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School of Computing and Informatics

Framework for integrating ICT in teaching and learning in secondary schools in Kenya.

By

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Declaration

This research project, presented on this report is my original work and to my knowledge has not been presented for any other University Award.

Signed…….. **Date……**

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This project report has been submitted as part fulfillment of the requirements for the award of Masters of Science in Information System of the School of Computing and Informatics of the University of Nairobi, with my Approval as the University Supervisor.

Signed…… **Date…….**

Prof. Peter WaiganjoWagacha

Dedication

This research project is dedicated tomy beloved wife Sylvia Wambui, my loving children Dennis Wakhu, Felix Njoroge, Chelsea Muthoni and my late brother, Daniel Wakhu.

Acknowledgement

I am deeply indebted to all who supported me in carrying out this research. Whether mentioned or not, I sincerely extend my gratitude to all of them.

My gratitude goes to my supervisor Professor Peter W.Waiganjo for his constant guidance, support, encouragement and advice he gave me. May God Almighty bless you so much Prof.

I cannot miss to sincerely thank Dr. D. Orwa who together with Prof Waiganjo, constantly encouraged and advised me. God bless you abundantly

Many thanks go to my examiners who examined and corrected my work. God bless you.

To my parents, I say God bless you mightily for your constant and encouragement

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God bless you all.

Abstract

The purpose of this study was to develop a framework for integrating ICT in teaching and learning in secondary schools, by first investigating the challenges in integrating ICT in teaching and learning in secondary schools. The study attempted to establish the effects of ICT literacy levels of teachers and learners, technical and financial support and sustainability of ICT integration, the ICT infrastructure available in schools to enable them integrate ICT in teaching and learning and the perceptions of school managers and administrators and teachers in integrating ICT in teaching and learning in secondary schools. For this study, an exploratory approach, using descriptive survey design was used. The study was carried out in Kajiado County, Kenya. The study targeted a population of fifty public secondary schools in Kajiado County. The researcher used purposive sampling to select subjects for the survey. As such, only schools that benefited from the ESP-ICT government funds for the financial year 2011/2012 were selected for survey. Kajiado County is divided into three zones: Kajiado North, Kajiado Central and Kajiado South. In each zone there were five schools that benefited from the ESP-ICT funds from the Ministry of Education. These are the schools that were sample for this survey.

The instruments used in the survey were questionnaires for teachers, head teachers, students and the ICT designate teacher. An observation schedule for each of the fifteen schools was also used. Collected data was then analyzed using descriptive and inferential statistics, where frequencies, modes, percentages, correlations and cross-tabulation were the main techniques.

Major findings were that integration of ICTs in teaching and learning in secondary schools of Kajiado County faces a lot of huddles. One of the huddles is the perception of curriculum implementers, who find it hard to embrace ICTs in their teaching because of being contented with the traditional ways of teaching, or because of perceived work load and length of syllabus. Teachers also had a problem of lack of ICT skills. Head teachers and school managers did not have clear policy on ICTs in their schools. Learners have very limited ICT skills to use the ICTs in and learning. Another challenge is limited infrastructure. Internet access is a major challenge. Electricity is a problem in some schools, and most schools do not have alternative sources of power in the event of power blackouts. Some schools do not have computer laboratories. There was also lack of technical and financial support. Based on the findings, we have proposed a decentralized county-based framework for integrating ICTs in teaching and learning in secondary schools. Each county education office should develop its own curriculum for capacity building teachers on ICT integration.

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LIST OF ABBREVIATIONS

B.O.G	Board of Governors
CD	Compact Disk
CDF	Constituency Development Funds
CFSK	Computers for Schools Kenya
C.R.E.	Christian Religious Education
DTP	Desktop Publisher
DVD	Digital Versatile Disk
ESP-ICT	Economic Stimulus Program – Information and Communication Technology
G.C.E.	General Certificate of Education
G.o.K	Government of Kenya
H.T.	Head Teacher
ICT	Information and Communication Technology
ICT4E	Information and Communication Technology for Education
IT	Information Technology
KSh	Kenya Shilling
LAN	Local Area Network
LCD	Liquid Crystal Display
PEOU	Perceived Ease of Use
P.T.A.	Parents Teachers Association
PU	Perceived Usefulness
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
UNESCO	United Nations Educational Scientific and Cultural Organization

GLOSSARY OF TERMS

B.O.G.	It is the management team that runs a school.
Cloud computing	It is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet).
Community sponsored school	This is a school that is sponsored by the local community through CDF funds.
Computer Lab	A room specifically made and equipped with ICT apparatus for teaching and learning all subjects
Computer Use	The ability to do basic operations on the computer such as opening and closing applications, booting and shutting down the computer.
District school	This is a school whose students come only from the district in which the school is in.
ICT	It is the integration of computers and telecommunication facilities for the purpose of communication.
ICT4E	Stands for ICT For Education.
ICT designate teacher	This is a teacher in a school who has been appointed by the school principal to champion ICT usage in the school and also.
ICT integration	A seamless incorporation of technology to support and enhance student engagement in meaningful learning and for attainment of curriculum objectives.
ICT Policy:	A document that guides an organization on the usage of ICTs.
Multimedia Laboratory:	This is a computer laboratory equipped with ICT equipment that can enable use of text, sound, picture and video in teaching and learning.
National school:	This is a school whose students come from all counties in the country.

CHAPTER ONE

1.1 Introduction

1.2Background of the study

Kenya aims to be a globally competitive and prosperous nation with a high quality of life by the year 2030 (Kenya Vision 2030). No doubt that education will play a vital role in order for the country to achieve this noble goal. Information and Communication Technology has a critical role to play in helping education deliver its mandate. In Sessional Paper No 1 of 2005, it was stated that education needs to be transformed so as to be responsive to the 21st century needs for education and training. A policy framework was provided in this Sessional Paper. The policy articulated the integration of modern tools in teaching and learning in schools.

The National ICT Policy launched in January 2006 aimed at improving the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services. One of the main sections of the National ICT Policy is that of education. One of the objectives states in part "…the use of ICT in schools, colleges, universities and other educational institutions in the country so as to improve quality of teaching and learning". As such, the government has already embarked on an ESP-ICT project aimed at equipping all secondary schools in the republic with ICT infrastructure such as computers, multimedia laboratories, and other related accessories. The government has also embarked in a capacity building of teachers in the area of ICT integration. But questions abound:

i) What ICT skills do teachers and learners have in order to integrate ICT in teaching and learning?
ii) How are the perceptions of school administrators, managers and teachers towards ICT integration in teaching and learning?
iii) How reliable and sufficient is the infrastructure for integrating ICT in teaching and learning in secondary schools?
iv) How will schools sustain the project after the expiry of the government funds?
v) What technical support do schools have towards sustenance of ICT in teaching and learning in secondary schools?

These are some of the questions this study attempted to answer, using Kajiado County as a case.

1.3 Problem statement

Information and Communication Technology has become the backbone of all economies of the world. ICTs are used in all sectors of the economy, and education is not an exception. The use of ICT in education has been emphasized by the government of Kenya for several reasons. First, the government has an obligation to provide education to all her citizens, even in times of scarce financial resources for hiring more teachers. Second, there is globalization and the general shift of all economies of the world into knowledge-based economies. Knowledge-based economies require educational institutions to develop individuals with the ability to transform information into knowledge and apply that knowledge into a dynamic cross-cultural context.

ICT integration in education is a complex and protracted process (Wai-Kong, Miao et al, 2010). It requires the infusion of educational technology and ICT. For one to use ICT tools to teach, he/she has first to have the content of what is to be taught, the pedagogy and then the skills or knowledge of the ICT tool to use in teaching. Further, for any school to integrate ICT in teaching and learning there must be the goodwill of the school managers and administrators.

It has to be appreciated that teaching and learning are two processes that go together. As Kurmar quotes in his paper "Convergence of ICT and Education" (2008):

> *Stages of teaching and learning using ICT involve four stages: discovering ICT tools, learning how to use ICT tools, understanding how and when to use ICT tools and specializing in the use of ICT tools.*

Other than the four stages of integrating ICT tools in education, there are other challenges that hamper the exploration and exploitation of ICT tools in education. Bearing in mind that Kenya is a developing country, infrastructure in most parts of the republic is a major challenge. Internet and mobile telephone facilities have not reached most parts of the country. Electricity is a major challenge too in most parts of the country which are seriously in a rural setup.

Not everybody embraces technology. Many are individuals who are technophobia. They fear to learn anything new especially if it is technical in nature. There are those who are just resistant to change. Others have the fear of being replaced by technology and therefore their perception towards it is negative.

This study will, therefore, venture in answering the question: “What challenges are experienced by teachers and learners in integrating ICT in teaching and learning in secondary schools of KajiadoCounty?”

1.4 Purpose of the study

The main purpose of this study was to investigate challenges in integrating ICT in teaching and learning in secondary schools usingKajiadoCounty as a case, and then develop a framework for integrating ICT in teaching and learning. This study tried to establish the role played by the school administration in integrating ICT in secondary schools. ICT skills of both learners and teachers were also investigated. Also investigated was the sustainability of the process of integrating ICT in teaching and learning in secondary schools. The study also investigated challenges posed by the required infrastructure.

1.5 Objectives of the study

The following were the objectives of the study:

1. To investigatethe ICT skills teachers and learners have.
2. To investigateperceptions of school administrators, managers and teachers towardsICT integration in teaching and learning.
3. To investigate the available infrastructure, financial support and technical support for ICT integration in teaching and learning in secondary schools.
4. To develop a framework for integrating ICT in teaching and learning in secondary schools.

1.6 Research questions

This study ventured to seek answers to the following questions in regard to the challenges facing ICT integration in secondary schools.

1. What ICT skills do teachers and learners have to help them integrate ICT in teaching and learning?
2. How do teachers, school administrations and school managers perceive the integration of ICTs in teaching and learning?
3. What ICT infrastructure do schools have in order to integrate ICT in teaching and learning?

4. How are schools intending to finance the process of integrating ICT in teaching and learning after the expiry of the government support to the project?
5. What technical support do schools have for integration of ICT in teaching and learning?

1.7 Research assumptions

The following were the assumptions of the study:

- The schools that received ESP-ICT funds have already started using ICTs in teaching and learning.
- All public secondary schools in the country will eventually be given funds to purchase ICTs for teaching and learning.
- The findings from the study using KajiadoCounty as a case are representative of the whole country.
- The researcher will get a feedback from all respondents.

1.8 Scope of the study

The main aim of this surveywas to investigate challenges in integrating ICT in teaching and learning in secondary schools in Kenya. KajiadoCounty was used as a case.The survey targeted a total of fifty public secondary schools. The survey sought to answer the following questions.What ICT skills do teachers and learners have to help them integrate ICT in teaching and learning? How do teachers, school administrations and school managers perceive the integration of ICTs in teaching and learning? What ICT infrastructure do schools in KajiadoCounty have in order to integrate ICT in teaching and learning? How are schools intending to finance the process of integrating ICT in teaching and learning after the end of the government support to the ESP-ICT project? What technical support do schools of KajiadoCounty have for integration of ICT in teaching and learning?

1.9 Limitation of the study

The following werethe limitations of the study

- The researcher waslimited only to schools that have benefited from the ESP-ICT funds from the government in the financial year 2011/2012. These are the only schools in KajiadoCounty that have started integrating ICT in teaching and learning processes.

- Opinion of other stake holders such as parents and other sponsors of the schools were not captured because of the logistics of tracing them.

1.10 Significance of the study

The findings of this survey will have both theoretical and practical implication for the current government initiative of implementation of ICT integration in secondary schools in the country and in achieving the Vision 2030 objectives.

Theoretically, thissurvey is meant for the advancement of knowledge about ICT integration in secondary schools in Kenya. This surveyhas highlighted challenges in ICT integration in teaching and learning in secondary schools in Kenya.

Practically, thereport of the survey may lead to the improvement of the strategies of integrating ICT in teaching and learning of all subjects across all levels of education in Kenya. This is through the identification of strengths and weaknesses of the process of ICT integration in secondary school education after a careful address to the questions posed in this survey.

The results of this survey may help in formulating strategies of making students move from being passive recipients of knowledge into active participants of learning process; from passive reproducers of knowledge into producers of knowledge and collaborating with other learners either in the same or different school through the use of ICTs.

The result of the survey can also be of benefit to the Ministry of Education in formulating a strategy of ICT integration in schools. In a similar vein, results of this survey can be used to enlighten all stake holders on how to achieve the objectives highlighted in the National ICT Policy 2006 on education and e-learning.

Last but not least, thesurvey will forma base on which other researchers may develop their studies.

1.11 Summary

In this section the researcher outlined existing and anticipated problems in the integration of ICT in teaching and learning in secondary schools in KajiadoCounty. Out of the problems, the objectives of the study were stated. Research questions were also formulated. The researcher stated the assumptions, scope and limitations of the study. Lastly the significance of the study was outlined.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The purpose of this section is to highlight other works that have been carried out by other researchers in relation to ICT integration in education and/or other related topics. In this section the researcher tries to find gaps in ICT integration education process. The researcher will review literatures related to the followings:

- Teacher and learner computer literacy
- ICT infrastructure
- ICT policy
- ICT technical and financial support
- Perceptions of stake holders

2.2 Review on perception of stake holders

Stake holders'perceptions towards ICT integration in secondary school education is an important ingredient to its success. More significant is the perception of curriculum implementers, learners, school administrators and managers, towards ICT integration in teaching and learning at secondary schools. Musumba (2007) revealed that there was a positive association between management attitude and the integration of ICTs in the teaching and learning process. According to Asia and Pacific Regional Bureau for Education (UNESCO, Bangkok, 2004) the shift in pedagogy requires teachers to be equipped with a new set of skills, perceptions and knowledge to take on a pivotal role in learning environment. In the publication, there is further avowal that one's perception to ICT itself can both be a factor in its own right inhibiting ICT integration, and also contribute to other barriers. The publication further asserts that other teacher-level barriers towards ICT integration are perception that technology does not enhance learning, teachers' negative experience with ICT in the past, lack of ICT skills hence fear for being embarrassed in front of his/her learners, and long-standing pedagogical practices. Teachers' perceptions towards ICT integration in education may also be as a result of fear of technology changing their roles. Baines (1999) pointed out some factors that conspire to create anxiety in teachers, especially when faced with changes relating to new

technologies. According to Baines, teachers are aware that application of ICT solutions has led to unemployment in other professions. The author further points out teachers, too, fear being unemployed due to ICTs in teaching and learning. According to Weller (2003), there are those who are resistance to change. Weller points out that when changeis brought by technology, the technophobia will be a strong group in this resistance. What underlines much of this resistance is the fear about potential of technology to alter ones situation, status or even job.Omwenga (2003) agrees to this. According to him, the feeling of ICTs posing a threat to their professional roles and image makes teachers to be hesitant to integrate ICTs in teaching.

Kumar (2008) avers that managing change is one of the biggest problems, as teachers don't want to accept change easily. Kumar further asserts that change management issues must be addressed as new work practices and new ways of processing and performing task are introduced.
According Hawkridge (1985) ICT in education may put students in control and put teachers in new roles as technicians, selectors of courseware, individualizers of instruction, mangers, schedulers and advisers. Hawkridge further points out that educators feel some learners will gain computer literacy and take advantage of whatever becomes available to them through technology.

Perception towards ICT integration could be as a result of the ever-changing ICT in terms of hardware and software. Crawford (1997) points out that IT is unpredictable. He asserts further that it is very difficult to predict how IT will develop and this uncertainty makes planning by the school managers and administrators rather difficult.

School managements and administrations are not left out. Bork (1981) points out nine myths about computer in teaching. One the them is that computers are too expensive to use in teaching.
Technical and financial support on ICTs is another factor emanating from the school administrators and managers. As Jones (2004) points out, breakdown of computers causes interruptions and if there is lack of technical support, then it's likely that the regular repair of computers will not be carried out resulting in teachers not using computers in teaching. Becta (2004) agree that due to lack of technical support in schools, then it is likely that technical maintenance will not be carried out regularly, resulting to higher risks of technical breakdowns. This will result to teachers being discouraged from using ICT because of fear of equipment failure.

According to ICTs in Education Options Paper Draft (2006), school administrators, teaching staff and students should be provided with ICT integration awareness. According to the draft, Computer for Schools Kenya (CFSK) should undertake training of trainers and educational administrators. In this study, the researcher sought to find out whether such trainings took place and if they did, what impact they have on the perceptions of the teachers and school administrators and managers.

2.3 Review on teacher/learner ICT literacy

In the most recent past, ICT has become one of the basic building blocks of modern society. Everybody is now required to have basic knowledge of ICT tools ranging from the mobile phone, internet, computers, digital cameras, etc. in order to fit in the society. To be effective in the 21st century, citizens and workers must be able to exhibit a range of functional and critical thinking skills such as information literacy, media literacy and ICT literacy (Anderson, 2010). Teachers and learners are not an exception. As Kumar (2008) puts it, many countries now understand the importance of ICT and mastering basic skills and concepts of it as part of the core of education. According to Kumar, ICT integration in teaching and learning has four stages:

- Discovering ICT tools
    - Discovering of ICT tools by teachers and students. Linked with emerging approach in ICT development
- Learning how to use ICT tools
    - Learning of the use of the ICT tools
- Understanding how and when to use ICT tools to achieve a particular purpose
    - Ability to recognize when and where ICT will be most helpful
- Specializing in the use of ICT tools
    - Deep knowledge about ICT tools

Wai-Kong et al (2009 – 2010) summarized four broad stages of ICT adoption and use in education system from both developed and developing countries. According to them, the first stage is that of *emerging*. This is where teachers and students are discovering ICT tools and their general functions and uses. Here, according to Wai-Kong et al, emphasis is usually on ICT literacy and basic skills. The second stage, referred to as the *applying* stage, involves learning how to use ICT tools and beginning to make use of them in different disciplines. The third stage is the *infusion* stage where

teachers and learners understand how and when to use ICT tools to achieve a particular purpose. The fourth stage is when the learning situation is *transformed* through the use of ICT.Nangue (2011) further avers that in order to use ICT effectively for teaching, then teachers must possess basic ICT skills. Teachers' professional development has been identified as key factor in the successful integration of ICT in schools (Fluck, 2003). According to UNESCO, Bangkok (2004) an important incentive for teachers to upgrade their knowledge of and skills in ICT integration is formal certification of in-service professional development leading to a degree.

