PREPAREDNESS FOR ADOPTION OF INFORMATION COMMUNICATION AND TECHNOLOGY IN INSTRUCTION IN SECONDARY SCHOOLS IN BUNGOMA COUNTY, KENYA

BY:

ANYONJE FLORENCE M. WASICHE

D. Phil

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DECLARATION

Declaration by the candidate

This thesis is my own original work and has not been presented for a degree in any other university. No part of this thesis should be reproduced without the prior permission of the author and/or Moi University.

ANYONJE FLORENCE MUTEHELI ..... Date: ……

Declaration by the supervisors

This thesis has been submitted for examination with our approval as university supervisors.

PROF. PATRICK ACLEUS KAFU ……..... Date: …….

Dean,

School of Education

University of Eldoret, Eldoret, Kenya

PROF. JACKSON KIPROP TOO ……. Date: ……

Senior Lecturer

Department of Curriculum Instruction and Educational Media,

Moi University, Eldoret, Kenya

DEDICATION

To all the noble scholars in the field of Education Technology, my parents, Jerusa and Benjamin Wasiche and my children Sharon Kasiti, Benarivo Muteheli, Leticia Atemba and Wayne Temba.

ABSTRACT

Information Communication and Technology (ICT) plays an important role in education institutions by facilitating and improving the teaching and learning process to be in line with

the information technology age. In spite of having many studies undertaken on the use of ICTs in education, there is lack of a major current study specifically undertaken to address preparedness for ICT adoption in secondary schools in Kenya. This study was set to investigate whether schools in Bungoma County were ready for ICT adoption in terms of resources, infrastructure, teacher competencies and challenges encountered in preparation for ICT adoption in school instruction. The study was guided by the Adoption and Diffusion Theory and the Technology Acceptance Model. Based on pragmatism paradigm, the study was a survey carried out in Bungoma County. Both qualitative and quantitative methods were used to collect data from school Principals, teachers and ICT specialists. A sample of 102 schools was drawn from a population of 342 secondary schools in the county with 483 participants. Instruments for data collection were questionnaire, interview and observation schedule. Data was analyzed using descriptive statistics and presented in frequency distributions and percentages. The study found out that there were a variety of ICT resources in schools but some teachers lacked proper competencies to effectively use ICT resources during classroom instruction. The study found out that schools in urban areas were better prepared to adopt ICTs for instruction unlike those in rural areas. However, despite a few challenges, all schools were making commendable effort to adopt ICT as an innovative tool for instruction. Therefore, the researcher recommended that ICT resources should be availed in all schools and teachers prepared thoroughly and continuously on practical use of ICTs during instruction. All stakeholders should be sensitized on the importance and use of these technologies in the instructional process.

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ABBREVIATIONS

BECTA	- British Education Communications and Technology Agency
CD	- Compact Disk
CDF	- Constituency Development Fund
CIEM	- Curriculum Instruction and Educational Media
DVD	- Digital Video Disk

DSL	- Direct Service Line
EFA	- Education for All
ICT	- Information Communication Technology
INSET	- In – Service Education and Training
ICTs	- Information Communication Technologies
IT	- Information Technology
KBC	- Kenya Broadcasting Cooperation
KICD	- Kenya Institute of Curriculum Development
LCD	- Liquid Crystal Display
KNEC	- Kenya National Examinations Council
MDG	- Millennium Development Goals
MOE	- Ministry of Education
MOHEST	- Ministry of Higher Education Science and Technology
NEPAD	- New Partnership for Africa's Development
PEOU	- Perceived Ease of Use
PU	- Perceived Usefulness
SMASSE	- Strengthening Mathematics and Science in Secondary Education
TAM	- Technology Acceptance Model
TSC	- Teachers' Service Commission
TV	- Television
UNDP	- United Nations Development Programme
UNESCO	- United Nations Education Social and Cultural Organization
UNICEF	- United Nations Children's Education Fund

US - United States

USAID - United States Agency for International Development

WWW - World Wide Web

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CHAPTER ONE

INTRODUCTION OF THE STUDY

1.1 **Introduction**

This chapter is the introduction of the conducted study. It discusses the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, assumptions of the study, significance and justification of the study, scope and limitations, theoretical framework and definitions of operational terms.

1.2 Background of the study

Information Communication and Technology (ICT) is a generic term that was coined by Library Scientists to refer to a diverse set of technological tools and resources used to create, disseminate, store and manage information (Primo, 2003). It includes computers, radio, television, mobile telephony, internet, networking and data processing capabilities and the software for using these technologies. Kwapongo (2007) says ICTs provide the capacity to harness, access, apply information and disseminate knowledge in all kinds of human activities. Oxford Advanced learners' dictionary defines ICT as an abbreviation for Information Communication Technology which is the study of the use of computers, the internet, video and other technology used in communication, Hornby (2008). Instruction is a step by step presentation of knowledge and activities by a teacher usually within a school environment. It is the interpretation, presentation of knowledge, attitudes and skills to learners. It deals with methods, materials and media used in implementing the curriculum (Otunga et al 2011). This term also refers to modern innovative materials used as mediators in instruction, research and management of educational institutions (Richey 2008). Instructional technology includes all kinds of hard and soft media which are used to make communication

in the classroom easier for the teacher and learner. It is a form of non-textual material that a teacher may use in the instructional process (Garrison and Anderson 2003). According to Aggarwal (2004) educational technology is a system where machines, materials, media, men and methods are interrelated and work together to fulfill specific educational objectives. He further says it is the practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources. A good educational system recognizes the role and place of technology.

Information is a basic resource in today's society. We are living in an emerging global information intensive society with a global economy that is dependent on creation, management and distribution of information resources. This is made possible by interconnected global networks like the internet. Knowledge workers including executives, managers and professionals spend most of their time creating, using and distributing information. This trend points to a strong impact of IT (Information Technology) in schools, individuals and society, (Crane 2009).

(Murray and Waller (2007) say that IT has enabled universal connectivity so that now digital multi-media are available for all applications anywhere, any time. IT has created a global society, and is needed in schools to support operations like instructional delivery and managerial decision making. A Learning Management System (LMS) can be used to deliver, track, manage and train in education matters. Educators can track attendance, time on task, student progress, post announcements, check course activity and participate in class discussions. Students can submit their work, read and respond to discussion questions and

take quizzes. Derek (2003) in his definition says ICT includes media in the form of texts, image, animation, video and audio. Alonso (2005) defines ICT as a medium for delivering learning which supports traditional and modern practices.

Information Communication and Technology when applied to education becomes educational technology. The use of media for instructional purposes dates back to the first decade of the 20th C (Saettler, 1990) with the introduction of films and mechanical teaching machines. Further, large scale use of technologies was employed in training soldiers. These included films, overhead projectors, slide projectors and Cuisenaire rods. In 1960, the University of Illinois initiated a class with computer terminals where students could access information and also listen to lectures that were recorded via television or radio.

By the Mid 1980's the UK council for Education Technology supported the use of education technology in the instructional process, (Woolley, 2013). Accessing digitized content became easy in many college libraries. Digitized communication and networking in education started in late 80's. Distance learning courses were introduced using computer networking for information. The Open University in Britain and the University of British Columbia began a revolution of using the internet to deliver learning, (Crow and Din, 2009). Practitioners put heavy emphasis on the use of learning networks. This historical background to use of technology in education shows the importance of using technology and even incooperating newer technologies as they continue to be invented in order to modernize the instructional process.

There are two types of instructional resources. These are the human resource which includes teachers and any other people who interact with learners during the learning sessions, and non-human resources which include teaching materials which may be print or non-print, (Schonwetter, 2008). Pollard et al (2002), identify people, buildings, equipment and materials to be essential resources in education. All these resources have an impact on what is possible to be done in schools and classrooms. There is growing interest in integration of ICT into classrooms. It is assumed that they offer a broad range of valuable benefits to instruction. These tools can enhance and improve education delivery. Education technology is an essential part of the 21st century therefore schools should take advantage of ICT.

ICT is a powerful tool in presenting information in different ways like texts, pictures, tables and graphs. Changes on information can be shown dynamically such as in mathematics or visualization of complex processes in science (Cobb and MacClain, 2002). The use of media for instructional purposes is traced back to the early 20th Century with the introduction of educational films and mechanical teaching machines. Large scale use of technologies was employed in training soldiers in the 2nd world war using films and projectors (Saettler, 1990), slide projectors and Cuisenaire rods were used in 1950's. In 1960 a classroom based on computer terminals for students to access information while listening to recorded information was introduced, (Woolley, 2013). By the 1980's there was digitized communication in education. With the advent of World Wide Web in the 90's, teachers started to use emerging technologies for teaching. With the drastic shift to internet functionality, new schemes of communication are used. Educators now use webcam technology where lessons are recorded live and uploaded on the website page for students to access (Calcampus, 2013).

Modern ICT make it possible to expand the walls of the classroom and enable the integration of resources such as scientific data, library collections, video and film archives from across the globe. A good example is the virtual classroom education. This is a form of distance learning in which course content is delivered by various methods like course management applications, multi – media resources and video conferencing. Students and instructors communicate via these technologies (Kurbel, 2001). ICTs make it possible to bring wisdom and lived experiences through resource persons thus bringing life to learning (Johnson, 2007). The concern of this study is whether schools have the essential resources to enable them use ICTs for instruction.

According to the National Development Policy, Kenya aims to be an industrialized and middle income country by 2030 (Republic of Kenya 2007). This policy document named Vision 2030 is based on three pillars which are economic, social and political development. To achieve the objectives of Vision 2030 there is need for skilled human resource at all levels of the economy. Vision 2030 recognizes the special role to be played by science, technology and innovation as the basis for rapid socio – economic transformation.

The government aims at providing globally competitive and quality education, training and research opportunities to meet the Vision 2030 objectives. One of the strategies is to establish a computer supply programme that will enable students to be equipped with modern ICT skills. Consequently, society can achieve the grandest of ideals; that education can reduce poverty and raise living standards (Annan, 2003).

Experts acknowledge a surge in demand for higher education which may only be met through technology- enhanced learning. ICT is handy in providing audio- visual education which fills the gap, especially for institutions facing staff shortage. Young Kenyans agree that ICT is a step towards advancement and a tool to help build a technologically literate work force to meet the changing needs of the information age. It is also a good option for non – fulltime students particularly in continuing education. In order for ICTs to be used effectively, teachers should have knowledge and competencies to use ICTs in instruction. Teacher preparation is important thus raising the questions of how prepared teachers are to use ICTs during instruction. In the case of Rwanda the government committed itself to a laptop for every Rwandan primary school pupil. This was part of its objective to steer the country into a knowledge based economy by the year 2020. The project was to strengthen the quality of free and compulsory primary education by adopting sophisticated tools for learning. The result was higher enrollment of pupils in primary schools (Karanja, 2011 and Andoh, 2012).

Technology also ensures greater enthusiasm for learning among students. With the presence of the fibre optic cable to promote Digital Education Channel, learners will be able to access audio, video and multi-media content (Gillward and Stork, 2008). The ICT initiative becomes the regional platform to empower educational institutions to adopt and use technology in knowledge acquisition. Students growing up in this digital age have extensive exposure to variety of media. Major high – tech companies like Google, Verizon and Microsoft are funding schools to enable them teach their students through technology. This can lead to improved student performance according Song and Kang (2012).

Flexible, borderless, and timeless learning is a pillar to regional curriculum harmonization and sharing of human resource in East Africa and beyond. With ICT, the quality of teaching, learning and management systems in schools will improve, therefore, raising education standards and by extension, quality of education. Students can easily access course materials, engage in asynchronous learning and studying at a time and location they prefer. (NSBA, 2011). The use of ICT by students can help develop a future work force that can effectively participate in the increasing networked world and the emerging knowledge economy.

Knowledge and skills in ICT will place Kenyan graduates at par with those from other countries, giving Kenya an edge in technological advancement, and enable her to produce graduates who can compete with those from developed countries. Nderitu (2012) notes that by 2022 Kenya may have ICT savvy youths who can do business on-line. He says that once this generation embraces ICT for instruction, Kenya will join countries like Rwanda, Mongolia and Nepal where children use ICTs to learn, play and access information on different subjects and in a variety of languages.

Adequate instructional resources that support structured teaching and learning enhance learner's achievement and enable the teacher to use modern practical pedagogical skills. Use of ICT can eliminate disparities among rural and urban schools in terms of content and content delivery. There is wide participation from students (NSBA, 2011). The internet has unlocked a world of opportunity for students. Students of all ages can connect, share and learn on a global scale. The most modern instructional tools are computers, internet, mobile and smart phones, teleconferencing, video conferencing, video and audio cassettes, digital and document cameras, interactive whiteboards. These technologies can improve instruction by

enhancing content delivery and making it memorable and interesting to learners. Modern forms of technology support multiple cognitive styles and learning behavior. They can be used to translate any content into another media making it memorable, interesting and accessible to all kinds of learners (Geer and Sweeny, 2012). Since these modern technologies are very important in instruction, the question is their availability in schools. Are schools actually prepared for accommodation of ICT resources?

Increased investment in technologies that support education is essential in enhancing equal access to education achieving quality education and narrowing the gap between remote rural schools and urban technologically urbanized learning schools. The preceding discussion has highlighted the importance of using ICTs in the instructional process. It is therefore important that both teachers and students embrace technology in order to gain these benefits. (Hicks, 2011). Since prior preparation is important, this study was designed to find out whether schools were ready to adopt ICT for instruction. Specifically, the study was to set to find out whether there were ICT resources, teachers' competencies and challenges faced in preparation efforts.

1.3 Statement of the problem.

Educational reforms, trends and innovations are always made to improve the quality of education, facilitate access to relevant education and reduce poverty. All these will in turn improve a country's economy, (Robinson, 2008).

Use of ICT is an integral part of the modern society. The last two decades have witnessed worldwide proliferation of information communication technologies even in the education

field. Integrating different forms of technology into the curriculum is very valuable to the teacher and the learner (Robertson, 2000). Success of education depends on ability to integrate technology effectively into the school curriculum. The role of technology in the instructional process is no longer optional but it is now an essential tool to enhance learning (Volman, 2005). It is an innovation that can deliver knowledge skills and attitudes necessary in this century. ICT sector has become one of the major drivers of the Kenyan economy. In recognition of the important role of the sector, the Kenya Vision 2030 identified it as an economic enabler of growth of other sectors. The availability of ICT is a foundation for development in the creation, and use of network – based services. These are new horizons for communication and connecting people around the world. Schools can get connected to the rest of the world by use of internet, (Bates, 2005). Whether schools are connected to the internet is a concern that formed basis for this study.

To maintain quality and expand access ICT provides a solution. Students have an opportunity to control learning at their own individual level. It can increase the efficiency and effectiveness of schools. Limited education resources can be utilized in a more cost-effective manner (Keengwe and Onchwari, 2011). Since these modern technologies are very important in instruction, the question is their availability in schools. Are schools actually prepared for accommodation of ICT resources?

Planning plays a vital role prior to implementation of any activity, (Cavanaugh, 2009). Before any ICT based program is launched, resources, infrastructure and expertise should be available. According to Allen and Seaman (2008) the technical experts to use these

technologies should be available. In the case of schools, administrators, teachers and technical support staff should be available and have relevant skills.

Schools must have appropriate ICT infrastructure that include networked computers and applications with high speed access to the global internet. They also require ICT resources like computers, television, audio devices and a host of other ICT media that can be used in instruction.

Within the past decade new ICT tools have fundamentally changed the way people communicate and do business. They have transformed the nature of education, where and how learning takes place and the roles of students and teachers. The crucial role of the teacher in the instructional process is widely acknowledged. However, with the emergence of newer technologies, there is need to equip serving teachers with current teaching practices and re – orient them with newer methods that include use of ICTs. (Manduku et al, 2010). There should be reforms in delivery of teachers' professional development programs.

The e-government strategy paper launched in 2004 shows that the government on its part is committed to raising quality and access to education by allocating funds for procurement of ICT equipment. The Minister for Information and Communication says the government is exploring innovative ways of harnessing ICT to promote learning in all educational institutions. Speaking during an International Conference on emerging technologies and future of ICT in June 2011, the Minister acknowledged that access to ICT and digital villages will support e – learning even in remote areas. He further said the government has given a

subsidy to educational institutions to enable them access broad band connections. Still the government intends to lower the cost of internet to enable these institutions to expand their academic programs (KenyaSchoolNet, 2003). The Ministry of Education (MOE) has an ICT department whose mandate is to formulate and supervise the ICT guidelines in schools. This department has been empowered to tackle challenges that will arise with adoption of ICTs in instruction. The Constituency Development Fund (CDF) has been used in some constituencies to equip schools with computers and in-service teachers in this new technology.

Further, the Ministry of Education (MOE) has mandated the curriculum planners at KICD to develop digitized content for subjects taught in schools. On its part, Kenya Institute of Curriculum Development established infrastructure for development and dissemination of e-learning curriculum support materials. The Institutes' Radio Broadcasting studios are used for production of educational radio lessons to schools and colleges. They have a Television channel for learners and the public. Further, Digital content developed for primary and secondary schools' curriculum has been packaged in DVDs that are available at Kenya Institute of Curriculum Development (KICD) and other 42 outlet bookshops across the country. The institute has rolled out an innovation which involves installing digitalized content in computers and other learning devices. So far this has been done in 3000 schools across the country (MOE, 2006). These efforts towards ICT integration by the government are commendable. This study was set to specifically find out which ICT resources are available in schools in Bungoma County.

For effective curriculum implementation, quality and effective teaching strategies are essential. Curriculum is dynamic hence need for changes and new methods of content delivery. KICD has developed an on-line primary school teachers' orientation course to ensure continuous professional development particularly in instruction. Through the Learning Management System (ELIMIKA) the institute provides knowledge on curriculum, and effective implementation skills, especially in the area of ICT use. It is not clear whether practicing teachers in schools get this important information and then make efforts to improve their teaching strategies.

Electrification of institutions as part of new infrastructural development is ongoing through the rural electrification programme. The Rural Electrification Authority has pledged to provide electricity to 29,895 public facilities in rural areas, schools included. They are doing public sensitization on use of solar energy and biogas to supplement electricity (Rural Electrification Authority, 2013). In the same light, the Ol Karia Geothermal power project launched in 2012 is the new largest green energy generation plant in Africa. It has potential to supply 280 megawatts. This project can help Kenya avoid over reliance on hydro electric -power and have a stable supply of clean, renewable and environment friendly geothermal power (Standard Group, 2013).

Another objective of this study was to establish whether teachers have the necessary competencies to use ICT for instruction especially those teachers in Bungoma County. According to a report by the Ministry of Education (MOE, 2007), the government of Kenya (GOK) has continued to invest in quality education through In-Service Education and

Training, providing free Primary and subsidized Secondary education. Researches on improving quality of education indicate that this can be achieved through improving teacher quality and their teaching techniques (World Bank, 2006).

The use of ICT is stressed during SMASSE training Programme. This is a program to in-service Science and Mathematics teachers sponsored by MOE and Japan International Co-operation (MOE, 2005). Its focus is pedagogy, instructional resources and mastery of content. INSET is used by MOE to upgrade teachers' skills and competencies. This is in conformity with worldwide consensus that improving quality of education depends on improvement of classroom practices (Kibe et al, 2008). Kenya Literature Bureau, a leading publishing Company in Kenya has digitized some of the course books and they are available on CD.

Indeed commendable efforts have been made to integrate ICT in education by the government and other relevant sectors. All these efforts may go to waste if individual schools have not made adequate preparations for adoption of ICT technology in teaching. It is in this view that this study was set to find out whether the schools in Bungoma County were prepared to adopt ICT for instruction. Specifically, this study was to find out whether there were ICT resources in schools, whether teachers have the necessary competence to use ICTs in classroom instruction and the challenges schools faced as they adopted ICT in instruction.

1.4 Purpose of the study

The study was designed to investigate the level of preparedness for adoption of ICT innovation in secondary schools. Specifically, the study sought to examine preparedness in the areas of ICT resources, teachers' knowledge and skills in ICT use and challenges faced in

preparation to adopt ICT for instruction. The study also compared preparation levels in schools in rural and urban areas.

1.5 Objectives of the study

In order to find out the level of preparedness for ICT adoption in schools, the study focused on the following objectives.

Main objective

To establish schools' level of preparedness for adoption of ICT in school instruction.

Specific objectives

1) To find out ICT resources available in schools.
2) To establish teachers' competencies in using ICT in school instruction.
3) To compare schools' level of preparedness to adopt ICT for instruction in rural and urban areas.
4) To find out challenges faced by schools in their efforts to adopt ICT for school instruction.

1.6 Research questions

The study was based on the following research questions.

Main research question:

How prepared are schools for adoption of ICT in school instruction?

Specific research questions were:

1) Which ICT resources are available in schools?
2) Do school teachers have the necessary competencies of using ICT for instruction?

3) What is the rural schools' level of preparedness to adopt ICT for instruction compared to that of urban schools?
4) What challenges do schools face in preparation to adopt ICT for instruction?

1.7 Assumptions of the Study

The study was based on the following assumptions;

1) All schools were embracing ICT in their strategic plans.
2) ICT is integrated in all the subjects taught in schools.
3) Respondents would give honest answers

1.8 Significance of the study

Information Communication and Technology promises improved methods of instruction. ICT can help students to develop thinking in a range of ways including reasoning, understanding and creativity in all subjects across the curriculum. The findings of this study are expected to:

1. Provide a framework to guide the Kenyan Government in planning for provision of education resources to ensure access, equity and quality education.
2. Form a base for the Ministry of Education and the Teachers' Service Commission on training needs for teachers.
3. Provide a framework for school managers and administrators to provide an ICT rich environment to enhance instruction.
4. Open areas for further research on use of ICTs in education in Kenya and around the globe. This will help the community to benefit from a knowledge based society.

1.9 Justification of the study

Whereas ICT has penetrated many sectors including banking, transportation communications and medical services, the Kenyan education system seems to lag behind. This study was set to

find out the level of preparedness in secondary schools to adopt ICT for school instruction. The findings and recommendations will shed light on ICT resources available in schools, teacher competencies and challenges in ICT adoption so that interventions, improvements and policies are made on ICT as an instructional tool. This is because ICTs have an important role to play in communication, knowledge sharing and accessibility to a wide range of courses.

1.10 Scope and Limitations

The scope and limitations of the study are given in the following section.

1.10.1 Scope

The research had the following as its scope:

Since preparation is important before undertaking any activity, this study confined itself to how prepared schools were to adopt ICT in instruction. The focus was availability of ICT resources, teacher competencies, comparison of preparedness in schools in urban and rural areas and challenges faced in preparations for ICT adoption. It was a survey carried out in 102 sampled secondary schools in Bungoma County. Data was collected by use of interviews, questionnaire and observation schedule.

1.10.2 Limitations

The study was limited by the following factors;

1. Some respondents were not free to give information but the researcher took time to explain to them the importance of the research.
2. Only three teachers were sampled per school to take part in the research yet some schools had many teachers. This was countered by some responses from the Principals and ICT specialists.

3. Time factor because the researcher is fully employed by the TSC and yet the research was done during school time. The researcher had to keep asking for permission from the school Principal to be able to visit the sampled schools.

1.11 Theoretical Framework

The study was based on the Adoption and Diffusion theory developed by Rogers (1995) and the Technology Acceptance Model (TAM) developed by Davis and Bagozzi in 1989.

