotal for successful integration. This study sought to find out the level to which involve learners in learning through ICT.

The fore going discussion presented various attitudes that can either promote or hinder learning and teaching through ICT. The teacher needs to be skilled in motivating the students online and creating an enthusiastic online environment. The attitude of facilitators towards online learning and its benefits will determine its effectiveness. Teachers need to be self-motivated, interested, and willing to integrate technology in their subjects. The reviewed literature failed to elucidate the various cultural, social and attitude issues among teachers and their causes. This study therefore assessed the perceptions of teachers on learning and teaching through ICT and how these perceptions hinder maximum utilization of ICT in learning.

2.7 Demonstration of a Research Gap

The Literature review has brought out the invaluable use of ICTs in education especially in the 21st century. Studies and research reviewed concentrated on why teachers and learners should use ICTs in teaching and the justification for eLearning, the benefits of learning through ICTs, developing an online curriculum-who are the various parties involved in designing a successful online program in schools and the challenges the use of ICTs in education and online learning.

Seamus & Kay, 2003, brings out the advantages of using ICT in learning by elucidating this; they promote high order thinking skills through collaboration, research tools available through ICTs and the global approach employed in study. The high order thinking is gained from the following online activities; offering ideas or resources; inviting critique; asking challenging questions; articulating, explaining and supporting positions on issues; exploring and supporting issues by adding explanations and examples; reflecting and re-evaluating personal positions; critiquing, challenging, discussing and expanding ideas of others; negotiating interpretations, definitions and meanings; summarizing and modeling previous contributions; proposing actions based on developed ideas.

The versatility of social software and other collaboration tools available today support constructivist environments that seek to motivate, cultivate, and meet the needs of the 21st-century learner (Beldarrain, 2006). The hindrances reviewed in the use of ICT in learning range from limited digital equipment, limited rural electrification and frequent power disruptions, limited penetration of the physical telecommunication infrastructure into rural and low-income areas, lack of technical training and support among others.

However the studies have little discussed the perception and attitude of various players on the implementation of education through ICTs and eLearning in schools. There is an overlook on the part teachers and learners play on successful implementation of learning through ICTs. The reviewed studies focused on why the use of ICT tools in learning is so crucial in this age and why this has not been such a big success in schools (benefits to challenges).

Wahome (2011),Wanjala (2013) and Mbaluko found out the ICT tools available in most schools and their use; computers and printers are used in printing, typing and publishing examinations, DVD/VCD used by English teachers to teach poetry and oral literature and also to watch set books. They failed to note however how individual teachers have appropriated other ICT tools available to them in instruction and learning. It is important to note that the available tools have not been properly put into use. For example how much do teachers use their smart phones to enhance learning? The competency of teachers in appropriating ICT tools in learning in most schools in Kenya has not been explored well in the reviewed literature. The individual perceptions and attitudes of teachers and learners in learning through ICTs is missing in the literature reviewed. As Njenga puts it, "the people issue, resistance to change, is the most difficult part of implementing new technologies like e-learning" (p.105).

This study sought to find out the extent to which the available ICTs have been integrated in teaching/learning in public secondary schools in Kajiado North sub-county. The perceptions on the use of ICT in education among teachers and learners was assessed, and an analysis on how good they tackle the impending challenges. Therefore the research explored on this untraded area.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents an in depth description of the methodology to address the research problem. The chapter outlines the research style as mixed methodology (qualitative and quantitative design), location of the study, target population, sample and sampling procedures, data collection instruments, validity and reliability of the instruments, knowledge analysis procedures and at last the ethical issues in the collection of data.

3.2 Research Design

Research design refers to the procedures used by the researcher to select a sample, administer the instrument and analyze data (Ogula, 2005). According to Kothari (2012), a research design is necessary in facilitating research operations thereby making research as efficient as possible and finally yielding maximum information with minimal expenditure of effort, time and money. The research used mixed method research design. According to Johnson and Onwegbuzi (2004), mixed method research design is a combination of quantitative and qualitative techniques, methods, approaches and concepts or language in a single study. The study used convergent parallel mixed method design. According to Creswell (2014), convergent parallel mixed method aims at collecting, analyzing and mixing qualitative and quantitative data in a single study. This design was purposely chosen because qualitative and quantitative data was collected concurrently using questionnaire and interview guides. Convergent parallel design was used because the study aimed at finding a convergence between perception and under-utilization of ICT tools in teaching and learning.

Quantitative and qualitative methods complement each other and provided for the triangulation of findings, hence greater validity of the emerging inferences. Whereas the former approach gave a more general understanding of the issue of the infrastructure and its effective implementation, the latter provided a detailed and in-depth understanding of the same. Creswell and Clark (2011) and Bulsara (2003) argued that the use of qualitative and quantitative approaches in combination provides a better understanding of research problems than either. Integration of qualitative and quantitative research designs has several advantages. Qualitative data can be useful in determining the validity of quantitative findings. Besides, quantitative data can be used to explain findings from qualitative data (Fetters, Curry, & Creswell, 2013). Thus triangulation as the qualitative and quantitative methods will complement each other to obtain reliable data.

This study used both cross-sectional and phenomenology research designs. A cross-sectional study involves observation of phenomena at one point in time (Babbie, 2010). A cross-sectional survey was adopted with questionnaires as the main instrument for gathering quantitative data from the participants, which then was analyzed by use of the statistical package for social sciences (SPSS). Cresswell (2014) described survey as a design that provides a quantitative or numeric description of trends or opinions of a population by studying a sample of that population. Survey design was ideal due to its appropriateness in collecting data in small amounts in a standardized form from a relatively large number of individuals within a short time The application of a cross sectional survey design allowed the researcher to compare variables of interest at the same time. The rationale of choosing the mixed methods design was to assess the extent to which ICT tools are being utilized in form of percentages and at the same time find out the perception and attitudes which might affect the maximum utilization of these tools in

teaching and learning. This was aimed at finding out the relationship between teachers and learners' perception on learning through ICTs and successful implementation of ICTs to improve learning.

3.3 Location of Study

The research targeted public secondary schools in Kajiado North sub-county which is part of the vast Kajiado County, Kenya. Public schools were chosen because of they are privileged in terms of government funding. There are 28 public secondary schools according the available data from the District Education Office Kajiado North sub-county office in Ngong (Karanja, personal communication, 2017). Kajiado North sub-county was appropriate for the study owing to the fact that it covers both urban and rural areas and has a diverse cluster of school representing both boarding and day, girls and boys and county and sub-county schools. This genre representation enabled the study to make reasonable generalization of the findings.

3.4 Target Population

According to Babbie, (2010), target population is all members of a real or hypothetical set of peoples, events or objectives to which an investigator wishes to generalize results of the research study. Kajiado North sub-county has a population of 28 public secondary schools, 8420 students and 345 teachers. The target population for this study consisted of the 28 schools; with principals, teachers, students and educational officials being the main focus.

3.5 Sample and Sampling Procedure

A sample is a selection of part of population with the aim of understanding some of the characteristics of the whole population (Ogula, 2005). The sample for this study consisted of 10

public secondary schools in the sub-county which is 35% of the total population of public secondary schools in Kajiado North sub-county. The sampling approach was guided by the proposal of Kombo and Tromp (2006) who says that a sample of 30% is large enough for big population. The sample size for teachers was 104 teachers out of 345 which translate to 30%. The number of teachers from each of the selected schools was chosen using simple random sampling in proportion to the total population of teachers. Simple random sampling gives equal opportunity for all members of the population being selected. Thus it removes the likelihood that the sample is biased by the individual selecting the sample. (Gay & Arasian, 2003).

The sample size for students was 150 of the 1500 students. They were selected using stratified random sampling for mixed schools and simple random sampling for single sex schools. Stratified sampling is the process of selecting a sample in such a way that guarantees desired representation of relevant sub-groups within the sample (Mugenda & Mugenda, 2008). Ten head teachers were selected purposively from the sampled schools because they had crucial information on the schools' vision in regard to ICT integration. Two education officials were also purposively sampled to participate in the study. The sampling matrix is represented in table 2.

Table 1: Sampling Matrix

Respondent	Target population	Sampling Design	Sample size	Percentage
Schools	28	Purposive Stratified	10	35%
Students	1500	Stratified Simple Random	150	10%
Teachers	345	Simple Random	104	30%
Head Teachers	28	Purposive	10	35%
Education Officials	6	Purposive	2	33%

3.5.1 Sampling of Secondary Schools

Ten schools were sampled using stratified sampling and purposive sampling. There is one national school, one county school and twenty six sub-county schools in Kajiado North sub-county which brings to a total of 28 schools. The national and county schools were purposively selected based on the fact that they offer computer studies as an examinable subject. Of the remaining 26 schools, eight were selected using stratified random sampling.

Stratified sampling method was chosen so as to achieve representation of various groups. The schools were grouped into; mixed day, mixed boarding, mixed day and boarding, girls boarding, and boys boarding. The sample consisting of four mixed day, one mixed boarding, one mixed day and boarding, one girls boarding and one boys boarding was drawn.

3.5.2 Sampling of Students

One hundred and fifty (10%) out of 1500 students were chosen to participate in the study in proportion to the population of the students in sampled schools. Six mixed schools participated in the study. Students were selected using stratified random sampling. In each participating class, boys and girls were put into two different groups. Pieces of paper were written with yes and no answers and were presented to the two groups to pick randomly. Those who picked yes participated in the study.

In single sex schools, learners were selected using simple random sampling. This is appropriate for this study because each member had an equal chance of being selected to assess the level of integration of ICT in learning.

3.5.3 Sampling of Teachers

Teachers were sampled using simple random sampling. The study used simple random sampling so that all the teachers are given an equal chance of being selected (Mertens, 2004). To get the number of teachers to be sampled per selected school, the study used proportion; sampling in consideration to the populations in different schools. The sample size was 104 out of 345 teachers which is 30% of the total population.

3.5.4 Sampling of Head Teachers

Ten head teachers were selected purposively representing 35% of the 28 head teachers in Kajiado North sub-county. Purposive sampling allows a researcher to use the cases that have the required information with respect to the objectives of the study (Creswell, 2014). The head teachers possess resourceful information on the level of integration of ICT in their schools and the extent of failure of success in learning and teaching.

3.5.5 Sampling of Education Officials

Purposive sampling was used to select two educational officials from the sub-county. These were the DEO and DQASO. They provided information on the overall evaluation of learning through ICTs in the sub-county. These people had important information on the implementation of ICT initiative in schools, government support on infrastructure, maintenance and training.

3.6 Data Collection Instruments

The research used questionnaires for teachers and students. Questionnaire is a carefully designed instrument (written, typed or printed) for collection of data directly from people (Ogula, 2005). The questionnaires were precluded by a brief introduction on the purpose of the study. The questionnaires included each open ended and closed ended queries.

The study also used interview guides. An interview guide is a written down general guide or plan which is followed to orally ask questions and make comments. It helps in leading a respondent towards giving some information. Interview guides were employed to school principals and Ministry of education officials in the sub-county.

3.6.1 Questionnaires for Teachers

The questionnaire for teachers had the following sections: section A which contained the information about the teacher, that is the sex, subjects and teaching experience; section B was on the available ICT and their usage; section C was on the obstacles to effective learning and teaching through ICTs; Section D on benefits of learning and teaching through ICTs and section E on recommendations and policy framework.

3.6.2 Questionnaires for Students

The questionnaire for students consisted of five sections: section A was on the demographic information- sex and class; Section B looked at how learners use the available ICT tools in learning and on what should be done to improve learning through ICTs; Section C on the obstacles to effective learning and teaching through ICTs; Section D on benefits of learning and teaching through ICTs and section E on recommendations and policy framework.

3.6.3 Interview Guide for School Principals and Education officials

The interview guide for school principals had four sections: section A; demographic information, that is, leadership experience and position, Section B; role played in appropriation of ICT resources and ICT use in schools, Section C; Obstacles to effective teaching and learning through ICT, Section D; benefits of teaching and learning through ICT, Section E; recommendations and policy framework.

The interview guide for education officials had the following sections: Section A; ICT tools and utilization, Section B; Challenges of education through ICT, Section C;Policies and recommendations.

3.7 Validity and Reliability of Research Instruments

Validity describes the extent to which a measure accurately represents the concept it claims to measure. There are two broad measures of validity; external and internal. External validity addresses the ability to apply with confidence the findings of the study to other people and other situations, and ensures that the conditions under which the study is carried out are representative of the situations and time to which the results are to apply. Internal validity

addresses the reasons for the outcomes of the study, and helps to reduce other, often unanticipated, reasons for these outcomes (Drost, 2011).

Reliability is the extent to which measurements are repeatable when different persons perform the measurements, on different occasions, under different conditions, with supposedly alternative instruments which measure the same thing. In sum, reliability is consistency of measurement or stability of measurement over a variety of conditions in which basically the same results should be obtained (Roberts, Priest, & Traynor, 2006).

3.7.1 Validity of Research Instruments

The study employed content validity to ensure comprehensive coverage of specific areas of learning through ICTs in schools (Cohen, Mannion & Morrison, 2007). The items on the questionnaires and interview guide covered the availability, competency in use, learning through ICTs and challenges of learning through ICTs.

Expert advice from two university supervisors was sought as well as the guidance from the department of research and evaluation. Their comments helped in checking that the instruments measure what they purport to measure.

The researcher sought to establish the validity of the instruments through pilot testing. A pilot test was conducted in one of the schools selected from the target population. The school was selected using simple random sampling out of the schools not selected to participate in the study.

3.7.2 Pilot-testing of Research Instruments

Pilot testing involves trying out the research instrument on a small number of samples. After the development of the questionnaire, a pilot study was be carried out to ensure that the items in the questionnaire were stated clearly, had the same meaning to all the respondents, and

also to give the researcher an idea of approximately how long it would take to complete the questionnaire. Pre-testing of research instruments is a pre-requisite step to be followed during instrument design as it aids in the identification of potential problems with the instrument exposing what works and what does not (Mugenda and Mugenda, 2008).