McFarlane (1997), had earlier pointed out that teachers who are uncomfortable with computers, and who fail to see how they can be used to enhance learning, simply do not use them. She further indicates that teachers must be given support they need, not just additional resources, but time and assistance to develop their own understanding and to apply this new knowledge to their planning and teaching. She also indicated that despite rapid expansion of technology, there are still large sections of the population who have remained personally unfamiliar with computers. She further asserts that due to this unfamiliarity, people have rather hazy view of the personal computer and the tasks of which it is capable.

Teachers are likely to resist introduction of ICTs into classroom for a variety of reasons (Omwenga, 2003). According to him one of the reasons is unfamiliarity with technology and the additional time and effort necessary for their effective use. This is also the case to students who are supposed to use ICTs in learning and searching of knowledge asMuthoni (2005) asserts. In her findings she points that for students to be able to use ICTs in learning process, they need to develop basic skills in the use of computers.

According to Bonnett (1997) some reasons put forward for limited diffusion of computers in teaching and learning in schools revolve around technical and practical problems such as ignorance of, and lack of confidence in, the use of ICTs, and unreliability of software and hardware in the crucial teaching moments. Earlier on, Blease and Cohen (1990) had pointed out that teachers should acquire better-than-average understanding of the uses and implications of information technology if we are looking to schools to ensure that future generations are computer literate, competent citizens of the 21st century society. Blease and Cohen further pointed out that people's efficiency in using the

new technology is very much enhanced by familiarity with its ways. They further noted that familiarity with the potential of the new technology leads us to newer, quicker and more efficient ways of doing things. This is particularly true in a classroom situation where things like simulations, power point preparations and presentations, and multimedia will be used. To drive the point home, Blease and Cohen indicated that UK raised the need of computer and ICT literacy of her population by enshrining it in the legislation of the 1988 Education Reform Act. So a question abounds: Should the government of Kenya do the same so that integration of ICT in education is smooth and easy for both teacher and student?

Kumar (2008) pointed out that lack of teachers equipped with ICT skills is a problem in ICT in education. He further indicated that institutions where ICT is going to be integrated in education, first of all their teachers must be well trained about ICT tools. He also indicated that large numbers of teachers in educational institutes are non ICT proficient, and resistance to change.

According to Sessional Paper No. 1 on Policy Framework for Education Training and Research (2004), the government appreciates and recognizes that an ICT literate workforce is the foundation on which Kenya can acquire status of knowledge economy. According to the paper, the government will make education the natural platform for equipping the nation with ICT skills in order to create a dynamic and sustainable economic growth. But questions abound: areteachers part of the workforce to be equipped with ICT skills in order for them to use the same in teaching? are students going to be equipped with ICT skills in order for them to use the same in learning and in the future? What are the impacts on ICT integration in education if teachers and students are not equipped with the ICT skills? These and other questions are what the researcher seeks to find in this study.

Pelgrum (2001) had earlier pointed out that most teachers consider the two main obstacles to using technology in pedagogical practices to be lack of resources and lack of training.

2.4 Literature review on ICT policy in schools

ICTs are not a panacea or cure-all of gaps in education provision (Wai-Kong et al). The right conditions need to be in place before the educational benefits of ICT can be fully harnessed, and a systematic approach is required when integrating ICT into education system. Such a systematic approach requires a plan or a policy for it to be plausible.

The Kenya ICT Policy (2006) aimed at improving the livelihoods of Kenyans by ensuring availability of accessible, efficient, reliable and affordable ICT services. The National Policy has several sections one of which set out objectives and strategies pertaining to ICT and Education. In this section, one of the objectives is "… the use of ICT in schools, colleges, universities and other educational institutions in the country so as to improve the quality of teaching and learning."The policy is not clear on the framework of integrating ICT in education.

ICT policy at school level is also an important ingredient to ICT integration in education. According to Maina (2005), ICT is not doing well in schools because of poor planning. Muthoni(2005)had a similar view to this and, further pointed out that school policy on ICT should consider the following:

- Appointing an ICT coordinator or head of ICT department in each school
- Having a school website
- Internet access policy
- Time table to be reorganized to allocate larger chunks of time to lessons to incorporate the use of ICTs in teaching and learning

Keiyoro (2010) further revealed that even when teachers had received some ICT training, not much time was allocated for the teacher to apply and implement the ICT skills.

Maina (2005) points out that the ICT coordinator should develop an ICT master plan to advise the school in technical and financial sustainability. But questions abound: do schools have ICT coordinators? If there really are ICT coordinators, do they have their roles clearly defined? These and other questions are what the researcher seeks to find in this study.

2.5 Literature review on ICT infrastructure

The lack of adequate ICT infrastructure has hampered provision of efficient and affordable ICT services in the country (Ministry of Information & Communication, 2006). According to Sessional Paper No. 1 on Policy Framework for Education Training and Research (2004), there are a number of challenges facing access and use of ICT in Kenya which include; high levels of poverty that hinder access to ICT facilities, limited rural electrification and frequent power disruptions. According to the paper, high cost of internet provision, costs associated with ICT equipment, inadequate infrastructure and support hinder the application of ICT in education.

Before any ICT-based program is launched, policy makers and planners must ensure the availability of appropriate rooms or buildings to house the technology, computers as well as affordable internet service for online learning, and availability of electricity and telephony (Kumar, 2008).According to Angwin (2012), the ambitious eLearning goals in Africa can only be achieved with classroom technology that is intrinsically sustainable. Angwin further asserts that ICT provision must take into account of the absence of reliable power supplies.

In this study the researcher will seek to find out whether schools have the required infrastructure to integrate ICT in teaching and learning.The researcher will also seek to find the reliability of the ICT infrastructure in secondary schools of KajiadoCounty.

When people think of sustainability of ICT, they think only of the infrastructure. However, according to Ferrao and Thompson (2012) expert and knowledge must also be sustainable.

Do schools in KajiadoCounty have technical and financial support for long term sustenance of ICT integration in education?

2.6. Review on other models

2.6.1 Program of Teacher Development model

Kumar (2008) came up with *Program of Teacher Development* model that identifies a series of four broad step that a school can follow in the adoption of ICT. These steps are: emerging, applying, infusing, transforming as shown in figure 2.1.

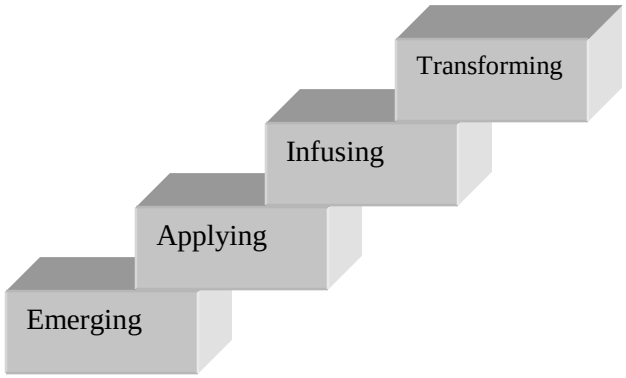

Fig 2.1: Program of teacher development by Kumar

a) Emerging

Schools take the initial step towards ICT development. Few computers and other ICT tools and infrastructure are put in place. Teachers and school administrators begin to acquaint themselves with the ICT and develop ICT literacy skills. This helps the teachers to feel comfortable and at ease with the ICTs

b) Applying

The ICT tools are applied in specific subject areas such as languages, sciences, mathematics, etc. according to this model, some of the competencies gained by teachers are:

i) ability to decide why, when , where and how ICT tools will contribute to teaching objective, and how to choose from among a range of ICT tools the most appropriate one to stimulate learning.

ii) Ability to assist students to search for learning materials from the internet and other sources specific to the subject area.

iii) Ability to decide when whole class or group multimedia presentations will be useful.

It is at this stage that most of schools management tasks such as processing of exams results, library and stores are done using computers.

c) Infusion

Teachers incorporate ICTs into all aspects of their teaching, subject preparations and management, in order to improve their own learning as well as that of their students. At this stage, ICTs enable teachers to become active and creative, able to stimulate and manage the learning of students, as they incorporate a range of preferred learning styles.

d) Transformation

The whole school system becomes transformed. Both teachers and students become aware of the basic philosophical issues about teaching and learning, about their roles as teachers or students and about the curriculum design. Teaching is transformed from teacher-centered to learner-centered. The teacher becomes a constructor other than an instructor. The learner is transformed from being a passive reproducer of knowledge to an active producer of knowledge and collaborator.

2.6.2 Idea and Product Technologies in Education model

This model was developed by Hooper and Rieber (1995). In this model, Product Technologies include hardware such as computers, televisions, CDs, radios, etc. Idea Technologies (figure 2.2) consists of the not-tangible forms that are usually supported by the Product Technologies.

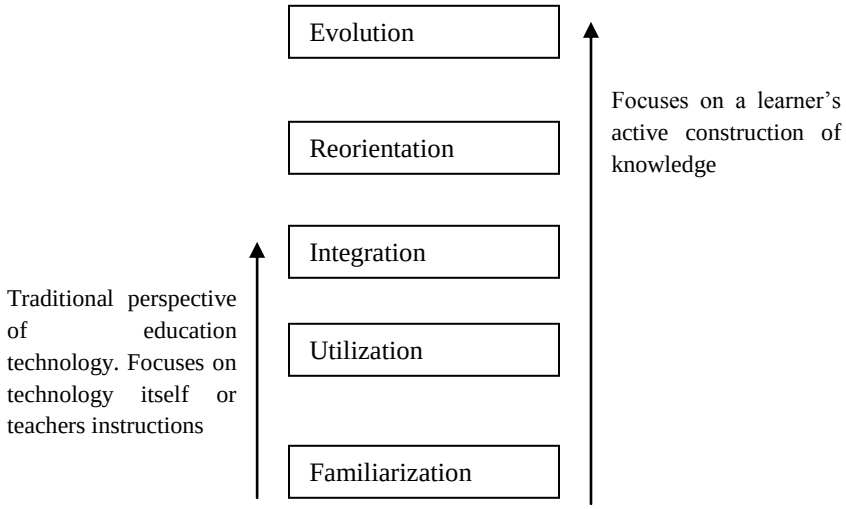

Figure 2.2: Idea and Product Technology model in education

a) Familiarization

This stage focuses on one's initial exposure to and experience with technology, e.g. a teacher in an in-service workshop learning how to use word processors, spreadsheets or presentation software

b) Utilization

This occurs when a teacher tries out technology or innovation in classroom.

c) Integration

This occurs when a teacher deliberately decides to designate certain tasks and responsibilities to technology. In this case, if technology is removed or is unavailable, the teacher will not be able to continue with teaching as planned.

d) Reorientation

It requires that teachers reconsider and re-conceptualize the purpose and function of the classroom. At this phase, the focus is now centered on the student's learning as opposed to teacher's instruction. Teacher's role changes from delivery of content to establishing a learning environment that supports and facilitates students as they construct and shape their knowledge using technology. The learner becomes the subject rather than object of learning.

e) Evolution

Serves as a reminder that the education system must continue to evolve and adopt so that it remains effective. The classroom learning environment should constantly change to meet the challenge and potential provided by new technologies.

2.6.3 Technology Acceptance Model (TAM)

According to Chatur, (2009), TAM is a theoretical model that was formulated by Fred Davis in 1986. It explains how users come to accept, adopt and use technology in their day-to-day activities. The model (figure 2.3) suggests that when users are presented with new technology, there are some factors that influence their decision on how or when they will use the technology. These factors include perceived usefulness (PU) and perceived ease of use (PEOU) of technology.

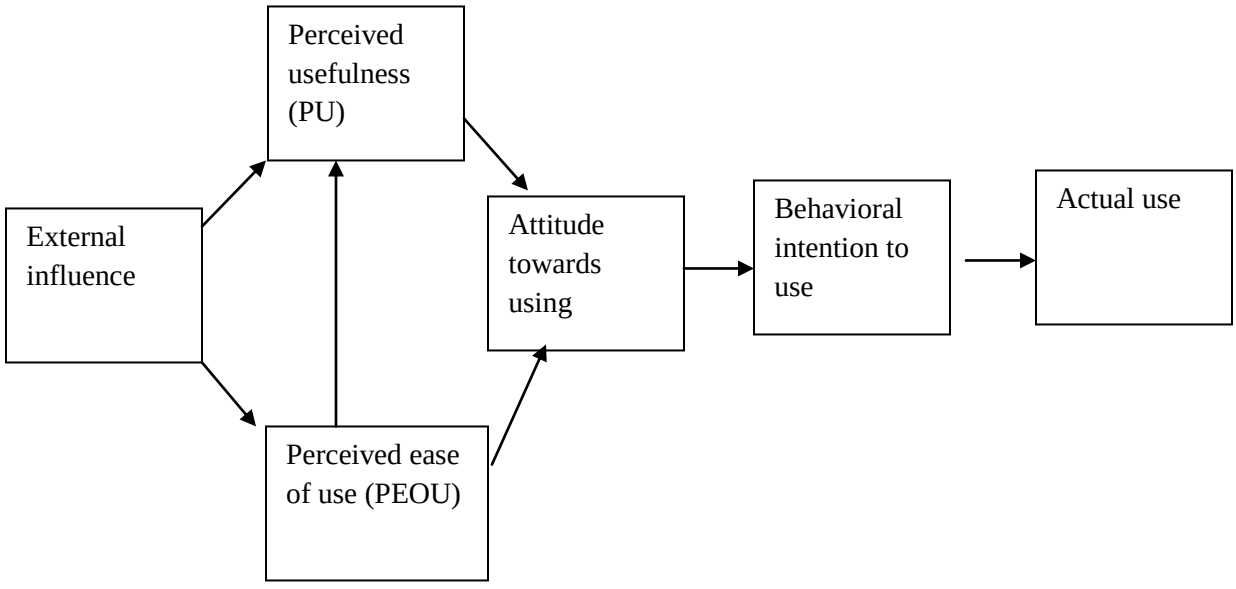

Fig 2.3: Original Technology Acceptance Model proposed by Fred Davis (1986)

TAM does not consider other factors such as technology skills and how they are acquired; technical support in the use of technology especially given that technology is continuously and quickly changing.

2.7 Conceptual framework

The purpose of the conceptual framework is to explain the interrelationships between variables (Orodho, 2005). According to Mugenda and Mugenda (2003), a conceptual framework shows graphical relationship between variables in the study.

Figure 2.4 shows the relationship between the independent dependent variables in this proposed study. In this framework, the independent variables are

- Teachers' and learners' ICT skills
- Perceptions of teachers, school administrators and school managers towards ICT integration
- ICT infrastructure
- Financial support
- Technical support

a) Infrastructure

This includes, and not limited to, availability of electricity, computer laboratory, school LAN and internet. Presence of ICT infrastructure can itself act as a motivator to teachers and learners acquiring ICT skills and using them in teaching. Its absence can discourage teachers and learners from acquiring ICT skills, or deter those who have the ICT skill from using them in teaching and learning. This means that presence of right infrastructure and in right quantity and time is mandatory for ICT integration in teaching and learning.

b) ICT skills of teachers and learners

The literature review has shown that infusion of ICT in teaching and learning involves four important steps: discovering of the ICT tools, learning how to use ICT tools, understanding how and when to use ICT tools and then specializing in the use of ICT tools in either teaching or learning. According to the conceptual model presented by the researcher, both the teacher and the learner must

go through the four steps in the order given. If a teacher, for example has limited skills on use of a particular ICT tool, such as a computer, then even if he/she has confidence in the use of a projector, he/she cannot be able to infuse technology in teaching.

c) Technical and financial support

Infrastructure might be in a school; teachers might have the ICT skills and willing to use them in teaching; but without technical support, ICT integration will slowly fizzle off due to failure of both hardware and software, or technical support on usage of the ICT tools. Teachers, as well as students, may not be technical savvy. They will need some sought of support for them to effectively use ICTs in teaching and learning.

d) Perception of teachers, school administrators, and managers towards ICT integration.

Teachers might have the necessary ICT skills. But wrong perception towards the use of ICTs in teaching might hamper his/her use of technology in teaching. So ICT skills must go together with the right perception and attitude. A teacher might be contented with the traditional way of teaching; he/she may perceive usage of ICT as a waste of time; a teacher might have ICT skills, and willing to use them in teaching, but the school administration has not laid down a policy on the usage of the ICTs in teaching, thus frustrating the teacher; the school administration may be willing to support the teachers in ICT integration in their classes, but the school management is not willing to release funds for ICT maintenance of ICT equipment and infrastructure. So if there is a broken link, then use of ICTs in teaching and learning will not be accomplished.

e) Change of attitude towards ICT integration and the infusion of ICTs in teaching and learning

Once there is the right infrastructure, teachers and learners have acquired the right ICT skills, then they will find it easy to use the skills in teaching and learning. Perception of ICTs in teaching and learning will be positive. Integration of ICTs will therefore take place.

From the framework depicted, for effective ICT integration in teaching and learning in secondary schools, the right infrastructure must exist. This will be determined by the goodwill of the school administrators who will approve funds for the infrastructure. Teachers and learners should, then,

have the ICT skills to use the infrastructure. The infrastructure, which consists of both hardware and software, will require continuous repair, upgrade and updates. These, entail the technical support, will need funds, which, again, calls for the goodwill of the school administrators. There are other variables such as school locality and its environment which constitute the moderating variables. Also there exist extraneous variables such as political interference.