Adoption and Diffusion theory

Education technology is a field of innovation and change. One major reason for lack of utilization of education technology is that most efforts are concentrated on developing instructionally sound and technically superior products. Understanding why people use or don't use this technology is left out.

The Adoption and Diffusion Theory was researched by Everett Rogers (Rogers, 1995). In his study he gives an overview of the adoption and diffusion theory. He suggests in this theory that the adoption of an innovation is not a single act but a process that occurs over time. Potential adopters go through five stages when interacting with an innovation. These are,

i) Knowledge – potential adopters form a positive or negative attitude of the innovation and how it works.
ii) Persuasion – potential adopters form a positive or negative attitude of the innovation.
iii) Decision – the innovation is actually adopted or rejected.
iv) Implementation – occurs when the innovation is actually used.
v) Confirmation – the adopter seeks information about the innovation and either continues or discontinues use of the innovation.

Rogers further discusses the concept of adopter categories. The concept states that for any innovation, a certain percentage will readily adopt the innovation i.e. 2.5%, early adopters make up 13.5%, Early majority 34%, Laggards or those who will completely resist the innovation comprise 16% of the population. These statistics given by Rogers show that all innovations go through a natural predictable and sometimes lengthy process before becoming widely adopted within a population.

Rogers also says that perceived attributes serve as basis for diffusion of an innovation. Perceived attributes are the opinions of potential adopters. He observes that people are more likely to adopt an innovation if it offers them a better way to do something, it is compatible with their values, beliefs and needs, is not too complex, can be tried out before adoption and has observable benefits. Educational technologists should think about how potential adopters will perceive their innovations and not exclusively on the innovations' technical superiority.

This theory is relevant in this study in that the process of adopting ICT in classroom instructions is not a single act. There are several stages involved. The potential adopters who are teachers in this case also go through five stages listed by Rogers as they interact with ICTs.

The teachers need to gain basic knowledge about ICTs', then form an attitude which may be positive or negative. Then they can decide whether to use the ICTs in instruction or reject them. At the implementation stage, these teachers will be seen using ICTs during instruction. If it satisfies their needs then at confirmation stage they will seek more information on how to use ICTs or discontinue the use. ICTs have a host of benefits if well used during instruction. If teachers are convinced that they can benefit themselves and their students by using ICTs to

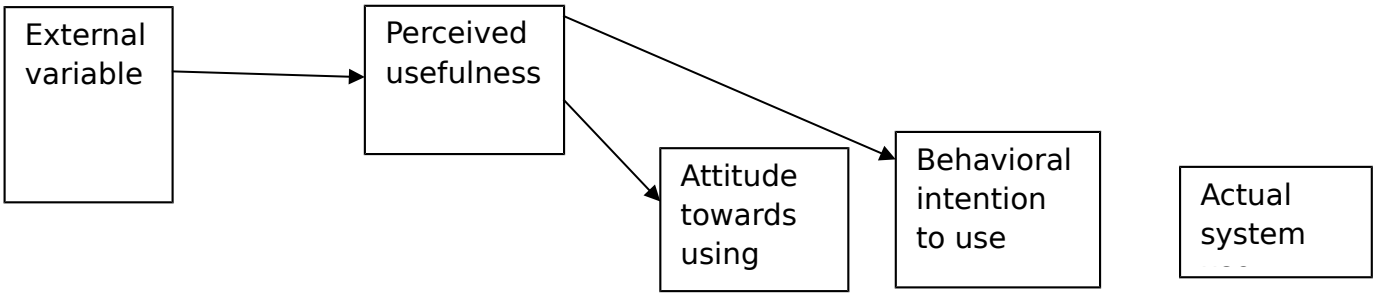
teach they will adopt them. This really suggests that prior basic knowledge about use of ICTs in instruction on the part of teachers is very important.

Rogers also discusses adopter categories where he specifically argues that all innovations go through a natural, predictable and lengthy process before becoming widely adopted. He says that perceived attributes serve as a basis for diffusion of an innovation. In the case of this study, diffusion of ICT into classroom instruction can only be successful if teachers view these ICTs as being in tandem with their beliefs, needs and have benefits to them during teaching. These ICTs should also not be too complicated to use during lessons. From this theory of Adoption and Diffusion, ICTs can be used in instruction if teachers have basic knowledge and skills of using them (Ely, 1999). Teachers will also adopt ICT if it makes their work easier.

Since this theory focused on ICT users, for emphasis this study also explored the Technology Acceptance Model (TAM) which is an information system theory that models how users come to accept and use technology. It was developed by Davis and Bagozzi in 1989 as an extension of Ajzen and Fishbein's Theory of Reasoned Action (TRA), (Davis 1989, Bagozzi and Warshaw 1992) to explain computer usage behavior.

Advances in computing and ICT are changing the way people meet and communicate. New technologies like computers are complex and decision makers are uncertain about their successful adoption which makes people form attitudes and intentions when learning to use them.

The model is shown in figure 1.1.



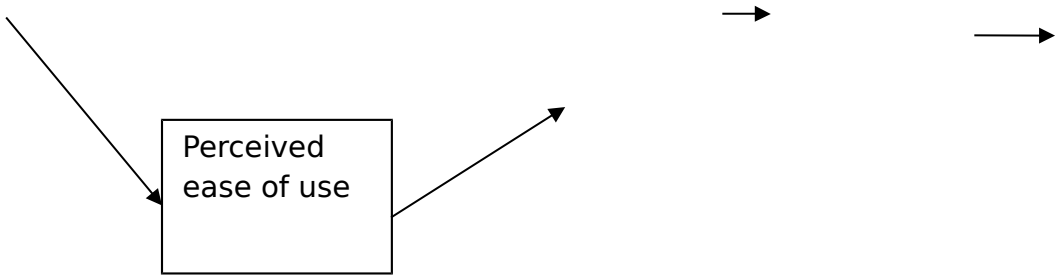


Figure 1.1 Technology Acceptance Model (Davis, 1989).

This model suggests that when users are presented with technology, its Perceived Usefulness (P.U) and Perceived Ease of Use (PEOU) influence their decision about how and when to use it. If a user perceives a specific technology to be useful they will have a positive user performance relationship.

Similarly, a user may accept an application if they see it easier to use as compared to another. Perceived usefulness (P.U) is defined by Davis as the degree a user believes that using a particular system will enhance the user's job performance. Perceived ease of use (PEOU) is the degree to which a user believes using a particular system would be free from effort (Davis, 1989). TAM works on the assumption that when someone forms an intention to act, they will act without limitation. But in the real world there will be limitations to act. PU and PEOU play a prominent role on ones decision. In the same view, compatibility, relative advantage and complexity have a significant relation to adoption of innovations.

IT is changing the process of teaching and learning. Therefore, education technology with a high level of PU and PEOU is more likely to induce positive perceptions. PU mediates the effect of PEOU on attitude and intended use. One is most likely to use new technology if he evaluates it to be useful.

As adopted in this study, TAM is relevant to teachers and school Principals. These will be willing to adopt ICT in instruction if they understand that it can improve their teaching which can lead to better performance by their students. The Principals need to understand the value of ICT and provide the relevant materials and infrastructure. The teachers should understand the value of ICT and how it can make their teaching strategy effective, varied and easier. With this understanding, they will develop a positive attitude towards use, move on to acquire the knowledge and skills and then actually use ICT. All these steps are found in the preparation stage before ICT is finally used in the classroom. According to the present study, provision of ICT resources, training teachers to use and also developing positive attitudes to use is very important to adoption of ICT. Teacher's exposure to ICT will influence their PU and PEOU and their attitude. The attitude developed will also influence their behavioral intentions to use ICTs resulting in actual system use. Without exposure, a negative attitude will be developed and the teachers will most likely not adopt ICT for instruction.

Earlier research on diffusion of innovation suggests a prominent role for PEOU. Studies on IT report that user's attitudes are important factors affecting the success of adoption of a system (Woelf, 1995). In the context of IT, TAM suggests a positive attitude towards technology when users see it as useful and easy to use. Teachers will develop a positive attitude towards ICT and use it in instruction if they find it useful and easy to use during instruction and also if it is easy for them to use. It is therefore important that teachers are competent in ICT use especially during instruction.

The Technology Adoption and Diffusion theory and Technology Acceptance Model both strongly point out the importance of user attitudes in adopting an innovation. If teachers (in the case of this study) can receive prior knowledge on ICT use during pre – service or in – service, then develop a positive attitude that ICTs are important in teaching and can make work easier, then they will comfortably adopt this technology. Indeed, adoption of ICT is an entire process which requires input, a positive attitude and the final result which is actual system use.

1.12 Definitions of Operational Terms.

The following operational terms have been defined for the purpose of this study.

Adoption **-** use of an idea, in this study it refers to the use of ICT in instruction.

Information Communication Technology – ICT – umbrella term that includes communication devices like radio, TV, Computer, network, satellite and telephony.

Information Technology – These are tools that can dispense information.

Innovation – introducing a new trend in educational instruction

Instruction – procedure of teaching and learning in the classroom

Knowledge – information and understanding how to use ICTs.

Networking – connectivity of several computers to enable sharing of information.

Preparedness – putting in place the resources needed for the smooth adoption of ICT e.g. physical and human resources.

Principal – head teacher of a secondary school.

Rural schools – schools located in remote areas.

School – institution where there are students and teaching and learning goes on.

Urban schools – schools located in town areas with varied modern facilities.

Vision 2030 – Kenya's new long-term national planning strategy covering the period 2008-2030.

1.13 Summary

This chapter has discussed the background of this study which includes statement of the problem, purpose and objectives. It has also given the research questions, assumptions, significance, justification, scope and limitations of the study, theoretical framework and definitions of operational terms in preparation for chapter two.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter the researcher reviewed literature related to ICT use in education. Specifically the review focused on ICT as an instructional tool, availability of ICT resources in schools, teacher competencies and challenges to ICT implementation in schools. The review attempted to establish existing knowledge gaps in adoption of ICT for instruction that laid the foundation for the main study.

2.2 General literature review

General literature review focused on the concept of ICT as an innovation in education. These are explained in the following sections.

2.2.1 The concept of ICT

Information communication technology (ICT) is an umbrella term that is used to describe the computing and telecommunication technologies. These are used to create, arrest, process, disseminate, store and manage information. They include devices like radio, television, cellular phones, and computer, internet and satellite systems (Primo, 2003). Lever, McDonald and Mizell (2003) define ICT as the use of at least a computer, internet and a host of other devices that convert information from text, images, sounds and motion into digital formats. These are then used in different communication settings.ICT plays a host of functions in public spheres of society and contexts of everyday life. They offer the possibility to realize a generally open interactive communication that is important for public sphere. Since they

shape verbal communication as a means of expression and reflection they can be used for democratic and discursive purposes (Heesen 2004).

The meditative function of ICT has the potential to promote one of the Millennium Development goals. That is, to help all people to communicate. Through this function, poverty and hunger can be eradicated and Universal Primary Education (UPE) can be achieved. ICTs promote gender equality and empowerment of women (UNESCO, 2007). The health sector can be improved, the environment sustained and global partnerships for a peaceful, just and prosperous world developed (Annan 2003). The EFA Global Monitoring Report (2012) observed that use of ICTs can help in achieving EFA goals. The report says these technologies have great potential for effective learning, knowledge acquisition and development of better and efficient school services.

ICT is a globally expanded network that is considered a suitable medium to build a global public sphere. Everyone is allowed to express any opinion hence the principle of universalization is practically realized. Being omnipresent, ICT expands the electronic communication networks into objective environment .Local networks are connected to the World Wide Web (www) with intelligent objects of utility. A virtual space for matching people and electronic interaction at a personal level is created. Maintaining existing relationships and creating new ones is an essential feature of human life. With this anthropological assumption, the individual, his personal needs and preferences are put at the centre of ICT applications particularly in the area of network technologies, (European Commission, 2010).

ICT creates an environment where all national sovereignties, religious, cultural, social and linguistic interests are respected and protected. The various ICT applications in all cultural and societal spheres can help to save, archive, and transfer traditional values of a community or nation. ICTs are open to a large audience, more disposed to criticism and reflection (G.8). Considering the sparse nature of most communities in developing countries, poor road networks that inhibit travel, ICTs that overcome space and time are an appropriate way of connecting people, (Asraf, Swatman and Hanisch, 2007). A living case is the rapid growth of use of mobile phones even in the remotest parts. ICTs can be used to bridge the digital divide and even the economic and gender differences. Lima and Brown, (2007) indicate that the constant changes in the world we live in keep generating new challenges for its inhabitants. According to them, ICT presents opportunities for people to be more engaged, informed and communicate within an interconnected world. Hence new skills must be mastered so that individuals are empowered and included in this knowledge society. This is the era where information is a most valuable asset. If these views of Lima and Brown are realized in education, the society is bound to benefit.

Specifically, ICTs are used by individuals for communication, entertainment and research. Information flow is faster, accurate and cost-effective especially when using internet or satellite. For researchers, there is almost enough information on various topics that can be researched, (Robinson, 2008). The use of ICT has the potential to distribute opportunities of learning more widely and equitably. ICT is an important and now popular mode of communication that has penetrated many sectors like banking, communication, business,

government, but the education sector lags behind (Wabuyela 2003).This innovation could bring a positive change in the way education matters are handled.

Since ICT is an important tool of communication in most sectors today its availability and competencies to use are important. ICTs play a leading role in promoting the economy of a country, (GOK, 2007). The rapid development of economies like China, Brazil, India, Russia, US can be attributed to the impacts of ICT (Lau and Sim, 2008). All sectors that embrace ICT have enough resources and competent staff to use them. A review of 150 distance education programs in Sub – Saharan Africa has revealed that the print mode is more widely used as compared to on – line and web – based learning. (UNESCO, 2007). This is as a result of limited ICT infrastructural development and unreliable supply of electricity. A proper needs assessment done will shed light on resources that are required and man power development. All these are done during the preparation stage which was the main objective of this study. If ICTs are actually important tools of communication in all sectors of the world economy it is imperative that prior preparations are made before their adoption in the various sectors. As Wabuyela (2003) puts it, the education sector lags behind in use of ICTs. Laaria (2013) also points out in her study that while other countries have achieved over 41% implementation of ICTs in secondary schools, the percentage in Kenyan Secondary schools remains low. Could this be as a result of no preparation being made to adopt ICT in the education sector? This study was set to actually find out the level of preparedness in secondary schools and especially those in Bungoma County.

2.2.2: ICT as an innovation in education.

ICT in education refers to modern innovative materials used as mediators in instruction. They work as specific media to compliment the instructional process. Derek (2003) says ICT includes media in the form of text, image, animation, streaming video and audio and when these are applied to education they become education technology. Alonso (2005) defines ICT as a medium for instruction which supports both traditional and modern practices. According to Song and Kang (2012) ICT is used widely in education for collection, management and analysis of information. It includes tools like computers, CD ROMS, projection TVs, word processors, image graphic software, email and internet based communication technology.

ICT is an innovation that is an essential part of the 21st century. Selwyn, (2011) says it facilitates giving and receiving feed-back and allows students to progressively revise their work. Keengwe and Onchwari (2011) noted that by implementing ICTs, schools can present high quality teaching and learning through real time conversation, learning by doing, directed instruction and delayed time conversations. The world is embracing the emerging educational paradigm where schools empower learners to become active and more responsible in managing their own learning, thus leading to acquisition of skills, knowledge and attitudes for lifelong learning. Present day learners belong to the ICT era where technology should be harnessed effectively to empower and provide limitless educational opportunities to them. The rapid technological and economical developments in the world have resulted in the emergence of knowledge societies that require all citizens to have the ability to use ICTs in order to function better.

Cuban (1998) says each new development in information and entertainment technology in society brought with it a desire to deploy such revolutionary technology into schools. This could bring the schools and specifically classrooms from the dark ages into the modern world. Technology was also adopted out of desire for modernization and standardization. Schools, like factories should produce uniform students in what they have been taught and acquired skills. This is only possible if they are exposed to these technologies early and given an opportunity to interact with them continuously.

The use of educational technology strategies for instruction is an issue of importance to educational administrators around the world. Technology is revolutionizing the way both teaching and learning process is conducted today. Technology provides a new and pleasurable experience for teachers and students. The use of educational technologies in enriching teaching and learning depends largely on the unique attributes which technology affords. These unique attributes in each technology make a difference by arousing learners' interest, stimulate their imagination, raise questions for discussion and a desire to find out more or solve problems. Technology also ensures greater enthusiasm for learning among students. The main purpose of using ICT in schools is to improve learning outcomes of students because of the ease with which information is accessed. Technology helps to relate academics to the practice of today's workforce. The use of computers and internet provides exposure to various types of equipment, how to operate them and helps the learners to get the technical know-how which is necessary for today's workforce. This increases the viability of tomorrow's workers.

ICT can be a solution to teacher shortage in school system since it gives room for diverse teaching methods. With the introduction of subsidized Secondary and free Primary education the enrolment in schools has more than doubled. The classroom is over-crowded with teachers having more work load than they can handle. In some areas the teacher-pupil ratio is 1:100 which is far beyond the recommended ratio of 1:40 (Laaria, 2013). Teachers find it hard to give individual attention to learners especially the slow ones. If teachers have ICT skills and competencies they can use this strategy to ensure quality learning for all students (Aguyo, 2010). However, are teachers competent enough in ICT use? Ballad (2000) is of the view that technology can reshape today's' school systems by giving students and teachers innovative ways of instruction. For administrators, they can learn new ways of organizing educational systems. This calls for staff training initiatives to equip them with competencies in design and implementation of ICT in education (Watson 2001).

Several studies on use of ICT as an innovation show that its use in the classroom is essential for providing opportunities for students to learn to operate in an information intensive age. Grimus (2000) points out that by teaching ICT skills in Primary schools, pupils are prepared to face future developments based on proper understanding. What is known provides important guidelines for uses of technology for teachers and students to develop competencies needed for the 21st century. Bransford (2000) and Volman (2005) agree that ICTs enhance student achievement and teacher learning.

Yelland's view is that traditional educational environments do not seem suitable for learners to be productive in the work place of today's society, (Yelland 2001). Dawes (2001) is of the view that new technologies have the potential to support education across the curriculum.

They provide opportunities for affective communication between teachers and students in ways that have not been possible before.ICT in education is influential in bringing about changes in ways of teaching. The Malaysian government has set up ‘smart’ schools across the country which have fully embraced ICT in their operations. There is compulsory seven day education session every year for teachers to update their skills. In Malaysia, it is believed that ICT operations keep changing with newer inventions. There is need for continuous teacher training to match newer technologies (Young and Quin, 2003).

A study done by Wong (2006) shows that technology plays a part in supporting face to face teaching and learning in the classroom. For example, the use of computers can help students become knowledgeable, reduce the amount of direct instruction given to them and give their teachers an opportunity to attend to those students with particular needs. Grabe and Grabe (2007) say ICTs play an important role in student motivation, skills and knowledge acquisition.ICT can be used to present information to students and help them complete learning tasks. Wanjala, Khaemba and Mukwa (2011) from their research show that ICT increases access to education, especially for students in remote areas. It can also improve administration of schools and education. According to Laaria (2013) ICTs perform functions like record keeping, research work, classroom instruction, financial analysis, examination results analysis, communication and supervision in schools. Aguyo (2010) is of the view that ICTs can be cost effective especially in terms of manpower. One teacher can reach many learners through the internet, interactive whiteboards and video conferencing technologies. Textbooks are available on – line and teachers and students can access the content and up - to date resources.

The review given above out-lines the importance of ICT in education and specifically in instruction. The studies cited outline how ICT as an innovation can improve the instructional process and modernize learning. These studies however fail to shed light on the level of preparedness in schools so that the benefits of ICT can be felt maximumly. If ICTs are important the question is, are they available in schools? Are teachers competent enough to use them during instruction? What challenges are faced as schools prepare to adopt ICTs for instruction?

This study aims to find out whether individual schools are ready to benefit from ICT use in education by adopting these new technologies in everyday classroom instruction.

2.3 Related literature review.

Related literature was reviewed to provide the researcher with reliable information on what has been researched in the area of ICTs, reveal their contributions and knowledge gaps to be filled by the present study. It also helped to isolate the important issues that formed the basis upon which the present study was built. Using technology to enhance students learning has become an important area of discussion in the field of education technology (Kozma, 2007). ICT devices are emerging as recent technologies that are integral to the school system.

2.3.1 Availability of ICT resources

Creating an ICT enabling environment requires technical infrastructure and ICT media resources. These are important to support production, sourcing and delivery of ICT content. Hennessey (2010) observes that lack of physical facilities impedes ICT implementation in schools in Africa. He says ICTs require supporting infrastructure like laboratories and furniture to be in place before implementation. For example, with internet connectivity information from on-line libraries in distant areas can be accessed, stored and retrieved for use

at a later time. However, access to the internet is expensive. Aguyo (2010) says that in Kenya there are limited ICT resources to support curriculum delivery. Standard software and hardware to meet local education requirements is not easily available.

Silica's study done in 2005 indicates that lack of access to resources puts off teachers in their quest to use ICT in instruction. The respondents complained about difficulty in accessing computers, poor quality hardware and in appropriate software. A similar problem was experienced in schools in Turkey.There were few computers and slowness of ICT systems (Toprakci, 2006).

Recent research in Syrian schools indicated that insufficient computer resources were an impediment to technology integration in the classroom (Albirini 2006). Korte and Husing (2007) in their European school's study found that some schools still did not have broadband and internet access. A research done in India shows that ICT has been integrated in most of the higher learning institutions. At the Primary and Secondary school levels there was lack of basic infrastructure and ICT resources (Kozma, 2007).This hampered use of ICT in instruction at these levels. The Department of Education in South Africa has put in place a policy that by 2013 all learners in the general and higher education would be ICT capable. Despite this, a study carried out by Hodgkinson in 2006 showed that not all schools in South Africa had internet access or computers. The study done in Grahams' town revealed that only 8 out of the 13 schools sampled had internet access. This may be limiting teachers and learners the quality education afforded by ICT. The use of ICTs as meditational tools in

instruction is predicated on the availability of internet connectivity which is problematic in developing countries (Hodgkinson, 2006).

The International Telecommunication Union (ITU) at the World summit meeting in Geneva in June 2006 recommended that every country should have a national broadband strategy to ensure universal access. The target should be to have 40% of households in developing countries accessing internet by 2015. The UN Secretary General, Ban Ki Moon at the ITU Geneva meeting impressed upon African countries to deploy proper infrastructure and educate the masses on the benefits of ICTs to help achieve MDGs. This implies African countries have to prepare well in terms of infrastructure and manpower development in order to be able to use ICT resources in education (World Bank, 2006).

Community network initiatives in China bring together villages, towns, cities, educational institutions into virtual villages. The International Tele-computing Consortium in China works with schools and universities to create community-based networks and establishes computer centres with internet access. During school hours they are used by students and teachers, after school time community members are allowed to use them. Technology grants are also given to individuals and educational institutions to stimulate innovations in the education sector including ICT (Gouyauan et al, 2005).

A survey of ICT use in Namibia done in 2009 showed this country had the best infrastructure in the region. In Namibia 98% of all information is channeled through ICTs (Yuksel and Yildrim, 2009). The government and IT industry have purposed to create a technically competent work force. However, they are faced with the challenge of making IT cheaper and

more accessible to the public. In the education sector, School Net Namibia is an NGO assisting schools to access computers and internet. Solar energy is provided where there is no electricity. They also have a Linux server connecting several computers to a Local Area Network (LAN). Modems are used though they are slow in accessing the internet hence proving expensive for schools.