After development of the questionnaire, the instrument was pre-tested to ensure correctness of items in the questionnaire, and that respondents interpreted same meanings from them. The researcher was also likely to have an idea of time it would take the respondents to complete the questionnaire. According to Saunders, Lewis and Thornhill, (2007) a sample size sufficient to provide an effective pilot test should be ten. In this study, the researcher conducted a pilot-test in one public secondary school in Kajiado North sub-county by distributing ten (10) questionnaires to teachers and students that were not included in the main study.

3.7.3 Reliability for Quantitative Data

To test reliability, the researcher used test-retest technique. This involved administering the same instrument twice to the same group of subjects (Orodho, 2009). The researcher administered questionnaires to students and teachers differently and gave a one week lapse between the first and second test. For every similar response, two marks were allocated and for every different response, one mark was allocated. The results were correlated using spearman rank order correlation co-efficient. A correlation co-efficient of 0.7 and above was considered high enough to pass the instrument as reliable.

3.7.4 Reliability for Qualitative Data

The interview guides were checked to test their credibility and dependability. Credibility tests checks whether there is a correspondence between the way respondents perceive social constructs and the way the researcher portrays their view points. One of the ways of checking

credibility is member check (Mertens, 2004). The researcher at the end of every interview summarized what was said and asked the interviewees whether it reflected their position.

The dependability of the interview guides was also tested. Dependability measures the quality and appropriateness of the inquiry process. It finds out whether multiple researchers using a particular instrument can reach similar interpretations (Creswell, 2014; Mertens, 2004). To do this, the researcher interviewed one teacher who would not be included in the study and after some days asked a fellow teacher to interview the same teacher. The researcher checked the extent to which the proposed interview guide gave the same information.

3.8 Data Collection Procedures

The researcher sought the approval of the department of Post Graduate Studies in Education to collect data after fulfilling the research proposal requirements. Using the University data collection letter, the researcher went ahead and sought a research permit from the Ministry of Education, Science and Technology. The researcher then visited the education offices in Kajiado North sub-county in order to submit copies of the research permit. This was done in order to obtain clearance to visit schools.

Further clearance was sought from the principals in consideration to different school programmes so that the research does not become a distraction to learning. The researcher then met participating groups, did a self-introduction and finally introduced the topic and aim of the research. The respondents were taken through the ethical considerations guiding the research with specific emphasis on voluntariness, confidentiality and the prospective benefits of the research. The questionnaires were distributed and collected after the respondents were through

filling them. Interviews were conducted on prior arrangement with the respondents in regard to their availability.

3.9 Data Analysis Procedures

The study used the concurrent triangulation; comparing the two sets of quantitative and qualitative data to determine convergence, difference or some combinations. To analyze quantitative data, the study used descriptive statistics. The information gathered was organized into different categories of respondents and coded to make data reduction possible. It was then interpreted using SPSS and presented using tables, frequencies, percentages, graphs and charts.

The procedure for analyzing qualitative data was; documentation of data, categorization of data into concepts and themes, connection of data to show how one concept may influence another and reporting the findings. Quantitative and qualitative data was mixed in interpretation and discussion section by presentation of quantitative statistical results followed by qualitative quotes supporting or disconfirming quantitative results (Creswell, 2014).

3.10 Ethical Considerations

The study was carried out guided by the established research ethical considerations. According to Mugenda (2008), ethics in research entails application of ethical standards in planning the study, data collection and analysis, dissemination and use of the study findings. The ethical guidelines which guided this study followed the APA general ethical principles of psychologists and code of conduct (2002) and other sourced research ethics from other research institutes. The principles were contextualized to fit the situation of this study. The principles are (The British Psychological Society (2010):

Beneficence and Non-maleficence: The principle of beneficence includes the skilled mandate to do effective and important research so as to better serve and promote the welfare citizens. Beneficence relates to the advantages of the research, whereas non-maleficence relates to the potential risks of participation. A researcher should think about all potential consequences of the analysis and balance the risks with proportionate profit. The type, degree, and range of potential risks should be assessed likewise as the peoples' value system that ranks numerous harms (Fouka & Mantzorou, 201I). Kajiado North County is a multi-cultural society. It is also has diverse economic classes among residents. This means that it accommodates students and teachers of various classes. Not everyone sees the influence of technology the same way. Some might not have used a computer in their life. The researcher took note of type of questions so that they would not sound offensive.

Informed consent: It means a person knowingly, voluntarily and showing intelligence, and in a clear and manifest approach, offers his/her consent. Informed consent seeks to include the rights of autonomous people through self- determination. It also seeks to stop assaults on the integrity of the patient and defend personal liberty and veracity. For an informed consent to be ethically valid, the following components must be present: Disclosure- the purpose of this study will be explained education administration in various schools and a brief statement on the purpose will be provided on the questionnaires. Understanding: The participant must understand what has been explained and must be given the opportunity to ask questions and have them answered by one of the investigators. The questions were precise and to the point and in a language understandable to the respondents. Voluntariness: The participant's consent to participate in the research must be voluntary, free of any coercion or promises of benefits

unlikely to result from participation. The researcher did not compel the respondents to answer questions.

Respect for obscurity and confidentiality: anonymity is protected once the subject's identity cannot be connected with personal responses. It’s the freedom an individual has to determine the time, extent, and general circumstances under that private information are shared with or withheld from others. Whenever subjects refuse to report personal data as they regard it an invasion of privacy, the researcher ought to respect their views. This may even apply to report aged, income, marital status, and different details that the subject may regard intimate (Fouka & Mantzorou 201I). The researcher explained to the respondents that their responses would only be used for academic purposes. The researcher did not record names of the respondents and did not coerce them share what they are not comfortable with even if it is part of the study.

Integrity: Researchers seek to promote accuracy, honesty and truthfulness in the science, teaching and practice of psychology. The researcher disengaged in activities like cheating, fraud, subterfuge or intentional misrepresentation of fact in reporting research findings. Guided by this principle of integrity, the researcher avoided any form of plagiarism by acknowledging the sources and any form of malpractices like imagined responses from respondents.

CHAPTER FOUR

PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This section of the research study discussed the findings and results based on the collected primary data and information from questionnaires. This chapter is arranged according to the research questions themed as; demographic data, the available ICT tools, usage of ICT tools, obstacles to effective usage of ICT tools, benefits of teaching and learning through ICT and recommendations on effective teaching and learning through ICT. The primary aim and goal of this study was to find out the extent to which ICT tools are utilized in public secondary schools in Kajiado North sub-county.

In this research, data was collected using self-administered questionnaires and interview guides. Data obtained from individual interviews was analyzed thematically by identifying information which is important for the study, summarized and presented in narratives and direct quotes. Data from questionnaires was analyzed and interpreted using Statistical Package for Social Sciences software version 20.0 and summarized using bar charts, frequencies and percentages. The findings were discussed in reference to reviewed literature.

4.1.1 Response Rate

The study sampled 10 schools, 150 students, 104 teachers, 10 school heads and 2 education officials. An analysis of the response rate was carried out to determine the validity of the results. According to Mugenda and Mugenda (2012), determining the return rate is important because a low response rate is an indicator of questionable validity of research results. High response rates ensure more accurate survey results (Creswell, 2014). The total number of

questionnaires distributed to teachers and students was one hundred and four (104) and one hundred and fifth (150) for students respectively. The return rate was fairly good for teachers because 72 questionnaires were duly filled and returned which accounts for 70% of the questionnaires distributed. The return rate from students was also good as 125 out of 150 questionnaires were returned which is 83% of the total number of questionnaires distributed. All the principals from the ten sampled schools and two educational officials from the sub-county were interviewed.

4.2 Demographic Characteristics of the Respondents

This study majorly involved teachers and students. Among the demographic questions of interest to the researcher included the designations of the respondents which involved the teachers stating their sex, age, level of computer literacy work experience and the type of school they teach in. This information was important for this study because the researcher was interested to see whether there is any relationship between these variables and the level of integration and utilization of ICT tools in teaching and learning. The students stated their sex, class and type of school; either boarding, day, mixed, national/county or sub-county school.

4.2.1 Sex of the Respondents

The study sought to ensure fair distribution of responses from both sexes. However it was found out that Kajiado North sub-county has more female teachers than male. The number of female and male students' respondents is almost the same. This demographic information is summarized in the following table.

Table 2: Sex of Teachers and Students

	Teachers		Students	
	Frequency	**Percent**	**Frequency**	**Percent**
Male	28	38.9	66	52.8
Female	42	58.3	59	47.2
Total	**72**	**100.0**	**125**	**100.0**

Regarding the sex of the respondents, the findings from the study revealed that most of the teachers were female (58.3%) while 38.9% were male teachers. On the other hand most of the students involved in the study were male students (52.8%) while the other respondents (47.2%) were female students. This shows an equal distribution in terms of the gender of the respondents.

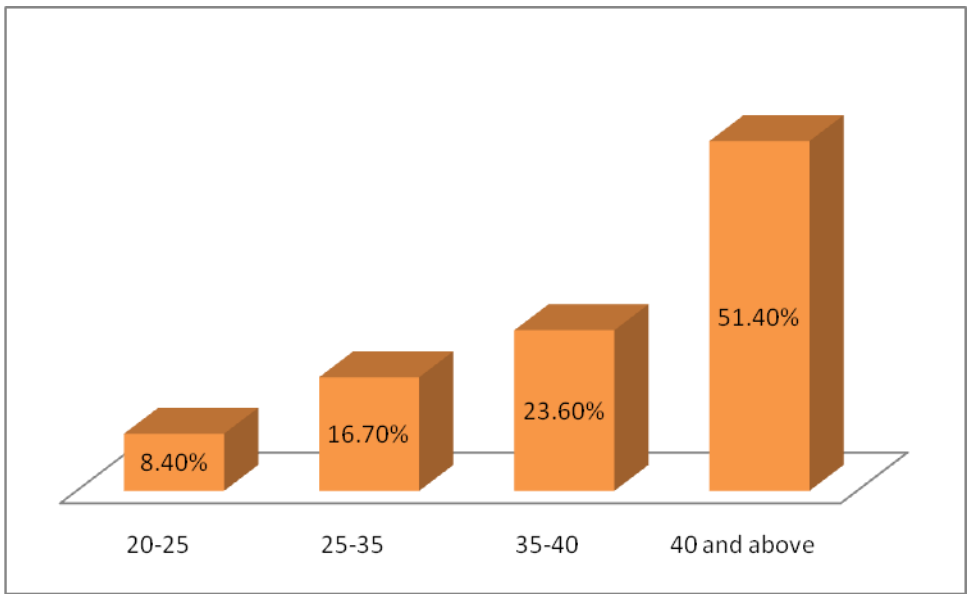

Figure 1: Age of the Teachers

Majority of the teacher respondents (51.40%) involved in this study were aged 40 years and above. The other respondents (49%) were aged between 20-40 years for age. This means that majority of teachers have been teaching for some time and are in cognizance with the 2006 Government of Kenya educational digital roll-out which requires optimum integration and utilization of ICT in teaching and learning. The vision of the MoEST was to facilitate ICT as a universal tool for education and training. In order to achieve this vision every educational institution, teacher, learner and the respective community should be equipped with appropriate ICT infrastructure, competencies and policies for usage and progress. It calls for recognition of the fact that ICT provides capabilities and skills needed for a knowledge-based economy (MoEST, 2006).

4.2.2 Type of schools where Teachers taught

The types of schools were categorized to comprise of girls boarding, boys boarding, mixed day and mixed day and boarding. The aim for gathering this data was to assess the level of disparity on ICT infrastructure among different types of schools.

Table 3: Type of School for Teachers

Response	Frequency	Percent
Girls boarding	16	22.2
Boys boarding	16	22.2
Mixed day	38	52.8
Mixed day and boarding	2	2.8
Total	**72**	**100.0**

Most of the teachers involved in the study were from mixed day schools (52.8%). There were an equal number of teachers from girls boarding and boys boarding involved in the study (22.2%). A small percentage of the remaining respondents were from mixed day and boarding (2.8%). The aim of this question was to find out whether there is a connection between the type of school and the level of utilization of ICT in teaching and learning. It is noted in the Education Policy Framework (EPF) that there are a number of challenges concerning access and use of ICT in Kenya. These include high levels of poverty that hinder access to ICT facilities, limited rural electrification and frequent power disruptions (MoEST, 2006). These compounding challenges are more explicit in small schools.

4.2.3 Teaching Experience in Years

The core concern here was to find out how long majority of teachers have been teaching so as to see whether there is any relationship with their perception on ICT in education. The work experience is phased as follows; 1-10 years, 10-20 years and 20 and above.

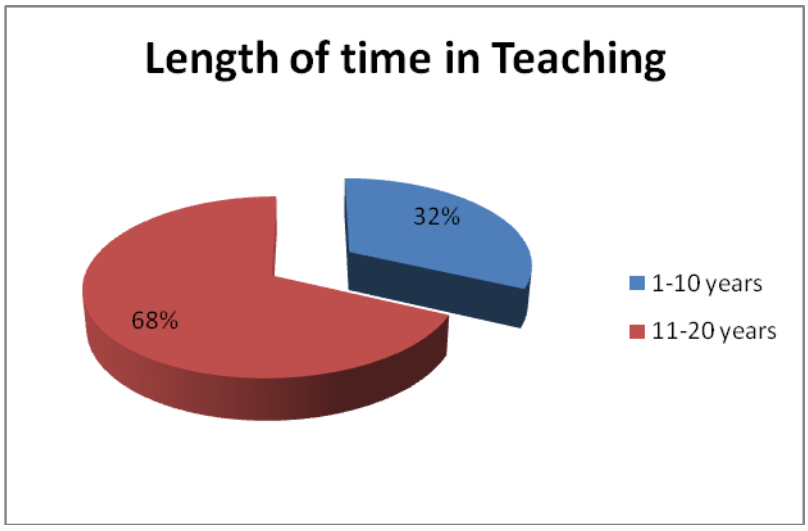

Figure.2: Length in Teaching

Majority of the teachers have worked for between 11-20 years (65.3%) while 31.9% have worked for 1-10 years. A small percentage did not respond to this question. Most teachers have not embraced maximum utilization of ICT in learning. The lack of theoretical knowledge and practical management of ICT, control and maintenance skills of ICT staff leads to these units being managed, controlled and maintained virtually on trial and error basis by most teachers (Amutabi,2004).