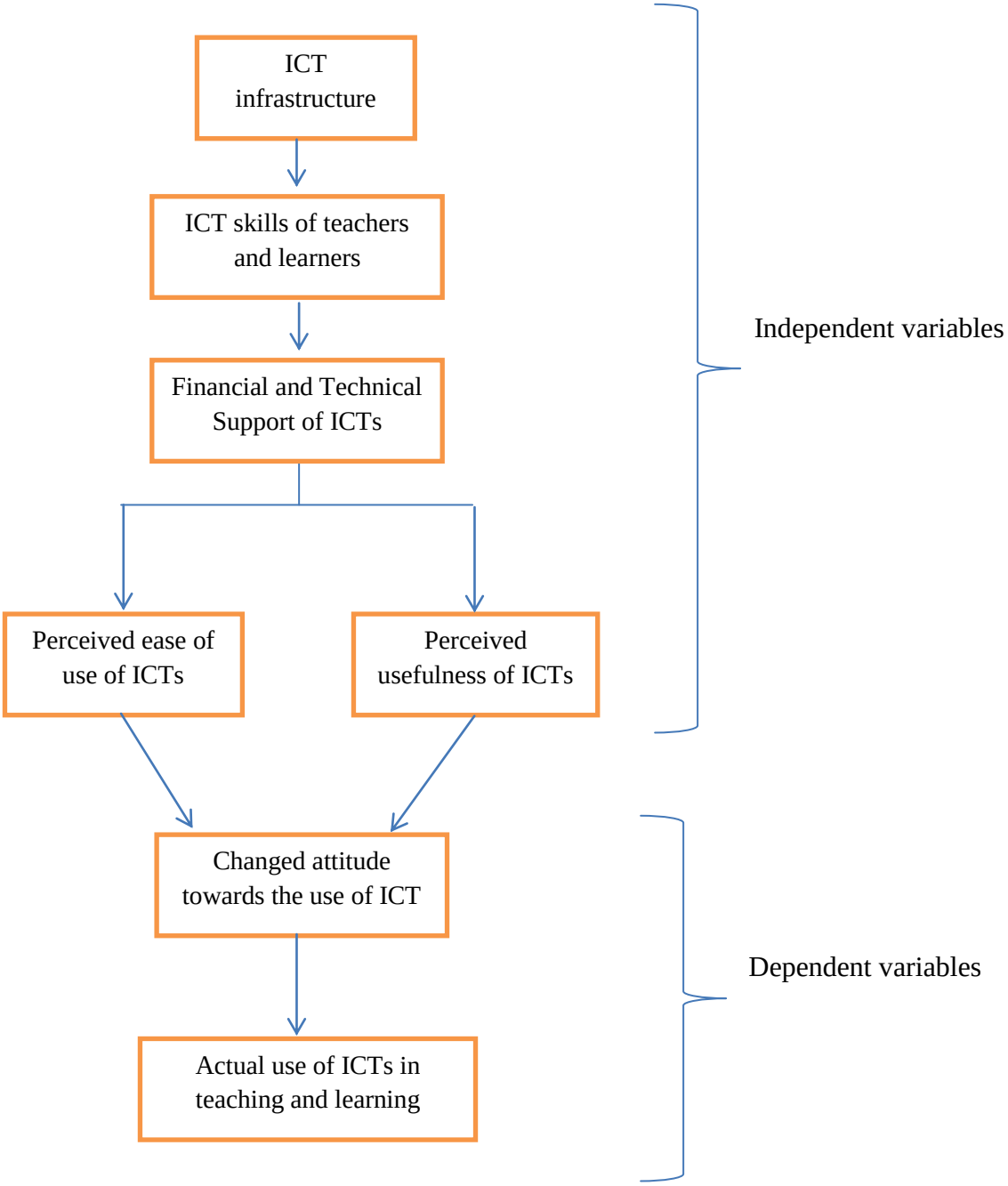

Fig. 2.4: Conceptual Framework: Determinants of effective ICT integration in secondary school teaching and learning

2.8 Summary of the literature review

The literature review has shown that there are gaps in the implementation process of ICT integration in secondary schools. Most of the studies reviewed were undertaken in countries that are developed or that started integrating ICT in their education much earlier than Kenya. Until the year 2010, ICT integration in education was only a policy on paper. By 2010 the ministry embarked on a pilot program of integrating ICT in secondary school education in five schools in every 210 constituencies that existed by then. The researcher, therefore, embarks on finding out whether there are challenges in integrating ICT in Kenyan secondary schools, particularly in KajiadoCounty.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The main purpose of this section is to discuss the research design, the locale of the study, the targeted population, and the sampling strategies which were employed in selecting the sample, the research instruments that were used, methods of data collection and the techniques used in analyzing the collected data.

3.2 Research design

This study adopted descriptive survey to educe information on challenges in integrating ICT in teaching and learning in secondary schools of KajiadoCounty. According to Saunders et al (2009), descriptive survey is that whose purpose is to produce an accurate representation of persons, events or situations. Survey research seeks to obtain information that describes existing phenomena by asking individuals about theirperceptions, behavior or values (Mugenda and Mugenda, 2003).

3.3 Locale of the study

This survey, whose main objective was to investigate challenges in integrating ICT in teaching and learning in secondary schools of KajiadoCounty,then develop a framework for integrating ICT in teaching and learning,was carried out in fifteen public secondary schools of KajiadoCounty. KajiadoCounty is divided into three zones: Kajiado North, Kajiado South and Kajiado Central. The approximate population of students is 6000 while that of teachers is 200. Kajiado Country is bordered by NakuruCounty to the north, NarokCounty to the west and Machakos and Nairobi counties to the east.

3.4 Targeted population

Population, as Saunders et al (2009) puts it, is the full set of cases from which a sample is taken. A targeted population is that population which the researcher wants to generalize the results of a study (Mugenda and Mugenda, 2003).The survey, which sought to bring forth challenges in integrating

ICT in secondary schools' education,was carried out in Kajiado County, Kenya. According to the records at the Kajiado County Education Office, there are a total of 50 public secondary schools in the county. The study, therefore, targeted a population of fifty public secondary schools.

3.5 Sample

In this survey, purposive sampling was used since it enables one to use his/her judgment to select cases that will best enable one to answer their research question(s) and to meet one's objectives (Saunders et al 2009). In purposive sampling, subjects are chosen according to a certain specified criteria (Orodho, 2005). According to Mugenda and Mugenda (2003), purposive sampling allows a researcher to use cases that have the required information with respect to the objectives of his or her study. Therefore, the sample of schools in this study is that of schools that benefited from the GoK's funds on ESP-ICT Integration in secondary school education. In KajiadoCounty, where this surveywas conducted, the number of schools that benefited from GoK's funds on ESP-ICT Integration in secondary school education is fifteen.These schools are 28% of the targeted population. 20 to 50% of the target population is enough for descriptive survey (Mugenda and Mugenda, 2003).These schools are scattered in the three main zones of KajiadoCounty as follow:

- Five schools in Kajiado North district,
- Five schools in Kajiado Central,
- Five schools in Kajiado South.

This implies that 15 H.T.s, 15 ICT coordinators,80 subject teachers and 160students participated in this study that was aimed at eliciting challenges in integrating ICT in teaching and learning in secondary schools of KajiadoCounty.

3.6 Research instruments

The researcher usedquestionnaires and observation schedules to educe challenges in integrating ICT in teaching and learning in secondary schools of KajiadoCounty. Table 3.5 summarizes how the research instruments were distributed.

Respondent	By mode of	
	Questionnaire	**Observation schedule**
H.T	15	-
ICT Coordinator	15	-
Subject teacher	80	-
Student	160	-
Schools		15

Table 3.5: distribution of the research instrument

3.6.1 A questionnaire for the H.T.

It was divided into two parts. First part consisted of personal information of the H.T. such as gender, age, teaching experience, academic attainments and professional qualifications of the respondent. The second part sought information about the respondent's opinions, comments and explanation on ICT integration in teaching and learning in their school. It is important to note that the H.T. represents the school and therefore it was in this part that the researcher extracted information of the contribution made by other stake holders such as the B.O.G., P.T.A. donors etc. The questionnaire also sought information on technical and financial support on ICT integration in teaching and learning in the respective schools.

3.6.2 Questionnaire for the ICT Coordinator

First part of the questionnaire gathered information on respondent's age, gender, teaching experience and academic/professional attainments and qualifications. Part two of the questionnaire brought forth information on adequacy and reliability of ICT infrastructure in the school, general organization of ICT usage in the school, technical and financial support on ICT integration in education of the school and the ICT policy of the school. The questionnaire further, elicited information on the frequency of usage of ICT by other teachers in teaching. The questionnaire sought information on challenges the ICT coordinator observes on teachers and learners in integrating ICT in teaching and learning.

3.6.3 Questionnaire for the subject teachers

The questionnaire was in two parts. First part was on personal information such as gender, age bracket, teaching subjects and period in the teaching profession. Second part of the questionnaire educe information on ICT training and competencies of the teacher, problems encountered when using ICT tools with student or in teaching, any value added to the teaching when using ICT/digital content and the support offered by the school management and administration to the teacher when using ICT tools in teaching.

3.6.4 Questionnaire for the student

Part one of the questionnaire was on personal information of the respondent such as age bracket, gender, class. Part two sought information on ICT competencies of the learner, and their ability to use ICT tools to learn and search for information. This part also elicited information on the usage of ICTs by their teachers in teaching scenario.

3.6.5 Observation schedule

The observation schedule assisted the researcher to gather information that was not captured in the questionnaires and also to counter check the response given by respondents in the questionnaires. In the observation schedule the following was observed:

- Physical ICT infrastructure
- Availability of internet and upload/download speeds
- Availability of electricity
- Storage of ICT tools such as projectors, laptops, speakers, cameras printers and printing material.
- School ICT policy
- ICT integrated lesson plans and lesson notes
- Any other relevant observation

3.7 Piloting of the research instrument

Piloting of the questionnaire was done to a selected sample, which was identical to the actual sample. Mugenda and Mugenda (2003) suggest that piloting should be done with a sample of between 1% and 10% depending to the sample size. Sampling is important for the following reasons

i) Deficiencies in the piloting will be detected (Orodho, 2005).
ii) Vague questions will be revealed in the sense that the respondents will interpret them differently. The researcher will then rephrase the questions (Mugenda and Mugenda, 2003).
iii) The researcher will discover which questions the respondents felt uneasy about answering (Saunders et al, 2009).
iv) It reveals the appropriateness of the techniques used.

3.8 Reliability of measurement

Reliability refers to the extent to which data collection techniques or analysis procedures will yield consistent findings (Saunders et al, 2009). It is the degree which a test consistently measures whatever it measures (Gay, 1992). The reliability of the study was used to focus on the degree to which empirical indicators of theoretical concept are stable or consistent across two or more attempts to measure the theoretical concepts. The researcher used the test-retest reliability. It conducted as follow:

- The developed questionnaire was given to a few identical subjects for study. These subjects were not part of the sample**.**
- the answered questionnaire responses were scored manually
- After a week, the same questionnaires were administered to the same group of subject.
- A comparison between the first and the second was made.

The Spearman rank order was used to calculate the correlation coefficient so as to establish the extent to which the contents of the questionnaire were consistent in eliciting the same response every time the instrumentwas used. A correlation coefficient of 0.7 was considered high enough to judge the reliability of the instrument. The formula used was

$$\rho = \frac{1-6\sum di}{n(n\,x\,n-1)}$$

where ρ = correlation coefficient between rank orders

d_i = difference between rankings and n = number of pairs of ranking

3.9 Validity

Validity is the degree to which a test measures what is supposed to measure (Gay, 1976). According to Orodho (2005), validity refers to the degree to which the sample of the test represents the content that the test is designed to measure. Validity establishes whether the questionnaire content is measuring what they are supposed to measure. It also measures the degree to which data obtained from an instrument meaningfully and accurately reflects or represents a theoretical idea. In this study, validity was established by seeking opinion of experts in the field being studied. One of the experts was the supervisor of the researcher. The opinion of the experts and the results of the pilot study facilitated any necessary modifications of the questionnaires hence improving their validity.

3.10 Data collection

The researcher collected data by use of questionnaires and observation schedules. Questionnaires were prepared for subject teachers for each subject, ICT coordinator in each of the sample schools and head teacher for each of the sample schools. In every school, one teacher for each of the subjects taught filled a questionnaire. The subjects were Mathematics, English, Kiswahili, Biology, Chemistry, Physics, History, Geography, C.R.E., Business Education and Agriculture. Data collected using questionnaires was both quantitative and qualitative. Data was also collected using an observation schedule prepared for each of the participating schools.The researcher set aside two weeks to visit schools sampled for this research.

3.11 Data analysis

Data analysis is the process of breaking down data and to clarify the nature of the component parts and the relationship between them (Saunders et al, 2009).Where questionnaires were used, both qualitative and quantitative approaches of analyzing data were employed. According to Mugenda and Mugenda (2003), to permit quantitative analysis, data must be converted to numerical codes representing attributes or measurements of variables.Mugenda and Mugenda also assert that open ended questions may lead to qualitative data which may require qualitative analysis. So to allow for quantitative analysis, the researcher converted the data to numerical codes representing measurements of variables.

Where observation schedules were used, quantitative approach was employed. Qualitative data was analyzed through discussion. Mostly the qualitative data was through observations made by the researcher in the sample schools. Findings and data analysis were made by the researcher using descriptive statistics. The researcher then drew tables and graphs to show different categories of information of the research and different responses from the respondents involved in the study.

3.12 Operationalization of variables

Table 3.6: Manifestation of variables in the study

Objective	Independent Variable	Indicators	Measurement(s)	Scale	Data collection instrument	Data analysis
To investigate if teachers and learners in secondary schools of KajiadoCounty have the necessary ICT skills for them to use ICT tools in teaching and learning.	ICT skills	Ability to use ICTs in teaching and learning	• Number of teachers who are able to use ICTs in teaching and learning • Number of ICT lessons prepared by a teacher since the last training • Number of powerpoint notes prepared by the teacher • Number of schemes of work prepared using an application software • Number of lesson plans prepared using an application	Nominal Ratio	Questionnaires Observation schedule	Descriptive and inferential statistics

			software			
To investigate perceptions of school administrators, managers and teachers towards ICT integration in teaching and learning in secondary schools ofKajiadoCounty.	Perceptions of school managers and administrators	Support by school administration of ICT integration in teaching and learning	Number of school administrators, managers and teachers that support or not support ICT integration.	Nominal	Questionnaire	Descriptive and inferential statistics
To investigate theICT infrastructure available for integrating ICT in teaching and learning in secondary schools of KajiadoCounty.	Infrastructure available	• Digital content • Internet • Computer lab • Number of computer • Digital cameras • Televisions • Radios • Electricity	▪ Availability to the teacher ▪ Quality ▪ Reliability	Ordinal Nominal	Questionnaire Observation schedule	Descriptive and inferential statistics
To investigate the financial	Financial	Budget for ICT	▪ Availability	Nominal	Questionnaire for	Descriptive and

supportof ICT integration in teaching and learning in secondary schools ofKajiadoCounty.	support available	integration	▪ Amount of annual budget		ICT designate teacher	referential statistics
To investigate the technical support available in ICT integration in teaching and learning in secondary schools of KajiadoCounty.	Technical support	Presence of technical staff Servicing of ICT tools utility software	• Frequency of servicing ICT tools • Working of the ICT tools • Frequency of computer virus scan	Nominal Ratio	Observation schedule Questionnaire	Descriptive and inferential statistics

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

In this chapter the findings of the survey are presented. The main objective of the survey was to investigate challenges in integrating ICT in teaching and learning in secondary schools of KajiadoCounty.Collecteddata was analyzed using descriptive and inferential statistics, i.e. percentages, frequencies and correlations. Each analysis was followed by an interpretation and then by a discussion.

After collecting the data, a codebook was prepared for both qualitative and quantitative data. The codes were then keyed in and analysis done using SPSS (version 16) software, and, to some extent,Ms Excel 2010. All responses from the questionnaires and the observation schedule that were open-ended were treated as qualitative data.

4.2 QuantitativeData Analysis

4.2.1 ICT skills of teachers and learners

What ICT skills do teachers and learners of KajiadoCounty have for them to be able to use ICTs in teaching and learning? To answer this question,the researcher sought to educe the ICT skills from the teachers and learners separately.

4.2.1.1 Response from the teachers

Teachers were asked if they had done any ICT course.73.1% of the respondents indicated to have done ICT courses while 26.9% indicated not to have done any ICT courses as shown in table 4.1.

Percentage of teachers who have done ICT course(s)

	Percentage	Cumulative Percentage
Teachers who have done ICT courses	73.1	73.1
Teachers who have not done any ICT courses	26.9	100.0
Total	100.0	

Table 4.1

Of those who indicated to have at least done some ICT courses, 89.5% have actually done a certificate course while only 10.5% had done a diploma course in computing. This is depicted in figure 4.1

Percentage of teachers who have done diploma or certificate courses in computing

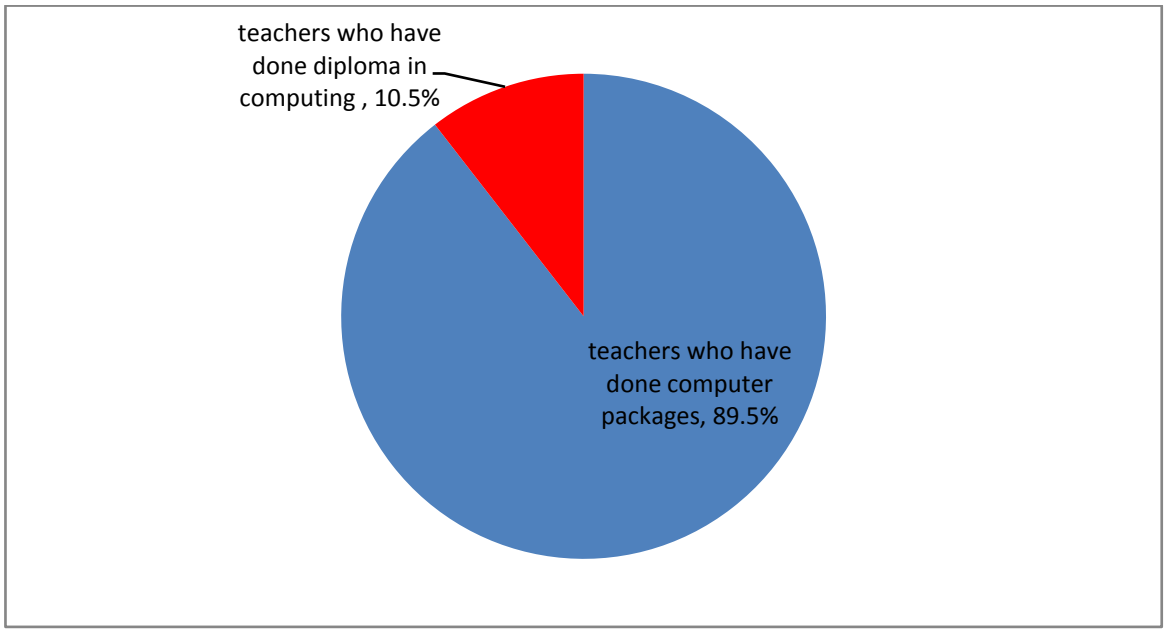

Fig 4.1:

Of interest to note is the duration of the ICT courses done. The mode falls on 1 week (figure 4.2). This means that in one week the respondent had completed studying computer packages. This time is not sufficient enough for one to have done a serious course on computer packages.