A study on e learning readiness in public secondary schools in Nakuru Municipality (Karanja 2011) revealed that secondary schools in Kenya lack adequate ICT infrastructure and connectivity to support effective e learning delivery. In addition, the study says that there are no standardized software application programs and digital content to enhance the e learning process. Teachers lack capacity to integrate ICT tools in education. This particular study focused on whether schools were ready for e learning without specifically looking at the preparation process. This study by Karanja (2011) also focused on computer use for e - learning and yet ICT encompasses many other tools which are highlighted in the present study.

Teachers' ICT skills play a significant role in adoption of ICT in schools. Hennessey (2010) observes that teachers' attitudes, beliefs, adequacy and skills influence successful implementation of ICTs. Dzidonu (2010) agrees with this view. He observes in his study that in many African countries levels of teachers ICT skills and knowledge is a major obstacle to ICT adoption. He recommends that there should be a comprehensive pre – service course on ICT skills. Higgins and Mosley (2011) recommend that teachers should understand the value

of ICTs in teaching and exactly how to use this technologies during instructional process. In addition, in – service for those in the profession should be continuous.

From the studies done on availability of ICT resources, it is evident that ICT resources were scarce in most schools. In view of this, the present study, which was set to assess preparation levels in schools was relevant in that these resources may not have been prepared or sourced for before the implementation process. The study by Silica (2005) showed that ICT resources were scarce. On the other hand, Toprakci (2006) noted poor infrastructure like slow network connection. This could be an indicator that prior preparations were not made to avail the necessary ICTs and ensure they were in good working condition before teachers were allowed to use them during instruction. This could have caused the challenges highlighted in the studies that were reviewed.

2.3.2 Use of ICT in instruction.

Teacher training in the use of technology for education is a key factor for implementation of good ICT based practices. Though the authorities in education have of late made an effort to train serving teachers in use of technology in instruction, there are still many teachers who consider themselves as lacking the necessary skills to take on ICT in their own practice. According to a study done in Spain (Arroyo 2006), the trainings could be failing to deliver on pedagogical implications that link technology and teaching of a particular subject. It could also be the technical character given to training programs in education technology. This research suggests that an innovation is less likely to be adopted if it deviates greatly from previous values, beliefs and practices. At present the question is not whether teachers should

use technology in instruction but how they can use it to transform their teaching to create new and interesting learning opportunities, (Kenya SchoolNet 2003). The question still remains, what content is given during training? Is it tailored to match the needs of these teachers?

Kelleher (2000) reviewed the use of ICTs in science classrooms in selected schools in Australia. While he accepts that ICT cannot replace normal classroom teaching, he says it can bring positive forces in science classrooms for a deeper understanding of the principles and concepts of science. It can provide new, authentic, interesting, motivating and successful educational activities. In another study on use of ICTs in teaching science, Pickersgille (2003) explored effective ways of utilizing the internet when teaching science in K – 12 in the US. He found that it expands teachers' pedagogical resources. Teachers can help students to search for information rather than give them facts. Students become aware of the world around them as they research using the internet. These studies show the benefits of using ICT to teach science but do not explore whether the teachers have skills to use these ICT resources.

The importance of technical support in ICT integration cannot be under – estimated. In a research done to find out the role of technical support in ICT integration (Lewis 2003), it was found that many teachers in Sub – Saharan Africa shied away from using ICT because of lack of technical support. Technical problems like waiting for websites to open, failing to connect to the internet, old and mal-functioning computers, printers and projectors could not be handled by teachers. These impeded the smooth delivery of the lesson. Korte and Husing (2007) recommended that ICT technical support staff should be in cooperated to help teachers use ICT without losing time fixing technical breakdowns.

According to (Kashorda et al, 2007) the following five factors influence the likelihood that good ICT learning opportunities will develop in schools. These factors are: ICT resources, ICT leadership, ICT teaching, school leadership and general teaching. The study further indicates that the success of integration of new technology into education varies depending on the ways in which it is applied. This study failed to consider prior preparation yet the preparation stage is important before actual integration takes place.

Young and Quin (2003) noted that using computers enabled teachers to facilitate learning. The teacher can interact with individuals and small groups rather than whole classes. They become co-learners with their students, particularly in relation to learning technical skills. This changing role of teachers from their traditional authoritarian /disciplinarian model has been a source of resistance to technology. Even though, the teacher student ratio is reversed from 40:1 to 1:40 (Lever et al, 2003). This is because the student has access to knowledge from a variety of teachers and is not just restricted to the physical classroom teacher. Fairman (2004) supports these views when in his research he says computers in schools have the potential to encourage significant and rapid shifts in the role of teachers and students in classroom instruction. They support broader improvements in teaching and learning.

In his study on teachers use of ICTs Schoepp (2005) is of the view that when new technologies need to be integrated in the classroom, teachers have to be trained on the use of these new innovations. Despite initial training to develop appropriate skills, knowledge and attitudes in ICT use, there should be continuing provision of professional development to

maintain appropriate skills and knowledge. Another research done on ICT integration in science education, potential benefits were reported. It encourages communication and collaboration in science research activities. Gillespie (2006) says new technologies enable students to collect science information and interact with resources like the internet. This increases student motivation, facilitates, clearer thinking and develops data interpretation skills. In view of these benefits and need for teacher competencies, the present study was designed to find out whether teachers actually have skills to use ICT during instruction.

Empirica (2006) produced a report on the use of ICT in European schools. This was a survey of head-teachers and classroom teachers done in 27 countries. The findings show that teachers who did not use computers in classrooms lacked basic skills. This view is similar to that of Balanskat et al, (2006) done in Denmark and Netherlands. Lack of competencies contributed to the teachers' resistance to change in classroom practices. In a study on the use of ICT in pre-service Teacher Education programs in Turkey done in 2009 the findings revealed that the following strategies could provide a generic approach towards enhancing ICT integration: technology plans, in-service training, strong infrastructure, technical support and role models.

From the above studies based on use of ICTs in education, these technologies are important in changing teaching and learning. However, these studies have not explored the issue of preparation. The study by Arroyo (2006) showed that teachers could not link technology and teaching of a particular subject. This view points out the fact that perhaps prior preparation of relevant content is not made so the trainings do not benefit the teachers. Another study by Pickersgille (2003) explains that both teachers and students can use the internet to get the

current information. It is imperative that internet signals are availed and teachers and students have knowledge on how to get to the internet and how to search for information. This calls for prior preparation which was a major objective of the present study. The report by Empirica (2006) on ICT use shows that teachers were reluctant to change their teaching methods because they were not competent enough to use ICTs. This could be as a result of them not being prepared adequately. Preparation is important before any innovation is rolled out. In these previous studies, much more could have been achieved if the users had been well prepared to use these new innovative technologies.

2.3.3 Challenges to ICT integration in instruction.

Whereas ICT has many benefits in instruction, its use still faces many challenges. A study done by Ertmer (1999) revealed that there were extrinsic barriers like time, support resources and training; and also intrinsic ones like attitudes, beliefs, practices and resistance to change. BECTA (2004) classified these barriers as teacher-level and school-level. From these two studies the major barrier found was lack of confidence on the part of teachers. They feared that technology may fail during lessons or some of their students were more versed in technology use than them. To avoid embarrassment teachers did not use technology. At the school level, ICT resources were scarce and some broke down during use. This trend was discouraging to teachers.

Another study by Rebecca and Marshal (2012) suggests that if teachers are to be convinced of the value of using ICT in teaching, their training should focus on sound teaching strategies. From this research, teachers who had attended professional development courses in ICT still

did not know how to use it in the classroom. They complained that the courses only focused on ICT skills' acquisition but not how they could use it in classroom to teach.

BECTA (2004) recommends that when planning for training it is important to consider time for training, pedagogical training and ICT use in initial teacher training programmes. Gomes (2005) from his study done in Portugal says that lack of training on how to use ICT technologies in specific science areas made teachers to avoid ICT use in instruction.

A study done in Australia reported that 98% of teachers use internet mostly for tasks like e-mail, research and to prepare lessons. Even though, they have not yet incorporated internet applications into traditional teaching methods. There is also lack of on-line content and advanced teacher training on ICT use (Mason 2001).He advocates for comprehensive staff training initiatives so that teachers become active in the design and implementation process. Still in another study done in Australia on challenges to ICT integration it was found that many teachers lacked knowledge and skills to use ICT. They were not even enthusiastic about the changes and integration of supplementary learning associated with ICT (Newhouse, 2002).

Resistance to change was another barrier. It was an indication that something was wrong (Earle, 2002). Teachers are unlikely to use new technologies in their teaching if they see no need to change their professional practice. Teachers who resist change are not rejecting the need for change but lack the necessary education in accepting the changes. Perhaps they do not understand the long term benefits these new technologies offer (Korte and Hussing, 2007).

Current research has shown that the level of barriers varies from one country to another. Developed countries are highly sophisticated with high quality technologies found right in the home so children and even adults have enough experiences with them. This is not the case in third world countries whose technologies are of low quality (Kafu, Lecture notes 2011). In developing countries teachers' lack of technological competence is a main barrier to their acceptance of technology. This has been cited in studies carried out in Syria and Saudi Arabia (Al-Alwani 2005).Some teachers lack hands-on skills because ICTs are new phenomena to them.

The lack of newer infrastructure has increased the technological gap between developing and developed countries. Many developing countries rely on limited and expensive internet and satellite communications to connect to the rest of the world. There are basic infrastructure in the big cities and none in rural areas. According to a UNESCO report 26% of the US population use internet, 0.8% does in Latin America, 0.5% does in South East Asia, 0.4% do in Eastern Europe and only 0.1% do in Sub-Saharan Africa. Developed countries have electricity, specific buildings and machines that use ICTs. Software has been designed and developed to be used in education. At the same time the expertise to use these technologies have knowledge and skills hence competent enough in ICT use (BECTA 2008).

A research done in Turkey showed that lack of in service training, appropriate software and hardware were all main barriers to integration of ICT in pre-service teacher education programs. There was also lack of appropriate course content, instructional programs and administrative support (Yuksel 2009). Emergence of modern ICT tools calls for reform in

teacher's professional development programs. Professional development providers should give specialized skills such as instructional design, computing and innovative skills.

Findings of a study on ICT integration in schools in Pune city in India (BECTA 2008) support teachers' professional development. This is an on- going process and not an event. Pre-service, in- service and on- going training should be done targeting daily needs and challenges that occur. Another research in Turkey (Ozden 2007) points out that lack of training opportunities for teachers in the classroom environment was the main barrier in integrating ICTs in science education. The study recommends in-service training programs for science teachers.

A research done in Australia on barriers to integration of ICT in classroom environments revealed that teachers had a strong desire to integrate ICT in education. But they encountered drawbacks like lack of confidence, competence and access to resources. Since these are essential components of technology use the study recommends provision of resources, effective professional development, sufficient time and technical support for the teachers (Bingimlas, 2009). A study by Trucano (2005) had suggested support from school administrators in provision of ICT resources. School Principals should be ICT literate and understand the value and role of ICT use in the instructional process (Laaria, 2013).

There was a general agreement among observers in the US that schools attempting to use ICTs need to have on-site technical assistance. These specialists would mentor teachers and students, install and maintain ICTs and assist with integration of ICT into the curriculum.

According to BECTA (2004) if technical maintenance is not carried out regularly there is a high risk of technical breakdowns. This discourages teachers from using ICT because it may fail during a lesson and confuse students and the teacher or cause embarrassment.

Research on use of ICTs in different settings over the years shows the barriers to be on the teachers majorly. It is how ICT is used that makes the difference in learning outcomes (BECTA, 2000). Effective adoption of ICT in the classroom takes time. Teachers' attitudes, skills, beliefs and practices affect the way they choose to use ICT and how effective they are at using them. Teachers need support to develop both new technical and pedagogical skills. The curriculum should be flexible enough to accommodate this (Higgins and Mosley, 2010). Teachers' pedagogical practices and reasoning influence their use of ICT which in turn impacts on student achievement. A study was done in 820 Chinese Schools. Its aim was to explore direct and indirect related variables in ICT integration in the classroom. Results showed that classroom use of ICT directly depends on teachers' constructivist, beliefs, attitudes and perception about ICT use (Guoyuan, 2005).

A study done in Syria (Abdulkafi, 2006) surveyed attitudes of high school English teachers who were using ICT in classrooms. The study was based on the teachers' computer attributes, competencies, access to ICT resources, cultural perceptions and personal characteristics. The findings suggest that these teachers had a positive attitude towards use of ICT in instruction. This is as a result of their vision of technology itself, their experiences with it, the cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice. The existence of ICTs does not transform teachers' practices. However,

ICTs can enable teachers to transform their practices given a set of enabling conditions. There is anxiety from teachers over being replaced by technology or losing their authority in the classroom with ICT use. The roles are getting reversed where learning is now more students centered, but the teacher remains a guider and a facilitator of the entire process (Kafu, 2011).

Watson (1999) argues that integrating new technologies into educational settings requires change in attitude which is handled differently by different teachers. Considering different teachers attitudes to change is important because teachers' beliefs influence what they do in classrooms. BECTA (2004) claims when teachers understand how these technologies will benefit their teaching then they develop a positive attitude hence willingness to use. The teachers also need relevant training, support, guidance or reward for integration of ICT in instruction. According to Empirica (2006) teachers who were not using new technology in the classroom were of the opinion that its use had none or unclear benefits.

A study done in Nigeria shows that the government values ICT and has funded it to the tune of 5.4 billion Nigerian naira so that it can be used in education and governance. In Tanzania the MOE is working on a pilot design aimed at using ICT to offset the teacher shortage. At the 6th International e- learning conference held in Dar es-salaam, it was reported that ICT implementation in Tanzania was hampered by unclear policies, finance, technical support, high cost and unmatched ICT facilities (Kizito, 2012).

Use of ICTs in instruction in Kenya is not a new concept. From a study done by Makau (1990) teachers expressed a negative attitude to integration of computers in teaching and

learning. They found them noisy, disruptive to learning and cumbersome moving from the normal classrooms to the computer rooms for lessons. The study showed that teachers were not willing to accept change, instead they wanted to maintain their authoritarian and know it all role. Wabuyela (2003) agrees that ICT use in education is still minimal with teachers avoiding to use these technologies. This is because of scarcity of resources and also teachers lack of ICT competencies. He recommends pre-service and in-services trainings in order to successfully integrate ICT in classrooms. He also proposes a review of teacher preparation, staff development and a national plan to in-co-operate ICT into the curriculum.

A study by Manduku, Kosgey and Sang (2010) on ICT implementation in Kenya shows that the government has formulated a national ICT policy to ensure efficient, accessible, reliable and affordable ICT services. Kwake and Adegun (2008) observed that the government planned to spend Kshs. 497.25 billion to make ICT accessible to a large population by 2015. Despite these efforts ICT adoption in schools has remained elusive. Many schools are still not connected to the national electricity grid and there are frequent power failures. Schools lack finances to purchase enough ICT resources and teachers lack the necessary skills to adopt ICTs for instruction. Hence many learners are deprived the benefits of using ICTs in the learning process. To effectively implement ICT teachers need to be well trained on how to use ICT in the process of teaching and learning.

A study done in Bungoma (Wanjala, Khaemba and Mukwa, 2011) on barriers to ICT implementation found out the following:

i. Teachers did not understand how ICT could make them productive.

ii. They were not confident to use ICT in the classroom.

iii. There was lack of software and hardware resources.

iv. Lack of technical support.

v. Lack of time to experiment with new technologies.

vi. Negative attitude and resistance to change.

The study concluded that all these barriers could be as a result of inadequate pre-service teacher training, lack of in-service and perhaps training that is not tailored to teachers' ICT needs.

The present study was, therefore, set to find out preparedness in schools for ICT adoption in school instruction. Perhaps if prior preparation had been made the challenges faced in previous studies may have not occurred. For example enough resources should have been sourced for. The resources should be in good working condition. Teachers should have been given adequate and relevant training to build their confidence. Infrastructure should be availed all over schools especially the internet and electricity. It is possible that with prior preparation the education sector can realize better academic achievement and the teaching and learning process can be improved with proper use of ICTs.

2.4 Summary

This chapter has discussed general literature review and related literature review. From the review it is clear that the instruction paradigm in education is undergoing a shift. A review of the literature shows many studies have been done on use of ICTs, the studies cited show the importance of ICT in education and the challenges that face its implementation in instruction. The studies even propose solutions to established challenges. These studies all miss out on preparation of the users and resources. The aspect of preparation could be missing hence the

many challenges in the process of integrating ICT in instruction. Before any successful ICT – based program is launched in the school system considerations and preparation should be made in the areas of resources, infrastructure and expertise.

For example the study done in Spain (Arroyo, 2006) shows that, teachers were not well prepared hence they were not confident to use ICT in classrooms.

In the study by Pickersgille (2003) the internet is an important resource but accessing it is not easy in most areas. Schools need to have the right infrastructure to connect to the internet. Other studies show that lack of infrastructure impedes use of ICT hence the importance of putting these in place before adoption. Schoepp (2005) says teachers should be trained on use of new innovations as they come. Preparation should be made for this to succeed. The research by Balansakat (2006) in Netherland and Denmark shows teachers were resistant to use ICT because they lacked skills. This could mean they were not prepared in advance hence their reluctance. Similarly, teacher attitudes, beliefs and practices are important in their use of ICT.

Teachers need to have a vision of ICTs, come in contact with them practice using them during training before using it to teach. The study done in Syria shows the teachers were positive about use of ICT because they were prepared in advance before they integrated it into the classroom. The study by Rebbecca and Marshal (2012) showed ICT training only focused on skills acquisition and not how to use them to teach. This would mean the programs for trainings were not prepared and assessed to be relevant. The teachers did not benefit from the training hence the need for prior preparation in order to get relevant content to pass on to the trainees (teachers). ICT has a positive impact on instruction, some countries have fully

integrated ICT but others are facing challenges which could have been avoided if prior preparation had been made before adoption as proposed in the present study.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes the design and methodology that were employed in the study. The main sections discussed include: the research design, location of the study, study population and sampling techniques, research instruments, piloting, data collection procedures, field experiences, ethical considerations and summary.

3.2 Research Design.

The study adopted pragmatism as it is a philosophical paradigm. Pragmatism is action oriented research that seeks solutions to problems in a practical manner (Cohen, 2000). Truth is rooted in practice, meaning an ideology is true if it works satisfactorily. According to (Rescher, 2000) pragmatism works on the assumption that reality is different for all of us. Reality is ever changing based on our actions. Truth and knowledge are only based on evidence available at a particular time in history. This truth is gotten by testing what works. Rescher further says human actions must be judged in the context of the unique events and circumstances surrounding the actions. Pragmatism relies on abductive reasoning which moves between induction and deduction. For example, in pragmatic research one would observe a theory and then assess it through action. Pragmatism is the foundation of mixing research methods.

The researcher adopted the pragmatic paradigm because it can yield better results because of its potential to allow mixing of research methods. Morgan (2007) says, inductive results from a qualitative approach can serve as in – puts to the deductive goals of a quantitative approach and vice versa. Ormerod (2005) views pragmatism as a paradigm that accommodates multiples stances and values. It looks at the way different world views are derived from lived

experiences. In the case of the present study the researcher would be able to make conclusions about preparedness for ICT adoption using both qualitative and quantitative data.

Pragmatism emphasizes on creating knowledge through action. This research was set to find out whether schools were ready for ICT adoption. By collecting data from schools about ICT resources, teachers' competencies and challenges to ICT adoption, the researcher would get the real picture of what was happening in schools. This information would enable proper plans to be made on ICT resources, teachers' competence in use of ICTs and how to handle any challenges schools face in their effort to adopt ICT for instruction.

This paradigm is also relevant for the present study because it can serve as a general paradigm for social research. The school being a social institution and instruction a social activity, the researcher would get to know whether the teachers were using ICTs or not, whether ICTs were available in schools or not. This information would enable the researcher to make generalizations about preparedness for ICT adoption in schools. In adopting this paradigm, the researcher was aware that many other researches have been done in the field of ICT use in education. However, pragmatism stresses that knowledge keeps on changing (Rescher, 2000). True ideas are those that can be verified, validated or corroborated through experimentation, observation or interview.

Since the study was based on pragmatism the researcher decided to adopt the mixed model research where both quantitative and qualitative approaches were used to gather data. In this type of research there is a mix of quantitative and qualitative approaches within a stage of study or across different stages of the study. (Green and Caracelli 1997). This ensures the

methods complement one another, gives more detailed results and highlights what information would have been missed if only one of the approaches was used. The researcher was aware that no individual research methodology is fully satisfactory. However, combining them increases the reliability of research findings. The two approaches share the goal of understanding the world in which we live, they share a unified logic and the aim is to understand and improve the human condition (Howe, 2008). According to Gorard (2004) mixed methods research has been identified as a key element in the improvement of social science including education research. In the case of the present study, both quantitative and qualitative data would enable the researcher to know whether schools and school teachers were ready to adopt ICT for instruction.

According to Creswell (2009) quantitative research is a type of research that attempts to explain phenomena by collecting numerical data. The findings correspond to the reality and can be generalized to the population (Mugenda and Mugenda, 1999). Quantitative research is focused with particular variables to be studied. It is objective and independent of individual perceptions. Tools for data collection in quantitative research are questionnaire, observation records which can yield empirical data. Quantitative approaches were used to gather data on available ICT resources, frequency of in – service for teachers to enable them use ICTs and frequency of ICT use during instruction. Data collected was presented in tabular form with explanations. The researcher chose this approach because the target population was large and numerical data collected would be easy to analyze and interpret.

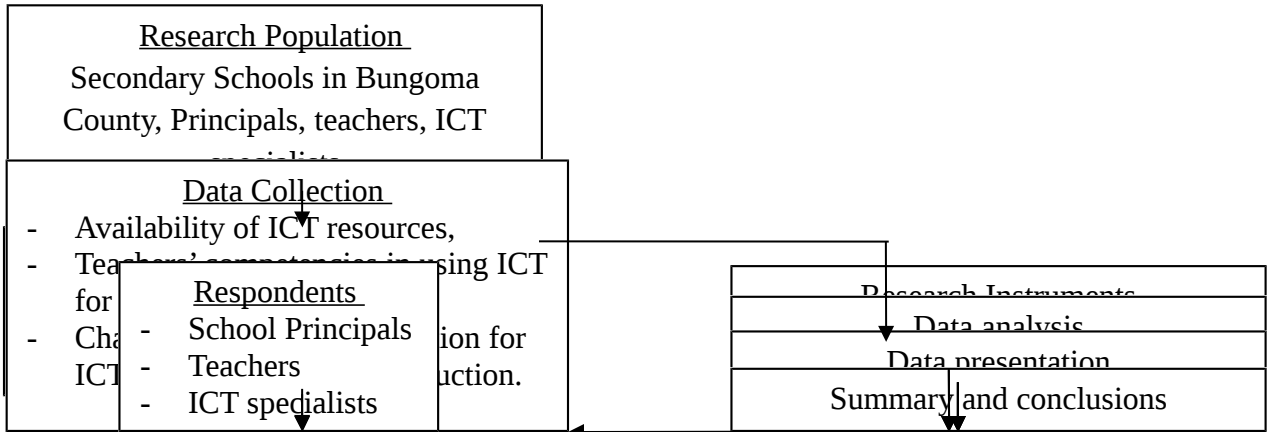
On the other hand, qualitative research seeks to understand a certain phenomena by studying social interactions, peoples' views and practices and the meaning and the significance of what they think (Morse, 2002). According to Gobo (2005) qualitative research is deep, rigorous, uses multiple methods to gather data and makes use of flexible analysis and explanation methods. It is also sensitive to the social context within which data is produced. The proponents argue that research should be done in a natural setting under natural conditions. The instruments for data collection here are observation, interview, relevant documents, photographs, video tapes. Qualitative approaches were used to find out the teachers knowledge and skills on ICT use and also their views on how prepared their schools were in adopting ICTs for school instruction. The researcher chose to use qualitative approach because by looking at the respondents' words, actions and records meaning can emerge. In the case of the present study the research would know whether the teachers were actually ready to adopt ICTs for instruction. The findings enabled comparisons and conclusions to be made and generalized with certainty to the entire population.