4.2.4 Responses on whether there are any Courses attended on Computer Literacy

The aim of this information was to find out the percentage of teachers who have computer knowledge in order to see their influence utilization.

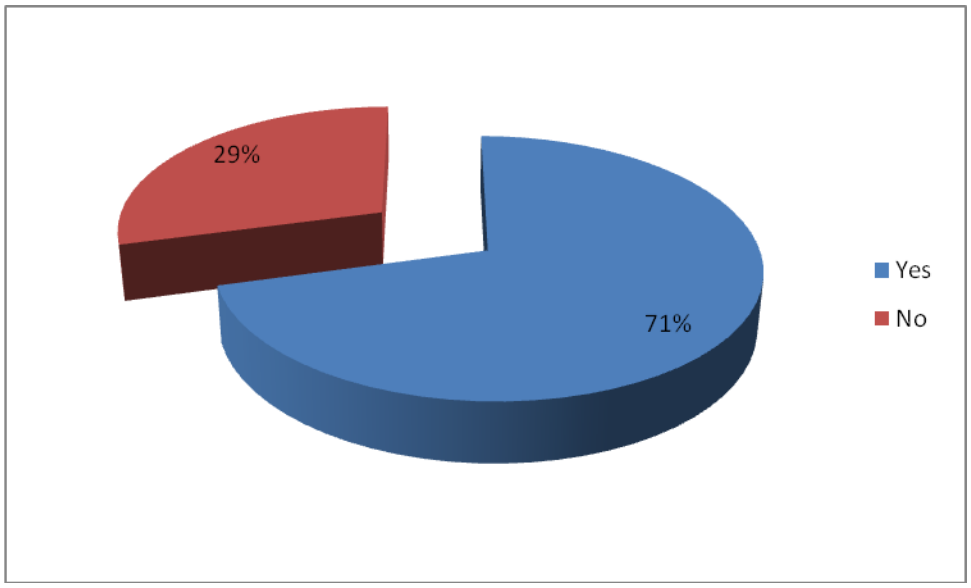

Figure 3: Courses attended on computer literacy

Majority of the teachers 71% said that they attend courses from time to time while 29% said that they have not attended any courses on computer literacy. This shows that a higher percentage of the respondents were computer literate. Computer literacy is not however enough to roll out learning through ICT, teachers should be trained and supported on online teaching and

instruction. They need to be cognizant of how the details of their subjects will be implemented in the new environment (Wong & Li (2008).

4.2.5 Level of computer literacy among Teachers

The researcher sought to find out to what level have majority of teachers trained either by their own initiatives, school sponsorship or government recommendation. The goal for this concern is to find how competency influences integration and maximization and the ability to positively stimulate learners through ICT.

Table 4: Level of computer literacy

	Frequency	**Percent**
Certificate	39	54.2
Diploma	3	4.2
Degree	5	6.9
Masters	3	4.2
No Response	22	30.6
Total	**72**	**100.0**

Most of the teachers (54.2%) said that they did computer literacy courses at certificate level. Other small percentages of the respondents said they did their computer literacy courses during other levels of study. A large number of respondents (30.6%) did not respond to this question. Technical competence influences teachers' use of ICT in teaching. In the same light pedagogical and didactic competences are significant factors if effective and efficient

educational interventions are likely to be implemented (Peralta and Costa, 2007; Tasir et al (2012).

4.2.6 Class level of Students

The study also involved students. The class of students was important in getting more varied responses from learners. This data is important to the study to achieve fair distribution of students from different classes.

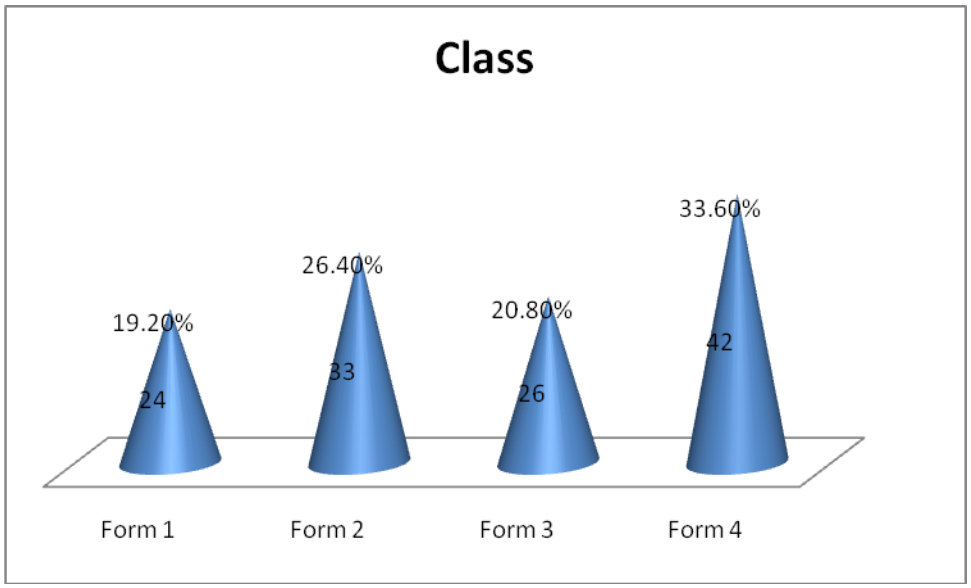

Figure 4: Class

The findings from the above table show that there was an equal distribution of respondents from forms one to form four. In this regard, the findings were representative of all students in public secondary schools in Kajiado North Sub-County.

4.2.7 Type of school for Students

The categories of schools included; girls boarding, boys boarding, mixed boarding, mixed day and mixed day and boarding. There was a problem in answering this from some learners because two mixed day schools were to be changed to be girls boarding schools. Some girls from

these schools chose to fill them as girls boarding instead of mixed day. The researcher analyzed them in their current status.

Table 5: Type of school

	Frequency	**Percent**
Girls boarding	16	12.8
Boys boarding	27	21.6
Mixed boarding	2	1.6
Mixed day	76	60.8
Mixed day/boarding	4	3.2
Total	**125**	**100.0**

Majority of the students were from mixed day (60.8%). Twenty one percent (21.6%) of them were from boys boarding while 12.8% were students from a girls boarding schools. A small percentage (3.2%) said that they were from a mixed day/boarding school. Lastly 1.6% said that they were from mixed boarding.

4.3 Availability of ICT Tools in Public Secondary Schools in Kajiado North Sub-County

The researcher wanted to find out the ICT tools and resources available to teachers and learners in most public secondary schools in Kajiado North Sub-County. Training on education through ICT is not similar to computer literacy. To be proficient in computer operation does not mean that one can facilitate teaching and learning through ICT. More training on e-curriculum development, classroom delivery, assessment and evaluation should be done (Tinio, 2002). That

is why it was important to measure the level to teachers have been trained to teach through ICT to use the available tools in order to use the available tools.

4.3.1 Responses on whether the respondent has attended training on teaching through ICT

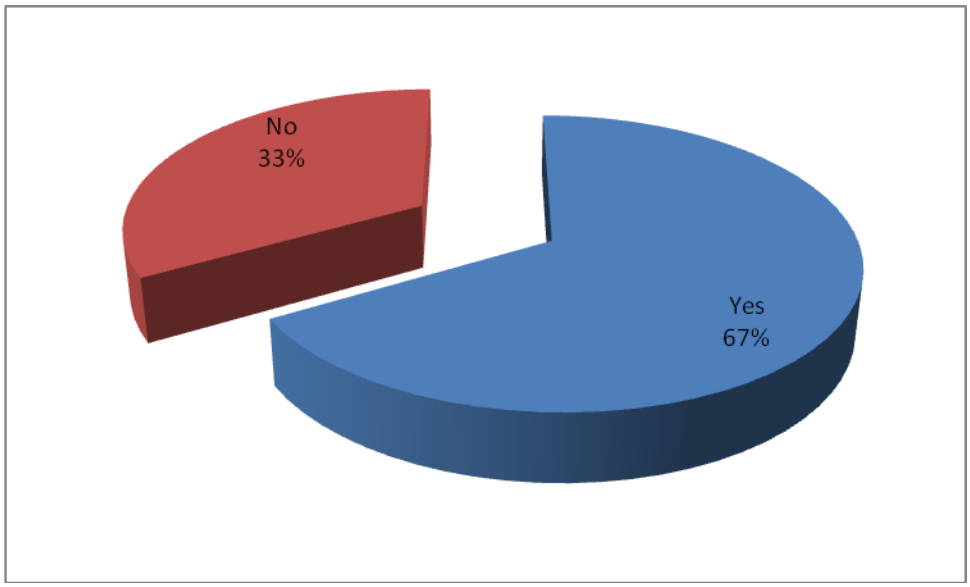

Figure 5: Training on teaching through ICT

According to the figure above, majority of the respondents said that they have attended training on teaching through ICT while 33% of the teachers have not attended any training. Training of teachers is the most crucial stage in implementation and usage of ICT in learning. This fact is underlined well in the vision of the MoEST; to facilitate ICT as a universal tool for education and training. In order to achieve this vision every educational institution, teacher, learner and the respective community should be equipped with appropriate ICT infrastructure, competencies and policies for usage and progress (MoEST).

These findings are similar to a survey done by Wastiau et.al (2013) on students and teachers' confidence in their digital competence and frequency of ICT based learning found out that there is a relation between teachers' digital competence and their use of ICT in the

classroom. Hence, participation in professional development activities can significantly influence their ICT use. There is a significant correlation between the levels of knowledge about ICT and the use of ICT in education.

4.3.2 Training on teaching through ICT

The study sought to find out what inspires teachers to attend education through ICT courses. The relevance of this question to the study was to find out to what extent personal interest in technology and ICT in general contributes to full utilization of ICT in teaching and learning.

Table 6: Initiative of attending training on teaching

	Frequency	**Percent**
College in-service training	10	11.9
Ministry of education sponsorship	35	43.6
School sponsorship	13	14.1
Personal initiative	24	30.4

Many of the respondents (43.6%) said that the training on ICT was an initiative of the Ministry of education sponsorship. Following closely was 30.4% respondents who said that it was a personal initiative while 14.1% said that it was a school sponsorship and 11.9% said that they received ICT training during college in-service training. Majority of the teachers who have taken a personal initiative to train on teaching and learning through ICT described more detailed responses on how they use the available ICT tools in teaching and learning. Personal attitudes, perceptions and interest contribute either positively or negatively on utilization of ICT in

learning and teaching. These findings is in line to a conceptual study done by Jimoyiannis & Komis (2007) which finds that teachers' attitudes towards ICT in education have a significant influence on ICT adoption and implementation behaviors in the classroom.

The findings are also related to a study by Watson (2002) who found a relationship between teachers' personal interest and teaching through ICT; teachers who do use computers in their classrooms tend to be those who can clearly relate the use of technology to their pedagogic strategy for their own subject. In particular it is these teachers who recognize and enjoy the pedagogic potential of ICT because it relates to their own philosophical underpinnings about teaching and the nature of their subject. ICT use in schools, resides in the professional competencies and interests of only a few teachers. For them the focus is not a future 'information age', but the fact that it supports the nature of the learning

4.3.3 ICT tools are available in most Schools

The researcher wanted to know the most common ICT tools found in majority of the schools at the disposal of teachers. The results are as shown below showing both students and teachers' responses.

Table 7: Student Response on ICT tools available in Schools

Students	Frequency	Percent
Computers	80	64.0
Printers	30	24.0
Scanners	28	22.4
Radio	45	36.0
Television	55	44.0
DVDs/VCDs	56	44.8
Internet	65	52.0
Overhead projectors	36	28.8
LCD	24	19.2

Majority of the students (64%) reported that they have computers in their schools while 52% reported to have internet in their schools. A small number of students (36%) reported to have Radio, Television (44%) and DVDs/VCDs (44.8%) in their schools. Few students reported the availability of printers (24%), scanners (22.4%), overhead projectors (28.8%) and LCD (19.2%) in their schools. This means there are at least few ICT tools available in most schools. The question is how these tools are used in teaching and learning. These findings supported Wahome (2011), Wanjala (2013) and Mbaluko (2009) who found out the ICT tools available in most schools were computers and printers which were used in printing, typing and publishing examinations, DVD/VCD were used by English teachers to teach poetry and oral literature and also to watch set books.

4.3.4 Availability of ICT supporting Infrastructure

The researcher intended to know the infrastructural capacity supporting learning and teaching through ICT in many schools. This included; electricity connection, back-up generator in case of power interruptions, computer labs, projectors and internet connection. The findings are presented in table.10 below:

Table 8: Infrastructure available in Schools

Students	Frequency	Percent
Electricity	125	100
Computer lab	125	100
Back-up generator	39	31.2
Internet	71	56.8
Projector	64	51.2

According to the above table, electricity and computer labs are the main infrastructures in school. Students also reported availability of internet and projectors in their schools (56.8% and 51.2% respectively). The low percentage of available back-up generators in cases of power disruptions compounds the problem of effective teaching and learning through ICT. The roll out of ICT in teaching has faced insurmountable challenges due to these obstacles. These findings were similar to the challenges highlighted by the ministry of education on implementation of ICT in education; limited rural electrification and frequent power disruptions. Where there is electricity, hindrances to application of ICT included; high costs of Internet provision, costs associated with digital equipment, inadequate infrastructure and support. Another problem was limited penetration of the physical telecommunication infrastructure into rural and low-income

areas. Specifically, the main challenge was limited access to dedicated phone lines and high-speed systems or connectivity to access e-mail and Internet resources (MoEST, 2006).

