APPLICATION OF INSTRUCTIONAL TECHNOLOGIES IN TEACHING AND LEARNING IN PUBLIC SECONDARY SCHOOLS IN KIAMBU SUB-COUNTY

BY

SALOME WANGUI MWAI

K50/69614/2013

A RESEARCH PROJECT SUBMITTED TO THE UNIVERSITY OF NAIROBI, SCHOOL OF JOURNALISM AND MASS COMMUNICATION IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF ARTS IN COMMUNICATION STUDIES

OCTOBER, 2015

DECLARATION

This is certify that this research project is my own original work and is in no way a reproduction of any other work that has been previously presented for award of a degree in any university.

SALOME WANGUI MWAI	……	……
REG. No: K50/69614/2013	SIGNATURE	DATE

This project has been submitted for examination with my approval as University Supervisor.

DR GEORGE GATHIGI	……	……
	SIGNATURE	DATE

DEDICATION

This research is dedicated to my husband, Nicholas N. Murigi who inspired me to go for further studies and served as a pillar of strength and support throughout my studies; to my beloved sons Murigi and Mwai for their patience, encouragement and perseverance through the strenuous time until the completion of my study.

ACKNOWLEDGMENT

I am grateful to God for seeing me through my studies. It has taken God to balance work, family and studies. I wish to express my gratitude to all university lecturers who have participated in the course of my study. Special thanks to my supervisor Dr. George Gathigi for his dedication, insight and guidance in writing this research project.

Thanks to my family for support, patience and perseverance during the entire period of my study. Your love, encouragement, inspiration and patience are highly valued.

May God bless you all

ABSTRACT

The purpose of the study was to examine the application of instructional technologies in teaching and learning in public secondary schools in Kiambu Sub-County. The focus was on four main subject matters: Availability of instructional technologies in schools, ICT application in teaching and learning, competence by both teachers and students, perceived benefits of ICT use and problems faced in the application of ICT in teaching. The study is closely connected to the national educational policy which has aimed strongly at supporting the implementation of ICT in pedagogical practices at all institutional levels. The study was informed by two theories namely Technology Acceptance Theory (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT). Technology Acceptance Theory assumes that beliefs about usefulness and ease of use are always the primary determinants of information technologies adoption in organizations. Unified Theory of Acceptance and Use of technology suggests that performance expectancy (perceived usefulness), effort expectancy (ease of use), social influence and facilitating conditions are direct determinants of technology acceptance (behaviour intention) and use (behaviour). Advances in ICT in education imply teachers' acceptance and willingness to use technology in teaching and learning. The perceived usefulness and ease of use of any technology determines the pedagogical application of ICT skills in teaching.

Data was drawn from a total of 51 teachers and 115 students from six public secondary schools in Kiambu Sub- County. The research adopted a mixed methods approach to data gathering using questionnaires and semi structured interviews to gather data from students, teachers and principals. The data was then analysed using Exel program. It was then interpreted and inferences made and presented descriptively using pie charts, tables and percentages.

The study findings revealed that most of the instructional technologies were available but inadequate in terms of quantity. ICT application in teaching and learning is low despite capacity in the skills of both the teachers and the students. There is also recognition of benefits associated with ICT use. However, the findings indicate ICT use in class is marred by a number of setbacks that are school based, administrative and teacher based that need to be addressed to enhance teaching and learning. The study recommends that there is need to embrace change among all stakeholders for effective use of ICT facilities and enhance ICT application in teaching and learning.

ABBREVIATIONS AND ACRONYMS

ESTERELLA:	Encouraging Students through Technology to Reach High Expectations in Learning Life skills and Achievement
ICT	Information Communication Technology
IJEDICT	International Journal of Education and Development Using Information Communication Technology
CD-ROM:	Compact disc, contains data accessible but not writable
DVD:	Digital versatile disk
NEPAD:	New partnership for Africa's Development
VLE:	Virtual Learning Environment
KEMI	Kenya Education Management Institute
OECD	Organization for Economic Co-operation and Development
KICD	Kenya Institute of Curriculum Development
MOEST	Ministry of Education Science and Technology
PPP	Public Private Partnership
EMIS	Education Management Information Systems
NI3C	National ICT Innovation and integration Centre

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: BACKGROUND AND INTRODUCTION

1.1 Introduction

This chapter covers the background of the study, the statement of the problem, the purpose of the study, the objectives, the research questions, the significance of the study, the justification of the study, the scope, theoretical framework as well as the limitations of the study. This study focuses on the application of instructional technology in teaching and learning in public secondary schools in Kiambu Town, a Sub-county of Kiambu County. Kiambu County is located in the Central Kenya and comprises twelve constituencies namely: Lari, Juja, Ruiru, Kikuyu, Limuru, Kabete, Kiambaa, Githunguri, Thika Town, Kiambu Town, Gatundu North and Gatundu South. It covers an area of 2,543.42 square kilometers. It has a density of 638 people per square kilometre. The county is predominantly rural but its urban population is increasing as Nairobi is growing rapidly. The population tally in the county according to the Kenya National Bureau of Statistics is 1,623,282. It has 60.8% of the urban population. The county is a high potential area in terms of resources with high social economic status compared to other parts of the region.