The study was a survey that enabled the researcher to find out how prepared schools were to adopt ICT for instruction. Survey is a method of collecting information by interviewing or administering a questionnaire to a sample of the population in order to determine the current status of that population in respect to one or more variables. It involves the study of a large number of subjects drawn form a defined population. This type of design can yield both qualitative and quantitative data from the sample with the intention of using that information to justify current conditions and practices or make plans to improve them (Nsubuga, 2000) According to Oso and Onen (2005) a survey is a present oriented methodology used to investigate populations by selecting samples to analyze and discover occurrences. This

method is effective in collecting descriptive data concerning the characteristics of a population. Survey is useful for educational fact – finding and provides a great deal of accurate information. Views, attitudes and suggestions of educational practice can be collected and used to make conclusions or solve existing problems.

The researcher preferred survey design because it is a systematic and standardized way of collecting data from a sample. It is easy to carry out a research in a systematic and standard way so that the findings can be acceptable. This type of design elicits original data that can be used to describe a large population that cannot be observed directly. In the case of the present study, there are many schools and teachers in Bungoma County. It would not have been easy for the researcher to reach each of them hence the need for this type of design. Another advantage of this design is that it requires collection of quantifiable information from the sample to explain an existing situation with the aim of justifying or improving that particular situation. A survey uses questionnaires and interviews to determine opinions, attitudes, perceptions and preferences of people whom the researcher is interested in, (Kombo and Tromp, 2006). This design helped to show how prepared schools were to enable full adoption of ICT in school instruction. Data collected was both qualitative and quantitative. It was analyzed using basic descriptive statistics to give replicable findings. The researcher was able to make conclusions about preparedness for adoption of ICT in instruction. The research was carried out in stages as shown in figure 3.1

Figure 3.1: The Research Design



Recommendations and suggestions for further research

(Source: Adopted from Ochanji, 2000)

Figure 3.1 shows the target population, from which the sample was obtained, sampling techniques, research instruments, data collection, analysis and presentation, summary, conclusions and recommendations for further research.

3.3 Location of the study

The research was carried out in Bungoma County, one of the forty seven counties created under the new constitution of Kenya in 2010. This county is located in Western Kenya along the Uganda boarder. It borders Busia to the South, Kakamega to the East and Trans Nzoia County to the North. There are seven administrative districts namely; Bungoma North,

Bungoma West, Bungoma Central, Bungoma East, Bungoma South Kimilili and Mt. Elgon. Bungoma County covers an area of three thousand and thirty two square kilometers. (3,032 Km^2). It lies between latitude 0°25.3' and 0°53.2' North and longitude 34°21.4' and 35°04.4' East. Its altitude rises from 1200 metres above sea level in the West to over 2000 metres above sea level in the North. The temperatures of this county range from a minimum of 15-20° C to a maximum of 22-30° C. It has an average of 1200mm to 1800mm rainfall annually. (Ref Appendix A page 170) The Great North Road cuts through this county as does the Kenya - Uganda railway line. A few of the roads in the County are tarmacked but the rest are weather roads that become almost impassable during heavy rains. There are two airstrips, one in Bungoma and another in Webuye town (Bungoma 2007, Beareau of Statistics).

Through the rural electrification program most areas in the county have electricity.

In its strategic plan 2008 – 2013, the Rural Electrification Authority purposed to connect all major public facilities including schools to electricity by 2013. In Bungoma County, out of 342 secondary schools, 254 which is 74% of them are connected to electricity, (Rural Electrification Authority Strategic plan 2008 - 2012).

Urban centres are cosmopolitan while the rural areas are mainly inhabited by the local people (Bukusu). Their main economic activity is agriculture with 70% of the population depending on farming. Business thrives in the urban areas even though there are small scale traders mostly in the rural areas. Bungoma is Kenya's third most populous county after Nairobi and Kakamega with a population of 1,375,063 people (Kenya National Bureau of Statistics 2009). Fifty three percent (53%) of this population lives below the poverty line. In the education

sector there are 900 Primary schools, 342 Secondary schools and 48 tertiary institutions. The enrollment in Primary schools is about 93,860 pupils and 57,680 students in Secondary schools. The teacher student ratio in secondary schools is 1:58 (D.E.O Bungoma 2012).

Education in Kenya lays emphasis on good grades in examinations. Good grades determine promotion to the next level, higher education and admission to prestigious courses like medicine, engineering, law, actuarial science to name but a few. This notion has created competition among students and schools to excel in examinations. Bungoma County is not left behind in this competition. Performance in National examinations in Bungoma County is shown in table 3.1

Table 3.1 KCSE Performance for Bungoma County, 2007-2012

Year	Candidature	Mean Score	Grade
2007	8995	4.860	C -
2008	9122	4.922	C -
2009	35120	5.169	C
2010	39855	5.250	C
2011	41648	5.410	C
2012	50617	5.439	C
2013	61575	5.5	C

Source: D.E.O Bungoma - 2013

The County's Performance in National Examinations has stagnated at grade C in the last five years which is fairly low. Perhaps this is as a result of the large number of students compared

to the number of teachers which is given as 1030 teachers in the whole County (DEO Bungoma 2012).

The large population in this county was of interest to the researcher. She wanted to find out how secondary schools in this county were preparing to embrace ICT since it is this technology that can enable teaching to be done effectively even to a large population. The student enrolment in secondary schools is high (57,680) yet the teachers who are supposed to attend to these students are only 1030. This calls for proper preparations to be made to give quality education and make it accessible to all children in the country despite their background or status.

A study done to find out instructional resources in this county in 2009 showed that the following instructional media were available in schools: the radio, television, pictures, maps, charts, resource people, films, models, books, newspapers, dioramas and writing boards (Wasiche 2009). The research further reveals that despite the presence of varied instructional media, most teachers did not use these media during instruction. They mostly used the chalk board and the recommended class texts to teach. This could be a contributing factor to the stagnated results in National Examinations. In order to improve results in the national examinations and vary teaching to make it interesting to learners ICTs can be integrated in instruction. If ICTs are improving the instructional process around the world, this researcher chose to assess the progress of ICT adoption in Bungoma County specifically. Are teachers in this county well prepared to also improve the instructional process?

Bungoma County is one of the forty seven counties in Kenya. The Kenyan system of education is academic oriented where emphasis is on cognitive skills and passing examinations is very important. The curriculum for all schools is developed by Kenya Institute of Curriculum Development (KICD) and examinations set by a central body, Kenya National Examinations Council (KNEC).All students in the republic are taught the same curriculum and sit a common examination. If ICTs can be used in instruction it is possible that the same content can be taught to all students across the country. No student will have advantage over others during examinations whether they come from rural or urban areas. The researcher chose to do the research in Bungoma County in order to find out if there were ICT resources and competent staffs to enable students in this county compete favorably with those from other counties in Kenya.

Bungoma County was accessible to the researcher, and it was easy to interact with the respondents who were teachers, ICT specialists and school Principals. These particular respondents understand the importance of ICTs hence they would give the researcher the required information, (Kombo and Tromp, 2006). Looking at the costs involved the researcher felt this County would be appropriate. The researcher would get time and finances to carry out research within this county.

3.4 Target population

The target population comprised three hundred and forty two (342) secondary schools in Bungoma County with a population of 78,645 students. There are 1030 teachers in the public secondary schools in the county. The respondents in this study were Principals, teachers and ICT specialists. The sample consisted of 483 respondents selected from 102 sampled

secondary schools in Bungoma County. This study focused on schools from rural and urban areas. This was considered appropriate because it would ensure equitable representation of each stratum in the sample. The sample was determined by a prior calculation of the sample size required to meet confidence limits for population values. According to Ary (1972) a sampling fraction of 30% of the total population in descriptive research is acceptable. The Principals of each sampled school participated in the study giving a total of 102 Principals. 3 teachers from each sampled school also participated in the study giving a total of 306 teachers. An ICT specialist from each of the sampled schools was supposed to take part in the study but only 75 schools had these personnel. All the 75 therefore took part in the study. The total number of the respondents was 483.

3.4.1 Sampling techniques

Since the target population was big (342 schools) a sample was selected to provide information that would be generalized to the whole population. The study used purposive, stratified and simple random sampling techniques to get a sample.

i) Purposive sampling

The technique allows a researcher to use cases that have required information in respect to the objectives of the study. The researcher should specify the criteria for choosing the particular cases. The method was used in this study because it can yield focused information. The researcher only selected cases that had useful information saving on time and money. The technique was used to select Bungoma County because the area was accessible to the researcher. It is also one of the counties in Kenya meaning schools in this county follow a common curriculum and do common examinations. The teachers in this County should also be using varied teaching strategies including ICT. The same technique was used to select

public secondary schools. It was in these schools that information required for the study would be found. The Principals of the sampled schools and ICT specialists were purposively selected to participate in the study. School Principals were selected because they are in charge of all resources in schools. These include teachers, instructional resources, students and other staff. It is the Principals who prepare school budgets, purchase and maintain school resources. The researcher felt these Principals should be included in the study to shed light on available resources and how they were being used in schools, especially ICTs.

ICT specialists were also purposively selected because they would give information on ICT resources available in schools, their use, safety and maintenance. These personnel would give personal focused information required for the study.

ii) Stratified random Sampling

In this procedure the population is divided into groups or strata that share a common characteristic. Then random sampling is used to select respondents from each stratum to form a sample. Using this technique schools were categorized as rural and urban. It was used in this study because it ensures equitable representation of each stratum in the sample. The technique accounts for the differences in the sample characteristics and because it uses a smaller sample it is cost effective. It also accounts for the difference in sub – group characteristics and guarantees desired representation increasing the efficiency of the population estimate (Gay 2000). The researcher then selected schools from rural and urban areas. This gave a picture of preparation levels in most schools across the county since the schools are either located in rural or urban areas.

iii) Simple Random Sampling

This technique selects a sample without bias from the sample size. Each unit in the population is given an equal opportunity to be included in the sample. Items are picked at random from a list, container or table of random numbers. It was used in this study because it ensures that each member of the sample size has an equal and independent chance of being included in the sample. The method yields data that can be generalized to a large population. The technique was used in the study to select a random sample. 52 schools from the rural category and 52 from the urban category were selected giving a total of 102 schools. It was also used to select (3) three teachers from every sampled school who participated in the study. Names of teachers were randomly selected from the school Time Table in the Principals' office.

3.5: Research instruments

The study used questionnaire, interview and observation schedules as the main tools for data collection. The selection of these instruments was guided by the objectives of the study.

i) Questionnaire

A questionnaire is a collection of items to which a respondent is expected to react to in writing (Oso and Onen, 2005). According to Kothari (2003) a questionnaire consists of a number of questions printed or typed in a definite order to be filled in by a respondent. Nowadays a questionnaire can be filled in over the internet. Questionnaires are better tools of data collection because they allow the respondent to make their responses carefully without interference. They reduce bias because each respondent receives an identical set of questions. They can address a wide range of issues and they are easy to analyze. The present study used self – made questionnaire. It was used because it has the ability to reach a large population and does not take so much time to be filled. There is uniform question presentation and since the target population was literate it was unlikely that they would have difficulties responding

to questionnaire items. The purpose of the questionnaire in this study was to collect data concerning the available ICT infrastructure, resources, teachers' competencies and challenges that schools faced in preparation for adoption of ICT for instruction. Teachers and ICT specialists each responded to a questionnaire. (Ref Appendix B (1) page 166 and Appendix C (1) page 171).

i) Interview

An interview is a verbal communication between two or more people where one party asks questions while the other party answers. It can be face to face, on telephone or the internet. It is also referred to as an oral administration of a questionnaire. The researcher can clarify questions for respondents and obtain data to meet specific objectives of the study. From an interview a researcher can get sensitive and personal information by establishing interaction and genuine conversation with the respondents. (Mugenda, 2008)

This instrument was used because it allows the researcher to get information that cannot be directly observed or obtained through the questionnaire, and it provides in-depth data required to meet specific objectives of the study. Interviews are flexible because the interviewer can clarify questions or use probing questions to elicit genuine or personal information from the respondents (Oso and Onen, 2005). In this study, Interview was used in order to provide more clarifications, elaborations and explanations and as a follow up of the questionnaire. Principals of the sampled schools were interviewed to find out how the school resources are acquired, utilized and maintained, especially in the area of ICT. These individuals are in – charge of school finances and the human resources (teachers), controlling acquisition maintenance and use of all resources in schools. ICT specialists were also interviewed to find

out resources available and how they are used in schools. They also gave their views on the level of preparedness for ICT adoption in their schools. Teachers were also interviewed to find out how competent they were in ICT use and ICT resources available in their schools. (Ref Appendix B (2) page 169, Appendix C (2) page 173 and Appendix E page 176).

ii) Observation Schedule

This is a systematic method of collecting data by looking at an object or activity (Routio, 2007). Observation is visual though the other senses like smell, touch, taste and hearing are involved. Observational studies rely on observing actual behavior and hence document what people do rather than what they say they do (Iacono, 2009). Using observation schedule a researcher gets first hand information there is high validity of the information. Observation allows the researcher to put behavior in context and therefore understand it better. This instrument was used in the study because it is visual and enables the researcher to gain first hand information. It gives a true and accurate picture of actual behavior or situation. Unusual aspects can be noticed and information recorded as it occurs. In this study observation was used to get information related to actual infrastructure like electricity, internet connection, ICT resources and storage facilities in schools. It helped to bridge the gap between what the respondents said, and indicated in the questionnaire and what was actually available in the schools. (Ref Appendix D (page175).

3.6: Piloting of instruments.

This is a pre-test of the research instruments carried out on a selected sample similar to the actual sample. Its purpose is to determine reliability of the instruments before they are used in the main study. A pilot study is important in that it reveals flaws in construction of questions

so that they can be re-phrased for clear understanding by all respondents. Unclear directions, insufficient writing space, wrong numbering are revealed and corrected before the main study. A pilot study enhances reliability of the instruments and is intended to detect any research bias. The pilot study was conducted in two randomly selected secondary schools from the rural and urban setting in the neighbouring Trans – Nzoia County. These were Michael Wamalwa Secondary School Birunda in the rural setting and Kitale Day Secondary School in the urban setting. The pilot study was done in March 2012 before the main study which was done from June to October 2012. It was done to find out the reliability of the instruments. The pilot study enabled the researcher to improve the skills of using the instruments before the main study.

The researcher chose to do the pilot in Trans Nzoia County because of its close proximity to Bungoma County hence similar features. The teachers of the two counties are peers and the schools follow the same curriculum. The two counties have similar history in education development. Data from the pilot study was used to evaluate and improve the questionnaire and interview schedule. The researcher was able to familiarize with the travel arrangements to the sampled schools especially those in the rural areas and also got a hint of the expected challenges during the actual research.

3.7 Validity and Reliability

3.7.1 Validity

Validity is a measure of how well a test measures what it is supposed to measure (Kombo and Tromp 2006). It is the degree to which results obtained from the data analysis actually represent the phenomena under study. The data obtained must accurately represent the

variables of the study. Oso and Onen (2005) define validity as the extent to which research instruments measure what they are intended to measure. These give research results that can be accurately interpreted and generalized to other populations.

According to Wiersma (2004), analysis of items' content, criterion and construction of related evidence through pre-testing of study instruments validates the tools. In this study, the researcher focused on content validity. This would yield data representing particular concepts that were being measured in the present study. The researcher consulted the supervisors and lecturers from the department of Curriculum, Instruction and Educational Media- Moi University and classmates to determine the appropriateness of the research instruments. They were requested to assess what concepts the instruments were trying to measure and also determine whether items in the instruments accurately represented the concept under study. The views of the experts were used to correct the items before they were used in the actual study.

3.7.2 Reliability:

It is a measure of the degree to which research instruments gives consistent results after repeated trials (Trochim, 2006). Frankel and Wallen (2000) define it as the degree to which scores obtained from an instrument are consistent measures. It aims at showing the consistency of the research instruments when administered to a sample several times. In this study the researcher was concerned with the consistency of the research instruments. To ascertain the reliability of the questionnaire, the split half technique was used. This technique eliminates error because only a single administration is done so the conditions are the same for all items and respondents. It is also saves on time and finances. The scores were randomly

divided into two groups. They were odd numbered and even numbered items. Each subject's total score from the two groups of items was computed.

The results were analyzed and the reliability coefficient was calculated using the Spearman's Brown Formulae.

$\partial = 2r/1+r$

Reliability co-efficient of 0.85 was obtained and the researcher felt this was good enough for the acceptability of instruments.

3.8 Data Collection Procedures

Data was collected from selected 102 secondary schools in Bungoma County which had been purposively selected for the study. These institutions had been selected using stratified random sampling technique. On the first visit, the researcher familiarized herself with the school Principal and explained the purpose of the study. The Principals were purposively selected such that the Principal of each sampled school participated in the study. In most schools, the researcher managed to meet and interview the Principals on the first visit. In two schools the Principals were not present but had delegated duty to their deputies so these were interviewed on behalf of their seniors.

On request to be taken round the school, the researcher was able to observe the infrastructure relevant to ICT use like electricity, internet connection, satellite dish and ICT laboratories. Some schools had specific rooms for storage of ICT resources and on visiting these rooms the researcher observed the available resources and recorded them on the observation checklist. (Ref Appendix D page 175).The researcher was introduced to the ICT specialists by the Principals though many schools in rural areas did not have these personnel. They were given a

questionnaire to fill. Most of them were co-operative and accepted to be interviewed immediately after filling in the questionnaire. On the part of the teachers, the Principal gave the list of teachers in their schools using the master school timetable. The researcher selected three teachers to participate in the study using simple random sampling technique. Teachers' names were written on small pieces of paper, which were folded and put in a box. The researcher then picked three pieces of paper randomly from the box. Those whose names were picked constituted the respondents. These teachers were called by the Principal and introduced to the researcher who explained the purpose of the study. They were given copies of the questionnaire to fill.

In most of the sampled schools the teachers who had filled the questionnaire were interviewed at a later date. This was mostly done when the researcher visited the sampled schools again to pick the questionnaire. In a few schools the Principals had a busy schedule; the researcher had to visit several times to secure an interview with them. Most of the teachers were co-operative, except a few who had many lessons to attend to hence kept the researcher waiting. Fortunately, the research did not interfere with any of the school programmes as the respondents were talked to during their free time except the school Principals.

Both qualitative and quantitative data was collected, coded and analyzed using basic descriptive statistics. Results were presented using percentages and tables. The findings are discussed in detail in chapter four.

3.9 Field Experiences

The study enabled the researcher to visit most parts of Bungoma County. The road network was poor especially in the rural areas which made data collection strenuous and lasting longer than the researcher had anticipated. The research processes was also tiring because the

researcher was a full time employee of the TSC and had to attend to school duties first. Permission had to be sought from the Principal to be away on some days to collect data. In such a case, the researcher would organize with colleagues to take up her lessons.

Most of the respondents were cooperative, ready to spare time to fill the questionnaire and be interviewed. In a few schools, Principals were too busy but after several visits the researcher managed to secure an interview with them. Many teachers in the sampled schools were eager to know why the research was being done. The researcher took time to sensitize them on the need to broaden and vary their teaching strategies by use of a wide range of ICTs.

Sometimes the selected teachers were attending to lessons so the researcher had to wait. The researcher was patient but this consumed time in some schools so the researcher could not visit several selected schools in a day as planned. Some respondents filled in the questionnaire and were interviewed the same day but for others the researcher had to visit again to secure an interview. This was time consuming. Despite the challenges, the researcher was able to see and experience most of the activities that took place in secondary schools during school days. Some schools had enough and modern instructional resources while others hardly had anything. Even though, learning was taking place in all schools.

3.10 Ethical considerations

The researcher sought consent from the relevant institutions and respondents before carrying out the study. She sought permission from Moi University, School of Education and then the National Council for Science and Technology in the Ministry of Higher Education Science and Technology. A research permit was issued which the researcher presented to the District Commissioner and the District Education Officer, Bungoma County. The researcher then

visited the sampled schools and sought consent from the Principals to allow her carry out research in their schools. She talked to the respondents explaining the importance of the study before asking them to fill the questionnaire or interview them. She also assured them that the information they gave would be treated confidentially and only for the purpose of the present study. The researcher observed strict schedules to avoid interfering with regular school programs. She only talked to teachers when they did not have a lesson.

3.11 Summary

This chapter has discussed in detail the research design and methodology. It has highlighted the research design, location of the study, target population and sampling techniques. It has also discussed the research instruments, validity and reliability, piloting, data collection procedures, field experiences, ethical considerations and summary. The data collected was analyzed and discussed in chapter four.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This study was based on preparedness for adoption of ICT in instruction in secondary schools. Its objectives were as follows:

- To find out ICT resources available in schools.
- To establish teachers' competencies in using ICTs in instruction.
- To compare schools' level of preparedness to adopt ICT for instruction in rural and urban areas.
- To find out challenges faced in schools in preparation to adopt ICT for school instruction.

This chapter focuses on results obtained from analysis of data collected based on the research objectives. The procedure was to present the findings, interpret then discuss them.

4.2 Methods of data analysis

The data collected was coded, collated and analyzed using quantitative and qualitative methods which involved presentation of statistical data in form of frequency distribution tables and percentages. The explanations of the latter were mainly descriptive. Information obtained from the analysis was discussed and it helped in drawing of conclusions and making recommendations.

4.3 Demographic description of the sample.

The study comprised 483 respondents. It included 306 teachers because 3 teachers were selected from each sampled school, 102 Principals and only 75 ICT specialists. Some of the sampled schools especially in rural areas did not have any ICT specialists hence the smaller number of ICT specialists in this study.

Schools in both rural and urban areas participated in the study. Table 4.1 gives a summary of the location of the selected schools.

Table 4.1: Location of schools

Location	Frequency (n)	Percentage (%)
Rural	50	49
Urban	52	51
Total	102	100

This table indicates that 50 (49%) schools from rural areas participated in the study. Because of poor road network and limited time the researcher did not manage to reach two of the sampled schools in the rural areas for data collection. From the urban areas, all the 52 (51%) schools selected participated in the study. This slight disparity could be as a result of infrastructure. Schools in urban areas could be easily accessed because of good road network than those in rural areas.