Table 9: Availability of ICT Tools in Schools according to Teachers

	Frequency	**Percent**
Printer	56	77.8
Radio	8	11.1
Scanners	32	44.4
Computers	65	90.0
Television	7	9.8
DVDs/VCDs	6	8.4
Internet	9	12.5
Overhead projectors	3	4.2
LCD	12	16.7

According to the teachers, majority of the schools have computers and printers, that is (90%) and (77.8) respectively. Most schools have scanners (44.4%). Few respondents reported availability of LCD (16.7%), internet (12.5%), radio (11.1%), television (9.8%), DVDs/VCDs (8.4%) and Overhead projectors at 4.2%. The majority of tools (computers and printers) found in secondary schools agree with the reviewed studies. Wahome (2011),Wanjala (2013) and Mbaluko (2009) found out the ICT tools available in most schools were computers and printers are used in printing, typing and publishing examinations.

To underscore the necessity for improvement of ICT infrastructure, one head teacher noted; "we are sourcing for personnel with knowledge in computer to train teachers. We are also liaising with computer software producers to provide the school with necessary materials:" (Principal E, 15 May, 2017).Another school principal noted; "we have not mobilized ICT resources from various stakeholders because the school is still new with minimum infrastructure."(Principal D, 13 May, 2017). There is need for all stakeholders in the school to put more concerted efforts in purchasing and maintaining of ICT tools and resources

4.4 Teachers and Students Use of ICT Tools in Teaching and Learning

This study sought to establish the extent to which teachers and students use the ICT tools and resources like computers, internet, projectors, ICT software such as excel spread sheets for exam analysis and others in teaching and learning. The first part required the respondents to mention the available ICT tools at their disposal and their usage, and the second part to report the extent to which they use the tools in specified purposes.

4.4.1 Students' use of ICT resources in learning

The aim of this was to assess level to which learners have integrated ICT resources in learning through the induction of their teachers. The resources included the different computer software and videos available in various schools for use. The findings from the field were tabulated and presented as follows;

Table 10: Students' use of the available ICT resources in learning

Students	Very often	Often	Sometimes	Rarely	Never
Use of Kiswahili set-books or plays software in learning	37(29.6%)	20(16.0%)	21(16.8%)	15(12.0%)	32(25.6%)
Use of English set-books or plays software in learning	40(32.0%)	19(15.2%)	21(16.8%)	14(11.2%)	30(24.0%)
Use of internet research sites for various subjects in learning	10(8.0%)	7(5.6%)	25(20.0%)	19(15.2%)	61(48.8%)
Use of Ms. Excel and Word software in learning	10(8.0%)	12(9.6%)	18(14.4%)	18(14.4%)	60(48.0%)
Use of School e-mail and website in learning	8(6.4%)	10(8.0%)	20(16.0%)	25(20.0%)	60(48.0%)
Use past questions and answers software in learning	42(33.6%)	27(21.6%)	17(13.6%)	9(7.2%)	28(22.4%)
Use videos in learning	3(2.4%)	12(9.6%)	19(15.2%)	22(17.6%)	65(52.0%)
Use of Computer assisted programs for science and mathematics software in learning	8(6.4%)	12(9.6%)	21(16.8%)	14(11.2%)	67(53.6%)

Many students use Kiswahili set-book plays software in learning with 29.6% stating they use it very often, 16% reporting that they used them often and 16.8% saying they used them sometimes. Some reported that they either rarely (12%) or never (25.6%) use them. The utilization of English set-book plays software in learning was almost similar among students; 32% used them very often, 15.2% used them often and 16.8% used them sometimes. This was a fair level of utilization compared to teachers which means that these resources were left to subject teachers. On the other hand, asked on whether the students used internet research sites for various subjects in learning, majority of them said that they never use while 20.0% said that they

use sometimes. Many students (48.0%) don't use Ms. Excel and Word software in learning while a small number (14.4%) said that they use sometimes.

Majority of the students (48%) said that they do not use School e-mail and website in learning. A small number (20%) rarely use school email while 16% said that they use sometimes. On the extent to which they use past questions and answers software in learning, 22.4% said that they never use them while 20% said that they rarely use. Additionally, most of the students said that they have never used videos in learning. From the above tabulated data, it can be observed that the usage of the available ICT resources is minimal in most schools. These findings agree with the study of Wahome who conducted a research on the extent of use of ICT in public secondary schools in Murang'a County. The research found out that integration of ICT in education was at its infancy stage and majority of the schools were using ICT tools for basic use like typing, printing and analyzing examinations. The main challenges facing schools in using ICT are; inadequate ICT tools and resources, lack of enough trained computer teachers and inadequate funds which boil down to ineffective utilization among learners (Wahome, 2011).

4.4.2 Teachers' use of ICT tools in Teaching and Learning

This part of study was meant to answer the second research question on usage of ICT tools in teaching and learning. Here below are the findings:

Table 11: ICT tools used in teaching and learning

	Frequency	Percent
Computers for filling in marks	22	30.6
Printers for printing of exams and learning materials	19	26.4
Internet for downloading learning materials	13	18.1
DVDs/ VCDs for watching set books	11	15.3
Computers for internet	10	13.9
LCD and projectors for projecting notes during lessons	6	8.3
Internet for conducting educational research	6	8.3
Computers for office work	5	6.9
LCD on power point and projectors for preparing word	4	5.6
Computers for showing animations to students	4	5.6
LCD and projectors for projecting images from laptops	3	4.2
Scanners for preparing schemes of work	3	4.2
Internet for getting notes online	3	4.2
LCD and projectors for storage of information	2	2.8
Scanners for reproducing copies of documents	2	2.8
Printers for printing handouts	1	1.4
DVDs/ VCDs for revision materials and answers	1	1.4

The main uses of the resources found in the schools were summarized and the findings are as shown in table 11 above; Computers for filling in marks is the one most used at 30.6%, printers for printing of exams and learning materials follows closely with 26.4%, internet for downloading learning materials (18.1%), DVDs/ VCDs for watching set books (15.3%) and computers for internet (13.9%). The rest of the tools recorded minimal usage of 10% and below. They are; LCD and projectors for projecting notes during lessons, Internet for conducting educational research and computers for office work.

The findings exposed limited utilization of ICT in teaching and learning among teachers in most schools. The study noted a concerted effort from many principals in mobilizing for more ICT tools. Asked on the principals' role in mobilization of ICT resources, one principal stated, "I network with various stakeholders to get the tools. We are also engaging computer teachers to create awareness on the challenges in implementing ICT in learning in order to implement appropriate interventions." (Principal D, 13, May, 2017). This finding was congruent to that of Tezci, (2009) that found out that the most common uses of ICT are the Internet, e-mail, word processing and educational CDs, though rarely used. Tezci also found that ICT use in classroom was limited and this was attributed to the low level of teachers' experience on teaching through ICT.

4.4.3 Teachers' use of ICT resources in teaching and learning

The study wanted to find out the extent to which the available tools were used in learning and teaching. The aim of this was to assess how individual teachers have integrated ICT resources in teaching. The findings from the field were tabulated as shown below;

Table 12: Extent in using the available ICT resources in teaching and learning

Teachers	Very often	Often	Sometimes	Rarely	Never
Kiswahili set book DVD plays	5(9.7%)	7(9.7%)	8(11.1%)	25(34.7%)	27(37.5%)
English set book DVD plays	1(1.4%)	6(8.3%)	14(19.4%)	8(11.1%)	23(31.9%)
Time tabling software in teaching and learning	29(40.3%)	15(20.8%)	4(5.6%)	2(2.8%)	9(12.5%)
Exam analysis in teaching and learning	35(48.6%)	15(20.8%)	3(4.2%)	2(2.8%)	5(6.9%)
School e-mail and website in teaching and learning	15(20.8%)	9(12.5%)	11(15.3%)	10(13.9%)	12(16.7%)
Past questions and answers software in teaching and learning	26(36.1%)	20(27.8%)	8(11.1%)	1(1.4%)	5(6.9%)
E-learning platform in teaching and learning	4(5.6%)	6(8.3%)	10(13.9%)	11(15.3%)	23(31.9%)
Video tapes in teaching and learning	9(12.5%)	10(13.9%)	9(12.5%)	12(16.7%)	14(19.4%)

In response to the extent to which teachers used the various ICT software, majority of the respondents stated that they either rarely (34.7%) or never (37.5%) use Kiswahili set book plays in teaching and learning. Many teachers had not used English set book plays in teaching and learning with 31.9% reporting that they had never used them while 19.4% had used them sometimes. Many teachers (61%) often use time tabling software in teaching and learning.

Majority of the teachers (69.4%) use exam analysis in teaching and learning. To the extent to which the respondent use past questions and answers computer software in teaching and learning, majority of the teachers (63.9%) said they use them while 11.1% said that they use it sometimes. A good number (31.9%) never use e- learning platform in teaching and learning.

Most teachers either rarely (16.7%) or had never 19.4%) used Video tapes in teaching and learning.

In the light of the above analysis, it can be noted that teachers use the available ICT software and tools to a small extent in teaching and learning. Majority only use them for exam analysis, timetabling and storage or retrieval of past questions and answers. These findings are similar to a study conducted by Yildirim, (2007) who found out that the major uses of ICT by teachers was to prepare lesson notes and assessments instead of improving students' performances. Similarly, Wahome (2011) found out that majority of schools have computers and printers to type and print examinations and official documents only.

4.4.4 Teachers' use of the available ICT Tools and Software

The aim of this question was to find out how teachers utilize the available ICT in teaching and learning. This was important to the study because the level of integration and utilization is measured.

Table 13: Available ICT tools and software in teaching and learning

	Frequency	Percent
Computers for administrative work and examination analysis	57	79.1
Time-tabling software to program the lessons	13	12.5
Exam analysis software to compute results more easily and monitor students' progress	55	76.3
Language software on computers to learn proper pronunciation of words, intonation and word stress	8	11.1`
Video tapes for learners to grasp the content better	35	48.6
Past papers and answers software to test students on mastery of different topics	18	25
Internet for research and downloading reading materials	9	12.5
E-mail to send notes to learners	10	13.8
Past questions software to sample questions, set exams	59	82
Mobile phones for downloading materials	16	22.2

From the table above, the major available utilized tools and software are; past questions software to sample questions and set exams (82%),computers for administrative work and examination analysis (79.1%),exam analysis software to compute results more easily and monitor students' progress (76.3%) and video tapes for learners to grasp the content better (48.6%). Only a small percentage use Past papers and answers software to test students on mastery of different topics (25%), e-mail to send notes to learners (13.8%), internet for research and downloading reading materials (12.5%), time-tabling software to program the lessons

(12.5%)and Language software to learn proper pronunciation of words, intonation and word stress (11.1%). Conclusively, the level of integration was minimal among many teachers in schools.

The minimal use of ICT among teachers finds its reason mainly in lack of enough ICT tools but more so, on the incompetency of teachers on e-teaching. To overcome impediments to education through ICT, some strategies should be put in place. These impediments are either technological (lack of enough ICT infrastructure) or personal (individual attitudes). To gain the knowledge necessary to implement online curriculum effectively, teachers must have the necessary training, mentoring, and support, preferably on the equipment they will use. These findings agree with Tasir et al (2012) who conducted a research on the relationship between instructors' level of competency on the use of ICTs and the level confidence and efficiency in Malaysian schools. He found out that teacher's competency, teacher's confidence level, and teacher's satisfaction toward ICT training programmes is a very important factor that can increase the levels of the competency and confidence. Therefore, ICT trainers must formulate strategies that not only may increase teachers' satisfaction but also exceed their expectations of the acquired knowledge that they may gain at the end of the course.

4.5 Benefits of Teaching and Learning through ICT

The study sought to find out from students and teachers how learning through ICT helps them to learn and teach better. This was important to the study because maximum integration and usage of ICT in learning depended on how much learners and teachers appreciate its benefits.

Table 14: How ICT tools help students to learn better

Students	Frequency	Percent
Understanding better by watching educative videos	40	32
By interacting with other students	14	11.2
Getting more information on what we have learnt	38	30
Get more skills from computers like proper pronunciation	5	4.0
Store information more safely for future reference	8	6.4
To become more innovative and creative	16	12.8
To become more active learners	5	4.0
To learn new things	20	16

Most students reported that ICT tools help them to understand the content better by watching educative videos (32%). Most students also revealed that ICT tools help them to get more information on what they have learnt. Few respondents (16%), said ICT tools help them to learn new things thus becoming more innovative and creative (12.8%) and interacting with other students (11.2%). A similar study by Gonzalez (2010) summarized the benefits of ICT in education; it is essentially a communication-collaboration- knowledge building conceptions. It is seen as a medium to engage in discussing, debating, developing understanding and building knowledge. In this case, learning through ICT is conceived of as a space for engaging in learning tasks and activities that may lead to higher-level learning experiences.

A related study by Keengwe and Wachira (2008) revealed that computers can be used to support meaningful learning in five ways: knowledge construction but not reproduction;

conversations not reception; articulation not repetition; collaboration not competition; and reflection not prescription.

4.5.1 Benefits of Teaching and Learning through ICT according to Teachers

The study aimed at knowing the benefits of using ICT in teaching and learning. This was fundamental to the study because the spread of an innovation largely depends on the positive impact of the expected outcomes. A new tool gains popularity in as much as it supports the mastery of the core content and realization of the expected outcomes and in this case the expected learning outcomes.