Kiambu Town is the commercial and administrative capital of Kiambu County. Due to its proximity to the city of Nairobi (16 kilometres), the town hosts key government offices for the main ministries. It hosts two hundred and thirteen (213) public secondary schools which run on both the day and boarding system for boys and girls. Most of the schools in the county are beneficiaries of the ESP-ICT program (Economic Stimulus Program) that has facilitated acquisition of basic information communication technology (ICT) infrastructure to enable them integrate ICT in the management of schools and in the teaching and learning. The principals of

the beneficially schools were trained on how to manage the ICT integration program at the school level.

Kiambu County government is focused on adopting and integrating ICT for the provision of quality services. The county government has noted that ICT has the capability of boosting economic growth if well adopted and implemented. The county has recently developed an automated receipting system aimed at improving revenue collection. The county is keen to embrace ICT in delivery of quality and affordable services to the public. They are developing ICT platforms where the public can access and share information easily.

Information and Communication Technology (ICT) pervades virtually all domains of modern life, personal, social, professional and educational. ICT (Information and Communication Technology) is used as an umbrella term that includes any communication device or applications encompassing: radio, television, cellular phones, computer and network hardware and software satellite systems, as well as various services and applications associated with them, such as video conferencing and distance learning. Up until now when ICT has been incorporated into the curricula of most secondary schools, the focus has tended to be on skills in the use of tools such as specific word processing and presentation of software or contemporary internet search engines. Nevertheless, educators are increasingly employing emerging technologies as a crucial meaning-making tool assisting learners to construct and engage fundamental disciplinary concepts and to collaborate with intellectual partners inside and beyond the physical confines of their secondary schools (UNESCO, 2002).

The use of technology has evolved rapidly and become a powerful teaching and learning tool in Kenyan secondary schools. According to Pelgrum (2002), technology in education includes the application of technology that support education within institutions such as in

scheduling and grade reporting. The author also explained that instructional technology is a sub-set of educational technology based on the concept that instruction is a sub-set of education. Learning is purposive and controlled in the situation where instructional technology took place. In Kenya, the government's effort to implement ICT in schools was first initiated by publishing sessional paper No. 1 of 2005 where ICT was given prominence. Learning and teaching was to be transformed to embrace ICT skills appropriate for 21st first century (GOK, 2005).

1.1.1 Background to the Study

Countries that have harnessed the potential of Information and Communication Technologies (ICTs) have attained significant social and economic development. In addition, they are rapidly transforming into information and knowledge – based economies. The demands of the 21st century dictate that learners should be equipped with requisite skills to competently engage and perform in the new information age. These skills commonly referred to as 21st century skills include critical thinking, problem solving, collaboration, creativity and communication (KEMI 2014). It has been argued that ICT is a principal driver of economic development and social change worldwide (Kozma, 2005; Leach, 2008). In many countries, the need for economic and social development is to justify investments in educational reform and in educational ICT. In this view the Kenyan Ministry of Education expects ICT to be widely deployed for teaching and learning in primary and secondary schools. The Kenya National ICT policy was adopted in 2006 after several years of effort in trying to put it in place. The aim of the policy was to improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services as reported in the ICT in Education Options Paper (MoEST, 2005).

Although the national ICT policy has several sections, objectives and strategies regarding ICT in education are spelt out in the information and technology section. In this section, the objective regarding the use of ICT in schools, colleges, universities and other educational institutions to improve the quality of teaching and learning is spelt out. One important strategy outlined in this report is the promotion and development of specific e-learning resources that would address the educational needs of primary, secondary and tertiary institutions. A significant step in this direction is the digitisation of the curriculum, which is ongoing at the Kenya Institute of curriculum Development (KICD). The Kenya Institute of Curriculum Development (KICD) has been singled out as the sole government body charged with the responsibility of developing the ICT curriculum as well as distributing the educational material. Under the subtitle 'E-Learning', the ICT policy goes on to outline the strategies that will be used in the promotion and development of ICT in teaching and learning.

Other strategies outlined in the policy include: promoting the development of e-learning resources and an integral e- learning curriculum, create awareness of the opportunities offered by ICT as an educational tool to the education sector, facilitate sharing of e-learning resources between institutions and integrate e-learning resources with other existing resources. The Ministry of Education has taken steps to support the implementation of the National ICT strategy for education and training either by direct action or through various institutions and agencies such as the New Partnership for Africa's Development (NEPAD). The New Partnership for Africa's Development (NEPAD) is a vision and strategic framework for Africa's Renewal. NEPADS e-schools programme aims at promoting open and distance education for teacher development and capacity building in the public sector and modernizing education and assisting in the reconstruction of education infrastructure in post- conflict environments (KEMI, 2014).