The study also surveyed the sex of the teachers because both males and females are given equal chances during recruitment exercise. The new constitution (2010) also lays emphasis on equal chances and affirmative action for both males and females in all sectors, especially employment opportunities. The present study aimed to find out ICT competencies of all practicing teachers despite their sex hence the need to know how they are distributed in schools. The findings are given in table 4.2

Table 4.2: Sex of teachers

Sex	Frequency (n)	Percentage (%)
Male	206	67.3

Female	100	32.7
Total	306	100

Table 4.2 shows that 206 (67.3%) male teachers participated in the study while the female teachers were 100 (32.7%). This result implies that there was a disparity in the sex of teachers in secondary schools. There are more male teachers than females. According to EFA report of 2012, girls face challenges in entering schools than boys. So their chances of getting jobs like teaching is lower compared to the boys. A UNESCO report (UNESCO, 2007) also shows that majority of women are in marginalized position. Many of them are affected by socio – cultural factors that deprive them of access to higher education. This could also be the reason why there are more male teachers than the female ones. The disparity could also be resulting from the fact that previously males were given priority in education matters more than females. Even though, this is not the case at present.

Teachers were also asked to state their age so that the study could assess whether one's age affected their use of ICTs. The statistics are given in table 4.3

Table 4.3: Teachers' Age

Age	Frequency (n)	Percentage (%)
20 -30	67	21.9
31- 40	78	25.5
41- 50	99	32.4
Above 50	62	20.2

Total	306	100

Results in table 4.3 show that 67 (21.9%) teachers in the selected schools were in the age bracket of 20 and 30 years. Another 78 (25.5%) were in the age bracket of 31 and 40 years while 99 (32.4%) were in the age bracket of 41 and 50 years. Those aged above 50 years were 62 (20.2%). This finding shows that most teachers in secondary schools are aged between 31 and 50 years. This age bracket is for active and productive people. For teachers they should be actively involved in teaching activities, trying out newer technologies in order to improve academic performance of their students. Jimoyianis and Komus (2007) observed that majority of teachers aged below 41 years were eager to use ICTs as compared to those aged above 50 years most of whom had no ICT skills. The latter avoided using ICTs for instruction though they used these technologies for communication and personal work.

The study also asked teachers their duration in teaching with a view of finding out whether they can use different strategies to teach including ICTs. The findings are given in table 4.4.

Table 4.4: Teacher's duration in teaching

Duration in teaching	Frequency (n)	Percentage (%)
Below 5 yrs	94	30.7
10-20 yrs	112	36.6
Above 20 yrs	100	32.7
Total	306	100

Results in table 4.4 show that 94 (30.7%) teachers in the selected schools teachers had taught for less than 5 years while 112 (36.6%) had taught for between 10 and 20 years. There were 100 (32.7%) teachers who had taught for more than 20 years. This finding means most teachers in secondary schools are experienced because they have taught for quite some time. This finding implies that these teachers must have used different teaching strategies during their teaching.

Teachers' qualifications were also sought in this study because during training teachers are taught how to use different strategies of teaching to deliver content in class. This would help determine their competence. The teacher's responses are given in table 4.5

Table 4.5: Qualifications of Teachers

Qualification	Frequency (n)	Percentage (%)
Post graduate	11	3.6
Graduate	204	66.7
Diploma	85	27.8
Other	6	1.27
Total	306	100

The analysis of data collected on this item shows that all the sampled teachers were trained and therefore professionally qualified to teach. There were 11 (3.6%) teachers with post graduate degrees. The number of graduate teachers was highest at 204 (66.7%), while diploma holders were 85 (27.8%). Only 6 teachers (1.27%) had other qualifications which included Approved Teacher scale and P1 certificate. This finding shows that most teachers (70.3%) in secondary schools are well trained and have a first degree qualification. This is because nowadays there are more higher education institutions including private ones where many people can register to learn.

Teachers were asked about their workload with a view to find out if it had any effect on the teaching strategies they employed. Their responses are given in table 4.6

Table 4.6: Teachers' workload

No. of lessons Taught	Frequency (n)	Percentage (%)
10-15	40	13.9
16-20	52	16.9
21-25	86	28.1
26-30	104	33.9
Above 30	24	8.0
Total	306	100

Results in table 4.6 show that 40 (13.9%) teachers in the selected schools taught between 10 and 15 lessons per week, 52 (16.9%) teachers taught 16-20 lessons per week and another 86 (28.1%) taught between 21-25 lessons per week. A higher number of teachers, 104 (33.9%) taught between 26 and 30 lessons a week. This finding implies that many secondary schools do not have enough teachers bearing in mind the MOE recommendation that teachers should teach 27 lessons per week. If a teacher has more than 30 lessons per week as shown in table 4.6 then perhaps that teacher is not very effective because that is a big workload. Such teachers do not even have time to prepare for lessons and they are not effective in the classroom. This could be the reason why some students do not perform well in the examinations. If ICT resources were available and teachers had the necessary skills it would be easy for them to handle the high workload. Ballad (2000) says ICTs give students and teachers innovative ways of instruction which makes the whole process interesting and memorable. All this can be achieved if needs assessment and prior preparation is done before adoption.

Schools population was also of interest to this research because ICT resources can be cost effective when used with a large population of learners. Some schools witnessed an influx of students when subsidized secondary and Free Primary Education program was introduced in 2008 and 2003 respectively. The students' population in the selected schools is shown in table 4.7.

Table 4.7: Student population in selected schools

Student population	Frequency (n)	Percentage (%)
200-500	38	37.5

500-1000	54	52.9
Above 1000	10	9.6
Total	102	100

Results in table 4.7 show that 38 (37.5%) of the selected schools had a population of between 200 and 500 students, while 54(52.9%) schools had between 500 and 1000 students. Only 10 (9.6%) of the sampled schools had above 1000 students. This implies that most secondary schools (62.5%) have between 500 and 1000 students. This is a large population that requires enough resources to ensure meaningful instruction takes place. With ICTs like computer, projector, radio, TV and digital camera, teachers can vary teaching strategies to suit the large number of students. Hennessey (2010) and Aguyo (2010) note that lack of ICT resources are an impediment to ICT implementation in schools in Africa and Kenya respectively. One of the objectives of this study was to find out whether there were ICT resources in schools. If these resources were available, teachers would easily teach even a large population by use of LCD projectors, video conferencing and internet.

The study was also interested to find out staff levels in the sampled schools. This is because of the high number of students in schools nowadays especially the public ones. Results are given in table 4.8

Table 4.8: Staff levels in selected schools

Teachers' Population	Frequency (n)	Percentage (%)
Less than 20	57	55.9
20-50	32	31.4

More than 50	13	12.7
Total	102	100

Results in table 4.8 show that 57 (55.9%) of selected schools had less than 20 teachers while 32 (31.4%) had between 20 and 30 teachers. Only 13 (12.7%) of the selected schools had more than 50 teachers. The staff levels in most of the selected schools were low compared to the students' population. The finding implies that teachers actually have a heavy teaching workload in that they have a wide curriculum and many students to attend to. The teacher shortage is one reason why ICTs should be availed in schools to facilitate effective instruction to the large population of students. As Wong (2007) put it, ICTs support face to face teaching and learning, present information and enable students complete learning tasks.

An ICT specialist is important to give technical support and advice on acquisition, use, safe storage and maintenance of ICT resources. An ICT specialist looks after school networks, installs orders and maintains software and hardware and provides technical support to teachers and students. Since ICT resources are expensive to acquire, the present study sought to find out whether these personnel were available in schools. The findings are given in table 4.9.

Table 4.9: ICT Specialists' Location

Location	Frequency (n)	Percentage (%)
Rural	25	33.3
Urban	50	66.7
Total	75	100

Results in table 4.9 show that 25 (33.3%) of the selected schools in rural areas had each an ICT specialist while 50 (66.7%) of the sampled schools in the urban areas had an ICT specialist. This finding implies that schools understand the importance of these specialists and have contracted them though the number is lower in rural areas.

The study also found out that most of the ICT specialists in the sampled schools were males. There were 63 (84%) male ICT specialists and only 12 (16%) females. This finding could mean that there are more men trained and hence hired to work as ICT specialists. This is because equal chances of employment are normally given to both males and females but the present study established that female ICT specialists were fewer. Perhaps not many females have ventured into the field of ICT as compared to the males. Cunningham (2007), amongst other researchers identified emotional, cultural and structural barriers which girls and women face in achieving technological equity. He says those women's negative experiences with technologies limit their participation in courses related to technology. This finding supports the lower number of ICT female specialists which was the case in the present study. In the same vein, a report by the organization of Economic Development and Cooperation done in 2007 revealed that there are significant differences between men and women in ICT related employment especially software, engineering and IT specialists.

The ICT specialists were asked to give their qualifications and the summary is given in table 4.10.

Table 4.10: ICT Specialists' Qualifications

Professional Qualifications	Frequency (n)	Percentage (%)
Degree	2	2.7
Diploma	32	31.4
Certificate	43	65.9
Total	75	100

Results in table 4.10 show that only 2 (2.7%) of the ICT specialists in the selected schools had a degree, 32 (31.4%) had a diploma and most of these specialists, 43 (65.9%) had a certificate in IT. The finding shows that these specialists at least had some training in the work they were doing. Training is important for these specialists because the tools they handle are delicate and expensive. They need to be handled with care so that they are in good working condition all the time. ICT specialists should have knowledge of operating systems, networking and hardware and software used in schools according to the study by Song and Kang (2012). The knowledge they have will enable them recommend the right ICT resources to be purchased, how they can be used and proper maintenance of these resources.

This study also sought to find out the nature of employment of the specialists. The findings are summarized in table 4.11

Table 4.11: Nature of Employment of ICT specialists

Nature of Employment	Frequency (n)	Percentage (%)
TSC	12	16
BOG	58	77.3
Other	5	6.7
Total	75	100

Results in table 4.11 reveal that 12 (16%) ICT specialists in the sampled schools were employed by the Teachers Service Commission while majority 58 (77.3%) of them were employed by schools' Board of Management. A few, 5 (6.7%) of them were employed by other bodies like churches, sponsors and donors. Those employed by the Teachers' Service Commission were actually teachers of Computer Studies but they also acted as ICT specialists in schools. This finding shows that stake – holders do understand the important role played by ICT specialists so they have contracted them. With ICT specialists, the correct ICT resources are purchased, maintained and safely kept so that they can be used anytime especially for instructional purposes.

ICT specialists according to Hennessey (2010) have a role to look after school networks, install, order and maintain software and hardware and provide technical support to teachers and students. Laaria (2013) adds that the specialists should do administration and supervision of equipment, know licensing deals and be aware of health and safety during use of ICTs. High level of training is therefore key for these technical experts.

The present study established that ICT specialists in the selected schools carried out duties like teaching computer studies, helping other teachers to use ICT during lessons (especially computers) and maintaining ICT resources and equipment. They also gave advice to the school administration on ICT needs. In a few schools they were involved in purchase of ICT equipment.

4.4 Availability of ICT resources

The main research objective was to establish the preparedness of schools for adoption of ICT innovation for instruction. To achieve this, the first specific objective was to find out whether

ICT resources were available in schools. Results of data collected from the teachers and ICT specialists questionnaire are shown in table 4.1

Table 4.12: Availability of ICT resources

Resource	Available		Not Available	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Computer	72	70.6	30	29.4
LCD Projectors	16	15.7	86	84.3
Printers	92	92.3	8	7.7
Television	77	75.5	25	24.5
DVD	79	77.5	23	22.5
Video Deck	77	75.5	25	24.5
Radio	62	60.8	40	39.2
Flash Disks	95	93.1	7	6.9
Video Camera	2	2.0	100	98
Modems	80	78.4	22	21.6
Mobile phones	11	12.7	89	87.3
Laptops	44	43.1	58	56.9
Digital camera	14	13.7	88	86.3

Results in table 4.12 show that 72 (70.6%) of the selected schools had computers while 30 (29.4%) did not have any. Computers are important devices in implementation of ICT in instruction so their availability will go a long way in opening ways to use ICTs in instruction. From the interview schedule for Principals the researcher gathered that most schools had acquired computers through donations from well wishers, sponsors, CDF kitty and government funding.

For purposes of instruction, a projector is important to enable students to see well information that is displayed. There are different types of projectors like desktop, home theatre, overhead, slide and opaque. This study was specifically interested to find out whether there were LCD projectors in schools. These are Liquid Crystal Display that uses liquid crystal panels plus the latest computer and optical technology to project both still and moving images in vivid colour. They have an in – built audio speaker making them handy in audio visual presentations. Where computers are not enough, an LCD projector can be handy.

Results in table 4.12 show that this facility was rare in the sampled schools. Only 16 schools (15.7%) had LCD projectors while the remaining 86 (84.3%) did not have this facility. This finding implies that some ICT resources are not available in schools hence not well prepared to use these resources in instruction.

Printers are used to transfer information from soft copy to hard copy. The Kenyan education system is examination oriented. Most examinations given in schools are in hard copy form. Printers also enable handouts and regular assessment tests to be given to students. Almost all sampled schools, 92 (92.3%) had printers while only 8 (7.7%) of them did not have this resource. This finding shows that schools understand the importance of having printers and have made efforts to acquire them. This could be as a result of using printers to print examinations, hand-outs and important documents to be filed or used in the school.

A TV set is handy in teaching. By use of TV students can get the latest information on what is happening around the globe. Similarly, when used together with a DVD machine or video deck students can watch or listen to recorded information relevant to their academic work. Table 4.12 shows that 77 (75.5%) of the selected schools had TVs and if used for instruction, students would have varied teaching techniques since TVs are audio-visual learning resources.

The study found that schools have DVD machines and video decks. A total of 79 (77.5%) of the selected schools had DVD machines while 23 (22.5%) did not have them. Looking at the case of video deck 77 (75.5%) of the selected schools had this facility while 25 (24.5%) did not have it. These resources are important because they supplement and vary teaching strategies. It is schools in the rural areas that did not have these facilities. Since the DVD and video deck need to be powered by electricity. Some schools without electricity also did not have the DVD and video deck.

The use of radio in instruction is not a new idea. Results showed that 62 (60.8%) schools had radios which they used for purposes of instruction. However, 40 (39.2%) did not have this item. This means some students are able to get the latest information from education programs aired on different radio stations.

Storage devices are important for safe keeping of ICT content. Apart from the in-built storage devices, the research gathered that 95 (93.1%) schools had flash disks and only 7 (6.9%) did not have them. Flash disks can be used to transfer content from one computer to another. This device can help facilitate sharing of information among teachers, students and even schools.

Modems facilitate research using the internet. Once on the internet, teachers can get current information which they can use to teach in different areas of the curriculum. From the data given in table 4.12, 80 (78.4%) of the selected schools had modems and only 22 (21.67%) did not have them. This finding implies that in most schools the internet can be accessed so as to get the most current and varied information relevant to students. It was also found that most teachers had their personal modems which they used for their own research and communication. The schools did not meet the cost incurred when teachers used their personal modems to research for instructional content.

ICTs that overcome space and time are an appropriate way of connecting people. The rapid growth of the use of mobile phone even in the remotest parts is one example of such technology (Asraf et al 2007). Today, mobile phones are an important communication device. The latest models of mobile phones can be used for instruction in the classroom in subjects like English, Kiswahili and Geography. Mobile phones can be used to access the internet and research materials on varied topics. This study found out that most teachers had their own mobile phones which they used for their personal communication. However a few of the selected schools 11 (12.7%) had mobile phones that were used specifically for classroom instruction. Most schools, 89 (87.3%), had not set aside any mobile phones for classroom instruction. This finding implies that the mobile phone is viewed as a tool for individual communication but not an instructional resource. Hoppe (2009) says latest models of mobile phones (smart phones) have more computing power that can be harnessed into education. Teachers and students can surf the internet for the latest information, record and play multi – media content and display animations and power point presentations. They can help simplify

language and mathematical concepts, Kizito (2012). Hence teachers should experiment more with the mobile phone as an instructional tool.

The laptop is another ICT resource that has gained importance of late. This gadget is portable and can store power for a longer period as compared to the desktop computer which relies on constant supply of electricity / power in order to function. The study found out 44 (43.1%) of the selected schools had acquired laptops to be used for classroom instruction. The other 58 (56.9%) schools did not have laptops though some relied on desktop computers. This result shows that laptops are not yet popular in schools, or they are expensive so schools may not afford to purchase them. Even though, most schools had received donations of desktop computers so maybe they were satisfied using them instead of purchasing laptops. It was also found out that some of the teachers had their personal laptops but hardly used them during classroom instruction.

The use of real objects in presenting information to students cannot be underscored. Not many schools are able to take students out for fieldtrips to see specific objects and features because of distance or lack of finance. To overcome this hurdle, a digital camera is handy. Photographs can be taken, uploaded and shown to students during classroom instruction. Results in table 4.12 show that only 14 (13.7%) of the selected schools had digital cameras while a majority, 88 (86.3%) did not have this important resource. This finding implies that perhaps the camera is still viewed as an instrument to be used for commercial rather than educational purposes. School administration and teachers should be sensitized that it is cost effective to have a digital camera, take photographs of educational features and show them to students during lessons. The study also found out that very few of the sampled schools had a video camera.

This one can be used to record events and showed later to students. Only 2 schools (2.0%) had a video camera while the remaining 100 schools (98.0%) did not have this resource. Perhaps the digital and video camera is not common in schools because of its being fairly new but very important in school instruction. Even though some smart phones that have cameras can be used to take photos and then this can be uploaded and used as displays during instruction. Still, these smart phones can be used to download photos from the internet so they can be used in class.

ICT resources are expensive to acquire and delicate to handle so they need to be kept safely. Results from the Principals' interview and observation schedule showed where ICT resources were kept in most schools. These results are summarized in table 4.13.

Table 4.13: Storage Facilities for ICTs

Storage facility	Frequency (n)	Percentage (%)
Computer room	40	39.2
Principals office	22	21.6
Classroom	10	9.8
Staffroom	30	29.4
Total	102	100

The results in table 4.13 indicate that Principals understand the importance and delicate nature of ICT resources and have organized for the safe storage of these resources. Out of all the sampled schools 40 (39.2%) of them had computer rooms where all these resources were kept and accessed when need arose. In another 22 (21.6%) of the selected schools this resources were kept in the Principal's office; perhaps this was for safety and accountability whenever they were given out for use. Carrying them from one place to another all the time may damage this equipment. In 10 (9.8%) of the selected schools some of the ICT resources were kept in the classrooms. These were mostly computers. The study noted that in one school there was a desktop computer in each class which means it could be easily accessed by the teacher and even the students during classroom instructions or when students wanted to do research on the internet. However, there are strict rules on when and how the hardware should be used. Still in 30 (29.4%) of the selected schools ICT resources were kept in the staffroom. A teacher could take these resources to class when need arose and return them to the staffroom. The researcher noted that the TV and Radio were mostly kept in the staffroom and used by teachers for entertainment or to get the latest news broadcasts. Despite this they could be used by a teacher for classroom instruction when there was need.

This finding implies that ICT resources are valued in schools and therefore kept safely. The rooms were mostly under key and lock with instructions on how and when to use these facilities because of their delicate nature. From this finding, there is need for all schools to provide safe storage facilities for ICT or come up with learning resource centres where ICT can be kept safely and easily accessed when need arose.

From the Principals interview, it was established that some schools had set aside funds to acquire ICT materials. Even though, some of the principals confessed that the funds set aside for ICT were a very small percentage as compared to what was spent on acquisition of other educational materials. It was also found that in some schools ICT resources were purchased by the Principal. In others it was done through tendering system while in other schools it was done by the computer teachers or school ICT specialists. This finding implies that the right ICT resources are acquired especially if expert advice is sought. Without expert's advice items that are fake, out of service and or of low quality may be purchased. These will not work and will even be more expensive to maintain.

For security and maintenance of ICT resources, it is important to have a specialist or technician. An ICT specialist looks after school networks, installs, orders and maintains ICT hardware and software and provides technical support to teachers and students. From the Principal's interview, only 75 (73.5%) of the selected schools were reported to have ICT specialists while 27(26.5%) did not have these personnel. In some schools, computer teachers doubled up as ICT specialists, maintaining ICT resources, fixing them and assisting other teachers to use them.

The internet is an important research tool. It can enable one to gather the latest information on varied topics. However, a study by Aguyo (2010) noted that the access to internet is still expensive. This study sought to find out how schools accessed the internet and the findings are shown in table 4.14

Table 4.14: Internet connectivity

Mode of Connectivity	Frequency (n)	Percentage (%)
Dial up	8	7.8
Direct connectivity	17	16.7
Broadband	20	19.6
Satellite dish	2	1.9
Mobile phone	32	31.4
Visiting cyber café	23	22.6
Total	102	100

From table 4.14, 8 (7.8%) of the selected schools connect to the internet through dial up, 17 (16.7%) through direct connection, 20 (19.6%) by broadband connection and only 2 (1.9%) schools had a satellite dish. Some 32 (31.4%) of the selected schools used mobile phones while 23 (22.6%) schools indicated that their teachers had to visit cyber-cafés if they wanted to access the internet. This result means efforts have been made to use ICT in schools by availing internet. Still there are some schools that do not have this provision. Bearing in mind the financial implications and inconveniences of using cyber-cafés, it would be cost effective if every school made it priority to have internet connection. They could do this by purchasing modems, or linking up with internet service providers so that that they can subscribe and have access to the internet all time. Most activities like examination registration are now done on-line so it is imperative that all schools have internet connection. A study by Kenya SchoolNet (2003) revealed that access to internet was very limited and when available it was only used for administrative purposes. MOE (2007) proposed that schools need to establish Local Area Network (LAN) in order to improve sharing of learning resources.

Most ICT resources use electricity or other forms of energy in order to operate. Access to electricity is imperative. Electrical energy is linked to development and use ICTs. Through the rural electrification program the government has extended electricity to many rural areas. Even though some schools are still not connected to the national electricity grid, those that are connected often experience frequent power failures. This study investigated the source of power in schools and the results are given in table 4.15

Table 4.15: Source of power in schools

Source of Power	Frequency (n)	Percentage (%)
Electricity	81	79.4
Solar energy	0	0
Generator	4	13.7
No power	17	6.9
Total	102	100

Results in table 4.15 show that most of the sampled schools were connected to electricity that is 81 which is (79.4%). None used solar energy though 4 (13.7%) of the selected schools used generators. Still there were 17 (6.9%) schools that did not have any form of power supply. This finding shows the main electricity suppliers have made commendable effort to connect most educational institutions to electricity. Because of this, ICTs can easily be used during instruction. Since most ICT innovations need electricity, schools that are connected to electricity should ensure these resources are being used as a teaching strategy. A study by

Rebecca and Marshal (2012) proposes that solar panels can be used to power ICTs as is the case in India. They say in their study that slum areas in India lack electricity but use solar panels to connect computers and use them in their daily activities. These technologies will make learning interesting, memorable and varied to learners. The teachers will also develop interest in using these resources because they are available.

Earlier research on ICT adoption in schools revealed that the availability of resources was an impediment. Farel (2007) for example found out that investing in ICT in schools in developing countries was high. The study by Hennessey (2010) shows that one of the greatest challenges of ICT implementation in schools is balancing educational goals with economic realities. Prudent decisions have to be made about what models of ICTs should be implemented and still be conscious of maintaining economies of scale. A study by Wims and Lawler (2007) revealed that ICT facilities were rare in Kenyan educational institutions hence implementation was not very successful. From the findings of this study ICT resources available in schools were: computers (70.6%), projectors (15.7%) printers (92.3%) television (75.5%) DVD (77.5%) video deck (75.5%) radio (60.8%) flash disks (93.1%) video camera (2.0%) modems (78.4%) mobile phones (12.7%) laptops (43.1%) and digital camera (13.7%). These resources were found in both rural and urban schools. These resources are important in the instructional process. They influence how teaching and learning takes place and its outcomes. In order to acquire ICT resources prior preparations have to be made. In USA for example, technology kits which include computers, printers, fax and internet connectivity are provided to schools (Petrova and Sinclair 2005). The World Bank has set up the Global Development Learning Network to provide a wide range of cost-effective ICT tools for

connecting policy makers and development practitioners across the world (World Bank, 2006).