Table 15: Benefits of Teaching and Learning through ICT

	Strongly Agree	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**
Use of internet facilitates learning	37(51.4%)	27(37.5%)	4(5.6%)	1(1.4%)	0
Use of ICT supports better attainment of the expected learning outcomes	32(44.4%)	30(41.7%)	6(8.3%)	1(1.4%)	0
Learning through ICT improves performance of learners	31(43.1%)	30(41.7%)	8(11.1%)	0	0
Learning through ICT supports independent learning	21(39.2%)	37(51.4%)	9(12.5%)	0	2(2.8%)
ICT makes learners more innovative	30(41.7%)	28(38.9%)	9(12.5%)	0	2(2.8%)
ICT enhances creativity among learners	30(41.7%)	27(37.5%)	7(9.7%)	2(2.8%)	3(4.2%)
ICT promotes high order thinking	27(37.5%)	25(34.7%)	13(18.1%)	3(4.2%)	1(1.4%)
ICT promotes lifelong learning	26(36.1%	26(36.1%)	9(12.5%)	4(5.6%)	2(2.8%)
Learning through ICT prepares learners for university education of research and scholarship	36(50%)	24(33.3%)	6(8.3%)	3(4.2%)	0

Majority (88.9%) of the respondents said that Internet facilitates learning while small percentages 5.6% were not sure. A large number (85.8%) of the respondents agreed strongly that ICT supports better attainment of the expected learning outcomes. On the other hand majority (84.8%) of the teachers agreed that learning through ICT improves performance of learners. A large number (90.6%) said that learning through ICT supports independent learning. The respondents also agreed that ICT makes learners more innovative (80.6%) and that it enhances creativity among learners (71.2%). Other respondents (72.2%) agreed that ICT promotes high order thinking**.** It also promotes lifelong learning with 72.2% affirming to this. Majority of the respondents (83.3%) said that learning through ICT prepares learners for university education of research and scholarship. There was a general agreement from the findings on projected benefits of learning through ICT both from students and teachers. This however did not come out from the real classroom usage. This means that most teachers had not fully integrated learning and teaching through ICT.

These findings on the immense value of ICT in education by majority of the respondents, is similar to other reviewed studies. Gonzalez (2010) found that learning through ICT emphasized sharing of knowledge through communication and collaboration beyond the classroom walls. It was essentially a communication-collaboration- knowledge building conceptions. According to Keengwe and Wachira (2008), online classes can increase participation among learners. Other benefits of ICT in education included; improved learning by raising curiosity, technological literacy among students, increasing academic access to remote communities that were formerly deprived of education because of distance, culture, economic desires or gender disparities; and to organize students for the world of work (Watson, 2007).

4.6 Obstacles to Effective Learning through ICT

The study sought to find out the obstacles that hinder optimum utilization of ICT in education. This part was divided into the following sub-sections; Challenges to effective teaching and learning through ICT, Perception and attitudes on teaching and learning through ICT and effects of lack of enough ICT tools to learning.

4.6.1 Challenges to Effective Teaching and Learning through ICT

The researcher find wanted to find out the main challenges teachers face in teaching and learning through ICT. This was important to the study because the level of usage depends on how well teachers are able to highlight what can hinder ICT in education and the possible remedies. Data was tabulated and the results were summarized in the following table.

Table 16: Challenges of teaching and learning through ICT

	Frequency	**Percent**
Inadequate of ICT tools and resources like internet	22	30.5
Knowledge on the use	13	18.1
Availability of e-learning materials	14	19.4
Lack of enough rooms with proper power connections in schools	12	16.6
Inadequate time to prepare and deliver lessons using ICT	17	23.6
Power interruptions	14	19.4
Misuse of the internet	4	5.6
Overpopulated classes	2	2.8
Lack of enough ICT teachers	2	2.8

Lack of enough ICT tools and resources is the biggest challenge in teaching and learning through ICT (30.5%). Many teachers also reported inadequate time to prepare and deliver lessons using ICT (23.6%), unavailability of e-learning materials (19.4%), power interruptions, inadequate knowledge on the use of ICT (18.1%) and lack of enough rooms with proper power connections in schools as other challenges to education through ICT. Only a small percentage mentioned misuse of internet (5.6%), overpopulated classes (2.8%) and lack of enough ICT teachers as challenges. These results are similar to a study by Nkonge and Gueldenzoph, (2006) who found out that, inadequate hardware and software, slow internet connections, lack of technical expertise among the instructors, insufficient orientation for learners, and a lack of release time for instructors to develop and design their online courses have been cited also as barriers to faculty participation in developing and teaching online courses.

Yildirim (2007 in a related study revealed that barriers to the use of technology include; insufficient training, inadequate technical and pedagogical support, rigid school syllabi, inadequate motivation, lack of strong leadership and inadequate cooperation among teachers. The Ministry of education affirms lack of enough digital equipment at virtually all levels of education as one of the most notable inhibiting factors to ICT in education. Other challenges are limited rural electrification and frequent power disruptions. Where there is electricity, hindrances to application of ICT include; high costs of Internet provision, costs associated with digital equipment, inadequate infrastructure and support (MoEST, 2006).

4.6.2 Perception and Attitudes on Teaching and Learning through ICT

The study wanted to find out how individual exposure among students through their teachers and school administrations encourage or dissuade learners from learning through ICT.

4.6.2.1 Perceptions on Learning through ICT among Students

The study sought to find out the level of disposition among students to usage of ICT in learning. The purpose of this research question was to assess whether students have been introduced to appreciate the need to utilize ICT in learning.

Table 17: Perception and attitudes on teaching and learning through ICT

Students	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
Our teachers support learning through ICT	19(15.2%)	34(27.2%)	18(14.4%)	28(22.4%)	25(20.0%)
ICT tools are not available in my school	17(13.6%)	18(14.4%)	13(10.4%)	31(24.8%)	46(36.8%)
I adequately use the available ICT tools in school and at home for learning	14(11.2%)	33(26.4%)	14(11.2%)	27(21.6%)	37(29.6)
There is inadequate technical support is usage and maintenance of ICT in my school	21(16.8%)	29(23.2%)	19(15.2%)	28(22.4%)	28(22.4%)
It is difficult to learn using ICT	3(2.4%)	6(4.8%)	23(18.4%)	35(28.0%)	57(45.6%)
I do not enjoy lessons offered through ICT	6(4.8%)	5(4.0%)	17(13.6%)	31(24.8%)	64(51.2%)
Learning through ICT is an added work load	6(4.8%)	5(12.0%)	15(12.0%)	38(30.4%)	60(48.0%)
Most of our teachers do not use ICT in learning	42(33.6%)	34(27.2%)	12(9.6%)	14(11.2%)	22(17.6%)

Majority (61.6%) of the students strongly agreed that ICT tools were not available in schools. Many respondents (42.4%) stated that their teachers support learning through ICT while a similar number (42.4%) disagreed and said that they do not support. Many students do not

utilize ICT tools in learning either in school or at home. Many students (44.8%) stated that there was an inadequate technical support schools. Majority (73.6%) of the respondents also disagreed with the statement that it is difficult to learn using ICT. A big number of students (76%) enjoy lessons offered through ICT. Majority (78.4%) of the students disagreed that Learning through ICT is an added work load. Additionally 60.8% agreed that their teachers do not use ICT in learning.

From the above findings it can be noted that majority of learners support learning through ICT but admit the inadequacy of ICT tools and resources in their schools. The students were positive on learning through ICT but they had not been introduced to them by their teachers. In a related study, Jimoyiannis and Komis, (2007) revealed that teachers' pedagogical cultures shape their representations of ICT use in the classroom and they are likely to adopt practices with computers that reflect their beliefs about teaching and learning.

4.6.2.2 Perception on Teaching and Learning through ICT among Teachers

The aim of this question to the study was to find out the extent to which personal disposition through training, exposure, open mindedness and a digitally supporting environment (pro-ICT administration, available IT technicians, and parents helping to purchase tools) affected proper utilization of ICT in teaching and learning. The results are presented in the table below:

Table 18: Perception and attitudes on teaching and learning through ICT

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
I am not adequately trained on teaching through ICT	20(27.8%)	25(34.7%)	6(8.3%)	7(9.7%)	12(16.7%)
ICT tools are not available in my school	10(13.9%)	21(29.2%)	7(9.7%)	17(23.6%)	14(19.4%)
I do not adequately use the available ICT tools in the school and at home for teaching	10(13.9%)	23(31.9%)	8(11.1%)	17(23.6%)	10(13.9%)
There is inadequate technical support in usage and maintenance of ICT	23(31.9%)	22(30.6%)	6(8.3%)	11(15.3%)	7(9.7%)
It is difficult to teach using ICT	7(9.7%)	10(13.9%)	12(16.7%)	23(31.9%)	17(23.6%)
Teaching through ICT is an added workload	5(6.9%)	14(19.4%)	12(16.7%)	19(26.4%)	19(26.4%)
Teaching through ICT distracts learners from the core content	5(6.9%)	9(12.5%)	10(13.9%)	20(27.8%)	23(31.9%)
It is expensive to integrate ICT in teaching	10(13.9%)	24(33.3%)	7(9.7%)	16(22.2%)	11(15.3%)
The administration does not support learning through ICT	5(6.9%)	7(9.7%)	14(19.4%)	20(27.8)	23(31.9%)

Majority of the teachers (62.5%) said that they were not adequately trained on teaching through ICT. This finding was different with the findings on the demographic information in this study which found that majority of teachers have gone through computer classes. This shows that teaching through ICT needs more that an ICT literate teacher. It needs a personal commitment to learn ICT in education and put it into practice. Teachers should be trained and supported on online teaching and instruction. They need to be cognizant of how the details of their subjects will be implemented in the new environment. The attitude of facilitators towards online learning

and its benefits will determine its effectiveness. Technology provides opportunities to support student learning. However, to achieve the full benefits in education, technology requires strategic planning and integration of these tools into instruction that only a sense-making and skilled teacher can provide (Keengwe & Wachira, 2008).

Most teachers (43%) reported availability of ICT tools in schools. A similar number (43%) disagreed that the tools were available. This shows the in-equality of ICT tools and resources between schools. Some schools have a good digitally enabled environment in terms of infrastructure while others do not. Most teachers (44%) reported that they do not adequately use the available ICT tools in the school and at home for teaching.

Majority of the teachers (62.5%) agreed strongly that there was inadequate technical support in usage and maintenance of ICT. This finding was similar to a study by Yilmaz, (2011) who asserted that, in providing schools with hardware and internet connections, it is also crucial to provide the schools with technical support with regard to repair and maintenance for continued use of ICT in schools. A small number (23.6%) disagreed and said that there is adequate technical support. The findings according to the teachers also showed that it is not difficult to teach using ICT (55.5%). Few teachers (23.7%) responded that it is difficult to teach using ICT. This finding has its basis on the high percentage of teachers who have trained computer. But again this did not necessarily result to education through ICT in real classroom setting. Small percentage of them said that it is easier to teach using ICT. Teaching through ICT is not an added workload according to most (52.8%) of the respondents. A small percentage (26.3%) said it is an added workload. According to 59.7% of the respondents teaching through ICT distracts learners from the core content while 19.4% said it does not. Many respondents (47.2%) said that it is expensive to integrate percentage ICT in teaching while 37.5% said it is not expensive.

Majority of the respondents (59.7%) think that the administration supports learning through ICT, 19.4% were not sure while 16.6% said it did not support.

From the above summarized results, the study found out that perception and attitude manifested in one's disposition to technology and its usage affects utilization of ICT in learning either positively or negatively. These findings are tandem to a study by Jimoyiannis and Komis, (2007) who said that most effective teachers not only have a positive attitude towards ICT but had good ICT skills and used computers as a part of a stimulating environment favoring pupils' inquiry and collaboration. A similar by Teo, (2008) found a link between perception and utilization; teachers are more positive about their attitude towards computers and intention to use computer than their perceptions of the usefulness of the computer and their control of the computer (Demici, 2009).

4.6.3 Effects of inadequate ICT Infrastructure on Learning through ICT

The aim of this research question was to find out the negative impact of poor infrastructure to effective learning through ICT. This is important to the study in as much as it brings out the main barriers to learning through ICT from the point view of learners.

Table 19: Impact of inadequate ICT Infrastructure on Learning through ICT

Student	Frequency	Percent
Maximum computer utilization is not achieved	16	12.8
Lack of electricity or generator renders learning through ICT impossible	50	40.0
The benefits of learning through ICT is not achieved	10	8.0
The practical part of utilization after the teacher teaches is not realized	27	21.6
Lack of internet makes research impossible	13	10.4

Many respondents (40%) cited lack of electricity as the main impediment to full utilization of ICT in teaching and learning. Few respondents (21.6%) said the practical part of utilization after the teacher teaches is also not realized while the study also established that maximum computer utilization is not achieved. A small number (10.4%) further added that lack of internet makes research impossible. Lastly the research established that the benefits of learning through ICT were not achieved with a small number (8%) confirming this. From the findings on obstacles to learning through ICT, the school principals' interviews indicated that there are inadequate ICT tools and lack of training. One principal had this to say: "Currently we do have a computer lab. One class has been turned to a computer lab. We also lack enough trained personnel. In addition, it is expensive to maintain the computers." (Principal A, 11 May, 2017).

These findings correlate with the study of Nkonge and Gueldenzoph, (2006) who found out that; inadequate hardware and software, slow internet connections, lack of technical expertise

among the instructors and insufficient orientation for learners have been cited also as barriers to teachers' participation in developing and teaching online courses.

4.6.3.1 Extent to which ICT Infrastructure and Resources affect Utilization

The aim of the study in this question was to find out the extent to which inadequate ICT tools and resources, technical support, funding and training affect proper utilization of ICT in learning. This was important to the study because it exposed the level to which tools, resources, funding, training and other support from stake-holders impact on successful implementation and utilization of ICT in teaching and learning.