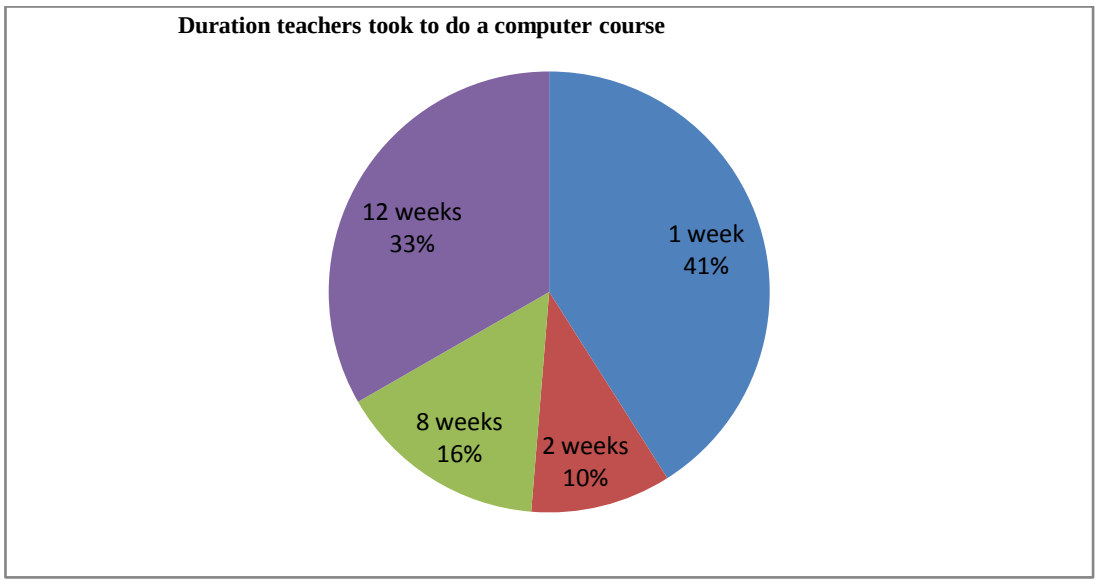

Fig 4.2:

The researcher went ahead and asked respondents to indicate how confident they were in using some ICT tools and software. Figure 4.3 summarizes the response. 75% of the respondents indicated that they could not use computer application packages confidently without assistance. Application packages are a major tool in ICT integration in teaching; schemes of work, lesson plans and lesson notes are made using application packages such as word processors and power point presentations. Students result analyses are done using spreadsheets. In any ICT integrated lesson, an LCD projector is a must. 59.6% of the respondents indicated that they could not use the tool confidently without assistance. Scanners and video cameras are other tools which a teacher may be required to use in an ICT integrated lesson. But from the chart, it is clear that majority of the respondents have a challenge in using these tools.

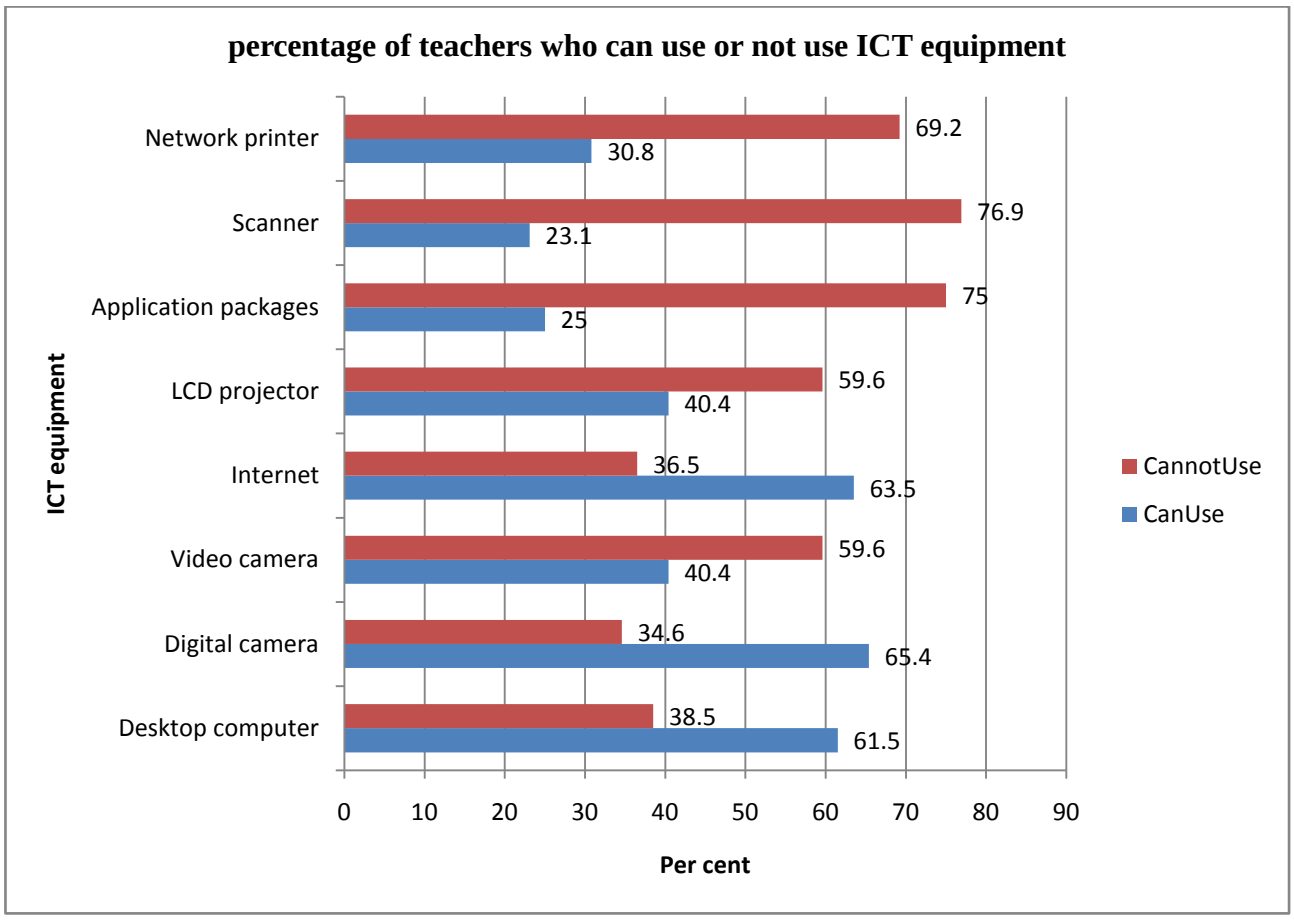

Fig 4.3

Crosstabs were also used to compare the usage of ICT tools and the level of computer literacy attained by the teachers in terms of those who have done a diploma in computing and those who have just done computer packages. Table 4.2 shows the results of the cross tabulation.

Comparison of abilities of using ICT tools with the level of ICT literacy of a teacher

			What ICT Courses you did?	
			Percentage of teachers who have done Computer packages	Percentage of teachers who have done a Diploma in computing
Can you use a desktop without assistance?	I can use it confidently without assistance	% within what ICT Courses you did?	64.7%	100.0%
	I have no confidence in using it	% within what ICT Courses you did?	35.3%	0.0%
Can you use a digital camera without assistance	I can use it confidently without assistance	% within what ICT Courses you did?	79.4%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	20.6%	0.0%
Can you use a video camera without assistance?	I can use the tool confidently without assistance	% within what ICT Courses you did?	44.1%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	55.9%	0.0%
Can you use internet search engine without assistance?	I can use the tool confidently without any assistance	% within what ICT Courses you did?	76.5%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	23.5%	0.0%
can you use LCD projector without assistance	I can use the tool confidently without assistance	% within what ICT Courses you did?	38.2%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	61.8%	0.0%
Ability to use computer application packages without assistance	I can use the tool confidently without assistance	% within what ICT Courses you did?	20.6%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	79.4%	0.0%
Can you use scanner without assistance?	I can use the tool confidently without assistance	% within what ICT Courses you did?	20.6%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	79.4%	0.0%
Can you use network printer without assistance?	I can use the tool confidently without assistance	% within what ICT Courses you did?	26.5%	100.0%
	I have no confidence in using the tool	% within what ICT Courses you did?	73.5%	0.0%

Table 4.2:

From the table, it is clear that teachers who have high qualifications in computing are more confident in using ICT tools in teaching than those who have low qualifications.

The researcher furtherused crosstabs to compare the gender of the teacher and the abilities to use ICT tools in teaching. Table 4.3 has the results of the analysis.

Comparison of ability to use ICT tools with the gender of the teacher

			Gender	
			Male	Female
Can you use a desktop without assistance?	I can use it confidently without assistance	% within what is your gender	66.7%	58.8%
	I have no confidence in using it	% within what is your gender	33.3%	41.2%
Can you use a digital camera without assistance	I can use it confidently without assistance	% within what is your gender	77.8%	58.8%
	I have no confidence in using the tool	% within what is your gender	22.2%	41.2%
Can you usevideo camera without assistance?	I can use the tool confidently	% within what is your gender	61.1%	29.4%
	I have no confidence in using the tool	% within what is your gender	38.9%	70.6%
Can you use internet search engine without assistance?	I can use the tool confidently	% within what is your gender	83.3%	52.9%
	I have no confidence in using the tool	% within what is your gender	16.7%	47.1%
can you use LCD projector confidently	I can use the tool confidently	% within what is your gender	61.1%	29.4%
	I have no confidence in using the tool	% within what is your gender	38.9%	70.6%
Can you use computer packages	I can use the tool confidently	% within what is your gender	50.0%	11.8%
	I have no confidence in using the tool	% within what is your gender	50.0%	88.2%
Can you use a scanner without assistance?	I can use the tool confidently	% within what is your gender	44.4%	11.8%
	I have no confidence in using the tool	% within what is your gender	55.6%	88.2%
Can you use printer without assistance?	I can use the tool confidently	% within what is your gender	55.6%	17.6%
	I have no confidence in using the tool	% within what is your gender	44.4%	82.4%

Table 4.3:

From the table, it is clearly seen that more female teachers than male teachers have a challenge in using ICT tools in teaching. The percentage of male teachers who indicated that they have confidence in using any particular ICT tool is higher than that of their female counterparts.

4.2.1.2 Response from students

The researcher sought to know the ICT levels of learners by asking them on the confidence of using computers to do some tasks. Chart 4.4 shows the response of the students.

Figure 4.4 is a summary of the response from the students.

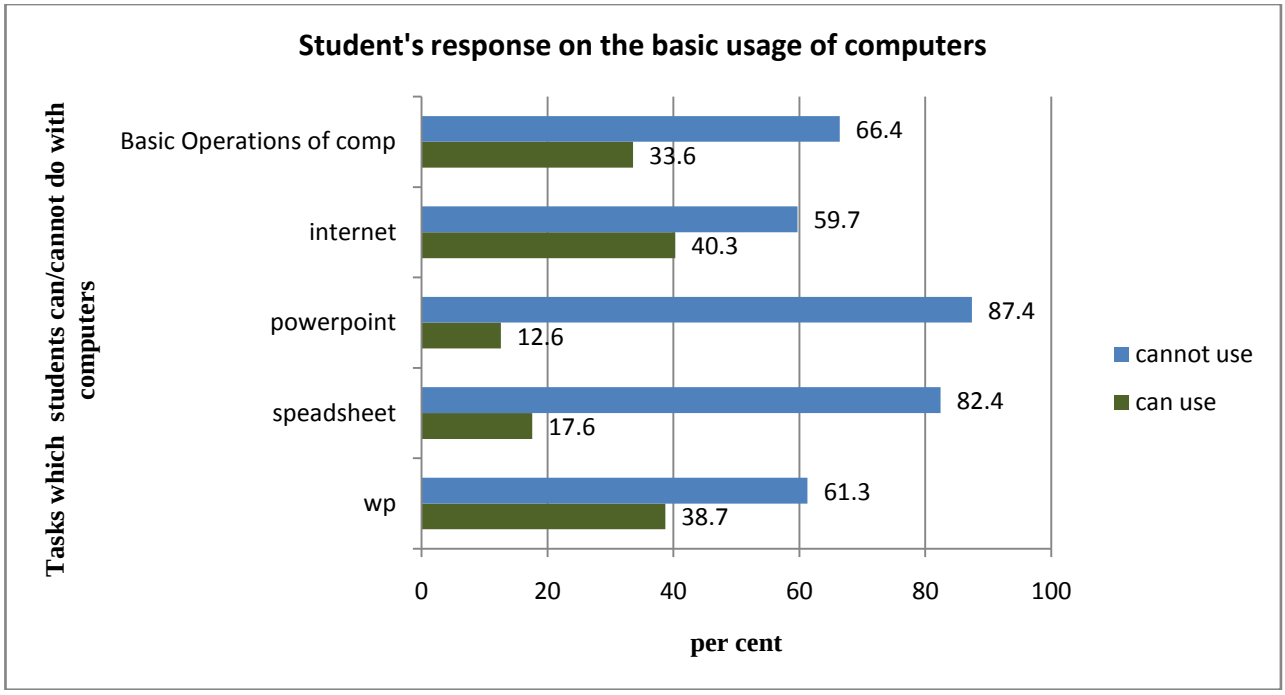

Fig 4.4

Majority of students cannot use application software or do basic computer operations such us switching off the computer, logging off, etc. But it is interesting to note that their ability to use computers is mostly on the internet usage (at 40.3%). This fact is proved to hold water by looking at the response to the question on what they use internet to do. Table 4.4 indicates that only 43.8% of students, who are allowed internet sessions in their schools, would use that internet session to download learning materials. 56.2% would use internet sessions on social sites like facebook and twitter.

How students use the internet session

	Percentage
Downloading learning material	43.8
On social sites	56.2
Total	100.0

Table4.4:

The researcher sought to know from the head teachers the type of schools they were heading in terms of whether the school is national, district or community sponsored. Table 4.5 shows the results.

Status of the schools (%)

	Percentage
National schools	18.2
District schools	45.5
Community sponsored schools	36.4
Total	100.0

Table 4.5:

From the table, 18.1% of the schools have a national status, 45.5% have district status while 36.4% are community sponsored.

The researcher sought to know from the headteachers whether students from their schools were computer literate or not. These schools were categorized as National, District or Community sponsored. The analysis was done using crosstabs in order to compare the ICT literacy of students with the status of the school. Table 4.6 below shows the results.

Comparing status of school with ICT levels of students

			most students in the school do not have ICT skills to use computers on their own			
			strongly agree	agree	disagree	strongly disagree
Status of the school	National	% within status of the school?	0.0%	0.0%	100.0%	0.0%
	District	% within status of the school?	20.0%	60.0%	.0%	20.0%
	Community sponsored	% within status of the school?	75.0%	0.0%	25.0%	0.0%

Table 4.6:

From the table, 100% of head teachers from national schools in the county disagreed that most of the students in their schools are computer illiterate, while 80% of head teachers from district schools indicated that most students in their schools are ICT illiterate. 75% of head teachers from community sponsored schools strongly agreed that their students are computer illiterate. From the observation schedule, it was noted that Computer Studies was taught in national schools as a separate subject. This could have been a contributing factor in the high level of ICT literacy in these national schools.

4.2.2 Perception of school administrators, managers and teachers towards ICT integration in teaching and learning

4.2.2.1 Teachers' perception towards ICTs in teaching and learning

One indicator of the teachers' perception towards ICT integration in teaching and learning is on the number of lessons they will use ICTs in teaching. From the teacher's questionnaire, 73% of teachers never use ICTs in their teaching (figure 4.5). Only 17% integrate ICTs in their teaching once in a week, 4% of the respondent teachers use ICTs twice per week, while 4% of the respondents use ICTs once in a month to teach.