The present study found that most schools had computers, radio, television and mobile phones. Through the subsidized secondary education, donation and Constituency Development Fund kitties most schools are equipped with these facilities. Projectors and digital cameras were found to be rare in the sampled schools. Yet these are visual resources that can help students to remember concepts which they have learned. The findings of a study done by Dahmar and Bhatnagar (1992) on the importance of the five senses in learning are shown in table 4.16

Table 4.16: Learners ability to retain learned concepts

Mode of learning	Retention percentage %
Seeing	50
Hearing	30
Reading	10
Tasting	5
Smelling	5
Total	100

Source (Dahmar and Bhatnagar 1992)

Table 4.16 shows that ability to learn and recall information is much higher in seeing with 50%. Hearing has 30%. A review of Edgar Dales Cone of Experience (Dale 1960) shows that more content is retained when learners learn by doing. According to Dale, learners remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear

and see, 70% of what they say and write and a higher score of 90% of what they do. This cone of experience lays the foundation for ICT use in instruction (Diamond, 1989). The most effective method of instruction involves direct, purposeful learning experiences such as hands on or field experiences. The cone makes connection between concrete and abstract ideas which is the purpose of teaching and learning. Since ICTs can enable this mode of learning to occur, they should be adopted in the instructional process. Watson (2001) supports this view when he says ICTs contribute to a more constructivist learning, increase in activity and greater responsibility of students. Kozma (2007) asserts that impacts of ICTs in the classroom should be assessed by looking at student outcomes. Teachers should use this cone of experience to make decisions about resources and activities in the instructional process. This view points to the fact that visual resources are very important and even more important if the visual and audio resources can be combined in teaching and learning. This means schools should be encouraged to acquire projectors and digital cameras and other audio-visual resources during their preparation stage.

The SMASSE in-service project for Science and Mathematics teachers encourages teachers to focus on instructional strategies that support meaningful learning and make lessons interesting to learners. Teachers should plan lessons having in mind resources that will make learning effective and then allow students to interact with these resources, (SMASSE 2003). The use of ICTs in instruction is a good platform for this SMASSE knowledge to be applied. This implies ICT resources should be available for teachers to exploit the different teaching strategies.

4.5 Teachers' competence in use of ICTs

The second objective was to establish teacher's competence in use of ICTs in classroom instruction. To achieve this objective, responses from the teachers' questionnaire, and

Principal's interview schedule were analyzed. When this was done results are presented in table 4.17

Table 4.17: Principals' knowledge in computer use in instruction

Knowledge	Frequency (n)	Percentage (%)
Have Knowledge	65	63.7
Do not have Knowledge	37	32.3
Total	102	100

Results in table 4.17 revealed that 65 (63.7%) Principals of the selected schools have knowledge in computer use while 37 (32.3%) do not have any computer knowledge. This finding implies that most Principals have knowledge in computer use. So they can use it to teach and for administrative purposes. In cases where the Principal is knowledgeable he or she can influence change and a positive attitude in the school. Such administrators can also readily avail ICT resources knowing their importance. A pilot project carried out in Thailand, Learning, Evaluating and Monitoring, Assisting, Rewarding and Nurturing (LEARN) indicated that school Principals were essentially important in bringing changes to their schools. In this particular case Principals motivated teachers and students to get ICT skills and gain confidence in using them. (UNESCO, 2008). Laaria (2013) is of the view that school leaders should be a role model in ICT use, visionary, planners and custodians of ICT infrastructure. They should promote staff professional development, share decision making and delegate responsibilities. Her study recommends that effective leadership in schools is important in conducting and supporting ICT implementation.

According to Hennessey (2010) teachers' ICT skills play a role in ICT implementation in schools. He further observes that their attitudes, beliefs and adequacy will influence how they adopt technology. In the same vein, Dzidonu (2010) notes that low levels of teachers' ICT skills and knowledge is a major obstacle to implementation. In the present study teachers' knowledge in ICT use were analyzed and results are shown in table 4.18

Table 4.18: Teachers' knowledge in ICT use in instruction

Knowledge	Frequency (n)	Percentage (%)
Have Knowledge	273	89.2
Do not have Knowledge	33	10.8
Total	306	100

Results in table 4.18 show that 273 (89.2%) teachers have knowledge in using ICTs for instruction. They understand that different ICT tools can be used to improve learning outcomes. Even though, 33 (10.8%) do not have any knowledge on how to use ICT for instruction. Most teachers indicated that they had knowledge in computer applications like MS Word, Excel, Power point and use of Internet. This result implies that a high percentage of teachers (89.2%) have knowledge in ICT and can use ICTs for classroom instruction. This also means there are varied teaching strategies that can be used by teachers during instruction as a result of their ICT knowledge. A study by Lau and Sim (2008) exploring the extend of adoption of ICT in secondary schools in Malaysia showed that the teachers considered

themselves to be good in using ICT for instruction. They supported the use of internet and ICTs for teaching and continuous skills improvement so as to be more effective. A report by Kidombo (2010) on factors influencing ICT usage among teachers in Kenya and Uganda indicated that nearly half of teachers in public schools were computer illiterate. As a result they were not using computers and internet to get the most current information and also enrich their teaching. This is not the case anymore according to the findings of this study which is summarized in table 4.18.

Higgins and Mosley (2010) stress that teachers should understand the need to implement ICT in teaching and exactly how to implement it during teaching in classroom. Basing on this view, the researcher asked teachers whether they had knowledge in ICT use and if so, how they had acquired these skills. The results that were analyzed are given in table 4.19

Table 4.19: Teachers' Acquisition of ICT skills

Source	Frequency (n)	Percentage (%)
College	88	28.8
SMASSE	76	24.8
ICT centre	12	3.9
KESI/ KEMI	44	14.4
Personal effort	55	18.1

From table 4.19, it is evident teachers got training on use of ICT from various sources. There were 88(28.4%) teachers who went through this training while they were in college. The SMASSE project gave knowledge to 76 (24.4%) and these were mostly mathematics and science teachers. ICT centers in the District catered for 12 (3.9%) teachers while 44 (14.4%) who had attended Kenya Education Management courses got ICT knowledge while

undergoing these in – service workshops. Some 55 (18.1%) teachers got ICT knowledge through their personal efforts. These teachers admitted they had learnt from colleges and cyber cafes close to them and they had financed these trainings themselves.

However, 31 (10%) teachers said they had no training in ICT use in the classroom citing the example of computers. These findings imply that teachers have ICT knowledge. However, there are 10% of teachers who do not have any ICT knowledge. This calls for exposure and sensitization so that these particular teachers can embrace new technology.

An earlier study by Toure (2008) in Ghana revealed that whereas teachers got training in ICT not much stress was put on exactly how to use these tools to teach. In the same view, a study by Kiptalam and Rodrigues (2010) done in Kenya showed that some teachers did not receive any prior ICT training during their formative years at university or teacher training colleges. These teachers had taken the self initiative to undergo ICT training especially after getting employed. This finding implies that such teachers had seen the need to update their skills because of newer technologies so that they can be competent and relevant in the current technological era. Research has also shown that students taught using ICTs in the Western World performed better in mathematics, reading and writing, (Volman, 2005).

Further, teachers were asked whether their schools had organized any in – service courses on ICT use and how many they had attended. Out of the 306 sampled teachers, 215 had at least attended an ICT in – service but 91 had not. Table 4.20 shows the frequency of ICT in – service attendance.

Table 4.20: Frequency of ICT in – service attendance

	Attendance	Frequency (n)	Percentage (%)

Not in serviced	None	15	4.9
In serviced	Once	84	27.4
	Twice	117	38.2
	Many times	90	29.4
Total		306	100

Table 4.20 shows that 15 (4.9%) teachers had not attended any in – service course on ICT use while 84 (27.4%) had attended once. There were 117 (38.2%) teachers who had attended twice while 90 (29.4%) had attended this in – service courses many times. This finding indicates there are efforts being made in schools to have teachers embrace ICT in instruction. Staff professional development is an important strategy especially if it focusing on how to equip teachers with proper skills and attitudes on ICT use in education (Kozma 2007). Kozma further says that ICTs are exerting impacts on pedagogical approaches in the classroom. He suggests that impacts of ICTs can be assessed by looking at student outcomes and learning of new skills, development of teachers' new pedagogical approaches and attitudes and finally other outcomes in schools and the community. New technologies and ideas can be given to teachers when they attend frequent in – service courses so that they continue to improve and vary their teaching strategies.

To confirm their competencies, teachers were asked some of the ICT resources which they had used during teaching. They named: internet, radio, DVD machine, mobile phones, computers, laptops, printers, projectors and flash disks. From the interview schedule, the study confirmed that some teachers were able to comfortably use the named resources during instruction. This finding shows that some teachers indeed have knowledge in ICT use for instruction. This finding can be supported by the findings of a research done in Ghana,

Cameroon and Mali to measure teachers' readiness to adopt ICT for instruction, (Boakye and Banini, 2008). That study revealed that teachers occasionally used ICTs to teach but used these tools mostly to do research, type lesson notes and design teaching and learning materials. Since ICTs offer a wide range of benefits to students and teachers these teachers are actually ready to adopt ICT for instruction. However, these are just a few of the entire teaching population. Some teachers may have knowledge but are not actually competent to use ICTs during instruction. Bingimlas (2009) notes that in Australia teachers lacked confidence and competencies in ICT use. Wabuyela (2003) says teachers avoid using ICTs because they lack the necessary competencies. This views and the findings of the present study show that maybe training in ICT use for instruction is not thorough. Perhaps the training is theoretical so the trainees have no real practical or hands on competencies to use ICTs during classroom instruction. These teachers need regular in – service training to improve their competencies.

The teachers were asked whether they had sourced for any content to use for teaching using any ICT resources. Their responses are given in table 4.21.

Table 4.21: Sourcing for teaching content using ICT resources

Sourcing	Frequency (n)	Percentage (%)
Sourced for content	192	62.8
Not sourced for content	114	37.2
Total	306	100

Table 4.21 shows that most teachers, 192 (62.8%) had at least sourced for content using ICT resources. They had sourced for information from the internet, colleagues in the teaching

profession, well performing schools, KICD, Radio, TV and vendors in the streets in various towns. However 114 (37.2%) teachers had not sourced for any content using ICT resources. This finding implies that ICTs provide information through the wide network they provide. If teachers can get into this network through ICT use they can acquire a lot of knowledge and materials to help them carry out instruction in a better way. Teachers should be aggressive even on their own to explore with newer technologies to improve instruction and also their knowledge base. Watson (2001) says many teachers are not in a position to make informed judgments on ICTs to support their teaching goals. ICTs shift the learning approaches which contributes to a more constructivist learning, increase in activity and greater responsibility of students. The teacher remains to support, advice and coach students rather than merely transmitting knowledge. By using ICTs teachers can get most current information, variety of ideas and this can enrich their teaching.

The teachers were also asked whether they had used ICTs to prepare lesson content in their subject areas. Table 4.22 gives a summary of the findings.

Table 4.22: Use of ICT to prepare lesson content

Use of ICTs	Frequency (n)	Percentage (%)
Used	79	25.8
Not used	227	74.2
Total	306	100

Table 4.22 shows that only 79 (25.8%) teachers from the selected schools had used ICT resources to prepare content for their lessons. Majority 227 (74.2%) teachers had not used any ICTs to prepare their lessons. This finding implies many teachers still rely on books as the only source of information to be used to teach. The teachers admitted they used recommended

texts and set books. A few teachers said they had used the computer to type their schemes of work, make lessons plans and type tests for their students. Others had used the TV and DVD to show students set books in Kiswahili and English Literature. The internet had been used to source for information in Chemistry, Biology and Geography subject areas. Some teachers used the internet to come up with projects for science congress competitions. This shows that some teachers have knowledge on how to use ICT to prepare lesson content. If more in-service workshops were held in the area of ICT use more teachers would actually improve their ICT skills.

Teachers' attitudes, beliefs, skills and practices affect the way they choose to use ICTs during instruction (Higgins and Mosley 2010). A study done in Syria, (Abdulkafi 2006) based on teachers competencies, access to ICT resources, cultural perceptions and personal attributes revealed a positive attitude towards ICT use. Empirica (2006) says teachers were reluctant to use ICTs because they were not competent enough. The Adoption and Diffusion Theory which was the theoretical framework for the present study stresses that teachers need to acquire knowledge about ICTs first then form an attitude, which will in turn lead to implementation or use. If their needs are met, they will continue to use. In order to find out teachers' attitude towards ICT integration in instruction this study analyzed responses from teachers' questionnaire based on their sex, age, location and teaching experience. (See Appendix B (1) page 166) Their responses are rated on a 4 Likert scale.

Table 4.23 gives results based on sex of teachers.

4.23 Teachers' Sex and use of ICTs

Frequency of	Sex	
	M	F

ICT use	Frequency (n)	%	Frequency (n)	%
Very often	32	32	54	20.2
Often	27	27	72	34.9
Rarely	29	29	47	22.8
Never	12	12	33	16
Total	100	100	206	100

Results in table 4.23 show that 32 (32%) female teachers from selected schools could use ICTs very often, 27 (27%) would use them often, 29 (29%) would rarely use ICTs and 12 (12%) would never use them at all. Looking at their male counterparts, results show that 54 (26.2%) male teachers would use ICTs very often, 72 (34.9%) would use them often, 47 (22.8%) would rarely use ICTs and 33 (16.0%) would never use this technologies during instruction. The EFA Report (2012) shows that girls face challenges in entering schools than boys. Most males were involved in ICT activities than females who have more roles to play in the home environment. Jimoyanis and Komin (2007) observed that the male teachers were more positive about ICTs than females who were either neutral or negative. However, the findings of the study imply that most teachers would use ICTs for instruction despite their sex. In this age of globalization and networking it is imperative that both men and women should have ICT knowledge. This will vary and improve their teaching, improve students' academic achievement and make learning an interesting activity. But this study found that more male teachers were more likely to use ICTs to teach than the female teachers.

The teachers' age was also analyzed to find out if it had any effect on ICT use in the classroom. The results are shown in table 4.24.

Table 4.24 Teachers' Age and use of ICTs

Frequency	Age bracket							
	20-30		31-40		41-50		Above 50	

Of use	Frequency (n)	%	Frequency (n)	%	Frequency (n)	%	Frequency (n)	%
Very often	25	37.3	27	34.6	17	17.1	5	8.0
Often	27	40.2	30	38.2	28	28.2	17	27.4
Rarely	11	16.4	19	24.3	42	42.4	21	33.8
Never	4	5.9	2	2.5	12	12.1	19	30.6

Results from table 4.24 show that teachers aged between 20 and 40 years (52) would use ICT more often than their colleagues who were aged above 40 years (22). There were more teachers in the 20 – 40 years category who could use ICTs often (57) as compared to those in the category above 40 years (45). Those who rarely used in the category of 20 – 40 years were 30 while there were 63 teachers who would rarely use ICTs. Those who would never use ICTs in the 20 – 40 years category were only 6 while the above 40 age bracket had 31. This finding implies that indeed age has an impact on ICT use. The younger teachers are more likely to use ICTs during instruction as compared to those teachers who are older. The finding also points to the fact that younger teachers are more competent and willing to use ICTs than the older ones. This could be because they are more exposed and ready to experiment with newer technologies. A study by Andoh (2012) shows that the quality of ICT use is linked to teachers age and experience. He points out in his study that majority of teachers aged below 41 years used ICTs more often to teach as compared to those aged above 50 years. The latter had no proper ICT skills to enable them use ICTs for instruction. The report by Kidombo (2010) reveals that younger teachers use ICTs more often than the older teachers. These senior teachers see ICT as a threat and cause of much anxiety therefore avoid using them. It could also mean that these older teachers were not exposed to newer technologies during pre-service training. These older teachers are also in management positions like Heads of Department, Senior Master/Mistress, Deputy Principal and hence have other duties to attend to and not just

classroom teaching. The younger teachers being relatively new in the field have all the time to experiment with technologies in order to make their lessons varied and interesting. A study done by Kwapong (2007) in Ghana revealed that young professionals aged between 20 – 30 years were more eager to use ICTs. This is because of higher curiosity and also they were still building their careers. These views do apply to present study since younger teachers were found to use ICTs more often that their older colleagues.

The present study also surveyed the location of teachers in the urban and rural areas with a view to establishing if it had any effect on use of ICTs in instruction. Results are given in table 4.25.

Table 4.25 Teachers' Location and use of ICTs

Frequency of use	Rural		Urban	
	Frequency (n)	%	Frequency (n)	%
Very often	44	29.4	68	43.6
Often	49	32.6	50	32.1
Rarely	39	26	32	20.5
Never	18	12	6	3.8
Total	150	100	156	100

The findings in table 4.25 indicate that more teachers 68 (43.6%) in urban areas, would use ICTs very often as compared to only 44 (29.4) teachers in rural areas. Those teachers who would use ICTs often in the urban areas were 50 (32.1%) as compared to 49 (32.6%) in rural areas. In urban areas those teachers who rarely used ICTs were fewer, 32 (20.5%) while there are more teachers in rural areas, at 39 (26%). Again those teachers who would never use ICTs in rural areas were found to be more, 18 (12%) while in urban areas there were only 6 (3.8%) teachers. This finding shows that where a school is located can influence teachers' use of ICTs. Those teachers in urban areas used ICTs more often because these resources are easily

available in their schools. It is also in urban areas where the latest technologies, goods and services are easily available. The teachers in rural areas are not so lucky because some of their schools do not have ICT resources and even relevant ICT infrastructure.

Teachers' duration in teaching was also analyzed to find out if it had any effect on use of ICTs in instruction. The results are given in table 4.26.

Table 4.26 Duration in teaching and ICT use

Frequency of use	Duration in teaching					
	Below 10 yrs		10-20 yrs		Above 20 yrs	
	f(n)	%	f(n)	%	f (n)	%
Very often	44	46.8	47	41.9	9	9
Often	21	22.3	35	31.2	27	27
Rarely	20	21.2	19	16.9	40	40
Never	9	9.5	11	9.8	24	24

Results in table 4.26 indicate that teachers who had taught for less than 20 years were likely to use ICTs very often during their lessons. Those teachers who had taught for over 20 years admitted that they would rarely or never use ICTs for instruction except 9 (9%) teachers who would use them very often and 27 (27%) who would use these resources often. This finding implies that duration in teaching affects ICT use negatively. Perhaps those teachers who had taught for a longer period do not have enough knowledge on use of these newer technologies or they are used to the traditional teaching strategies that stress on the teacher being an authority in the classroom. The finding could also mean these older teachers are not eager to experiment with newer technologies. The study by Jimoyianis and Komis (2007) on teachers' attitudes to ICT use showed that one's age had an effect on ICT use. The study revealed that most teachers aged above 50 years had no ICT skills so they avoided using them during instruction. Perhaps the latest technologies like internet are new to them or their training did

not in cooperate some of the newer technologies. A study by Aseey and Ayot (2009) observed that some teachers who were above 50 years wanted to maintain the authoritative role of teacher. So they insisted on using the traditional mode of teaching where the teacher had all the content and the learners were passive recipients. Those who had taught for a shorter period could be ready to use ICT because it is the modern way of communication which can be enriching in the classroom. This group of teachers may also have gone through training more recently when these technologies were stressed so they have hands-on experience.

This study analyzed the school Principals' views on how teachers in their schools used ICTs. The Principals' views are shown in table 4.27.

Table 4.27 Principals' views on use of ICTs

Use of ICT	Frequency (n)	Percentage (%)
Very often	17	16.7
Often	21	20.6
Rarely	37	36.3
Never	27	26.4
Total	102	100

The findings in table 4.27 show that 17 (16.7%) teachers in the selected schools would use ICTs very often, 21 (20.6%) teachers would use ICTs often, 37 (36.3%) teachers would do so rarely and 27 (26.4%) would never use these resources during instruction. These results imply that still a high number of teachers have not embraced ICT and may not use it to teach. This is despite their earlier views that they have knowledge in ICT use. Perhaps teachers have a negative attitude towards ICT use or ICT resources are scarce so teachers do not use them as often as they should. Still this could be stemming from the fact that teachers have ICT

knowledge but they are not competent enough to use ICT in instruction. Hennessey (2010) in his research noted that teachers' attitudes, beliefs, adequacy and skills influence their choice to adopt ICT in instruction. This view is similar to that of Davis (1989) in the Technology Acceptance Model. If teachers think ICT are easy to use (P.U) and that these resources can make their work easier (PEOU) then they would adopt these technologies. In this case perhaps the teachers do not have this knowledge so they shun ICTs. There is need for school Principals to sensitize, motivate and organize in-service trainings on use of ICTs so that all teachers can embrace ICT, Laaria (2013).

ICT specialists work more with ICTs and even help some teachers to operate these machines. These personnel were asked to give their views on teachers' use of ICTs in their schools. The views are given in table 4.28.

Table 4.28 ICT Specialists' views on ICT use in their schools

Use of ICT	Frequency f(n)	Percentage (%)
Very often	10	13.3
Often	24	32
Rarely	24	32
Never	17	22.7
Total	75	100

ICT specialists responses in table 4.28 show that 10 (13.3%) teachers in selected schools would use ICTs very often, 24 (32%) often, 24 (32%) rarely and 17 (22.7%) would never use ICTs for instruction. This finding implies that though most teachers (73.3%) would use ICTs for instruction there is still a small number (22.7%) that would never use these technologies. Again this calls for sensitization and in – service training to give practical skills in use of ICTs. If some teachers would never use ICTs for instruction it means they are reluctant to

change (Earle, 2002), or they do not understand the benefits of using ICTs for instruction. Lack of time because of a heavy workload in the school curriculum could also be denying them a chance to experiment with newer technologies (Wanjala, Khaemba and Mukwa 2011).

This study established that 63.7% of the school Principals were computer literate and only 32.3% were not (Table 4.17). This finding suggests that Principals understand the importance of using computers hence they have acquired the knowledge. It is expected that if they have knowledge they can encourage use of computers and other ICTs in their schools.

Results on teachers' knowledge in ICT show that a big number of them, 89.2% have knowledge in ICT use, only 10.8% do not have this knowledge. It can therefore be assumed that teachers are competent in ICT use. But is this so even in the classroom? Indeed, it is how ICTs are used that makes the difference in learning outcomes (BECTA 2000). Teachers who had attended professional development courses in ICT complain that the content given only focused on basic ICT skills acquisition but not how they could develop pedagogical aspects of ICT.

Teachers acquired ICT skills in different ways like during college training (pre-service), SMASSE, KESI trainings and even sponsored themselves to go for training in computer use. (Table 4.19).This shows the teachers have a desire to use modern technology hence they have made efforts to get relevant knowledge. Cuban (1998) said each new development in information and entertainment technology in society brought with it a desire to deploy the same in the classroom. As explained in the Technology Acceptance Model (TAM) when users are presented with technology its usefulness to them influences how and when they use it.

This is Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as given by Davis (1989). From the findings of this study, teachers still need to be sensitized on usefulness of ICTs, especially those who are aged above 40 years so they can adopt these teaching strategies. Since ICTs are now part of all society's activities it is correct to say that teachers can seek this knowledge and even use it in class if it can make their work easier.