The Session Paper No. 14 of 2012 is the current policy framework through which the Ministry of Education affirms commitment to enhance access to education in its quest for provision of quality education. The policy underscores Ministry's commitment to competency based teaching and learning that promotes acquisition of 21st Century skills and attitudes such as critical thinking, creativity, communication, collaboration and innovation that prepares learners to competitively participate in a knowledge based economy. Integration of ICT across all levels of subjects and education is envisaged to enhance 21st Century learning skills among others.

Among the key policies in Sessional Paper No. 14 of 2012 are ICT integration into the teaching and learning in our school by training of trainees and building computer labs and providing computers (laptops) laying greater emphasis on ICT integration to improve teaching and learning while continuing to support ICTs for educational administration and management (e-government) as well as development of digital literacy in support of knowledge economy.

Today, ICT in education encompasses a great range of rapidly evolving technology such as desktop, notebook, and handheld computers, digital cameras, local area networking, the internet, and worldwide web, CD-ROMS and DVDs, and application such as word processors, spreadsheets, tutorials simulations, electronic mail (email) digital libraries, computer aided instruction, video conferencing and virtual reality. It should also be noted that the use of newer ICT is being integrated with the use of older technologies. For example it is not uncommon to find textbooks sold with CD-ROMS containing multimedia or links to related websites. ICTs differ in several important dimensions from older technologies including the integration of multiple media, interactivity, flexibility of use and connectivity. These four dimensions-integration of multiple media, interactivity, flexibility of use and connectivity distinguish digital ICT from previous technologies. Because of these differences, educators are finding powerful

new ways to integrate digital technologies into the curricula (Macchiusi et al, 2000). According to (Khan, Hassan & Clement, 2012), the adoption and use of ICT in schools can promote collaborative, active and lifelong learning, increase students motivation, offer better access to information and shared working resources, deepen understanding, help students think and communicate creatively. In other words, ICT seems to change the way teaching and learning is carried out in schools. With emerging uses of ICT in schools, teaching could be changed from emphasis on teacher centred to student centred hence creating interesting and interactive learning environment. ICT facilitates a pedagogical shift entailing on educational interaction between teachers and learners.

1.2 Problem Statement

There are evidences supporting the introduction and use of new technologies in instruction. The World Bank (2004), argued that ICTs should be considered within education for the purpose of reforming curriculum, reinforcing teaching and learning to improve learning. There is some recognition that merely providing equipment is insufficient to promote educational change and the policies point to a desire for a nationally coordinated effort in the creation, dissemination and sharing of e-learning content to improve the quality of teaching and learning in schools. It is therefore the pedagogy of the application of technology in the classroom which is important: the how rather than what that is the crucial lesson emerging from the research. There is need to examine how exactly the ICT can be applied in teaching and learning for more effective learning. Teachers are expected to be the curriculum implementers in the classroom and it is expected that their sound knowledge on ICT and how to use it in teaching and learning will

not only go a long way in achieving this goal but also improve the standards of education. All of this means that teachers need to update their knowledge and skills to develop the educational process in the classroom.

Previous research has provided evidence of the significant contribution that ICT makes to improving methods of teaching and positively impacting the learner (Kennewell and Beauchamp, 2007).However many of these studies have been limited to investigating the impact of ICT on learners. There is substantially less research which focuses on the pedagogical application of ICT in teaching and learning. In order to integrate ICT into teaching and learning, teachers need to tailor their teaching strategy to suit the new trend of education, from a traditional style, teacher dominated way of teaching, to a more interactive method, with the help of ICT tools. Teachers are expected to conduct their lessons with the assistance from the ICT tools. The curriculum should be modified to cater for the expectation arising from various sectors of the economy as teachers try to integrate technology directly into the subject matter (Cohen, 2001). Computers are gradually regarded as indispensable in classroom and form part of the student learning experience. The National ICT policies touching on the curriculum and training of teachers in ICT skills and pedagogical application of ICT seem to have been singled out as basic to the implementation of ICT.

Advances in information technology have the potential to transform classroom teaching for example by providing alternatives to the standard lecture format and by giving students immediate access to a wealth of high quality interactive resources and tools. The presence of ICT in the interactive educational environment can help develop thinking skills and make classrooms an environment for educational growth.