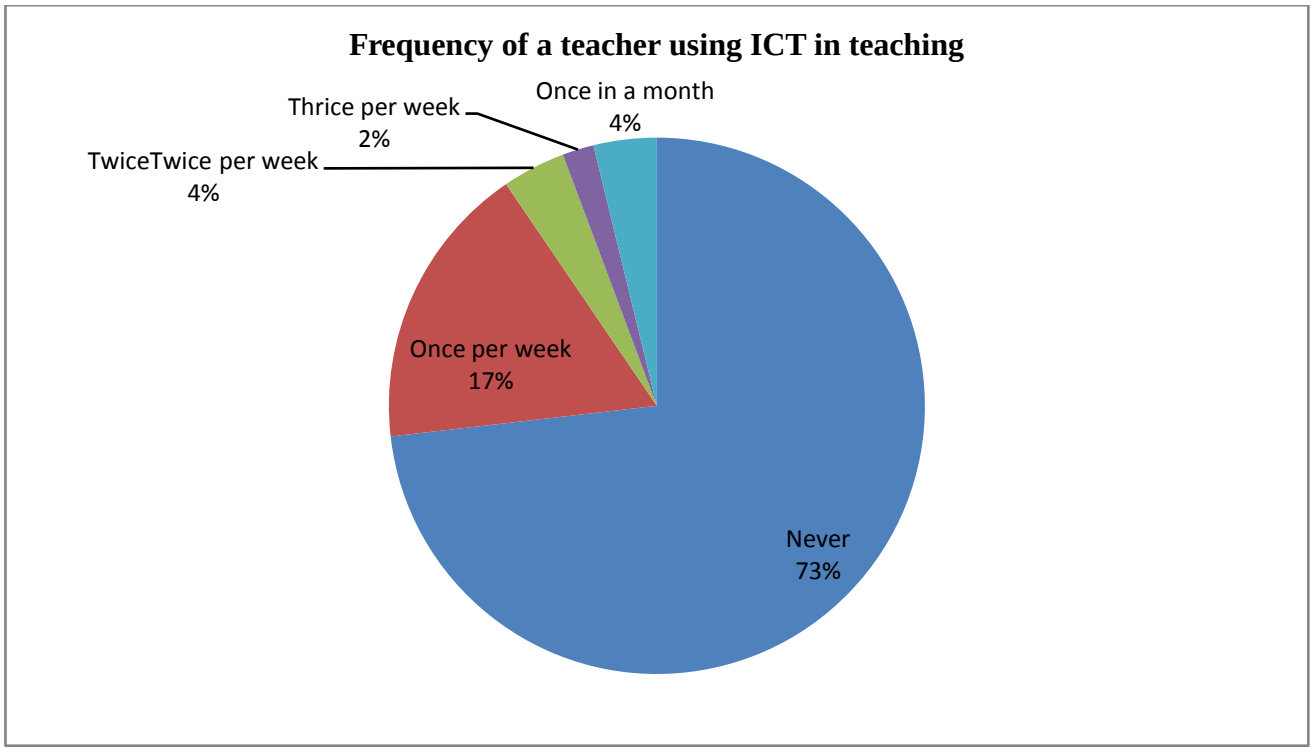

Fig 4.5

The researcher, also, sought to know reasons for a teacher not integrating ICTs as many times as they would wish in their teaching.Figure 4.6 shows the results. Of interest from the chart are the reasons that usage of ICTs is a waste of time (2%); lack of confidence in ICT usage (10%); high teaching workload (15%);wide syllabus at 6%;belief that they can achieve teaching objectives without ICTs, (17%). These five reasons are onperception of the teachers. Cumulatively, 50% of the respondent teachers do not use ICTs in their teaching for reasons based on perceptionand perception of their abilities.

Reasons for teachers not using ICTs in teaching

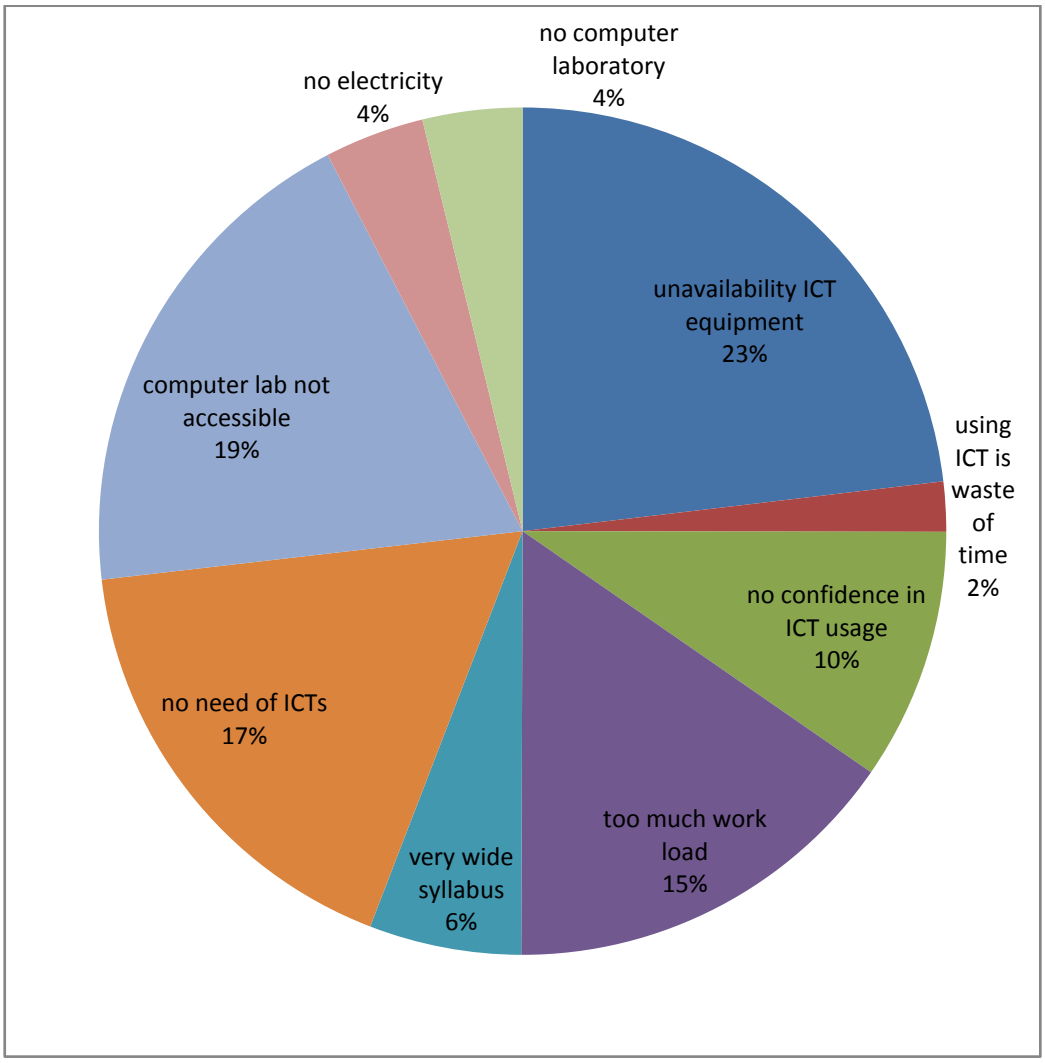

Fig 4.6:

The researcher also compared how gender affects perceptive reasons for not integrating ICT in class. Cross tabulation was done and result shown in table 4.7

Inhibitors of integrating ICT in class

			what is your gender	
			Male	Female
What inhibits you from using ICTs in teaching	Unavailability of apparatus in computer lab	% within what is your gender	22.2%	23.5%
	Using ICTs is a waste of time	% within what is your gender	0.0%	2.9%
	I have no confidence in using ICT equipment	% within what is your gender	11.1%	8.8%
	My work load cannot allow me to use ICTs as many times	% within what is your gender	11.1%	17.6%
	The syllabus is too wide to incorporate ICTs in teaching	% within what is your gender	5.6%	5.9%
	I can still achieve my teaching objectives without ICTs	% within what is your gender	16.7%	17.6%
	Lack of accessibility of Comp Lab	% within what is your gender	27.8%	14.7%
	No electricity	% within what is your gender	0.0%	5.9%
	No comp lab	% within what is your gender	5.6%	2.9%

Table 4.7:

From table 4.7, perceptive inhibitors include using ICTs is a waste of time, lack of confidence in using the ICTs, syllabus being too wide, imagining one can achieve the teaching objectives without ICTs. While 0.0% of the male teachers indicated that ICTs usage is a waste of time, 2.9% of female teachers thought ICTs waste time in class. 17.6% of female compared to 11.1% of male teachers indicated that their teaching workload cannot allow them to use ICTs as many times as they would

wish. 5.9% of female teachers compared to 5.6% of male teachers indicated that they cannot use ICTs in class more frequently because the syllabus is too wide.17.6% of female teachers compared to 16.7% of male teachers indicated that they can still achieve their teaching objectives without ICTs. The results show that more female than male teachers fail to use ICTs in their teaching due to perceptive reasons.

4.2.2.2 Administrators' perception towards ICTs in teaching and learning

For teachers and learners to use ICTs in teaching and learning processes, ICT tools must be at their disposal. Other than the tools, infrastructure must be conducive for the use of the ICT tools. School administrators, i.e. the Head teachers, can either encourage or discourage teachers and learners to or from using ICT tools. Referring to figure 4.6, 23% of teachers are not able to have ICT integrated lessons as many times as they would wish in a week because of unavailability of ICT equipment in the computer lab. 19% indicated that they are not able access the computer laboratory because it is under lock and key from the school head teacher. A total of 42% of the reasons for teachers not using ICTs in teaching are induced by the school administration. These results show most head teachers would prefer to control the usage of ICT equipment and infrastructure in their school, and as it is seen, it is affecting the process of ICT integration in teaching and learning.

The researcher, also, sought from the teachers whether all ICT apparatus for teaching and learningare kept in the computer laboratory, and if not kept in the computer laboratory, then they were to indicate where the apparatus are. Table 4.8 shows the responses. 40.4% of the respondents indicated that in their schools, all ICT apparatus for teaching and learning are kept in the computer laboratory while 59.6% indicated that in their schools, not all ICT apparatus for teaching and learning are kept in the computer laboratory.

Whether all ICT apparatus are kept in the lab

	Percentage
All ICT apparatus are kept in the computer lab	40.4
Not all ICT apparatus are kept in the computer lab	59.6
Total	100.0

Table 4.8:

Table 4.9 shows the respondents indication of where the apparatus that were not available in the computer laboratory were kept. 92.9% of the respondents said that some apparatus are kept in the head teachers' offices while 7.1% of the respondents did not know where such apparatus no in the computer laboratory are kept.

Where some of the ICT apparatus kept

	Percentage
Principal's office	92.9
I do not know	7.1
Total	100.0

Table 4.9:

Pearson's product moment correlation coefficient was used to show if there was any correlation between keeping some ICT equipment in the head teacher's office and the number of ICT integrated lessons by teachers in a week. The output was a correlation matrix shown in table 4.10. The table shows that there is a statistically week negative correlation coefficient for the association between the two variables.

Correlation between frequency of using ICTs in teaching and keeping some ICT equipment in the head-teacher's office

		Frequency of using ICT in teaching (per week)	Keeping some ICTs in principal's office
Frequency of using ICT in teaching (per week)	Pearson Correlation	1	-0.094
Keeping some ICTs in principal's office	Pearson Correlation	-0.094	1

4.10:

Although the correlation is weak, it cannot be ignored. The more head-teachers keep some apparatus in their offices, the less the teachers will have ICT integrated lessons.

Another indicator the researcher used to investigate the perception of the school administrators is the presence of an ICT policy in their schools. The researcher asked the head teachers whether they had an ICT policy. The response was as shown in table 4.11.

Availability of an ICT policy in schools

	Percentage
Presence of ICT Policy in the school	18.2
No ICT policy in the school	81.8
Total	100.0

Table 4.11:

Table 4.11 shows that only 18.2% of the head teachers said their schools had an ICT policy. 81.8% said their schools do not have an ICT policy. The researcher further sought to know why the schools did not have an ICT policy. Table 4.12 shows the responses

Reasons for not having an ICT policy in schools

	Percentage
Head teachers who thought it's difficult to make an ICT policy	22.2
Head teachers who have never thought of making an ICT policy	77.8
Total	100.0

Table 4.12:

From table 4.12, it can be seen that 22.2% of head teachers whose schools do not have an ICT policy thought that it was difficult to make one while 77.8% indicated that they had never thought about having an ICT policy. An ICT policy is a document that will guide the school in, amongst other things, the usage of ICT equipment in the school.

4.2.2.3 School Managers' perception towards ICTs in teaching and learning

All public schools in Kenya are managed by a group of people referred to as the Board of Governors. They are sometimes referred to as the school managers. They manage, among other things, the usage of the school finances. The researcher sought to find out the perception of school managers towards ICT integration in teaching and learning. The schools' head-teachers happen to be the secretaries to the B.O.G.s. The researcher therefore used the head-teachers to elicit information

on the goodwill of the B.O.G.s towards ICT integration in teaching and learning. A Pearson's correlation coefficient was used to determine if there was any correlation between the availability of a computer lab technician in the school, future funding of ICTs in teaching and learning in schools. The correlation matrix is shown in table 4.13. A negative, of -0.194, correlation exists between the school having a computer lab technician and the future funding of ICTs in teaching and learning in the schools. This means that as long as funding of ICTs will be a challenge, schools shall not have computer lab technician and this will pose as a challenge to the integration of ICT because of the continuous technical support required.

Correlations between presence of a computer laboratory and challenges to fund ICT in school

		Presence of a computer lab	Challenging to fund ICT in school
Presence of a computer lab	Pearson Correlation	1	-0.194
Challenging to fund ICT in school	Pearson Correlation	-0.194	1

Table 4.13:

4.2.3 I.C.T. Infrastructure in schools

Any infrastructure in schools is determined by funding that are controlled by the B.O.G. The researcher used observation schedule to note presence or absence of the necessary infrastructure for ICT integration in teaching and learning. Table 4.14 shows the modes of any one type of infrastructure. From the table, availability of internet and standby generator appears to be a challenge i. Other facilities, such as white board marker pens and their erasers and printing papers printer cartridges appeared to be missing in most schools as indicated by the observation schedule.

Mode of presence or absence of infrastructure

	are there computers in the school?	Is comp lab present?	Is internet present?	Is there a standby power generator?	does every computer have ups?	is there a school LAN	does school have mains electricity?	is there a printer in the computer lab?	is there an LCD projector in the computer lab?	does the computer lab have a whiteboard?	are there markerpens in the computer lab?	is there a whiteboard erasor in the computer lab?	are there printing papers in the computer lab?
Mode	Present	Present	Not present	Not present	present	Present	Present	Present	Present	Not present	Not present	Not present	Not present

Table 4.14:

Although table 4.14 does not show absence of electricity as a major challenge in most school, it is interesting to note that there were schools that had computers but no electricity. Analysis on table 4.15affirmsthat 21.4% of the visited schools did not have electricity, yet the government bought 11 computers, a laptop, printer, and provided funds for networking and 1 year internet supply.

Percentage of schools with or without electricity

	Percentage
Schools with electricity	78.6
Schools without electricity	21.4
Total	100.0

Table 4.15:

On computer laboratories, 7.1% of the schools visited did not have a computer laboratory, as depicted on the analysis on table 4.16.

Percentage of schools with or without computer labs

	Percentage
Comp Lab present	92.9
Comp Lab not present	7.1
Total	100.0

Table 4.16:

The researcher sought to know from the head teachers whether internet connectivity is reliable in their schools. Figure 4.7 shows the analysis of the response with a total of 64% of the respondent head teachers indicating that internet connectivity in their schools is not reliable. Only 36% of the respondents indicated that internet connectivity in their schools was reliable.

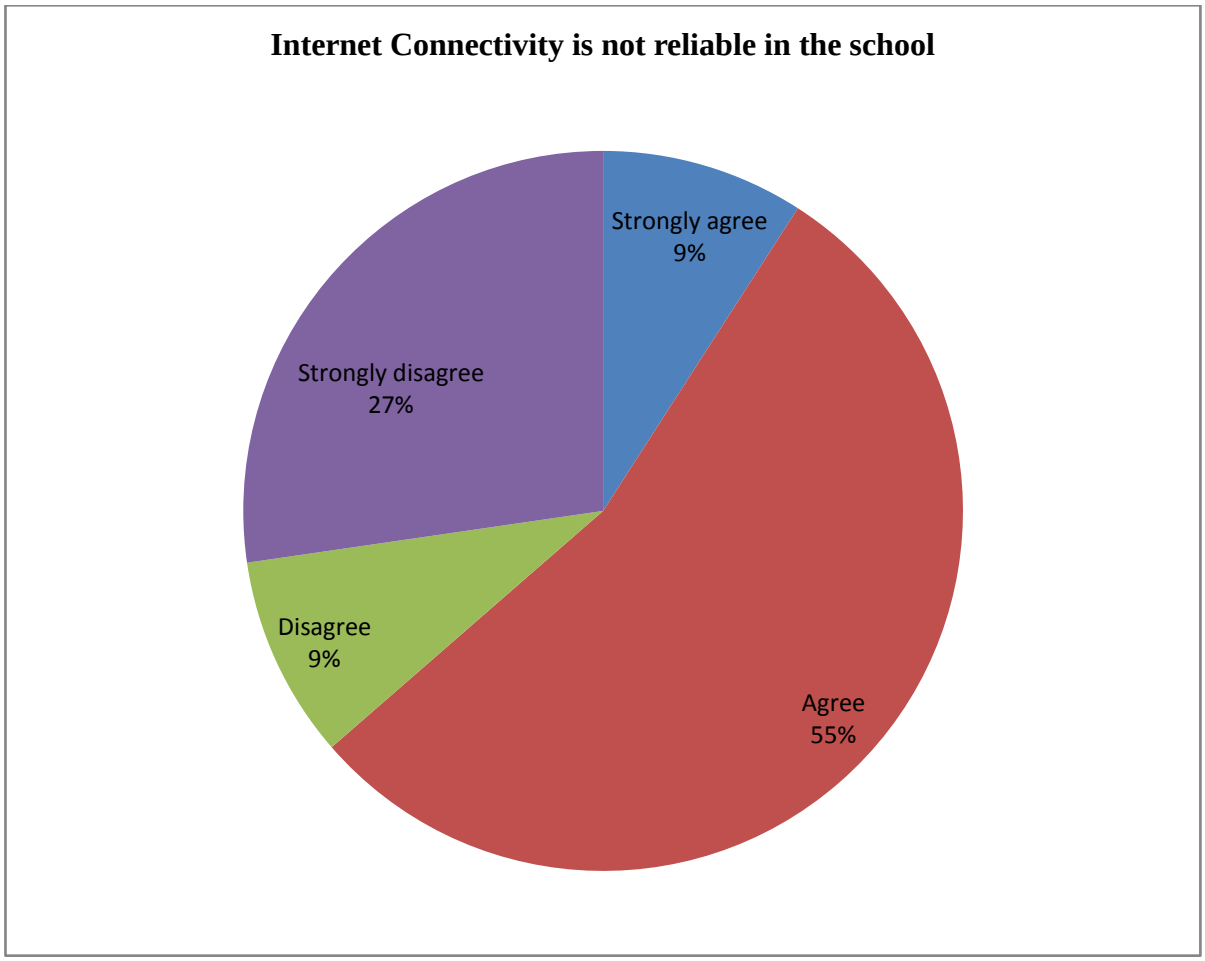

Fig 4.7:

4.2.4 Technical and financial support

On technical support, the researcher sought the opinion of head teachers on the need for schools having a computer lab technician. Table 4.17 indicates that 36.4% of the head teachers strongly agreed while 63.6% agreed on the need of a computer laboratory technician in their schools.