After getting the knowledge and skills, practice will prove whether teachers have internalized this. Some teachers agreed to have used ICTs like internet, radio, CD, mobile phones, computers, laptops, TV, printers, projectors and flash disks during some of their lessons. They agreed to have used these ICTs to source for information, (Table 4.22). This finding supports the view by Information Society Technologies Advisory Group that ICT is a globally expanded network suitable to build a global public sphere. They enable electronic communication, entertainment and research (European Commission, 2010). Information flow is faster, accurate and cost effective especially when using internet. If teachers have knowledge and relevant skills, they will considerably benefit from ICT use in instruction.

The present study has also established that majority of teachers (72.4%) had not prepared any lesson content in their subject areas using ICTs. Most likely they used what had been prepared by other people or they requested people with knowledge in ICT use to source for them content. Those who had used ICTs to prepare named schemes of work, lesson plans and set book shows to be areas where they had used ICTs. A few science teachers used the internet to teach the periodic table, cell division and also when coming up with projects for science congress. These findings show that though teachers have knowledge in use of ICTs but they should do enough practice before they can use them in the classrooms. Schoepp (2005)

suggests that for new technologies to be well integrated in the classroom, there should be continued provision of professional development.

Higgins and Mosley (2010) suggest that teachers' attitude, skills, beliefs and practices affect the way we choose to use ICT and how effective they are at using them. Guoyuan (2005) supports this view when he says teachers' use of ICT depends on their beliefs, attitudes and perceptions about ICT use. Manduku et al (2010) had observed that teachers in public secondary schools in Kenya had no skills and competencies needed for ICT implementation. The TAM model (Davis 1989) shows that Perceived Usefulness and Perceived Ease Of Use affect users' acceptance of technology. Teachers will most likely adopt ICTs for instruction if they evaluate them to be useful in the instructional process.

However, teachers' vision of technology itself, their experiences with it, cultural beliefs about it and its introduction in schools can create a positive attitude. All these can only be given to the teachers during preparation stage or pre-service training. BECTA (2004) concludes that when teachers understand how these technologies will benefit their teaching, then they will develop a positive attitude. This study found out that most teachers can use ICT for instruction despite their sex (Table 4.23). Looking at their age (Table 4.24) it was found out that age affects ICT use. Teachers aged above 40 years hardly used ICTs for instruction while younger teachers aged between 20 and 40 years used these resources more often. This finding is similar to that of Jimoyians and Komis (2007) and Dzidonu (2010). These researchers agree that the teachers' age affects the choice to adopt ICT or not.

Location of schools also affects ICT use. Teachers in rural areas lacked ICT resources and infrastructure. Even though some were competent enough in ICT use, they rarely used these resources because they were not available. The teachers in urban areas had enough ICT resources and could use them anytime. Such were advantaged and could even improve their skills because of continued use. Analysis of teaching experience revealed that teachers who had taught for over 20 years rarely used ICTs for instruction. Those who had taught for less than 20 years were found to be receptive to newer technologies and would use them more often for instruction. As put in the study by Andoh (2012) the older teachers avoided to experiment with newer technologies because they lacked the relevant skills and eagerness to use ICTs. The study by Kiptalam and Rodriguez (2010) showed that some teachers did not receive any prior ICT training during their formative years at university or teachers training colleges. However, the study by Toure (2008) says that whereas teachers in Ghana received training in ICT they got little training on how to use these gadgets in the classroom.

4.6 Comparison of Schools' level of preparedness to adopt ICT for instruction in rural and urban areas.

The third objective was to compare the level of preparedness for adoption of ICT in rural and urban schools. The present study was interested in finding out availability of ICT resources and infrastructure like electricity, internet connectivity facilities for storage of ICT resources and satellite dish in rural and urban schools. Information from the observation schedule, Principal's interview schedule and ICT specialists' questionnaire was analyzed (Ref Appendix C (i) page 171, Appendix E page 176). Analysis of data on availability of ICT resources in rural and urban schools revealed that ICT resources were available in schools in the two locations though schools in urban areas had more ICT resources than those in rural areas.

Specifically, schools had computers, printers, radios, mobile phones, modems, DVD machines, video decks, projectors, TV, laptops, flash disks, video camera and digital cameras. Despite this wide range of ICT resources, the quantity in urban schools is higher than that in rural schools. For example most schools in urban areas had more than 20 computers while some schools in rural areas had only one and this was used for administrative purposes. Mobile phones and laptops that were used specifically for instruction were only found in urban schools while those found in rural schools were for teachers who only occasionally used them for instruction.

Projectors, video and digital cameras were only found in urban schools though just a few schools had these resources. This finding implies that though ICT resources are available in both urban and rural schools the ratio is not equal. Urban schools have more and varied ICT resources as compared to rural schools. This means teachers and students in urban schools are advantaged because the teachers can use varied ICT resources that are available to teach. This is not the case in schools in rural areas.

Electrical energy is linked to development and use of ICTs. Despite the government effort to provide electricity to schools all over the country still some schools especially in the rural areas are not connected to the national electricity grid. The present study assessed availability of electricity in schools and the findings are shown in table 4.29.

Table 4.29 Availability of electricity

	Have electricity Frequency (n)	(%)	Do not have electricity Frequency (n)	(%)	Total

Location					
Rural	33	66	17	34	50
Urban	52	100	0	0	52
Total	85	100	17	16.7	102

Table shows that 33 (66%) of the selected schools in rural areas have electricity while 17 (34%) do not have electricity is mostly available in urban areas. All sampled schools in urban areas had electricity. This finding implies that schools in urban areas can use ICT machines that are powered by electricity while some schools in rural areas may not use some of these ICT gadgets for lack of electricity. Alternatively, they have to find other sources of power like generators or solar power which have financial implications.

Rebecca and Marshal (2012) observed that in India solar panels were used to power computers in schools located in slum areas. This is a good alternative which could also work in Kenya. There are solar panels but most people use them for lighting only.

This study also compared how rural and urban schools access the internet. Results are shown in table 4.30

Table 4.30: Internet connectivity

Location	Dial up f(n)	(%)	Direct Connection f(n)	(%)	Broadband Connection f(n)	(%)	None f(n)	(%)	Total
Urban	22	42.3	18	34.6	12	23.1	0	0	52
Rural	10	2	0	0	17	34	23	46	50
Total	32	31.3	18	17.7	29	28.4	23	22.6	102

Results in table 4.30 show that schools in both rural and urban areas have made efforts to connect to the internet through ways like dial up, direct connection or broadband connection. All sampled schools in the urban category could connect to the internet any time even though the cost of internet is high, Aguyo (2010) notes. With the operationalization of the National Fibre Optic cable through the East African Submarine System project, it had been expected that the cost of internet would come down. This is to yet to be realized as the cost of bandwidth remains high, (Gillwald and Stork 2008). For schools in rural areas 23 (46%) of them did not have any connection to the internet. This result shows that schools in rural areas were lagging behind in the area of modern instructional technologies compared to schools in urban areas. These schools in rural areas lack basic infrastructure like electricity, storage facilities and even ICT resources. Teachers in such schools have to look for ICT resources elsewhere, like visit cyber-cafés to access the internet and this becomes expensive for them. Such teachers may want to use ICT resources during instruction but since they are not available they resort to traditional teaching methods. This rural – urban digital divide denies teachers an opportunity to employ newer technologies in teaching and students a chance to reap from the benefits of learning using ICTs. The government and other stakeholders in education should aid schools in rural areas to access ICT resources so that newer technologies can be used in these schools. The schools' Boards of Management should facilitate greater access to ICTs and related components to teachers and students.

Availability of satellite dish in schools was also surveyed. This facility enables fast access and exchange of information. Results from the observation schedule are given in table 4.31.

Table 4.31: Availability of satellite dish

Location	Available f(n)	(%)	Not available f (n)	(%)	Total
Rural	0	0	50	100	50
Urban	2	4	50	96	52
Total	2	2	100	98	102

The findings in table 4.31 show that none of the selected schools in the rural areas had a satellite dish while only 2 (4%) schools in the urban area had a satellite dish. This could mean that this facility is expensive and most schools are not able to acquire and maintain it. The satellite dish could also be a newer ICT innovation which not many schools have used before. Its scarcity in schools impedes faster internet access and other services like teleconferencing and video – conferencing which can be important in the instructional process.

Safe storage of ICTs is important because this equipment is expensive and delicate. From the observation schedule the study gathered data on availability of ICT rooms and laboratories. Results are shown in table 4.32.

Table 4.32: Availability of ICT storage facilities

Location	Available f(n)	(%)	Not available f(n)	(%)	Total
Rural	4	8	46	92	50
Urban	50	96	2	4	52
Total	54	52.9	48	47.1	102

Results in table 4.32 show that 4 (8%) of the selected schools in rural areas had special ICT storage facilities like computer rooms and ICT laboratories while, 46 (92%) did not have special facilities to store ICT resources. In the urban area 50 (96%) of the selected schools had facilities to store ICT resources and only 2 (4%) did not have such facilities. This result shows that schools in urban areas have ICT resources and safe storage for them so they can be used and stored well to last longer. Schools in rural areas have no safe storage for ICT resources perhaps because these resources are rare in most schools and the few that are available can be kept in offices like the Principals' or school library. In such a case they are not easily used for instruction because they have to be moved from one room to another or library programs are interfered with to allow room for ICT to be used within the library.

ICT specialists interviewed revealed that only 10 (40%) schools in rural areas were ready to adopt ICT for instruction. The remaining 15 (60%) were not ready and these specialists cited lack of varied ICT resources and teacher incompetence to be an impediment to ICT adoption in instruction. In the urban areas the specialists admitted that 47 (94%) of selected schools were ready for adoption of ICT while only 3 (6%) were not ready for ICT adoption. Similarly, Principals' interviewed revealed that 29 (58%) schools in rural areas were well prepared and ready to adopt ICT for instruction while 21 (42%) schools in rural were not ready. From the urban area 50 (96.1%) Principals revealed that their schools were ready for ICT adoption and only 2 (3.9%) schools were not well prepared. Principals of schools in urban areas admitted that they had varied ICT resources and infrastructure to enable ICT adoption in instruction. They also agreed that their teachers were competent enough to adopt ICT for instruction. These findings imply that there are disparities in levels of preparedness for ICT adoption in

rural and urban schools. While urban schools have resources and competent staff, the rural schools have competent staff but they lack varied ICT resources so they are not ready for full adoption of ICT in instruction. The findings by Hennessey (2010) are similar to this finding. He noted that ICT implementation in schools in Africa is impeded by lack of physical facilities. Aguyo (2010) also noted that access to internet is expensive, and the study by Wims and Lawler (2007) showed that ICT resources were rare in educational institutions in Kenya hence implementation was not very successful.

Despite these differences Principals in both rural and urban areas had plans in place to ensure adoption of ICTs in instruction with immediate effect. The study established that all the sampled schools in the urban areas are connected to electricity which implies that most of the schools in urban areas have this important facility. From the sampled schools in the rural areas 33 (66 %) were connected to electricity while the remaining 17 (34 %) were not connected (Table 4.29). The interview schedule for Principals showed this same finding. Some Principals from the sampled rural schools said they used generators as alternative sources of electricity. The observation schedule also confirmed that some schools in rural areas did not have electricity. Most of the ICT resources require electricity in order to function well. This finding, therefore, implies that urban schools are better placed to use ICTs than schools located in the rural areas because of availability of electricity. Kozma (2007) says ICT integration in primary and secondary schools in India has been hampered by lack of basic infrastructure like electricity and ICT resources. School Net in Namibia provides solar power to schools that do not have electricity. Priority should be given for electrification to all schools and learning institutions for effective adoption of ICT.

Comparison was also done for internet connectivity in the rural and urban schools. Again, the present study established that all sampled schools in the urban areas were connected to the internet while 46% in the rural areas were not connected at all (Table 4.30) They used alternative means like modems or mobile phones (mostly personal ones) though these were slow to connect to the internet and hence expensive to use most of the time. Some teachers admitted they had to travel to urban areas to access internet in cyber cafes in order to get information they required. This has financial and time implications. While schools in urban areas can access information fast as a result of internet connectivity, those in rural areas take time to access the same. Kweyu (2010) in a study on teaching ICT in Kenyan Secondary schools suggests that the government should set up an e – learning platform that will host open educational resources to support the National Secondary School Curriculum. He also suggests the rural café system that provides enhanced web access in areas with limited or no access the internet through a Local Area Network.

ICT equipment is expensive and delicate to handle so they should be stored safely and be well maintained to be functional whenever needed. 50 (96%) of the sampled schools in the urban areas had special rooms for safe storage of ICT resources. These were ICT rooms, computer laboratories, departmental rooms, resource center or library (Table 4.32). Only 2 (4%) of the sampled schools in the urban areas had no special room for ICTs but they kept them in the office and others in the staffroom. For those schools in the rural areas only 4 (8%) of them had a special place for storage of ICTs while a big number 46 (92%) did not have. The study found that most schools in rural areas had very few ICT resources.

Many of the Principals in rural areas said they were still in the process of acquiring ICT resources. The few they had were kept in the main school office and could be accessed when needed.

ICT specialists have a good understanding of this technology, the resources and how they are used. Their responses on the comparison of rural and urban schools' preparedness for ICT adoption showed that 47 (94%) of schools in the urban areas were ready to adopt ICT for instruction. These schools had the resources required, infrastructure and teachers were competent enough to use ICT in the classroom. To support this finding most Principals from the urban schools agreed that they had enough ICT resources and infrastructure and their teaching staff were competent in ICT use. Only a few admitted that they were not ready but plans were in place to in- service teachers on use of ICT in the classroom and not just give them computer skills.

Responses from Principals in rural schools revealed that most schools were not ready for ICT adoption. Only 10 (40%) of the selected schools in rural areas were said to be ready for ICT adoption. Some of the teachers did not have any knowledge on use of ICT for instruction. The schools were also, trying to acquire some of the basic ICT resources. Most were looking for donors, well wishers, CDF and government funding to be able to achieve this. From this comparison the study found that there is actually a difference in the preparation process of adopting ICT for instruction. The urban schools were better placed to adopt ICT for instruction than rural schools. Teachers in urban schools easily access ICT resources but those from rural schools have to look for them in cyber-cafes or use modems. This is expensive and time consuming. Bearing in mind that students from the rural and urban areas sit the same

examination and should be taught the same curriculum, it beats logic that the teaching strategies differ. This is as a result of one group (urban) having the latest technologies while the other (rural) does not have the same. The teachers and learners in the rural areas might be missing out on the quality education afforded by ICTs.

4.7 Challenges facing Schools in preparation for adoption of ICT in instruction.

The fourth objective was to find out challenges facing schools in preparation to adopt ICT for instruction. Analysis of data from questionnaires and interview schedules revealed different challenges. The challenges include teacher competencies and lack of finances to acquire ICT resources.

The Principal's interview schedule revealed that some teachers had a negative attitude and lacked knowledge and skills to use ICTs in instruction. This implies that even if ICT resources were availed these teachers would not use them. So, motivation, sensitization and training should be done to help such teachers embrace ICT especially in instruction.

Schools also face the challenge of limited finances. ICT resources and infrastructure are expensive to acquire install and maintain for effective use. Schools have many financial needs and therefore very little money is set aside for acquisition of ICT resources. In this case only a few ICT resources are purchased or none at all since sometimes ICT resources are not a priority. This could be the reason why many schools do not have satellite dishes video cameras and projectors because these resources are very expensive. Teachers may be competent in using ICTs but because the resources are scarce they do not use them at all. This finding implies that use of ICTs depends on the availability of these ICT resources which should be in good working condition.

Lack of electricity especially in rural schools and frequent power failures was another challenge. Most ICTs are powered by electricity but sometimes there are electric faults or power rationing so the machines cannot be used. Most schools neither have generators nor solar power to serve as back-ups and assist in case of power failure. There is also internet failure due to poor network coverage especially in rural areas. This means that sometimes ICT resources are not used especially if there is no electricity.

From the teachers' interview schedule the study found out that teachers were also faced with challenges as they tried to adopt ICT for instruction. Some of them admitted that they did not have practical skills to use some ICTs during instruction. They knew these resources very well and even used them for personal issues like entertainment or communication but could not use them in class for lack of practical skills. This view implies that teachers have theoretical skills but lack practical skills in use ICT use. Their attitude could also be that ICTs can only be used for personal issues but not as an instructional tool.

Teachers also said that in some schools ICT resources were scarce, some were of poor quality, and some failed to work when need arose. This was frustrating for them, some teachers had skills but because resources were scarce they taught using the traditional way of relying on books and being the only authority in the classroom with information for students. This finding implies that lack of ICT resources and infrastructure is an impediment to ICT use in instruction.

The school curriculum is wide with a lot of content to be covered within a set of period of time. Being an examination oriented curriculum teachers struggle to cover the syllabus in time, revise and prepare candidates for examinations. It is assumed that success only comes from passing examination so all time is spent preparing students to pass examinations. Some teachers agreed that they had knowledge in using ICTs, these ICTs were available in schools but they lacked time to use them to teach. This finding implies that the examination oriented system of education is denying teachers an opportunity to use ICTs and students an opportunity to manage their own learning by use of ICTs.

There were ICT specialists in some schools. The present study also found out the challenges they faced. Most of these specialists cited lack of ICT resources in some schools. Some schools had just a few resources which were not adequate for the large number of students. These specialists also cited teacher incompetencies in using ICTs for instruction. Some teachers sought assistance from these specialists when it came to operating some machines like computers, projectors and printers. This implies that ICT resources are not enough and some teachers are not competent enough to use them. The ICT specialists were also challenged by lack of quality ICT resources. Some schools had enough ICT resources but lacked good storage facilities for them. In some schools poor quality machines were acquired which failed to work within a short period of time. In other schools, there were no technicians to service machines so there was frequent breakdown. Some ICT specialists were not contacted during budgeting or purchase of ICTs so the wrong resources were purchased. Maintenance of such poor quality resources turn out to be expensive.

To overcome all these challenges the respondents suggested some measures. For example, there is need for the government to prioritize supply of electricity to all learning institutions in the whole country. The cost of electricity installation to schools can also be subsidized since financial needs in schools are already many. Ways of using alternative energy sources like biogas solar and generators should also be explored. Service providers like Safaricom, Airtel, Yu and Orange should reduce the cost of internet connection and strive to connect all areas especially rural schools. The cost of ICT resources should be lowered or subsidized to enable all categories of schools to acquire them.

Principals and teachers also suggested that all stakeholders in schools should be sensitized on the importance of ICTs so that they support acquisition, use and safety of these resources. There should be training on proper use of ICTs and provision of these resources in large quantities so that they are easily available for use by students and teachers. There is also need to support the development and delivery of ICT in education sector. The national policy on implementation of ICT in educational related projects proposed in Sessional paper number 1 of 2005 (GOK, 2007) that ICT should be implemented fully in the education sector. There should be ICT specialists and technicians in school precincts to ensure these gadgets are well maintained and in good working condition so that they can be used anytime. ICT specialists should also be involved in procurement so that they give technical advice on the type and quality of ICT resources that should be acquired in schools.

Giving their views on the school curriculum, the teachers suggested that the school curriculum should be reviewed with a view to reducing the content in most subjects so that

there is enough time to in cooperate newer and better teaching strategies. This will give teachers time to plan lessons and use ICTs to improve the instructional process. Teachers agreed that there should be practical pre - service and in – service training regularly on use of ICTs during classroom instruction.

The findings of this study show that the challenges faced in schools are related to availability of resources, infrastructure and teacher competencies. These challenges are not unique to schools in Bungoma County alone. Becta (2004) classified barriers to ICT integration as teacher – level and school – level in developing countries. Teachers' lack of technological competence is a barrier to their acceptance of technology (Al – Alwani 2005). A study by Bingimlas (2009) recommends provision of resources, effective professional development, sufficient time and technical support for teachers to use ICT in the classroom.

Despite the challenges stated above, the respondents agreed that ICTs are important tools for instruction and if used together with the traditional teaching methods, students' performance can improve and learning can be enjoyable for learners. The Principals admitted that ICTs save time, enhance quality and access to education, are sufficient, effective and even make school management easy. They recommended the use of these resources.

4.8 Summary of the findings

The following is a summary of the findings based on research questions of the study.

a) **ICT resources available in schools**

The first research objective was to find out which ICT resources are available in schools. The study has established that there is a wide range of ICT resources available in schools. For example there are computers, projectors, printers, television, DVDs, video decks, radio, flash disks, diskettes, modems, mobile phones, laptops, digital cameras, scanners, speakers and

home theatres. These resources are important in instruction because they can improve learning, help learners remember concepts, make learning interesting and enable students have practical learning skills. They not only modernize the classroom but can also improve students' performance.

Therefore it is evident that schools have made efforts to acquire ICT resources because they understand the importance of ICT in education. Most schools have acquired these resources through donations, CDF kitty, government subsidies, well wishers and even harambees. Even though, some schools especially those in rural areas neither have enough nor a variety of ICT resources.

b) Teachers' competencies in using ICTs in instruction.

The second research objective was to establish whether teachers have the necessary competencies of using ICT for instruction. The role of the teacher in the instructional process cannot be underestimated. Traditionally, the teacher was an authority and disciplinarian in the classroom. He had all the knowledge and his role was to impart this knowledge to the students. This is not so today. Ballad (2000) says technology can facilitate innovative ways of instruction. Teachers need to be competent in order to use technology effectively in instruction. This study found out that most teachers had knowledge in use of ICTs, which they had acquired through pre-service training, in – services and workshops. Some teachers went to computer colleges to be ICT literate. However these teachers used ICTs for personal activities and hardly used them for school instruction.

Teachers' responses showed that only a few of them prepared what to teach using ICTs, but they did not actually use ICTs during instruction. Some teachers used the internet to get information to teach especially in science subjects. The teachers admitted they lacked

confidence to use ICTs in the classroom. This is because their training focused on ICT literacy skills and not using ICTs to teach in the classroom.

Asked how often they would use ICT for instruction most teachers who had taught for a longer period admitted they would do so rarely or never at all. This is because of the wide school curriculum in different subjects which does not give them enough time to experiment with newer technologies. The school Principals and ICT specialists also pointed out that some teachers would use ICTs for instruction while others would not. However, all teachers can and do use ICTs for their personal activities. Sometimes teachers ask ICT specialists to assist them mount ICT equipment to be used during instruction.

Therefore it is important that capacity building be done by all stakeholders in the education sector to ensure all teachers are competent and do use ICTs in instruction.

c) Comparison of schools' level of preparedness in rural and urban areas.

The third research objective was to compare the level of preparedness in schools in rural and urban areas. This study has established that schools in urban areas have more and varied ICT resources as compared to those in rural areas. All urban schools have electricity, internet connectivity and signals for most of the network providers. The schools in the rural areas have some ICT resources but are still making efforts to acquire more. 34% of schools in rural areas do not have electricity or internet connectivity so far and they do not have a place for safe storage of ICTs. Most ICT resources are kept in the Principals' offices. These schools do not even have ICT specialists to help in use and maintenance of the ICT resources.

The study has also established that schools in the urban areas are ready for adoption of ICT in instruction because they have the required ICT and some of the teachers have necessary competencies for using ICTs in instruction. Those in the rural areas are not ready because

most have a few ICT resources or none at all. For example those who have computers use them for office and administrative work. The teachers in rural areas are also not confident enough to attempt to use ICT resources in the classroom because they lack regular practice. It is important that schools in both rural and urban areas be at par in terms of instructional resources especially ICTs.

d) Challenges faced by schools in preparation for adoption of ICT in school instruction.