Table 20: Extent to which ICT Infrastructure and resources affects Utilization

	Very large extent	Large extent	Moderate	Small extent	Very small extent
Personal perception affect proper utilization of ICT	30(41.7%)	15(20.8%)	14(19.4%)	7(9.7%)	3(4.2%)
Pro-ICT school vision affect proper utilization of ICT	25(34.7%)	22(30.6%)	16(22.2%)	6(8.3%)	1(1.4%)
Inadequate ICT tools affect proper utilization of ICT	34(47.2%)	15(20.8%)	16(22.2%)	4(5.6%)	1(1.4%)
Lack of internet connection affect proper utilization of ICT	27(37.5%)	18(25.0%)	13(18.1%)	4(5.6%)	6(8.3%)
Lack of technical support affect proper utilization of ICT	32(44.4%)	18(25.0%)	15(20.8%)	4(5.6%)	1(1.4%)
Shortage of funds from the Ministry to ICT initiatives affect proper utilization of ICT	29(40.3%)	17(23.6%)	13(18.1%)	4(5.6%)	4(5.6%)
Computer illiteracy affect proper utilization of ICT	28(38.9%)	20(27.8%)	10(13.9%)	8(11.1%)	3(4.2%)
Incompetence in teaching and learning through ICT affect proper utilization of ICT	23(31.9%)	21(29.2%)	12(16.7%)	6(8.3%)	6(8.3%)
Inadequate training on teaching through ICT affect proper utilization of ICT	24(33.3%)	25(34.7%)	9(12.5%)	9(12.5%)	3(4.2%)

Majority of the respondents (62.5%) agreed to a very large extent that personal perception affect proper utilization of ICT. On the other hand 65.3% said that pro ICT school vision affect proper utilization of ICT with 22.2% saying that vision affects utilization moderately. Inadequate ICT tools largely (68%) affect proper utilization of ICT. Majority of the respondents (62.5%) said that lack of internet connection affect proper utilization of ICT. Similarly, majority of the respondents (69.4%) also said that lack of technical support affect

proper utilization of ICT. Majority of the respondents on the same tone (63.9%) said that shortage of funds from the Ministry to ICT initiatives affect proper utilization of ICT. Equally the findings revealed that majority of the respondents (66.7%) think computer illiteracy affect proper utilization of ICT. A big number of respondents (61.1%) said that incompetence in teaching and learning through ICT affects their proper utilization to a large extent. Majority of the respondents (68%) also stated that inadequate training on teaching through ICT affect proper utilization of ICT to a large extent.

These findings agree with other reviewed studies. Alemneh and Hastings (2006) said that some of the barriers to effective learning through ICT include; inadequate funds and lack of progressive national programs because many African governments remain unconvinced of the importance of research and scientific innovation in creating economic growth and they pay little attention to the national need for higher education and ICT infra- structure. Similarly Watson (2002), noted perception and attitude of teachers is a great hindrance to the implementation on ICTs in learning. Curriculum change theories have generally asserted that once a small cohort of innovators emerges, their adoption of the innovation cascades through their peer group of subject teachers.

Peralta and Costa (2007) found that technical competence influence teacher's use of ICT in teaching. However, the teachers cited pedagogical and didactic competences as significant factors if effective and efficient educational interventions are likely to be implemented.

Amutabi (2004) in a related study pointed out some of the barriers; the lack of trained and older technical personnel to manage control and maintain the progressively large numbers of those resources implies that their utility values, effectiveness and efficiency, cannot be

discovered. The new problems, which are closely linked with the introduction of the computer technology, include low computer literacy among staff, securing and installing ICT resources, hiring and training of technical personnel, and managing, controlling, and maintaining ICT within a rapidly changing environment

4.7 Recommendation and Policy Framework

The study sought to know the extent to which the outlined strategies may promote better learning through ICT. This aided the research to identify and recommend the focus areas if successful implementation, integration and utilization of ICT in learning was to be achieved.

4.7.1 Strategies to effective learning through ICT according to Students

The study intended to find out the most notable ICT utilization support base in schools. The aim of this was to assess the extent to which students are able to note the fundamental resources on ICT utilization.

Table 21: Strategies which aid effective Teaching and Learning through ICT

Students	Very Large Extent	Large Extent	Moderate	Small Extent	Very Small Extent
Training on ICT	64(51.2%)	30(24%)	11(8.8%)	4(3.2%)	10(8%)
Technical support	53(42.4%)	37(29.6%)	19(15.2%)	4(3.2%)	7(5.6%)
Collaboration with other schools on ICT	49(39.2%)	24(19.2%)	14(11.2%)	11(8.8%)	21(16.8%)
Support from school administration	60(48.0%)	27(21.6%)	20(16%)	6(4.8%)	7(5.6%)
Good planning on ICT infrastructure and training	49(39.2%)	36(28.8%)	18(14.4%)	6(4.8%)	11(8.8%)
Government funding	62(49.6%)	25(20.0%)	19(15.2%)	7(5.6%)	7(5.6%)
Community participation on ICT infrastructural development	45(36.0%)	24(19.2%)	20(16.0%)	6(4.8%)	24(19.2%)

Majority (75.2%) of the students agreed to a very large extent that training on learning through ICT help in effective learning through ICT. On whether technical support is required on use of ICT to help in effective learning through ICT, majority of them (72%) agreed to a large extent. Most of the students agreed to a very large extent that collaboration through ICT other schools on ICT in education support learning through ICT. Majority (69.6%) of the respondents reported the importance of school administration in ensuring maximum utilization of ICT in teaching and learning. Most respondents (68%) on the other hand agreed to a large extent that good planning on ICT infrastructure and training support learning through ICT. Majority again (68%) further said that government funding support learning through ICT.

Furthermore, from the interviews on the principals, the study revealed the most respondents recommend training of teachers on ICT, acquiring more ICT tools and software,

maximum utilization of tools, more funding from the government and having power back-ups in schools. One principal said this: "I encourage my teachers to expose learners to computers. They can only do this if they themselves are adequately trained on usage. I recommend that the school stakeholders should afford power back-up in our schools and come together to invest in ICT tools and equipment." (Principal B, 12 May, 2017).

4.7.2 Ways of achieving full Utilization of ICT in Teaching and Learning

The aim of this research question was to find out the opinion and recommendation of most learners on what should be put in place to achieve full utilization of ICT in learning. The researcher aimed at assessing whether learners are able to identify improvement in infrastructure, ICT resources, community participation and change of attitude as the main resources.

Table 22: Achieving full utilization of ICT in Learning

Students	Frequency	Percent
Buy more ICT tools	35	44
Better maintenance of ICT tools and resources	10	12.5
Improve the ICT laboratories	20	25
Connect electricity to all schools	4	5.0
Training on ICT in education	38	48
Shift from dependence on notes to ICT integration	16	20
More participation from local community	8	10
Government funding	15	19
Computer studies should be compulsory	2	3.0
More positive attitude towards technology	8	10
Good planning on ICT infrastructure	5	6.25
Increase the number of trainers	14	18
Maximum utilization of the available tools and resources	6	8

Many students recommended acquisition of more ICT tools (44%) and training on ICT in education (48%) as the main points of focus if ICT in learning is to be fully utilized. Few respondents also pointed other strategies like improving ICT laboratories (25%), shift from dependence on notes to ICT integration (20%), increased government funding (19%) and increasing the number of trainers (18%) as supporting factors in achieving full utilization of ICT in learning. Only a minimal number recommended more participation from local communities, more positive attitude towards technology and better maintenance of tools.

In a related study, Tondeur, Krug, Bill, Smulders, and Zhu (2015), found out that the involvement of all stakeholders was crucial for the ownership of ICT integration in education. Consequently professional development programmes should be part of a cycle of inquiry that supports teachers' learning, to try out and receive feedback. These trained teachers will easily stimulate learners to learn using ICT. Similarly, Yilmaz, (2011) reported that in providing schools with hardware and web connections, it's also crucial to supply the colleges with technical support with relevance repair and maintenance for continuing use of ICT in schools. Likewise, Levy (2003) advanced planning and policy development as key to successive ICT integration. This planning will allow money to be spent more efficiently such as buying one software package to serve multiple purposes, rather than several packages over several years.

4.7.3 Strategies to effective Teaching and Learning through ICT according to Teachers

The aim of this question was to find out the extent to which teachers recommend the various stated statements on digitally helping environment facilitate effective learning through ICT. These responses will aid the study to recommend the way forward with regard to full implementation and utilization of ICT in teaching and learning.

Table 23: Strategies to Effective Teaching through ICT

	Very large extent	Large extent	Moderate	Small Extent	Very Small Extent
Training on ICT help in effective teaching and learning through ICT	45(62.5%)	17(23.6%)	5(6.9%)	2(2.8%)	0
Technical support help in effective teaching and learning through ICT	33(45.8%)	27(37.5%)	6(8.3%)	2(2.8%)	1(1.4%)
Collaboration with other schools on ICT in education help in effective teaching and learning through ICT	22(30.6%)	37(51.4%)	8(11.1%)	2(2.8%)	0
Change of attitude help in effective teaching and learning through ICT	31(43.1%)	31(43.1%)	4(5.6%)	3(4.2%)	0
Support from school administration help in effective teaching and learning through ICT	37(51.4%)	27(37.5%)	2(2.8%)	3(4.2%)	0
Good planning on ICT infrastructure and training help in effective teaching and learning through ICT	38(52.8%)	22(30.6%)	7(9.7%)	1(1.4%)	1(1.4%)
Government funding help in effective teaching and learning through ICT	36(50.0%)	20(27.8%)	10(13.9%)	0	2(2.8%)
Community participation on ICT infrastructural improvement help in effective teaching and learning through ICT	20(27.8%)	21(29.2%)	13(18.1%)	10(13.9%)	4(5.6%)

The respondents (86.1%) said that training on ICT facilitate effective teaching and learning through ICT to a very large extent. They also said (83.3%) that technical support help in effective teaching and learning through ICT to a large extent. Majority of the teachers (82%) recommended collaboration with other schools on ICT in education to achieve effective teaching

and learning through ICT to a very large extent. In addition, majority (86.2%) stated that change of attitude can help in effective teaching and learning through ICT. A high number (88.9%) recommended the support from school administration to facilitate effective teaching and learning through ICT. A large number (83.4%) also said good planning on ICT infrastructure and training help in effective teaching and learning through ICT. Most respondents (77.8%) on the other hand said that government funding help in effective teaching and learning through ICT to a very large extent. Lastly few respondents (57%) wanted the community to participate on ICT infrastructural improvement to achieve effective teaching and learning through ICT.

In a close study to the current, Wong and Li (2008) disclosed that leadership promotion of collaboration and experimentation, and teachers dedication to student centered learning influenced effective ICT transformation. Likewise, Ng (2008) observed that a transformational leadership with qualities of identifying and articulating a vision, promoting acceptance of group goals, providing personalized support, giving intellectual stimulation, providing an acceptable model, creating high performance expectations, and strengthening school culture might influence the integration of ICT. Levy, (2003) recommended eight areas to concentrate in achieving successful education through ICT; Institutional, Management, Technological, Pedagogical, Ethical, Interface, Support and Evaluation. Pedagogical in this context means the method and process of teaching needs to be analyzed. Ethical means an overview of social, political, cultural, geographical, and legal issues. Interface is the actual website design and content navigation system that should be simply accessible and usable. Support is the communication and resource support needed to be in place while Evaluation includes re-looking at e-learning content development process and assessment of the students' learning.

4.7.4 Ways of achieving full utilization of ICT in teaching and Learning among Teachers

The study sought to find out the opinion of teachers on the strategies which should be put in place to gain optimum usage of ICT in teaching and learning. The aim of this question was to find out the main areas of consideration in rolling out of ICT in education and real classroom ICT integration from teachers.

Table 24: Ways of achieving full utilization of ICT in teaching and Learning

	Frequency	Percent
More funding from the government for ICT tools	16	22.3
In-service training for teachers on ICT	23	32
Embracing teaching through ICT among teachers	4	5.6
Making ICT in teaching compulsory	10	13.9
Buying more ICT tools in schools	11	15.3
Continuous training to teachers on teaching and learning through ICT	10	13.9
Commitment of school management and administration	15	20.8
Support from all stakeholders on learning through ICT	7	9.7
Technical support to teachers	25	34.7
Connect internet in schools	12	16.7
Motivation of teachers who have integrated ICT in teaching and learning	30	41.7
Support from all stakeholders on learning through ICT	2	2.8
Change of attitude especially among long serving teachers on ICT	11	15.3
Technical support to teachers	9	12.5
Constructing more ICT laboratories	1	1.4

Most of the respondents said motivation of teachers who have integrated ICT in learning and teaching (41.7%), technical support for teachers (34.7%), in-service training of teachers on ICT (32%), more funding from the government (22.3%) and Commitment of school management

and administration (20.8%) should be done in order to achieve full utilization of ICT in teaching and learning. Few teachers highlighted connecting internet in schools (16.7%), buying more ICT tools in schools and change of attitude especially among long serving teachers on ICT (15.3%), making ICT in teaching compulsory, continuous training to teachers on teaching and learning through ICT (13.9%) and technical support to teachers (12.5%) as other strategies which can be put in place in order to achieve full utilization of ICT in teaching and learning.

These findings were similar to studies done by Wanjala (2013) and Mbaluko (2009) on ICT in learning. They found out that, teacher needs to be skilled in motivating the students online and creating an enthusiastic online environment. The attitude of facilitators towards online learning and its benefits would determine its effectiveness. Teachers needed to be self-motivated, interested, and willing to integrate technology in their subjects. Similarly, Afshari et al. (2009) found a relationship between the head's level of computer competency and transformational leadership practices. They concluded that transformational leadership could help improve the integration of ICT into teaching and learning processes. Teachers should have the mandatory training, mentoring, and support, ideally on the equipment they use (Tasir, et.al., 2012).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter represents the summary, conclusions and recommendations of the study. It simply winds up the research work done and makes recommendations on utilization of ICT in teaching and learning in schools. Finally, the chapter suggests areas for future possible research related to the topic.