There is need of computer lab technician

	Percentage
strongly agree	36.4
Agree	63.6
Total	100.0

Table 4.17:

However, only 9.1% of the respondent headteachers indicated that there is a computer lab technician in their school while 90.9% of the head teachers indicated that their schools do not have a computer laboratory technician as shown on table 4.18

Presence or absence of computer lab technician

	Percentage
Schools with a computer lab technician	9.1
Schools without a computer lab technician	90.9
Total	100.0

Table 4.18:

On financial support, the researcher sought to know whether schools have funds to sustain ICT integration in teaching and learning. As table 4.19 shows, 27.3% of the respondents strongly agreed while 72.7 agreed that funding of ICT in teaching and learning will be a challenge in their school.

Funding of ICTs in teaching and learning will be a challenge

	Percentage
strongly agree	27.3
Agree	72.7
Total	100.0

Table 4.19:

Without financial support, schools will not be able to sustain computer lab technician, pay for internet connectivity, service their ICT equipment or even replace any consumables such as printer cartridges, printing paper etc. Without financial support on ICT integration in teaching and learning, schools will not be able to support the teaching staff in development of their ICT skills.

4.3 Qualitative Data Analysis

4.3.1 School Policy on ICT

Table 4.11 indicates that only 18.2% of the schools have an ICT policy. From the observation schedule, the researcher noted that the ICT policies in the schools where principals indicated to have them were not documented. There was no document to attest to the existed of an ICT policy. The policy was just verbal or in form a computer laboratory rules pinned on the notice board of the computer laboratory.

As a result of lack of a documented ICT policy in the schools, there was no clear organizational structure in the management and scheduling of ICT equipment. This implies that the use of ICT tools in teaching is based on whoever feels has the skills to use them and/or in first-come-first-served basis.

Head teachers had a lot of control of ICT equipment in the schools. The researcher noted that school laptops and LCD projectors were kept in the school principals office in at least eight schools visited. The reason was that the principals' offices were more secure than the school computer laboratory. Another reason that featured from four ICT designate teachers was that school principals feared that teachers would mishandle the equipment if left in the school computer laboratory. The irony is that those were just two items that have a total cost of approximately KSh.100,000. All computer laboratories of the schools visited by the researcher had at least eleven computers of approximately KSh. 45,000 each plus other ICT equipment. All computer laboratories in the schools had steel windows and doors with anti-burglary grills.Therefore the computer laboratories were secure enough to have all ICT tools for teaching and learning kept there in readiness for use by teachers and learners. It is therefore clear that most school head teachers do not trust their teachers to handle ICT equipment for teaching and learning and this could be posing as a threat to the process of ICT integration in education.

In the ICT kitty given by the government, the schools were supposed to buy one laser jet printer to be used for of ICT integration in teaching and learning. The printer was supposed to be kept in the computer laboratory. Only one school had the printer in the computer laboratory. In the rest of the

schools, the printer was in the secretary's office, meaning that it is used for office work only. So it is vivid that some ICT apparatus meant for use in teaching and learning were being used for other purposes other than the intended one.

An ICT designate teacher is one who is supposed to guide the school administration and management on matters to do with ICTs in the school. He/she acts as a teacher who is supposed to champion the use of ICTs in teaching and learning. He/she is supposed to guide the school administration in the drafting of the school ICT policy document. This is a person who is supposed to have a good ICT background. The teachers who were identified by head teachers as ICT designate teachers had no ICT background.Only one ICT designate teacher was pursuing a course on IT. Others were English teachers (from four schools), Geography teachers (from two schools) and a French teacher (from one school). The head teachers in the remaining schools indicated that they did not have an ICT designate teacher.

From above observations, it is clear that lack of a clear ICT policy in schools has hampered the use of the ICTs in teaching and learning. Teachers have been discourage to even try use the ICTs in their class lessons just by the fact that they have to go to the head teachers office to ask for apparatus.

4.3.2 Security of hardware and software

For proper use of ICTs in teaching and learning, both hardware and software must be secured in order to serve their purpose for long and effectively without interruption.

Of the fifteen schools visited, one had no computer laboratory; and the ones that had at least a computer laboratory, only one had no grilled doors and windows installed in the computer laboratories. The rest had their doors and windows reinforced with steel grills. One of the schools had also installed an anti-burglar alarm. However, in all the schools that had some physical security installed,only one had put in place gaseous fire extinguisher in the computer laboratory. This means that computers and other ICT infrastructure were not secure in the event of fire.

On physical security of the hardware, the researcher noted that no school had bought computer covers for their computers. KajiadoCounty is a semi-arid area which is mostly dry and windy and dusty. The researcher noted in twelve schools that their computers had a lot of dust. Dust causes electromagnetic interference of the electronic circuit of computers which results to malfunction of the computers. Dust also affects adversely the hard disk of the computers. Therefore it is clear that the life span of computers in schools of KajiadoCounty is short and this will affect the integration of ICTs in teaching and learning.

All fifteen schools visited had their computers installed with an antivirus. However, only two of the schools had their computers installed with updated latest antivirus. Thirteen schools had not purchases another antivirus programother than the one the Ministry of Education had purchased for them through the ESP-ICT funds for ICT integration in teaching and learning for the year 2011/2012. This means that by the time the researcher was collecting data from these thirteen schools, the antivirus programs in their computers was more than fifteen months old. The antivirus programs in the computers in these schools were outdated and were not serving the purpose they were intended to. The operating systems, the application programs and any other learning software installed in these computers were in danger of being corrupted or crashed by computer viruses.

4.3.3 Physical Infrastructure

Of the fifteen schools visited, fourteen had their computers networked. The one which had no LAN actually did not have a computer laboratory and their computers were still in the school store. However, of the fourteen schools which had their computers networked, only one school extended the LAN to cover the whole schools. That means thirteen schools networked only eleven computers and a printer in their school computer laboratories. The school which extended its LAN is a national school. The school administration in this particular school made sure that in every academic department, Principal's office and Deputy Principal's office, there is a working network port that can be used to exchange data and information within the school and also to upload or download teaching and learning materials to or from the www. Teachers in the thirteen schools that had only their computer laboratory networked can only interact with computers in the school laboratory. They can only prepare lessons from their school computer laboratory. This means that in case the computer

laboratory is in use or not accessible, then teachers in these particular schools cannot integrate ICTs in their teaching.

4.3.4 Technical and financial support

Lack of technical support was evident in eleven schools visited. The way the computers and other ICT equipment were kept was wanting. In twelve schools computers were very dusty. This was an indication that they are rarely used. It is also an indication that students hardly or rarely touch or use the computers. However, whether used or not, dust on and in computers causes electromagnetic interference on the mother board thus resulting to hardware breakdown. There seem to be no one to advise the school administrators on how to keep and maintain computers. In thirteen schools visited by the researcher, at least two computers in each school were not functioning either due to software or hardware failure. The researcher was also checking on whether the computers had been installed with the latest antivirus. Only one school had its computers installed with the most recently updated antivirus. The rest of the schools had an antivirus program that had expired. This was an indication of either ignorance from the school administration on the importance of an updated antivirus program, or the school did not have funds to purchase and install an antivirus program in their computers. Another indicator of lack of technical support and/or advice was in ten schools whose computers had been installed with operating systems and application software whose license keys had not been activated. Unlicensed software eventually fails and the computers rendered useless, in addition to data loss.

4.3.5 Teachers' attitude towards ICTs in teaching and learning

From the fifteen schools visited, only in one school did the researcher note teachers using laptops. In this particular school at least six teachers were noted to be carrying a laptop while going home or coming to school or going to class with it. In fact the researcher noted one teacher carrying a tablet to class. In this particular school, the Principal was found working on something on a laptop in his office and the laptop had a network cable connected to a network port on the wall. This is the school whose computer network extends to the whole schools. However in the rest of the schools, including those whose teachers indicated that the school laptops were kept by the head teachers, no teacher was seen carrying or had an indication of owning a laptop or tablet.There was no sign of a laptop or

a desktop being used by the school head teacher. However, the school secretaries had desktops and printers with them on their counters or offices. Owning a laptop, desktop or tablet is an indication of having some interest in using the same at ones working place. It is a good indicator of a positive attitude towards the use of the ICT tool in ones' daily activities.

4.3.6 Summary of challenges in integration ICTs in teaching and learning

From the above discussion, infusion of ICTs in teaching and learning in secondary schools of Kajiado County faces challenges that touch on perceptions and ICT skills of teachers and students; attitude of school administrators/managers on ICT integration; and infrastructure. Table 4.20 shows the summary of these challenges.

Summary of challenges in integrating ICT in teaching and learning in secondary schools

Students	Teachers	Administrators/managers	Infrastructure
• Have no ICT skills, thus have no confidence in using ICTs. • Do not use ICTs for learning purposes: most would prefer to be on social sites. • Do not know how to get learning information from the internet. • Have not been guided by their teachers on what and how to use ICTs in learning.	• Have no ICT skills, thus have no confidence in using ICTs in teaching. • Have wrong perception and attitude on ICT infusion in teaching and learning. They do not think ICTs will improve teaching and learning. • Fear of using technology in their teaching. • Cannot access ICT facilities for teaching. • Feel that they do have a high teaching load, hence no time to use ICTs in teaching.	• School administrators are controlling the usage and custody of ICT resources meant for teaching and learning. • No clear organizational structure • Have failed to give proper leadership in the usage of ICTs in teaching and learning. • Schools do not have ICT policies to guide in the usage of ICTs in teaching and learning. • They have directed some ICT equipment for teaching and learning to be used in other activities in the school other than the intended use. • Funds to sustain ICTs are a challenge in schools.	• Lack of computer laboratories. • Hardware and software security is not appropriate. • Unavailability of internet due to lack of signal in the schools' locality. • Unavailability of internet due to lack of funds to buy the data bundles. • No technical support to maintain the existingICT infrastructure.

Table 4.20

4.4 The Suggested Framework for ICT integration in secondary teaching and learning

Currently ICT integration in education is being coordinated from the National ICT Integration and Innovation Centre (NI3C) in conjunction with the Ministry of Education. NI3C organizes workshops for the ICT Champions once every 2 years. The ICT Champions are then expected to go to their respective constituencies to train secondary school teachers on integration of ICT in teaching and learning. The fact that the ICT Champions are teachers, there is a conflict of interest between the

TSC, the employer of the teachers, and the Ministry of Education, who are interested improved teaching and learning.

The researcher therefore recommends a decentralized framework for integration of ICT in teaching and learning. The researcher has recommended a CountyFramework for ICT integration in Teaching and Learning because it will goes along with the devolved government structure that was embraced in the new constitution.

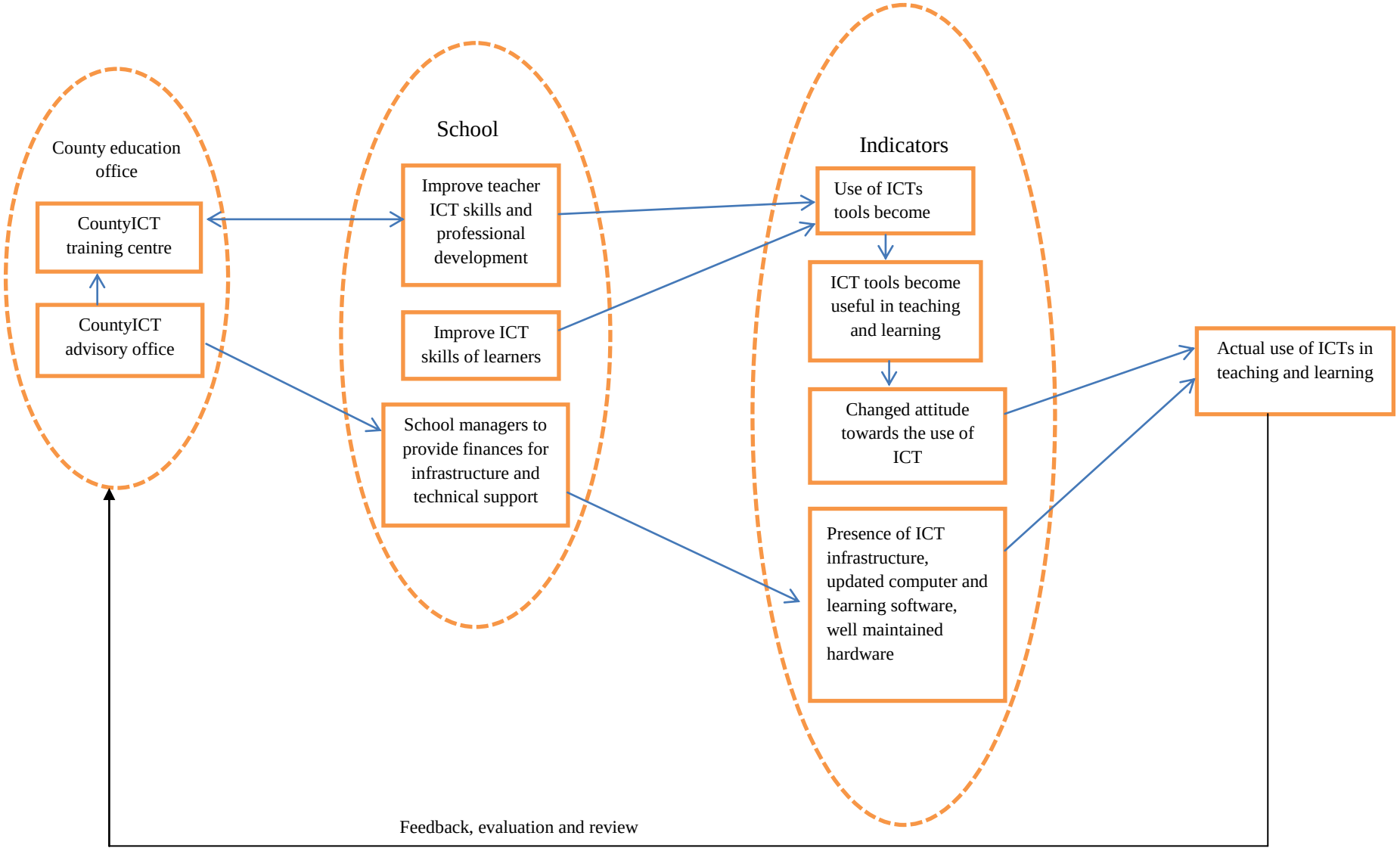

Fig 4.8: County framework for ICT integration

Stage 1: Setting up of CountyICT4E resource/training centre and advisory office

The CountyDirector of Education will establish a County ICT4E Advisory office. This office will be responsible of developing a curriculum for training teachers in ICT skills and ICT integration in teaching and learning. The office will also have the responsibility of developing the best ways of motivating teachers after they have trained. The office will also come up with the best method of ensuring that teachers actually use ICTs in teaching. The office will also be responsible of advising school administrators and managers on the best infrastructure, hardware, software and e-content to be acquired by schools.

The CountyDirector of Education will also be required to establish a CountyICT4E resource/training centre. This will be the centre where teachers in particular subject areas will be trained together. Currently, teachers are being trained from their stations on how to integrate ICTs in teaching. In the current setup, teachers are being trained together as a group, not taking care of diverse subjects each could be teaching. However, in this proposed framework, teachers of a particular subject will be trained together on how to integrate ICTs in their particular subject. The resource centre will also act as a central repository of digital teaching/learning content that will either have been developed or being developed by teachers in the county.

Stage 2: ICT infrastructure in schools

Before infusing ICTs in teaching and learning, proper infrastructure need to be laid down, teachers need to be given proper training on ICTs and their application in teaching in their respective subject areas; an ICT curriculum for students need to be developed and implemented; there is need, also, to have an ICT policy document for the school; the schools need also have a future plan of how ICTs will be maintained, i.e. technical and financial support of ICTs.

a) Infrastructure

i. Mobile phones

The framework allows the usage of internet enabled mobile phones with inbuilt digital cameras, in teaching and learning. In this case, the school is to invest on buying such mobile phones since they can be used by learners to access learning materials even in cases where

electricity is a challenge. Such phones will enhance collaboration of learners in other school. Also they will help learners to participate in making their own learning digital content and in this case promote critical thinking amongst learners.

ii. Hardware

Schools should make a proper choice of hardware in terms of hardware specifications. The computers should have multimedia capabilities so that teachers and learners can be able to view simulations and other videos related to teaching and learning resources.

Alternatively schools should invest on server machines. In such a case, the school LAN should be server based with all academic software installed in the server as all other computers in the laboratory become the clients. This alternative has advantage, in that, management and control of other computers in the school LAN will be easier from the server.

Schools should also consider data and information backup plans. As such the researcher recommends two options. First, the schools can buy high capacity external hard disk to be used to backup their teaching software and other necessary information and data. Second, schools can use the concept of cloud computing, where they will be accessing cloud-based applications through a web browser and simple desktop or a mobile device over a network. In this second option, schools' data will be stored in servers at remote locations. This will save the schools on costs of servers, cost of management and maintenance.