The fourth research objective was to find out challenges faced by schools as they prepared to adopt ICT in school instruction. This study has established that some schools have enough ICT resources while others do not. Schools hardly have enough finances to enable them meet all their obligations including of purchase of ICT equipment. Teachers' attitude is also negative making some to avoid using ICTs. Some teachers are not competent enough to use ICT in classroom instruction. Many teachers lack the confidence so they avoid to experiment with these new technologies. The school curriculum is also rigid, and coupled with a heavy workload teachers hardly have time to use ICTs to enrich their lessons. Sometimes the ICTs are not enough for effective use in the classroom. There are also cases of poor quality resources that break down all the time hampering usage when need arises. Lack of electricity to run ICTs and frequent power failures, poor and slow internet connectivity were also a challenge faced in schools. Therefore, if these challenges would be addressed by the Schools Management Boards, parents, teachers and even the government, use of ICT in school instruction would be done very well.

4.9 Summary

This chapter has presented data that was collected, its analysis, interpretation and discussion based on the main research objective which was to establish schools preparedness to adopt ICT for instruction. Results of the data analysis on availability of ICT resources show that there is a wide range of ICT resources available in schools like computers, TV radio, video deck and camera, printers, projectors, modems, laptops. Even though, schools in urban areas have more ICT resources than those schools in rural areas. On teachers' competence in use of ICT, the study established that most teachers have ICT knowledge but these teachers are not competent enough to use ICTs during classroom instruction. Comparing schools' level of preparedness, it is also evident that schools in urban areas are ready to adopt ICTs for school instruction but those schools in rural areas lack a variety of ICT resources and ICT competent teachers so they are not yet ready to adopt ICT for school instruction. Looking at challenges faced by schools in preparation to adopt ICT for instruction, the study found out that there are several challenges, for example, lack of enough ICT resources, incompetent teachers, finances to purchase and maintain ICT resources and scarcity of ICT technical staff. The school curriculum is also wide such that teachers do not have time to infuse ICT in instruction because they must complete the syllabus in time then prepare students for examinations. A discussion of these findings laid the basis for the summary, conclusions and recommendations in chapter five.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to find out preparedness in schools for adoption of ICT in classroom instruction. This chapter presents a summary of the findings based on the research objectives, draws conclusions and makes recommendations based on the findings in the previous chapter. This chapter is discussed under the following sub-headings:

5.2 Summary of the findings

a. Which ICT resources are available in schools?
b. Do school teachers have the necessary competencies of using ICT for instruction?
c. What is the rural schools' level of preparedness to adopt ICT for instruction in comparison to urban schools?
d. Which challenges do schools face preparation to adopt ICT for instruction?

5.3 Conclusions

5.4 Recommendations

5.5 Summary

5.2 Summary of the findings

The following is a summary of the study based on the research questions. They are derived from chapter four.

a) Which ICT resources are available in schools?

This study has established that there is wide range of ICT resources available in schools. For example, there are computers, LCD projectors, printers, televisions, DVDs, video decks, video cameras, flash disks, modems, mobile phones, laptops, scanners, speakers, home theatres and digital cameras. These resources are important in instruction because they can improve learning, help learners remember concepts,

make learning interesting and enable students have practical learning skills. They not only modernize the classroom but can also improve students' performance.

b) Do school teachers have the necessary competencies of using ICT for instruction?

The present study found out that most teachers had knowledge on use of ICTs but they were not competent enough to use these ICTs for classroom instruction. Both male and female teachers would use ICTs for instruction though the male teachers were found to be more willing to in co-operate these technologies in instruction than the female teachers. Looking at their age, those teachers aged below 40years were found to be more eager to experiment with these newer technologies as compared to those teachers aged above 50 years. Duration in teaching also affected ICT use, those who had taught for a longer period rarely used ICTs, but the younger teachers who had taught for less than 10 years were found to be more willing to adopt ICT for instruction. This study also established that there are in-service trainings and workshops being mounted in schools to sensitize and improve teachers' competencies in using ICTs for instruction. Even though, these workshops are rare.

c) What is the rural schools' level of preparedness to adopt ICT for instruction compared to that of urban schools?

This study established that schools located in urban areas were more prepared to adopt ICT for instruction as compared to those located in rural areas. This is because schools in urban areas have most of the ICT resources, infrastructure and competent staff. Schools located in rural areas have very few ICT resources, some even lack electricity. The teachers in rural schools hardly use ICT resources because they are not available

so their skills are not practiced regularly. They also get frustrated because of lack of ICT resources so they do not make efforts to use them in instruction.

d) Which challenges do schools face in preparation to adopt ICT for instruction?

The present study found out that some teachers lacked knowledge and skills and also had a negative attitude towards use of ICTs terming them to be time consuming yet the school curriculum was wide. Some schools lacked basic ICT resources and infrastructure. Since there are many financial needs in schools very little funds are set aside to purchase and maintain ICT resources.

5.3 Conclusions

From the summary of the findings it can be concluded that there are a variety of ICT resources in most of the schools in Bungoma County. Since ICTs are important in classroom instruction, efforts should be made to ensure teachers utilize them in the instructional process. This requires that teachers are equipped with knowledge and skills so that they can be competent enough to use ICT resources to teach. Some teachers have knowledge but lack the confidence hence the need for continued practice and in-service to give them hands on skills to enable them work even with the latest technologies.

Schools in urban areas are well prepared to adopt ICTs in instruction because of availability of a variety of ICT resources and a reliable supply of electricity. This study found out that schools in rural areas are making efforts to acquire at least some ICT equipment like computers, TV sets and even electricity connection through the rural electrification program. These efforts are commendable. Despite these efforts, teachers' competencies in ICT use is

still low and coupled with a heavy workload they might as well continue to use traditional methods of content delivery to cover the syllabus.

Schools face various challenges in adopting ICT for classroom instruction. The government and even well wishers should allocate more funds to schools for purchase of instructional resources and in – service of teachers to improve their skills and give them confidence in ICT use especially in the classroom. The Kenya Power and Lighting Company and internet providers like Yu, Orange, Safaricom and Airtel should prioritize electricity and internet connectivity to schools in rural areas so that ICT can be used effectively in these particular schools. The school curriculum should also be cut to size so that teachers can have enough time to use various teaching strategies including ICTs to teach. Technical failures of some ICTs may also discourage use of this technology in instruction. The ICT resources should be kept in good working condition all the time to effectively deliver content.

This study therefore concludes that there are ICT resources available in most schools but not all the teachers are competent enough to use these resources for instruction. Hence the level of preparedness for ICT adoption is not up to date especially on the part of the teaching staff.

5.4 Recommendations of the study.

From the findings and conclusions the study wishes to make the following recommendations.

1. ICTs are an integral part of technological developments of the twenty first century. In education they offer unique attributes which should be harnessed to improve learning and put learners at par with those from developed countries. In order to achieve this, availability of relevant ICT resources in schools should be mandatory. The cost of ICT

equipment should be reduced by waiving import tax and education software be assembled locally. School managers should at least set aside enough funds to purchase instructional resources including ICTs to promote instruction. ICT resources should be safely kept and well maintained so that they are in good working condition all the time. Internet Service providers like Safaricom, Yu, Orange and Airtel should expand coverage to the rural areas and lower the cost of internet connectivity. The use of solar energy, biogas or generators should be explored as an alternative to electricity.

2. Training in use of ICT should focus on its use in the classroom. This should be stressed in pre-service training in Kenya to make teachers more competent. Training should also stress on acquisition of practical skills so that examinations on this aspect are given to candidates. During Teaching Practice sessions, student teachers should be assessed by their lecturers and tutors on their ability to use ICTs during instruction. Refresher courses to update teachers on use of newer technologies should be regular.

3. There is a lot of content to be taught in most subjects of the school curriculum. This workload is heavy for students and teachers so they concentrate on covering the syllabus at the expense of using different teaching strategies. The system of education is also examination oriented and does not stress on acquisition of practical skills. This research recommends an overhaul of the system of education to enable students acquire relevant knowledge, skills and attitudes to compete with their colleagues around the globe. The system should be student friendly and give teachers a chance to experiment with different strategies so that learning is an interesting and memorable experience.

4. Preparation stage is important before venturing into any important activity. Students come to schools eager to learn. The present study recommends that prior preparation should always be made before rolling out of any program in the education sector. From this study, ICT resources are available but some teachers are not able to effectively use them for instruction because of lack of relevant competencies. Training on ICT use in the classroom should be improved, include technology use and be student centred.
5. All stake-holders in the education sector should be sensitized by curriculum experts on the importance of ICTs in the instructional process. Teachers should use ICTs during instruction and parents should inculcate in their children a positive attitude towards use of ICTs in education. The children should not just view ICT resources as mere entertainment tools. It therefore means the Ministry of Education, Kenya Institute of Curriculum Development (KICD), experts in education, teachers and ICT specialists have a duty to sensitize all Kenyans on the development and on use of ICTs in schools. Indeed ICTs are an important instructional tool.

The present study only focused on Schools' preparedness to adopt ICT for instruction. Other areas like ICT preparedness in other Counties, use of ICT to teach different subjects of the school curriculum and students' views about learning using ICTs.So further research can be done in the following areas:

1. The research was done in one county. The findings cannot be generalized to the whole country. A similar study can be done with a bigger sample in different regions or the whole country to assess whether all schools are ready for ICT implementation.

2. A comparative study can be done with students who have been taught using ICTs and those taught using the traditional teaching modes to assess their performance in national examinations. Such a study would help shed light on the impact of ICTs on students' performance in examinations.
3. Instruction is a two way process involving students and teachers. This study focused on availability of ICT resources and teachers' competencies. A similar study can be done focusing on students' reception of ICT use in instruction in Kenya.
4. Since there are different subjects in the school curriculum like English, Science, Kiswahili and Mathematics, studies can be done on use of ICTs in these subjects to show how effective ICTs can be in teaching different subjects in school curriculum.

5.5 Summary.

This chapter has given a summary of the findings, conclusions and recommendations that could lay basis for further study. This study has established that schools in Bungoma County have a variety of ICT resources and some teachers are competent in using these resources but others are not. There is uneven distribution of resources in urban and rural schools. There are several challenges faced in adoption of ICT like lack of enough finances to purchase resource, teacher incompetence and lack of storage and maintenance facilities for ICT resources. Despite the challenges, all schools in this county are making made commendable effort to adopt ICT for instruction.

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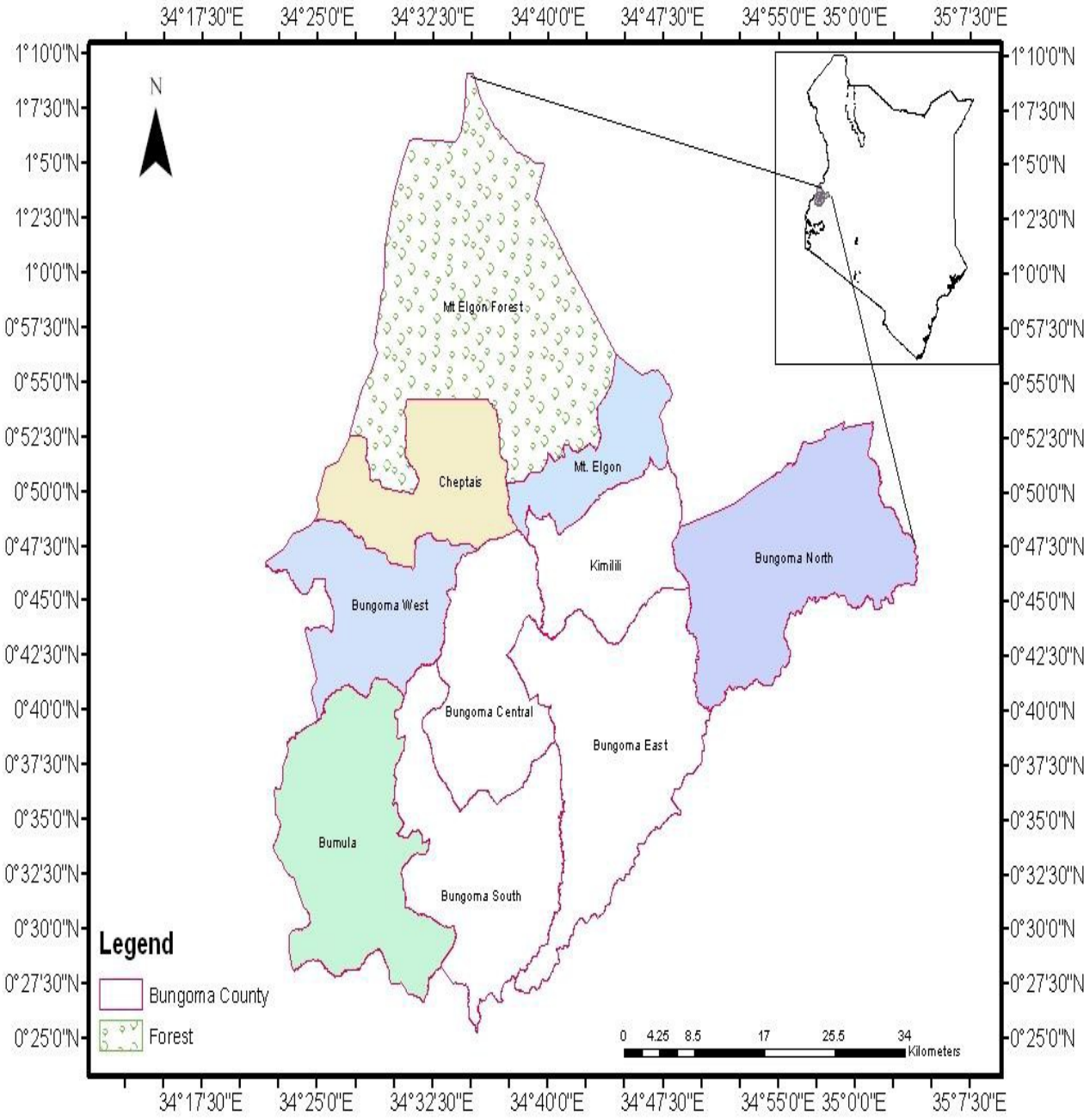
A MAP OF BUNGOMA COUNTY



Appendix B (1)

Teachers' Questionnaire:

A. General information (Tick (√) where appropriate)

1. Location of the school

Rural [ ] Urban [ ]

2. Teachers' sex

Male [ ] Female [ ]

3. Age between 20 – 30 yrs [ ] 31 – 40 yrs [ ] 41 – 50 yrs [ ] above 50 yrs [ ]

4. Professional qualification

Post – graduate [ ]

Graduate [ ]

Diploma [ ]

Other (Specify) [ ]

5. Teaching experience less than 5 yrs [ ] 10 – 20 yrs [ ] above 20 yrs [ ]

6. Number of lessons per week 10-15 [ ] 16-20 [ ] 21-25 [ ] 26-30 [ ]

B. Teachers' level of preparedness for adoption of ICT

1. Are you computer literate?

……

If yes, how did you acquire the skills?

……

……

2. Name the programs you can comfortably work with

…….....

3. Does the school organize any ICT in service courses for the teachers?

……

4. How many have you attended so far?

……..……..

5. Which of the following ICT resources are available in your school? Tick (√) appropriately

a) Computer	[ ]	(b) Projector	[ ]
c) Printers	[ ]	(d) Television	[ ]
e) Radio	[ ]	(f) Laptops	[ ]
g) Mobile phones	[ ]	(h) Internet	[ ]
i) Modems	[ ]	(j) e-books	[ ]
k) DVD	[ ]	(l) Flash disks	[ ]
m) Video deck	[ ]		

6. Have you ever used any of the resources named in 3 above during any of your lessons?

……..

Please specify which one(s)

……..……

7. How often would you use ICT during your lessons? Tick (√) appropriately.

Very often [ ] Often [ ] Rarely [ ] Never [ ]

8. Have you sourced for any ICT materials/resources for your subject area?

……

If yes, state from where

……

9. Give your opinion on your own and your schools' level of preparedness for adoption of ICT by ticking ( ) in the spaces provided

Statement	**Strongly Agree**	**Agree**	**Un -Decided**	**Dis-Agree**	**Strongly Disagree**
As a teacher I understand the ICT technology well					
I am ready to use ICT during most of my lessons					
My school has enough resources to enable it adopt ICT technology in instruction					
Most teachers in my school fear to use ICT and prefer the traditional teaching methods.					
To successfully use ICT in instruction one has to learn computer skills first					

10. Make any suggestions which you think will help in preparation for adoption of ICT in your school.

……

11. Has your school linked up with any other school/institution to share ICT materials?

……

12. a) Have you ever been involved in preparing ICT content in your subject area?

……...……..……..

b) If yes, state what you have prepared

…….

……

……..……

Appendix B (2)

Interview Schedule for Teachers

A. General information:

1. What is your professional qualification?

   ……

2. For how long have you taught?

   ……

3. How many lessons do you teach per week?

   ……

B. Teachers level of preparedness.

1. Do you have any knowledge on use of ICT in instruction?

   ……

2. Briefly explain how you got this knowledge?

   ……

3. Has the school organized any ICT in – service courses for teachers?

   ……

4. Have you attended any of these in – service courses?

   ……

5. What are some of the ICT resources available in your school?

   ……

   ……

   ……

6. a) Which of the ICT resources named in 5 above would you use comfortably during instruction?

   ……

   ……

b) Briefly explain why

……

……

7. In your opinion, how prepared is your school to adopt ICT in instruction?

……

……

8. What suggestions can you make to help prepare for adoption of ICT in instruction?

……

……

9. Has your school linked up with any other school / Institution to share ICT materials?

……

10. a) Have you ever prepared any ICT content in your subject area?

……

……

b) What have you prepared?

……

Appendix C (1)

ICT Specialist's Questionnaire

A. General information

1. Location of the school Rural [ ] Urban [ ]

2. Sex Male [ ] Female [ ]

3. Professional qualification

Graduate [ ] Diploma [ ]

Certificate [ ]

Other (Specify)……..……

4. How long have you worked in this school?

……...……

5. a) Nature of your employment TSC [ ] BOG [ ]

Other (specify)……..……..…

6. Specify your duties Tick (√) appropriately

a) Teaching computer studies [ ] b) Computer laboratory assistant [ ]

c) Facilitating other lessons [ ] d) Maintenance of ICT materials [ ]

C. Availability of ICT resources.

1. Have you been involved in acquisition of ICT materials?

……..…….

2 a) Which of the following ICT materials/resources are available in your school.

Tick (√) appropriately.

Computers	[ ]	Printers	[ ]
Projectors	[ ]	Television	[ ]
Radio	[ ]	Mobile phones	[ ]
CD	[ ]	DVD	[ ]
Flash disks	[ ]	Diskettes	[ ]
Video tapes	[ ]	Lap tops	[ ]

Digital Cameras [ ]

b) List any other ICT resources available in your school but not indicated above

……

3. In the last one year how often have these materials been used for instruction?

Very often [ ] Often [ ] Rarely [ ] Not used at all [ ]

4. Indicate where the ICT materials/resources are stored in the school?

a) Computer Lab [ ] (b) Classroom [ ]

c) HODs offices [ ] (d) Principal's office [ ]

e) Staff room [ ]

5. a) Is the school connected to the internet?

……

b) If not, what alternative method is used to access the internet?

……

6. In your opinion, how do you rate the teachers' readiness to adopt ICT in instruction?

……

7. Comment on your schools' level of preparedness to adopt ICT for instruction.

……...

Appendix C (2)

ICT specialists' interview schedule

A. General information

1. What is your professional qualification?

   ……

2. For how long have you worked in this school?

……

3. What are some of the duties you carry out as an ICT specialist?

……

……

B. Availability of resources

1. Name some of the ICT resources found in your school.

……

……

2. Briefly explain how these resources are acquired.

……

…….

3. a) Are these resources utilized during instruction?

……

b) How often?

……

4. Where are these resources kept in the school?

……...

5. How does the school access internet services?

……

……...…….

6. In your opinion, do you think the teachers in your school are ready to adopt ICT in instruction?

……

……

7. Do you think your school is ready to adopt ICT for instruction? Give your reasons

……

……

……

Appendix D

Observation Schedule

Part A: General information about the school.

Date:

School type:	Boys [ ]	Girls [ ]	Mixed [ ]
Location	Rural [ ]	Urban [ ]	

Part B: Availability of ICT materials/ resources

Tick from the list below the ICT materials available

1. Computers	[ ]	2. Projectors	[ ]
3. Printers	[ ]	4.Television	[ ]
5. Modems	[ ]	6.DVD	[ ]
7. Video deck	[ ]	8.Flash disk	[ ]
9. Diskettes	[ ]	10.Mobile phones	[ ]
11. Laptops	[ ]	12.Radio	[ ]
13. Digital camera	[ ]		

Part C: Availability of ICT infrastructure

1. Source of power [ ]
2. Internet connectivity
   a) Dial up [ ] b)Direct connection [ ]
   c) Broadband connection [ ]
3. ICT / Computer room/ Laboratory [ ]
4. Satellite dish [ ]

Appendix E

Interview Schedule for Principals

A. General information about the school (Tick where appropriate)

1. School type Mixed [ ] Boys [ ] Girls [ ]
2. Location Rural [ ] Urban [ ]
3. Population

No. of students

Between 200 and 500 [ ] Between 500 and 1000 [ ]

Above 1000 [ ]

No. of teachers

Less than 20 [ ] Between 20 and 50 [ ]

More than 50 [ ]

4. Source of power

Electricity [ ] Solar energy [ ]

Generator [ ] No power [ ]

5. For how long have you been in this position in this school?

0-5years [ ] 6-10years [ ]

6. a) Are you computer literate?

……

b) About how many members of your teaching staff are computer literate?

……

7. Is there a computer technician/ specialist in the school?

……

B. Availability of ICT resources

1. Indicate with a tick (√) if the following are available in your school.

Building for storage of ICT materials	[ ]	Computers	[ ]
Television	[ ]	Projectors	[ ]
Printers	[ ]	Internet connectivity	[ ]
Modems	[ ]	Video deck	[ ]
Laptops	[ ]	DVD	[ ]

Mobile phones [ ] Digital camera [ ]

Radio [ ]

2. What is the mode of connectivity to your school?

Dial up [ ] Direct Connection [ ]

3. Apart from fees what are the other sources of funding for your school?

……

……...……

4. a) Are there any funds set aside for the ICT department?

……

……...……

b) If yes, about what percentage of the school budget is dedicated to the ICT department per year?

……

5. Who in the school does the purchase of ICT materials?

……

6. Where are the ICT resources stored?

……

C. Teachers level of preparedness

1. Has your staff received any training on how to use computer technology in instruction?

……...…

2. Has the school organized for any in-service training or sponsored the teachers to attend any ICT workshops or trainings?

……

3. a) Do some teachers use ICT during instruction?

….……

b) How often?

Very often [ ] Often [ ] Rarely [ ] Never use [ ]

4. Do you think the teachers in your school are ready for adoption of ICT in instruction?

……

5. What plans does your school have to enable effective adoption of ICT in instruction?

……

……

6. What obstacles have you faced as a Principal in preparing to adopt ICT as a tool for instruction?

……

…….

7. Suggest ways you think these obstacles can be overcome

.....

.....

8. What is your view on the adoption of ICT as a tool for instruction in schools?

……

……

.....

.....