5.2 Summary of the Study

The theme of the study was the assessment of utilization of ICT tools in teaching and learning in public secondary schools in Kajiado North Sub-county. The purpose of this study was to awaken the need for learners and teachers to put into use the available ICT tools so as to promote more innovative, creative, independent and collaborative learning. The research was guided by the following research questions: The ICT tools are available in most secondary schools in Kajiado North sub-county, How teachers and students use the ICT tools in teaching and learning, The obstacles that hinder effective teaching and learning through ICT, The benefits of teaching and learning through ICT and recommendations and policy frameworks on effective teaching and learning through ICT.

The study used convergent parallel mixed method with the aim of collecting, analyzing and mixing qualitative and quantitative data from principals, teachers and students in a single study. The target population were; education officials, schools principals, teachers and students in public secondary schools in Kajiado North sub-county. The study sampled 2 education officials, 10 head teachers, 104 teachers and 150 students. Data was collected using questionnaires and interview guides.

The study used descriptive statistics to analyze quantitative data. It was then interpreted using SPSS and presented using tables, frequencies, percentages, graphs and charts. The procedure for analyzing qualitative data was; documentation of data, categorization of data into concepts and themes, connection of data to show how one concept may influence another and reporting the findings. Quantitative and qualitative data was mixed in interpretation and discussion section by presentation of quantitative statistical results followed by qualitative quotes supporting or disconfirming quantitative results.

Regarding the availability of ICT tools in public secondary schools in Kajiado North sub-county, the study established that majority of the schools had computers and printers. Few schools had scanners, Internet, Radio, Television and Overhead projectors. The study also revealed that many teachers had attended training on teaching through an initiative of the Ministry of education sponsorship and others through personal initiative. The study found a relationship between teachers' personal interest and teaching through ICT; teachers who do use computers in their classrooms tend to be those who can clearly relate the use of technology to their pedagogic strategy for their own subject.

The findings also indicated that teachers used computers and printers for filling in marks, printing of exams and learning materials, administrative work, exam analysis software to compute results more easily and monitor students' progress, internet for research and downloading reading materials, past questions software to sample questions and set exams and mobile phones for downloading materials. They also used video tapes to help learners to grasp the content better. The findings exposed limited utilization of ICT in real teaching and learning among teachers in most schools. The findings also revealed that students use computers for research, typing and storing data. This showed limited use of ICT in learning among students.

Even the fair percentage of students who use computers for research did not indicate that they use it for purely academic purposes.

Similarly, the findings indicated benefits of ICT in education to be; better attainment of the expected learning outcomes, improvement of performance of learners, more independent learning and more innovative and creative learning. Learning through ICT also prepared learners for university education of research and scholarship.

The findings identified lack of electricity or generators, inadequate ICT tools, inadequate time to prepare and deliver lessons using ICT, unavailability of e-learning materials, inadequate knowledge on the use of ICT and lack of enough rooms with proper power connections as the main impediments to teaching and learning through ICT. Other obstacles exposed in the findings included; lack of technical support in using the tools, poor maintenance of the tools, lack of support from the administration, lack of internet connection, poor funding from the government to ICT department in schools and personal perceptions and attitudes on learning and teaching through ICT.

The last question sought to find out the respondents' recommendation on more effective teaching and learning through ICT. The results from the study revealed that training on ICT, technical support, collaboration with other schools on ICT in education, change of attitude, support from school administration, good planning on ICT infrastructure, government funding, community participation on ICT infrastructural improvement were the main strategies to achieving effective teaching and learning through ICT.

5.3 Conclusions

From the findings, it is evident that few ICT tools are available in most public secondary schools in Kajiado North sub-county. The most notable tools in many schools are computers, printers, television sets and video players. Other tools and resources like smart phones with internet and tablets are personal possessions of individual teachers. They were occasionally used by teachers in learning. Therefore all education stakeholders should mobilize resources to get more ICT tools and infrastructure.

It was apparent that teachers and learners used mostly computers and printers. These tools were used mainly to type and print examinations, store learning materials and past question papers and answers for future retrieval, entering marks and analysis of examinations and for office work and administration. Television and video players are also used to watch set-books and watching educative programmes. It can be concluded that the ICT tools and resources were seldom used for real classroom teaching and learning. Teachers were not adequately trained and even the trained ones lacked the support from the administration and necessary infrastructure to integrate teaching and learning through ICT. So continuous training, improvement of infrastructure, technical support and support from the administration should be emphasized to achieve more usage of ICT in learning.

The study found out that ICT facilitates learning in a number of ways: It supported better attainment of the expected learning outcomes, improved performance of learners, ICT supported independent learning, made learners more innovative, enhanced creativity among learners, promoted lifelong learning and lastly it prepared learners for university education of research and scholarship. However all these benefits can only be realized through a digitally enabled environment (schools) through improvement of ICT tools and resources, motivation of teachers,

ICT supporting school administration, adequate training of teachers on teaching through ICT, technical support and positive attitude from teachers on education through ICT.

The findings revealed lack of electricity connection or constant power interruptions, inadequate knowledge on teaching and learning through ICT, inadequate ICT tools and resources, lack of technical support, lack of support from the administration and personal perceptions and attitudes among teachers as the main obstacles to learning through ICT. However it should be noted that change of attitude is the main catalyst to robust integration of ICT in learning and teaching. A technologically competent teacher will use his/her personal smart phone, tablet or/and laptop to stimulate learners through ICT. Techno-phobia teachers will always complain about the lack of tools.

5.4 Recommendations

Based on the results and findings of this study, the researcher makes a number of recommendations. First, education stakeholders, that is; the government, parents, teachers, local community and students should be involved in planning and appropriation of ICT tools and resources in schools. The purchase, usage and maintenance of the tools is to be taken as corporate responsibility of all the aforementioned stakeholders. Teachers should also use the available ICT tools effectively.

Second, teachers need to continuously update their knowledge base on teaching and learning through ICT. The government and school administration also need to organize for workshops and seminars on integration and utilization of ICT in teaching and learning. Teaching through ICT is not a reserve for computer teachers but a requirement of all teachers of this age and time. The curriculum also needs to be re-aligned to accommodate e-learning. This proposal

is in line with the reviewed literature on ICT in education: The Ministry of Education, science and technology, is tasked with the event of information content to be used on the digital platform, capability building and training for academics and other relevant education stakeholders (ICT Authority, 2015).

Third, the government should put it as a priority to connect electricity in all schools. The schools administration should also mobilize funds to acquire back-up generators in case of power interruptions. An IT expert needs to be employed in schools to offer technical support to teachers and learners on use of technology. It could be more beneficial for schools administrators to regularly benchmark with schools which have integrated these tools in learning and teaching. This recommendation is based on the findings on the challenges hampering effective teaching and learning through ICT.

Lastly, it would be of benefit for the Ministry of education to revisit the ICT policy of 2005 to schools. The policy left the responsibility of integration ICT in learning to school administrators. No clear framework has so far been rolled out on e-curriculum development, assessment and evaluation of teaching through ICT (MoEST, 2006). Teachers need to be involved in e-curriculum development. Assessment on teaching through ICT in real classroom setting would be done regularly by peer teachers and feedback acted upon for improvement. A test on the extent to which intended learning outcomes are achieved when ICT is used in teaching needs to be done in schools to make appropriate recommendations.

The researcher recommends that further studies be carried out in the following areas:

- Influence of school management and administration in facilitating maximum implementation and utilization of ICT in education.

- The roles of different school stakeholders in overcoming challenges hampering effective teaching and learning through ICT.
- A Kenyan cross county survey on utilization of ICT in teaching and learning through ICT to find out the extent to which the MoEST ICT in education guidelines have been implemented.
- Evaluation on the impact of ICT in teaching and learning in secondary schools

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APPENDICES

APPENDIX A: QUESTIONNAIRE FOR TEACHERS

I am a post graduate student at The Catholic University of Eastern Africa pursuing a master's degree in Educational Research and Evaluation. The purpose of this questionnaire is to gather information about the extent to which the available ICT tools like television, radio, phones, computers, and internet are utililized in teaching and learning in Kajiado North sub-county. You are encouraged to answer all questions because the responses are very important for this study. Your responses will be treated with confidentiality and used for academic purposes only. Do not write sign or write your name on the questionnaire.

Part A: Demographic Information

Instruction: Kindly indicate the appropriate response with a tick (√) in the spaces provided. Where an explanation is required, use the spaces provided.

1. Sex: Male ( ) Female ( )

2. Age bracket: 20-25 ( ) 25-35 ( ) 35-40 ( ) 40 and above ( )

3. Type of school:

Girls boarding ( ) Boys boarding ( )

Boys boarding ( ) Mixed day ( )

Mixed boarding ( ) Mixed day and boarding ( )

4. How long have you been a teacher?

1-5 years ( ) 6-10 years ( ) 11- 15 years ( ) 15 years and above ( )

5. Have you ever attended any courses on computer literacy? Yes ( ) No ( )

If yes, to what level?

Certificate ( ) Diploma ( ) Degree ( ) Any other (specify)----------

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6. Have you ever attended training on teaching through ICTs?

If yes, on whose initiative?

a. College in-service training ( )

b. Ministry of education workshops ( )

c. School sponsorship ( )

d. Personal initiative ( )

Part B: Availability of ICT tools and their Usage

7. Which of the following ICT tools are available in your school?

a. Computers ( )

b. Printers ( )

c. Scanners ( )

d. Radio ( )

e. Television ( )

f. DVDs/ VCDs ( )

g. Internet ( )

h. Overhead projectors ( )

i. LCD ( )

8. How do you use the above tools in teaching and learning? Indicate the tool and briefly explain how you use it in teaching and learning.

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9. To what extent do you use the available ICT resources in teaching and learning?

ICT Software	Frequency of use				
	Very often	Often	Some times	Rarely	Never
Kiswahili-set books or plays					
English set books or plays					
Time-tabling software					
Exam analysis					
School e-mail and website					
Past questions and answers					
e-learning platform					
Video tapes					

10. Which of the above ICT tools and software (refer to no.9) do you use in teaching and how do you use them?

ICT tools and software	How you use it to teach

Part C: Obstacles to effective Learning and Teaching through ICTs

11. What are your main challenges in teaching through ICTs?

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12. Indicate your level of agreement or disagreement to the following statements on teaching and learning through ICTs:

Strongly Agree (SA) = 5; Agree (A) =4; Not Sure (NS) = 3; Disagree (D) =2; Strongly Disagree (SD) =1

Statement	(SA) 5	(A) 4	(NS) 3	(D) 2	SD 1
I am not adequately trained on teaching through ICTs					
ICT tools are not available in my school					
I don't adequately use the available ICT tools in the school and at home for teaching					
There is inadequate technical support in usage and maintenance of ICTs					
It is difficult to teach using ICTs					
Teaching through ICTs is an added workload					
Teaching through ICTs distracts learners from the core content					
It is expensive to integrate ICT in teaching					
The administration does not support learning through ICTs					

13. To what extent do you think the following affect proper utilization of ICT in learning and teaching?

Very Large Extent (VLE) =5; Large Extent (LE)=4; Moderate (MD)=3; Small Extent (SM)=2 Very Small Extent (VSE)=1

Statement	(VLE) 5	(LE) 4	(MD) 3	(SE) 2	(VSE) 1
Personal perceptions					
Lack of pro-ICT school vision					
Inadequate ICT tools					
Lack of internet connection					
Lack of technical support					
Shortage of funds from the Ministry to ICT initiatives					
Computer illiteracy					
Incompetence in teaching through ICT					
Inadequate training on teaching through ICT					

Part D: Benefits of Teaching and Learning through ICT

14. Indicate your level of agreement or disagreement to the following statements on teaching and learning through ICTs:

Strongly Agree (SA) = 5; Agree (A) =4; Not Sure (NS) = 3; Disagree (D) =2; Strongly Disagree (SD) =1

Statement	(SA) 5	(A) 4	(NS) 3	(D) 2	(SD) 1
Use of internet facilitates learning					
Use of ICT supports better attainment of the expected learning outcomes					
ICT in learning improves performance of learners					
Learning through ICT supports independent learning					
ICT makes learners more innovative					
ICT enhances creativity among learners					
ICT promote high order thinking skills					
ICT promote lifelong learning					
Learning through ICT prepare learners for university education of research and scholarship					

Part E: Recommendations and Policy Framework

15. To what extent do you think the following strategies help in effective learning through ICT?

Very Large Extent (VLE) =5; Large Extent (LE)=4; Moderate (MD)=3; Small Extent (SM)=2 Very Small Extent (VSE)=1

Statement	(VLE) 5	(LE) 4	(MD) 3	(SE) 2	(VSE) 1
Training on teaching and learning through ICT					
Technical support					
Collaboration with other institutions on ICT in education					
Change of attitude					
Support from school administration					
Good planning on ICT infrastructure and training					
Government funding					
Community participation in ICT infrastructure improvement					

16. What do you think can be done to achieve full utilization of ICTs in teaching?

Thank you for your cooperation.

APPENDIX B: QUESTIONNAIRE FOR STUDENTS

I am a post graduate student at The Catholic University of Eastern Africa pursuing a master's degree in Educational Research and Evaluation. The purpose of this questionnaire is to gather information about the extent to which the available ICT tools like television, radio, phones, computers, and internet are utilized in learning in Kajiado North sub-county. You are encouraged to answer all questions because the responses are very important for this study. Your responses will be treated with confidentiality and used for academic purposes only. Do not write sign or write your name on the questionnaire.