Schools should acquire separate printers for use in ICT integrations and for office work. At least one printer capable of producing 20 copies per minute will be ideal for the process of ICT integration. Most schools used in this survey had purchased LaserJet printers capable of printing 30 copies per minute. However they were not in use due to the expensive cartridges that the schools were not able to purchase. The researcher recommends that schools buy cheaper inkjet printers whose cartridges are much cheaper and available.

All schools that participated in the survey had only one LCD projector. The researcher recommends that school invest on buying LCD projectors for every class in the school, have

a white board in every class, and a laptop for every class. In addition, the school LAN should be extended to each and every class. This way, teachers and learners can have a plenary internet session in class any time they are teaching.

iii. Software

The ministry of education should provide group licensed operating systems and application software. Such software should be upgradable to higher versions. The software should be compatible with the available hardware.

Schools should also explore the use of open source software.

Security of information, data, software and hardware of schools is a vital element. Schools should consider having good antivirus to protect their information systems. The researcher recommends that schools purchase internet antivirus that should be installed in the server. That way, it will be cheaper to manage security from one computer (the server) than buying antivirus for each and every work station in the school.

iv. Network

School LAN should be designed such that it has a central server in which education software are installed. A star topology is recommended since it is easy to install, it has no disruption when one component on the LAN is removed or failed, and it is also easy to trouble shoot a network problem.Cabling should be done using cat6 cables since they are more hardy than the cat5 or cat5e. There should also be a central server that the ICT designate teacher will be able to control and monitor the usage of the computers by the students. It is in such a server that educational software and other materials for teaching and learning can be installed and/or kept. The school central database can also be running in such a server.

In addition, all classes and academic departmental offices should be included in the school LAN, so that teachers can collaborate with others within or without the school at any time.

v. Computer labs

Schools should construct computer laboratories in which networked computers for teaching and learning can be installed. A school should have a computer laboratory dedicated for ICT

integration in teaching and learning. If Computer Studies is taught in a school as an examinable subject, then the school should have two computer labs; one for ICT integration in teaching and learning, and the other for teaching Computer Studies. With a clear ICT policy in a school, usage of such facilities should well be coordinated.

vi. Internet connectivity

Internet connectivity is a major challenge in integration of ICT in teaching and learning. Most schools that received funds for integrating ICT in teaching and learning are either district schools or community sponsored schools. These are schools found in the rural areas of the country where internet coverage is week.

vii. Digital content

Digital content are vital for ICT integration. There are two types of digital content: computer based digital and web based digital content. Computer based digital content are either stored in separate disks such as DVDs and CDs, or stored in the computer hard disk. Web based digital content are found on particular educational websites such as *tutorvista.com*. One advantage of computer based digital content is that teachers and learners will be able to access them even in absence of internet connectivity. Apart from being expensive due to proprietary licenses, once acquired by schools, they cannot be duplicated. Web based digital are mostly freely acquired from the internet. One can also download them and making them computer based. One disadvantage of web based digital content is that they might not have been subjected to thorough scrutiny, and as such may have a lot of errors.

In this suggested framework, there are CountyICT4E resource/training centre, web-based teaching/learning content can be downloaded and stored in secondary storage media for use in those internet disadvantaged schools.

b) School management/administrations

i. School ICT policy

Every school should develop an elaborate ICT policy that spells out among other things, the accessibility and usage of ICT equipment. It is in such a policy that security of software,

hardware and any other digital materials in the school will be spelt out. It is in such a policy that maintenance plan of the ICT equipment will be highlighted. The policy will also spell out on the mode or method of how all teachers and all learners will be accessing the ICT facilities such as computer laboratories, and other facilities such as laptops, printers, LCD projectors etc.

Mobile phones are also powerful ICT tools that can really enhance learning by students. Camera enable phones can be used by students to make learning digital content. Internet enabled mobile phones can also be used by students to collaborate with other students elsewhere on the globe. School ICT policy should be varied to allow usage of this device. Schools can purchase mobile phones to be used by students in the computer laboratory or even outside the classroom.

ii. Coordination of ICT usage in school

Schools should appoint an ICT Coordinator who will be the person responsible of the ICT oversight committee of the school. Under the leadership of the ICT coordinator, the ICT oversight committee should plan on the usage of the ICT equipment in the school. The committee should be responsible of the storage of ICT equipment in the school so that head teachers stop keeping some of these equipment in their offices. Such a committee should be the one to formulate and/review the ICT policy for the school.

c) Professional development

Staff development and training

Teachers should undergo compulsory training at the CountyICT4E training centre. The training should be broken down in to two sessions. In the first sessions, teachers should be trained in the basic ICT skills, common application software. This way, ICT tools become easier to use. Also, it is after such a training that teachers will have confidence in guiding learners on how to use ICTs in learning and researching for information.

In the second session, teachers should be trained how the ICT tools can be of importance in teaching and learning. This way, they will be able to see how useful ICTs can be in teaching and learning.

With this kind of training, attitude towards usage of ICTs in teaching and learning will be positive, and teachers will be able to infuse the ICTs in their teaching.

d) Students

i. Introduction of ICT in the school curriculum

According to the 8.4.4. Computer Studies curriculum, form one syllabus covers the basic concepts of computing, like history of computers, computer system, basic operations on computers and the operating system. Form two syllabus mainly covers computer packages such word processors, spreadsheets, databases, DTP, Internet and Information and Data Security and Control. As such the researcher recommends that it becomes a policy that Computer Studies be made compulsory for all students in forms one and two. This will enable learners to acquire computer skills so that they can be able to use computers effectively in learning other subjects and in collaborating with other students. By learning Computer Studies, learners will develop critical thinking skills which are mandatory in the usage of ICT in learning of other subjects.

Stage 3: ICT infusion in teaching and learning

After the right infrastructure has been laid down, teachers have been trained in ICTs and their usage in teaching and learning, learners have acquired the ICT skills, schools have developed ICT policies, and plans have been put down for technical and financial support of ICTs, then the usage of ICTs in teaching and learning can begin. Due to evolving software and hardware, this framework suggests that the CountyICT4E centre should monitor and get feedback from schools on ICT integration in education. It is from this monitoring and feedback that a continuous evaluation and review of the whole process can be renewed and made perfect.

Feedback, evaluation and retraining

The county education office should use the quality and standards assurance department to evaluate the usage of ICTs in schools. This will help the County ICT4E Training Centre to organize for further refresher courses for the teachers.

Software and hardware are continuously evolving. New learning software will be availed. Teachers, therefore will need a periodic retraining at the County ICT4E Centre.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter gives the conclusion and recommendation of the study, based on the findings.

5.2 Summary

The objectives of this study were to investigate the ICT skills that teachers and learners have for them to integrate ICT in teaching and learning, to investigate the infrastructure available for integrating ICT in teaching and learning, to investigate perceptions of school administrators, managers and teachers towards ICT integration in teaching and learning and to investigate financial and technical support of ICT integration in teaching and learning. The final product was to develop a decentralized framework for integrating ICT in teaching and learning. In particular the survey attempted to answer the following questions:

1. What ICT skills do teachers and learners have to enable them integrate ICT in teaching and learning?
2. How do teachers, school administrations and school managers perceive the integration of ICTs in teaching and learning?
3. What ICT infrastructure do schools in KajiadoCounty have in order to integrate ICT in teaching and learning?
4. How are schools intending to finance the process of integrating ICT in teaching and learning after the expiry of the government support to the project?
5. What technical support do schools of KajiadoCounty have for integration of ICT in teaching and learning?

In order to answer the above questions, the researcher issued questionnaires to head teachers, subject teachers and students. The researcher also used an observation schedule in each of the schools that participated in the survey. Validation of the research instruments was made after they were administered to a private school in the county, after which the researcher made adjustments accordingly. With permission from the head teachers of respective schools, the questionnaires were administered the teachers, students and the head teachers themselves. The collected data was coded

and then analyzed using SPSS version 16 and MS Excel 2010. Frequencies, percentages, modes and correlations were used to analyze the data.

5.3 Findings

After data analysis, the researcher came up with the following findings

5.3.1 On ICT skills of teachers for integration of ICT in teaching and learning

ICT skills of both teachers and learners are a major deterrent to integrating ICTs in teaching and learning. Table 4.1 shows that 73.1% of teachers have actually done some ICT courses. Chart 4.1 shows that teachers who have done the computer courses have either done diploma in computing (10.5%) or certificate courses in computer packages (89.5%). So majority of teachers who say are computer literate have done certificate courses in computer packages. However, from chart 4.2, there is a strong indication that the so called computer courses done by the majority of teachers who indicated to have done them, were done within a very short time of 1 week or 2 weeks. This time is too short for an individual to have done a serious course in computing and be tested in the same. Figure 4.3 attest to this fact. From the figure, 75% of teachers cannot comfortably use application packages, 76.9% cannot use a scanner, and 69.2% cannot print using a network printer, while 59.6% cannot operate a LCD projector.

A teacher who has no basic skills of a computer such as keyboard and mouse operations will not be able to use a computer to teach. As the literature review revealed, most teachers would shy from using technology because of fear of getting embarrassed when using it. The researcher showed that 38.5% of teachers did not have confidence in basic computer operations. As a result teachers shy off from using ICTs in their teaching for the fear of getting embarrassed in front of their learners.

In ICT integration, teachers are also expected to make their own digital content from the environment. In such situations, ICT equipment such as video cameras and digital cameras come in handy. Use of video and photo editing tools is also essential. Such digital content can be uploaded to a portal where other teachers or learners can access and use it. However, the researcher has shown that 59.6% of teachers cannot use a video camera while 34.6% of teachers cannot use a digital

camera. This possess as a challenge because it means that teachers will depend entirely on the off-the-shelf digital content which are too expensive for most schools to afford.

Internet is another very important tool in ICT integration in teaching and learning. Internet enables teachers to collaborate in their teaching with other teachers and learners too and also in acquiring web-based learning and teaching content. Portals such as the *Elimu Portal* are known to be used by teachers in sharing teaching experiences and other digital contents. Without the skills of using of the internet search engines, teachers will find it hard to use this otherwise powerful tool. Teachers will not be able to get web-based content for teaching and learning. They will not be able to collaborate with other teachers in terms of sharing locally made digital content. They will not be able to guide learners on how to get learning content from the internet. With 36.5% of teachers not being able to use the internet search engine, it is an indication that lack of internet skills by the teachers is a challenge in integrating ICT in teaching.

LCD projectors are very commonly used when teaching. They are mostly used when learners are supposed to observe diagrams, watch simulations, video clips when the teacher is presenting a lesson using power point. An LCD projector is very ideal where the class population is large and computers in the laboratory are not enough for all students. All schools that participated in this research had at least one LCD projector. However 59.6% of teachers indicated that they could not use an LCD projector without help. With 90.9% of the schools lacking a computer laboratory technician, who would otherwise be helping teachers in the computer laboratories, teachers shy off from using the LCD projector in teaching.

In an ICT integrated lesson, a teacher will be required to use at least one application package such as a word processor, a spreadsheet, a presentation package such as power point, etc. Tools such as video and picture editors are supposed to be used by teachers in preparing an ICT integrated lesson. However, from the findings of this research, 75% of teachers indicated not to have confidence in using application packages.

Printing is necessary in most ICT integrated teaching. A teacher will be required to print some tasks or instructions for the learners. However, with 69.2% of teachers not able to use a printer without help,

Crosstabs was used to find out whether the level of computer certification actually affects the level of confidence of using ICTs in teaching. Table 4.2 shows that teachers who have high levels of computer literacy have confidence in the usage of all ICT tools for teaching. This means that if the ICT literacy levels of teachers were improved, teachers would have confidence in the usage of ICT tools, which would translate to more of the teachers using the tools in teaching. In other words, the first step in ICT integration in teaching is to capacity build teachers in skills of ICT. This should then be followed by another capacity building on usage of ICTs in teaching. .

5.3.2 ICT skills of learners for the integration of ICT in learning

Level of ICT skills of learners was also affecting their usage of using ICTs in the learning process. Figure 4.4 shows that 61.3% of learners cannot use a word processor, 82.4% cannot use spreadsheets, 87.4% cannot prepare and use power point, 59.7% cannot use internet to get learning materials and 66.4% cannot perform basic computer operations such as mouse and keyboard operations, switching on and off of computers etc. Learners with such low ICT skills will not have confidence in using the computer to learn. They will not be able to use digital content that may be installed in their computers. Basic computer skills are necessary for learners to enable them to interact with a computer when using digital content by their own.

Table 4.4 revealed that 56.2% of learners who are allowed to use internet in their schools would use the internet sessions on social sites, while 43.8% would use the session to download learning materials. The reason for the government provided for internet funds for 1 year, was for teachers and learners to search and download web based teaching and learning materials from the internet, and for collaborative learning. With these findings, it appears that, learners' ICT skills and preferences are a great challenge to the integration of ICTs in learning. Learners' preference on the usage of internet is a challenge in integrating ICT in learning.

From the analysis shown in table 4.6, head teachers from the national schools indicated that they do not agree that majority of their students are computer illiterate. However, head teachers from the district and community sponsored schools indicated that most of their students are computer illiterate. Computer illiteracy amongst learners makes them shy off from using ICTs to learn or search for information from the Internet.

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5.3.3 Perception of school administrators, managers and teachers.

a) Teachers

Figure 4.5 shows the frequency of teachers using ICTs in teaching. From the table, 73% of teachers never use ICTs in teaching, 17% use ICTs only once in a week, 4% use ICTs in teaching twice in a week 2% use ICTs in teaching thrice in a week, while 4% use ICTs in teaching once in a month.

The reasons for teachers not using ICTs as many times as possible were cumulatively 50% on perception: i.e. 2% of the respondents indicated as a waste of time using ICTs in teaching, 15% indicated that their teaching work load could not allow them to use ICTs frequently, 6% indicated that the syllabus was too wide to allow ICTs usage, 17% indicated that they could achieve their teaching objectives without using ICTs in teaching and 10% indicated that they had no confidence in using ICT equipment.Table 4.7 indicated that more female than male teachers have negative perception on the usage of ICTs in teaching.

b) School administrators

Table 4.8 shows that 59.6% of teachers indicated that not all ICT apparatus for teaching and learning are kept in the computer laboratory. Table 4.11 shows that 92.9% of the teacher respondents said that ICT apparatus for teaching and learning that were not in the computer lab were actually kept by school head teachers in their offices while7.1% of the respondents said that they do not know where such missing apparatus are kept. With school head teachers keeping the ICT apparatus for teaching and learning in their offices, usage of such apparatus by teachers and students becomes a challenge.Table 4.10 clearly shows that there is a negative correlation (-0.094) between frequency of a teacher using ICT in teaching and keeping some ICT apparatus in the head teachers' offices. The greater the number of ICT apparatus kept in the head teachers' offices, the less the frequency of teachers having an ICT integrated lesson.

An ICT policy is supposed to guide the schools on the usage of ICT apparatus in teaching and learning. Table 4.11 shows that only 18.2% of schools have ICT policies while 81.8% of schools do not have ICT policies. Some of reasons given by the head teachers for not having an ICT policy in their schools were indicated in table 4.12: it is difficult to make one, at 22.2%; they never thought of making one, at 77.8%. These reasons are more on perception. So it appears vividly that school administrators' perception towards ICT integration to teaching and learning poses as a challenge to the process.

5.3.4 ICT infrastructure

Infrastructure to support ICTs in most schools is a major challenge in the process of ICT integration in teaching and learning. Table 4.14 shows that most schools do not have standby power generators to be used in case of power blackouts. This means that in case of power outages, teachers and learners will not be able to use ICT facilities to teach and/learn. Lack of electricity was also seen to affect ICT integration in education to 21.4% of the schools in KajiadoCounty (table 4.15). The main energy that drives most of ICT equipment is from mains electricity. In as much as the
Government gave schools money to purchase ICT equipment, they cannot be used unless those
Schools have supply of electricity.7.1% of schools do not have computer laboratories where ICT integration lessons can take place. Internet connectivity is another major deterrent of the process of ICT integration in teaching and learning. Figure 4.7shows that 64% of schools did not have internet connectivity due to challenges in signal coverage. Internet connectivity is needed because of several reasons. First, a lot of teaching and learning materials are found in the vast World Wide Web. Teachers and learners are supposed to access and if possible, download these materials. Second, internet is supposed to support collaborative teaching and learning. In this case, teachers and students in one school are supposed to collaborate, exchange ideas or have any other academic forums with teachers and students in other schools. Third, internet is supposed to facilitate e-learning. With internet connectivity, teachers and students are supposed to access learning portals.All these can only be enable if schools are interconnected through the internet.

Other basic facilities like white boards, marker pens etc. are also lacking in most schools. From the observation schedule, most schools had only one laptop that was to be shared amongst all teachers in

the school. Printer cartridges and printing papers were also a big challenge. Most teachers indicated that they cannot print their lesson notes, schemes of work or any other materials, because either they could not access the printers or there were no printing papers. However some of the infrastructure for integrating ICT in teaching and learning requires the goodwill of the school managers.

5.3.5 Technical and financial support of ICT integration

Table 4.18shows that 90.9% of schools do not have computer lab technicians. Computer lab technicians are required to give technical support to teachers when it comes to usage of ICT facilities such as LCD projector, connecting of such ICT facilities, etc. The lab technicians are also supposed to trouble-shoot and make any necessary repairs on software and hardware facilities in the school. Simple problems that might seem complicated to the teacher, and hence deter him/her from using technology in teaching, can be solved by computer lab technicians.

From the literature review, it was established that most teachers would prefer not to use technology in classrooms because of fear of being embarrassed when some tools fail. From the findings of this survey, the researcher showed that 70% of teachers could not use a network printer without help, while 60% of teachers could not use an LCD projector without help (figure 4.3). In such situations, schools need to have technical personnel who would assist teachers in usage of such ICT facilities. With lack of such technical support, teachers will shy away from using ICTs in their teaching.

From table 4.19, it is clear that all head teachers indicated that it will be a challenge to fund ICTs in education in the future after expiry of the government support. Without such funds, payment of internet connectivity and maintenance of the ICTs will be a challenge to the schools, which will automatically affect the integration of ICTs in education.

5.4 Conclusion

On the basis of the findings of this survey, it can be concluded that ICT integration in schools of KajiadoCounty is facing a plethora of challenges. Although the government is giving funds to schools each and every year to start the process, on the ground schools are not able to embrace the idea of integrating ICT in teaching and learning.

From the survey, the researcher has shown that ICT skills of both teachers and learners are a major deterrent of ICT integration in schools. Both teachers and learners need to sharpen their ICT skills in order to be able to use the ICTs in their teaching and/or learning.

Teachers' perception towards ICTs has hampered their speed of embracing them in their teaching. The researcher has shown clearly that teachers in KajiadoCounty prefer the traditional method of teaching. This is partly because of fear of using technology and partly because of schools' policies on usage of ICTs. Gender issue also came out so clearly with the findings showing that female teachers either do not have ICT skills or their perceptions are just wrong on the process of infusion of ICTs in teaching and learning.

Students are major player of infusion of ICTs in teaching and learning because they are the main consumers of the whole process. One main reason for introducing ICTs in teaching and learning was to make students be active learners who can collaborate with others, search and find learning materials from the web etc. however the researcher has demonstrated that due to their limited ICT skills, they do not know how to use the tools to learn by themselves. The researcher has demonstrated that schools that offer Computer Studies subject have their students being able to use ICTs more than schools not offering the subject.

The researcher has further shown that school administrations have also restricted the usage of ICTs in teaching and learning in secondary schools of KajiadoCounty. With some key apparatus such as laptops LCD projectors and printers being kept in principals' offices, and others such as printers are used to do office work, teachers shy off from using the apparatus. Further, the school administrators in most schools of KajiadoCounty have failed to provide leadership in the usage of ICTs in their schools, by not initiating the formulation of the school ICT policies. Without an ICT policy, usage

of the ICTs in teaching and learning will be haphazard. The researcher has also shown that the ICT designate teachers in most schools do not have any ICT background. As such, the type of ICT management that is expected from such teachers is lacking. To some extent, it could be the reason why most schools did not have an ICT policy document. The ICT designate teacher is supposed to champion the usage of ICTs in his/her school.

The researcher was able to demonstrate that majority of schools do not have funds to support ICT integration in teaching and learning after the government's funds expire. Lack of latest updated computer antivirus was an indication of the financial hardship most schools are going through. Most head teachers showed that in future their schools will not have funds to pay for internet connectivity. Also most head teachers indicated that their schools do not have funds to employ computer lab technician. Acquisition and disbursement of funds in schools is controlled by the school managers. Therefore the researcher has shown that school administrators and managers have hampered the process of infusion of ICT in teaching and learning

On infrastructure, the researcher found out that most schools lack the most essential facilities for integrating ICTs in teaching and learning. Internet connectivity was a major hindrance. Either the schools did not have funds to pay for connectivity, or internet signal was not available. As such teachers and learners are not able to collaborate with others; they are not able to acquire teaching and/or learning materials online; and e-learning is not possible. Security of hardware and software was also wanting in most schools of KajiadoCounty, with most computers being kept in unpalatable conditions and lacking latest antivirus programs. So the lifespan of most computers was short.

5.4.1 Further research

The researcher recommended the following for further research:

a) Computer skills and literacy among all learners and teachers is a necessary condition before infusion of ICTs in teaching and learning.
b) An investigation of ICT integration courses in teacher training colleges in Kenya.
c) An investigation of ICT infusion in education in private school that use G.C.E. system of education.

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Appendix A

Letter of Introduction

C/o of University of Nairobi
School of Computing and Informatics
Nairobi

To whom it may concern
Dear Sir/Madam,

Re: Data collection

I am a postgraduate student at the School of Computing and Informatics of The University of Nairobi. I am undertaking a project on Challenges in integrating ICT in teaching and learning in secondary schools of KajiadoCounty.

Your school has been selected to form part of this study. This letter is to kindly request you to assist me in by filling in the accompanying questionnaires. The data collected will be treated confidentially and strictly for academic purpose only.
Thanking you in advance.

Yours faithfully,

Joshua Gakirio Wakhu

APPENDIX B

Questionnaire for Subject Teacher

You are kindly requested to give appropriate information to the statements provide below by either ticking in the parentheses ( ) or by giving further information in the spaces provide. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

Section A: General information

This section seeks information about you and your school

1. What is your age bracket?
    a) 21 – 30 years ( )
    b) 31 -40 years ( )
    c) 41 – 50 years ( )
    d) Over 51 years ( )
2. Your gender is
    a) Male ( )
    b) Female ( )
3. Please indicate your teaching experience
    a) 0 to 5 years ( )
    b) 6 to 10 years ( )
    c) 11 to 15 years ( )
    d) 16 to 20 years ( )
    e) Over 20 years ( )
4. State the subject(s) you teach at your station._____
5. What is your work load in terms of number of lessons in a week?_____
6. What is your highest level of academic qualification?
    a) Diploma ( )
    b) Graduate ( )
    c) Masters ( )
    d) Any other (please specify)_____
7. What is your highest professional qualification

a) Masters in Education ( )

b) Bachelors of Education ( )

c) Post Graduate Diploma in Education ( )

d) Diploma in Education ( )

e) Any other (please specify)_____

8. Have your done any ICT courses?

a) Yes ( )

b) No ( )

9. If your answer to 8 above is "yes" then

a) What was the duration of the course? _____ months

b) State the course(s) you did

_____

_____

_____

_____

c) State the type of certificate awarded_____

10. If your answer to 8 above is no, then give reasons why you have not done any ICT course

_____

_____

_____

_____

11. Have you been trained in ICT integration in teaching?

a) Yes ( )

b) No ( )

12. If your answer to 11 above is yes then

i) How long was the training?_____

ii) Was the training time stated in 12 i) above adequate for you?

a) Yes ( )
b) No ( )

iii) Was the training relevant for you to integrate ICT in your teaching subject(s)?

a) Yes ( )
b) No ( )

13. Are your schemes of work typed or handwritten?
    a) Typed ( )
    b) Handwritten ( )
14. If handwritten, what could be the reason(s) for not typing and printing them? Please tick any reason(s) that apply to you below.
    a) I am slow in typing ( )
    b) I do not know how to use word processor ( )
    c) After typing, printing services are not available in my school ( )
    d) The administration accepts only handwritten schemes of work ( )
    e) The printer is available but it has no printing cartridge ( )
    f) Any other reason(s) (please state)_____
15. Are your class notes handwritten or in power point?
    a) Handwritten ( )
    b) Power point ( )
16. If handwritten, what could be the reasons(s) for not having power point notes? Please tick any reason(s) that apply to you
    a) I do not know how to make presentations using power point ( )
    b) I am slow in typing ( )
    c) I find making notes using power point adding no value in my teaching ( )
    d) I cannot access the computer laboratory to make power point notes ( )
    e) I am comfortable with my handwritten notes ( )
    f) Any other (please indicate) _____
17. The table below shows some tools used in integrating ICT in teaching and learning. Indicate, by ticking against each, which one of them you can use comfortably and confidently i.e. with minimum assistance from anyone.

    Rating scale is as follows: 1= I can use the tool confidently without anyone else's help

2 = I have no confidence in using the tool,

Tool	**1**	**2**
Desktop computer		
Laptop		

Digital camera		
T.V.		
Radio		
Video camera		
Internet search engine		
LCD projector		
Power point		
Spreadsheet		
Word processor		
Flat bed scanner		
Network printer		

18. In your own assessment, how many times in a week do you integrate ICTs in your teaching of one class?
    a) Never ( )
    b) Once ( )
    c) Twice ( )
    d) Thrice ( )
19. What inhibits you from using ICTs as many times as you would wish? Please tick all that apply to your case.
    a) Unavailability of some apparatus in computer laboratory ( )
    b) Using ICTs in teaching is a waste of time ( )
    c) I have no confidence in using ICTs ( )
    d) The syllabus is too wide to incorporate ICTs in teaching ( )
    e) I can still achieve my teaching objectives without using ICTs ( )
20. Is there a computer laboratory technician or assistant in your school?
    a) Yes ( )
    b) No ( )
21. According to you, are all ICTs apparatus available in the computer laboratory?
    a) Yes ( )
    b) No ( )

22. If your answer above is 'No', please state which apparatus are not readily available in the computer laboratory for use in teaching and learning

_____

_____

_____

23. Where are the apparatus named inabove kept?

_____

_____

_____

24. In your school, who coordinates the usage of ICT equipments and the computer laboratory? Please tick appropriately

    a) The head teacher ( )
    b) The deputy head teacher ( )
    c) The ICT teacher ( )
    d) No one in particular ( )
    e) Any other, please specify _____

25. Does your school have an ICT policy?

    a) Yes ( )
    b) No ( )
    c) I don't know ( )

26. If the answer to above question is'yes', were you involved in formulating the ICT policy?

    a) Yes ( )
    b) No ( )

Appendix C

Questionnaire for the Head Teacher

You are kindly requested to give appropriate information to the statements provide below by either ticking in the parentheses ( ) or by giving further information in the spaces provide. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

1) What is your age bracket?
    a) 21 – 30 years ( )
    b) 31 -40 years ( )
    c) 41 – 50 years ( )
    d) Over 51 years ( )
2) What is your highest professional qualification?
    a) Masters in Education ( )
    b) Bachelors of Education ( )
    c) Post Graduate Diploma in Education ( )
    d) Diploma in Education ( )
3) For how long have you been a head teacher?
    a) 0 to 4 years ( )
    b) 5 to 9 years ( )
    c) 10 to 15 years ( )
    d) Over 15 years ( )
4) What status is your school?
    a) National ( )
    b) Provincial ( )
    c) District ( )
    d) Community sponsored ( )
5) What class level has your school reached?
    a) Form 1 ( )
    b) Form 2 ( )
    c) Form 3 ( )

d) Form 4 ( )

6) How many streams does each of the classes have? Please indicate in the spaces below.
   a) Form 1_____
   b) Form 2 _____
   c) Form 3 _____
   d) Form 4 _____
7) What is the total number of students in your school? _____
8) Do you have a computer laboratory?
   a) Yes ( )
   b) No ( )
9) Do you have an ICT designate teacher in your school?
   a) Yes ( )
   b) No ( )
10) Is there a computer laboratory technician in your school?
   a) Yes ( )
   b) No ( )
11) Have teachers in your school been trained in ICT integration in teaching and learning?
   a) Yes ( )
   b) No ( )
12) Have you, as a head teacher, been trained in ICT integration in teaching and learning?
   a) Yes ( )
   b) No ( )
13) Does your school have an ICT policy?
   a) Yes ( )
   b) No ( )
14) Rank the following opinions about ICT integration in teaching and learning in your school in order of merit by ticking in the required column. The rating scale is
   1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree

Opinion	**1**	**2**	**3**	**4**
It adds no value to teaching and learning				
It will cause the school extra budget to sustain it in the feature				

The equipment supplied by the government is not enough for the whole school				
There is need for a computer laboratory technician in the school				
All the ICT apparatus should and are in the computer laboratory permanently and ready to be used by teachers				
ICTs will make teachers delegate work to students				
Internet connectivity is not reliable				
Students, if left alone in the computer lab, might browse to pornographic sites				
Some teachers, if left alone in the computer lab, will misuse the ICT equipment such as printing their own personal work				
The school does not have money to hire a computer lab technician				
Frequent power disruptions affect ICT integration				
Students in the school can be left alone in the laboratory				
Teachers in the school frequently use the laboratory to teach their subjects				
The head teacher should keep the key to the computer lab				
ICT s will make teachers lazy				

Appendix D

Questionnaire for the ICT Designate Teacher

You are kindly requested to give appropriate information to the statements provide below by either ticking in the parentheses ( ) or by giving further information in the spaces provide. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

1) What is your age bracket?
   a) 21 – 30 years ( )
   b) 31 -40 years ( )
   c) 41 – 50 years ( )
   d) Over 51 years ( )
2) What is your highest professional qualification?
   a) Masters in Education ( )
   b) Bachelors of Education ( )
   c) Post Graduate Diploma in Education ( )
   d) Diploma in Education ( )
3) What subject(s) do you teach in your stations? _____
4) Have you done any ICT-related course?
   a) Yes ( )
   b) No ( )
5) If your answer to 3 above is "yes" then
   a) What was the duration of the course? _____ months
   b) State the course(s) you did

      _____

      _____
   c) State the type of certificate awarded_____

4. If your answer to 3 above is 'no', then give reasons why you have not done any ICT course

   _____

   _____

   _____

6) Do you think a teacher needs to be taught ICT skills in order to integrate ICT in his/her teaching?
   a) Yes ( )
   b) No ( )
7) does your school have a computer laboratory?
   a) Yes ( )
   b) No ( )
8) In the following table, some tools for ICT integration in teaching and learning are highlighted. Indicate by putting a tick, whether the tool is available or not available. If available, please indicate the quantity where applicable.

Tool	Available	Not available	Quantity
Desktop computers			
Laptops			
U.P.S			
LCD projectors			
Networkprinters			
Networked computer labs			
Internet connectivity			
Digital cameras			
Video digital cameras			
Radios			
Televisions			
Standby power generators			
Printing papers			
Whiteboards			
Whiteboard marker pens			
Whiteboard eraser			
Software for downloading			

videos			
Small speakers for computers			
Powerful speakers of about 1000 W			
Recently updated antivirus software			
Firewall			
K.I.E. Digital content for every subject taught in your school			

11) In your opinion, does the school need to have an ICT computer lab technician?

a) Yes ( )

b) No ( )

12) Does your school have a computer lab technician?

a) Yes ( )

b) No ( )

13) If your answer above is no, then which of the following, what could be the reason(s) for not having a computer lab technician? Please tick all that apply.

a) I have not advised the head teacher on the issue ( )

b) The school administration sees no need for one ( )

c) Teachers are confident in using ICT tools ( )

d) I can do the work of the technician for the school ( )

e) The school contracts one when needed ( )

14) In your opinion, teachers in your station have confidence in using ICTs in teaching

a) Strongly agree ( )

b) Agree ( )

c) Disagree ( )

d) Strongly disagree ( )

15) In your opinion, students in your station have the basic ICT skills to use the digital content to learn.

a) Strongly agree ( )

b) Agree ( )

c) Disagree ( )

d) Strongly disagree ( )

16) In your opinion, students in your station have basic ICT skills to search for information any topic of their study from the internet

a) Strongly agree ( )

b) Agree ( )

c) Disagree ( )

d) Strongly disagree ( )

17) In your opinion, teachers at your station use power point notes to teach in class

a) Strongly agree ( )

b) Agree ( )

c) Disagree ( )

d) Strongly disagree ( )

18) Does your school have an ICT policy?

a) Yes ( )

b) No ( )

19) If the ICT policy is therewas all the teaching staff involved in making the ICT policy?

a) Yes ( )

b) No ( )

20) Is there an annual budget set aside for the ICT tools used in integration in teaching and learning?

a) Yes ( )

b) No ( )

21) If the answer to the above question is yes, approximately how much money is set aside for ICT tools in the school? _____

22) Are all the ICT tools kept in the computer laboratory?

a) Yes ( )

b) No ( )

23) If the answer to above question is no, which tools are not permanently in the lab and where are they normally, kept? answer by filling the table below

Tool	Where it is kept

24) What would be the reason for the tools meant for ICT integration in teaching and learning be kept away from the school laboratory?

_____

_____

_____

_____

_____

_____

Appendix E

Questionnaire for Students

You are kindly requested to give appropriate information to the statements provide below by either ticking in the parentheses ( ) or by giving further information in the spaces provide. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

1) What is your gender?
    a) Male ( )
    b) Female ( )
2) What form are you in?
    a) Form 1 ( )
    b) Form 2 ( )
    c) Form 3 ( )
    d) Form 4 ( )
3) Is there a computer laboratory in your school?
    a) Yes ( )
    b) No ( )
4) The table below shows some of the most common subjects done in schools. On the subjects that you are doing, indicate by ticking the appropriate column the frequency of your teacher using notes in a laptop when teaching you.

Subject	**Very frequently**	**Frequently**	**Occasionally**	**Never at all**
English				
Kiswahili				
Mathematics				
Biology				
Chemistry				
Physics				
Geography				
History				

C.R.E.				
Business Studies				
Agriculture				
Home Science				

5) The table below shows some of the most common subjects done in schools. On the subjects that you are doing, indicate by ticking the appropriate column the frequency of your teacher having taught you using videos or pictures downloaded from the internet

Subject	**Very frequently**	**Frequently**	**Occasionally**	**Never at all**
English				
Kiswahili				
Mathematics				
Biology				
Chemistry				
Physics				
Geography				
History				
C.R.E.				
Business Studies				
Agriculture				
Home Science				

6) Do students have internet sessions in your school?
   a) Yes ( )
   b) No ( )
7) According to you, most students will use the internet sessions for: (please tick all that apply)
   a) Searching and downloading learning materials ( )
   b) Chatting on social sites e.g. facebook and twitter ( )
   c) Searching and downloading past papers ( )

8) Which of the following can you do without assistance from anybody? Please tick appropriately to all that apply to you

a) Type an essay using word processor ( )

b) Manipulate mathematical problems using spreadsheet ( )

c) Make presentations using power point ( )

d) Search for and download text information from the internet ( )

e) Search for and download videos from the internet ( )

Appendix F

Observation Schedule

Section A:

Availability of infrastructure

Available = 1. Not available= 2

Infrastructure	Available = 1	Not available = 2	Quantity
Computer laboratory			
Internet			
Standby power generator			
U.P.S			
LAN			
Mains electricity			
Printer			
LCD projector			
Whiteboard			
Whiteboard marker pens			
Whiteboard eraser			
Printing papers			

Section B

Indicators of teachers using computers to prepare for the classes and teach using ICTs

A = available, NA = not available

Indicator	A	NA	Quantity
Schemes of work prepared using word processor			
Lesson notes prepared using power point			
Video clips downloaded from internet			
Pictures downloaded from internet			

Any other relevant observation made

_____