Part A: Demographic Information

Instruction: Kindly indicate the appropriate response with a tick (√) in the spaces provided. Where an explanation is required, use the spaces provided.

1. Sex: Male ( ) Female ( )

2. Class:

Form 1( ) Form 2( )

Form 3( ) Form 4( )

3. Type of school

Girls boarding ( ) Boys boarding ( )

Mixed boarding ( ) Mixed day ( )

Mixed day/boarding ( )

Part B: Availability of ICT tools and their usage

4. Which of the following ICT tools are available in your school?

a. Computers ( )

b. Printers ( )

c. Scanners ( )

d. Radio ( )

e. Television ( )

f. DVDs/ VCDs ( )

g. Internet ( )

h. Overhead projectors ( )

i. LCD ( )

5. How do you use the above tools (5) in learning? Mention the tool and explain briefly how you use them in learning.

---

6. Which of the following ICT software are available in your school and to what extent do you use them?

ICT Software	Frequency of use				
	Very often	Often	Some times	Rarely	Never
Kiswahili-set books or plays					
English set books or plays					
Internet research sites for various subjects					
Ms Excel and Word					
School e-mail and website					
Past questions and answers					
Video tapes					
Computer assisted programs for science and mathematics					

Part C: Obstacles to effective learning through ICTs

7. Indicate (√) whether the following infrastructure is available in our school

a. Electricity ( )

b. Computer lab ( )

c. Back-up generator ( )

d. Internet ( )

e. Projector ( )

f. Functioning computers ( )

8. How does the lack of any of the above resources hamper effective learning through ICT?

---

9. Indicate your level of agreement or disagreement to the following statements on teaching and learning through ICTs:

Strongly Agree (SA)= 5; Agree (A) =4; Not Sure (NS) = 3; Disagree (D) =2; Strongly Disagree (SD) =1

Statement	(SA) 5	(A) 4	(NS) 3	(D) 2	SD 1
Our teachers support learning through ICTs					
ICT tools are not available in my school					
I adequately use the available ICT tools school and at home for learning					
There is inadequate technical support in usage and maintenance of ICTs in my school					
It is difficult to learn using ICTs					
I don't enjoy lessons offered through ICTs					
Learning through ICTs is an added workload					
Most of our teachers do not use ICTs in teaching					

Part D: Benefits of Teaching and Learning through ICT

10. How do ICT tools help you to learn better?

Part E: Recommendations and Policy Framework

11. To what extent do you think the following strategies help in effective learning through ICT?

Very Large Extent (VLE) =5; Large Extent (LE)=4; Moderate (MD)=3; Small Extent (SM)=2 Very Small Extent (VSE)=1

Statement	(VLE) 5	(LE) 4	(MD) 3	(SE) 2	(VSE) 1
Training on learning through ICT					
Technical support on use of ICT					
Collaboration with other schools on ICT in education					
Support from school administration and teachers					
Good planning on ICT infrastructure and training					
Government funding					
Community participation in ICT infrastructure improvement					

12. What do you think can be done to achieve full utilization of ICTs in teaching?

Thank you for your cooperation.

APPENDIX C: INTERVIEW GUIDE FOR PRINCIPALS

The purpose of this interview is to gather information regarding the general vision of schools in maximization of ICT in teaching and teaching in public secondary schools in Kajiado North sub-county. The information you provide will be confidential and solely used for this research.

Part A: Demographic Information

1. Gender

Male ( ) Female( )

2. Age bracket

25-35 ( ) 35-40 ( ) 40-50 ( ) 50 and above ( )

3. What is your level of computer literacy

Certificate ( ) Diploma ( ) Any other (specify)----------

4. How long have you been a principals

1- 5 years ( ) 6-10 years ( ) 10-15 years ( ) 15 and above ( )

Part B: Role in appropriation of ICT resources and usage

5. What are some of the ICT tools our school has received from the national or county government in the recent past?

6.What is your role in mobilization of ICT resources from the various stakeholders of the school?

---

7. To what extent are the various departments utilizing ICTs in teaching and learning?

Very much ( ) Much ( ) Not much ( )

8. Has your school sent some teachers for ICT training?

---

9. How many of your teachers have undergone training on teaching through ICTs?

---

10. To what extent do the ICT trained teachers involve others in helping them to teach through ICTs?

---

11. How does the vision of your school support innovative learning through technology?

Part C: Obstacles to effective Teaching and Learning through ICTs

12. Is the infrastructure in your school adequate to support learning through ICTs?

---

13. What are some of the challenges you encounter in utilizing the available ICT tools in learning?

Part D: Benefits of Teaching and Learning through ICT

14. What are the teachers' assessments on teaching through ICTs?

---

15. What has been the impact of teaching and learning through ICT in your school?

Part E: Recommendations and Policy Framework

16. What are the strategies you have put in place to mitigate the challenges faced in utilizing ICT in teaching and learning?

---

17. To what extent does the schools vision and mission support ICT in learning?

---

18. What are your recommendations on better learning through ICT?

Thank you for your cooperation.

APPENDIX D: INTERVIEW GUIDE FOR EDUCATION OFFICIALS

The researcher will discuss and interview education officials guided by the following questions:

Section A: ICT Tools and Utilization

1. What role does the Ministry perform in appropriating ICT tools in schools?

---

2. How is the ministry involved in training teachers on teaching through ICTs?

---

3. Is the funding of ICT equipments and supporting infrastructure adequate in schools?

---

4. If not to question 2, how does the ministry ensure that the available resources are well maintained and fully utilized?

Section B: Challenges of Teaching and Learning through ICT

5. What are the challenges encountered in integrating teaching through ICT?

---

6. How is the ministry dealing with the challenges schools face in teaching through ICT?

---

7. What are the policies in place to support full implementation of learning through ICT?

Thank you very much.

APPENDIX E: AUTHORIZATION LETTER FROM CUEA

THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

Faculty of Education

Department of Postgraduate Studies in Education

CUEA/DVC-ACAD/FOE/PGSE/NACOSTI/007/Jan 2017

Date: 16th February, 2017

The Director,
National Commission for Science, Technology and Innovation,
NAIROBI, KENYA.

Dear Sir/Madam,

RE: WALTER OMARE MARANGA REG. NO. MED /1026190

I am writing to introduce to you **Walter Omare Maranga** who is a final year Masters of Education Degree student with specialization in Educational Research and Evaluation at The Catholic University of Eastern Africa, Nairobi – Kenya, and to request you to assist him to accomplish his academic research requirements.

Walter has completed all course work requirements for this programme. However, every student in the programme is required to conduct research and write a report/thesis submitted during the final year of studies.

Accordingly, Walter's research proposal has been approved. He will conduct research on the following topic:

"Assessment of Utilization of Information, Communication and Technology in Teaching and Learning in Public Secondary Schools in Kajiado North Sub-County".

Thanking you in advance for any assistance you give to Walter.

Sincerely,

THE CATHOLIC UNIVERSITY OF EASTERN AFRICA
DEPARTMENT OF POSTGRADUATE STUDIES IN EDUCATION
16 FEB 2017
P.O. Box 62157-00200 NAIROBI

Dr. Marcella Momanyi
Head of Department
Postgraduate Studies in Education

THE CATHOLIC UNIVERSITY OF EASTERN AFRICA (CUEA) P.O. BOX 62157 00200 Nairobi – KENYA
Tel: 020-2525811-5, 8890023-4, Fax: 8891084, Email: pgse@cuea.edu, Website: www.cuea.edu
Founded in 1984 by AMECEA (Association of the Member Episcopal Conference in Eastern Africa)

APPENDIX F: RESEARCH PERMIT FROM NACOSTI

THIS IS TO CERTIFY THAT:
MR. WALTER OMARE MARANGA
of CATHOLIC UNIVERSITY OF EASTERN AFRICA, 62157-200 NAIROBI,has been permitted to conduct research in
Kajiado County
on the topic: *ASSESSMENT OF UTILIZATION OF INFORMATION, COMMUNICATION AND TECHNOLOGY IN TEACHING AND LEARNING IN PUBLIC SECONDARY SCHOOLS IN KAJIADO NORTH SUB-COUNTY, KENYA*
for the period ending:
9th March,2018

Permit No : NACOSTI/P/17/13980/15854
Date Of Issue : 10th March,2017
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
for Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

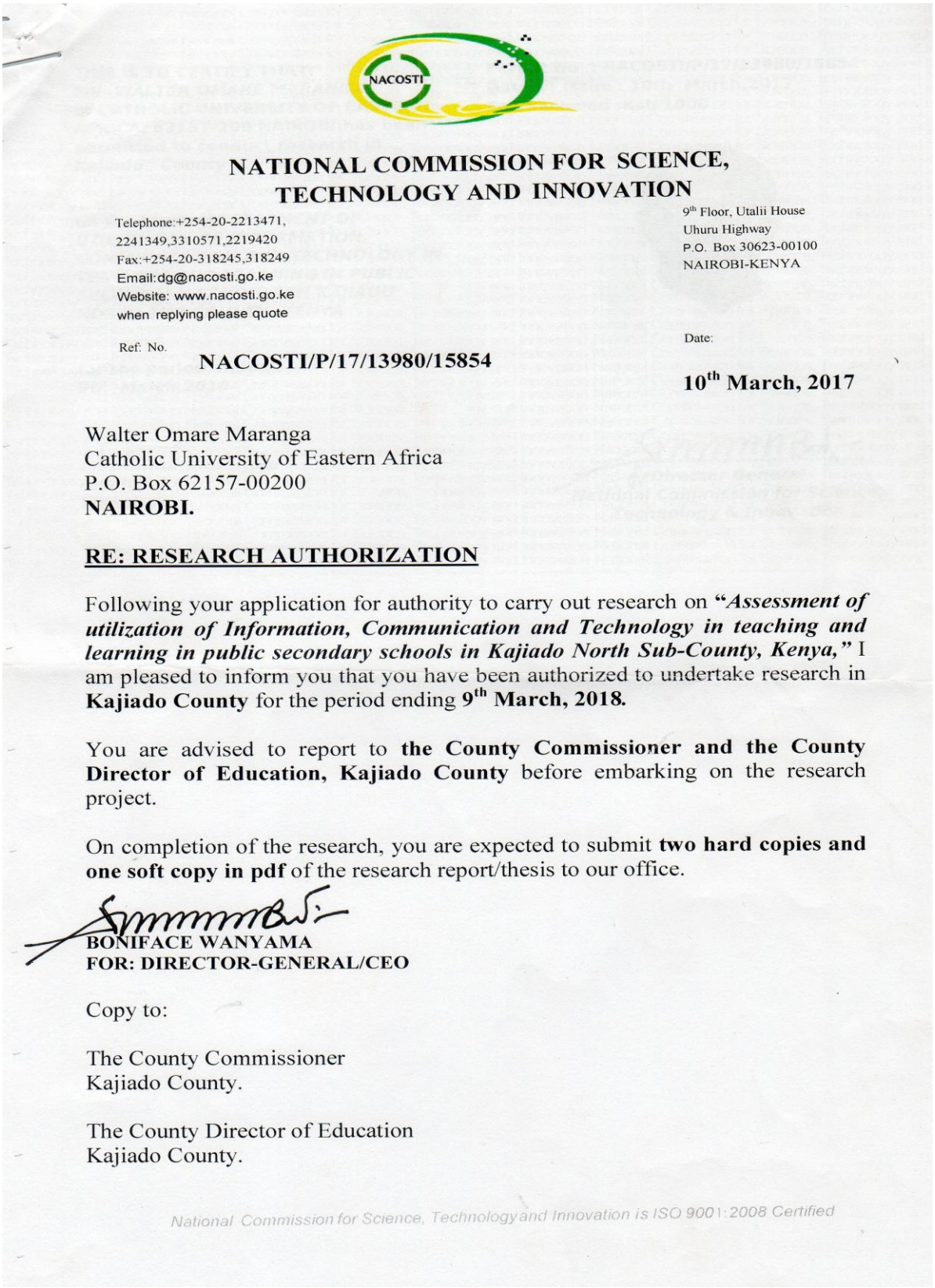
National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 13190

CONDITIONS: see back page

APPENDIX G: RESEARCH LETTER FROM NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/13980/15854**

Date: **10th March, 2017**

Walter Omare Maranga
Catholic University of Eastern Africa
P.O. Box 62157-00200
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of utilization of Information, Communication and Technology in teaching and learning in public secondary schools in Kajiado North Sub-County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Kajiado County** for the period ending **9th March, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Kajiado County** before embarking on the research project.

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

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kajiado County.

The County Director of Education
Kajiado County.

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

APPENDIX H: RESEARCH LETTER FROM THE MINISTRY OF EDUCATION

MINISTRY OF EDUCATION
STATE DEPARTMENT OF BASIC EDUCATION

Email : kajiadocde@gmail.com
When replying please quote

COUNTY DIRECTOR OF EDUCATION
KAJIADO COUNTY
P.O. BOX 33 - 01100
KAJIADO

Ref: KJD/C/R.3/VOL.I/223

16th March, 2017

Walter Omare Maranga
Catholic University of Eastern Africa
P.O. Box 62157-00200
NAIROBI

RE: RESEARCH AUTHORIZATION

The letter from National Commission for Science, Technology and Innovation Ref. NACOSTI/P/17/13980/15854 dated 10th March, 2017 refers.

This is to confirm to you that, you have been authorized to conduct your research on ***"Assessment of utilization of Information, Communication and Technology in teaching and learning in public secondary schools in Kajiado North Sub-County"*** *in* ***Kajiado County*** for a period ending **9th March, 2018.**

COUNTY DIRECTOR OF EDUCATION
KAJIADO COUNTY

GEDION M. MBINDA
FOR: COUNTY DIRECTOR OF EDUCATION
KAJIADO COUNTY