1.3 Purpose of the Study

Exactly how ICT should be integrated into the classroom is of great motivation to this study. Many Ministries of Education have made the commitment to bring ICT into schools but few have developed coherent strategies to fully integrate the use of computers as pedagogical tools in the classroom. Many governments view computers as a standalone subject requiring a curriculum focusing on basic computer literacy skills. While computer literacy is required, the integration of computers and the internet into the broader curriculum is where real learning begins. Too often the curriculum in the developing countries is rigid and overloaded, leaving little time for innovative classroom practices. Policies should make a commitment to helping teachers effectively integrate computers and internet technologies into the classroom by aligning curricula exams and incentives with the educational outcomes that they hope to gain. In the end, computers by themselves bring very little to the learning process-they are only tools for teaching and learning (UNESCO, 2002)**.** The study will therefore identify implications for future investment in the use of instructional technology for learning in schools. Instructional technologies are now embedded in our society. Focus has lifted from whether or not to use them in teaching and learning to understanding which technologies can be used for what specific educational purposes and then to investigate how best they can be used and embedded across the range of educational contexts in schools.

1.4 Research objectives

1. To determine the instructional technologies available and their application in teaching and learning in public secondary schools in Kiambu Sub-County
2. To examine the extent of application of instructional technologies in teaching and learning and their benefits and outcomes in Kiambu Sub-County Secondary schools.
3. To explore factors contributing to the application of instructional technologies in teaching and learning in Kiambu Sub-county secondary schools
4. To identify the barriers that hinder effective application of instructional technologies in teaching and learning in Kiambu Sub-County

1.5 Research Questions

1. To what extent are the instructional technologies available for teaching in Kiambu Sub-County Secondary schools?
2. To what extent are the instructional technologies applied in teaching and learning and their benefits in Kiambu Sub-county Secondary schools?
3. What are the factors that contribute to the effective application of instructional technology in the classrooms?
4. What are the barriers to the effective application of instructional technology in teaching and learning in the classrooms?

1.6 Significance of the Study

ICTs have become important drivers in the Kenyan economy. They have been applied in different fields ranging from economic, health, and disaster management, among others. Their

role in these fields has largely been positive. In all levels of education, ICTs provide many opportunities. It is therefore imperative to closely engage with the ICT discourse in Kenyan education system, which is the aim of this proposed research. In 2013, during the Jubilee government campaigns and after election in office, ICTs have been a centre of the manifesto and new policy. However, the debate, which has centred on laptops for public primary schools, addresses only a small segment of learners. This study recognises the broader ICT needs at all levels of education and will therefore address high school level. It is expected that this study will provide insights on the processes and framework which will assist school managers in making decisions that facilitate application of instructional technologies in secondary schools. The planners and policy makers can use the findings of the study as a base for revising the current ICT policy in order to overcome the challenges hindering smooth adoption and use of ICTs in schools in Kenya. Teachers are expected to find the results of this study useful as it highlights the opportunities and benefits of applying emerging technologies in classroom instruction

1.7 Justification of the Study

The use of technology in education attracts a lot of attention because there is a general belief that ICT instruments can help foster educational reform so as to prolong learning beyond classrooms. People often correlate ICT with pedagogical changes. By technology in education or ICT as has been mentioned by Macchiusi et al (2000) the term refers to “newer technologies involving audio and video tapes, computer based learning packages, interactive video and multimedia audio-graphic communication systems and video conferencing (online)”, which may be supplemented by traditional technologies such as print and radio and television. It has been

witnessed that there is increasing frequency of incorporating ICT into teaching. The increased use of ICT by teachers has opened up "new ways of looking at the curriculum and exploring methods to integrate technology directly into it" (Cohen, 2001, p. 356).

This policy has aroused interests in the study of how ICT or the internet can sustain quality education and how teaching strategy can be adjusted to include elements of such modern trend. The issue is becoming even more popular with the inspiration of the government to extend learning beyond the classroom. The Ministry of Education has developed a curriculum for integrating ICT in teaching and learning in preparation for the roll out of the National laptops. On launching the curriculum in August 2013 at the Kenya Institute of Curriculum Development (KICD), Education Cabinet Secretary Jacob Kaimenyi said that the laptop programme for the learners in the primary schools will enable the government to address access, equity and quality of education.

1.8 Theoretical Framework

1.8.1 Unified theory of acceptance and use of technology (UTAUT)

Technology is being increasingly integrated in classrooms to facilitate and enhance students' learning. From course management software to simulation and analysis systems, academic institutions are investing in technologies intended to provide an educational value to students. However, the success of new technology introductions cannot be achieved if the students and teachers do not accept and use the technology (Chen, 2011). A number of theoretical models have been proposed to facilitate the understanding of factors impacting the acceptance of information technologies (e.g., Davis, 1989; Chau, 1996; Venkatesh & Davis, 2000). Among

these studies, the Technology Acceptance Model (TAM) is one of the most influential and robust in explaining IT/IS adoption behaviour. The key purpose of TAM was to provide a basis for discovering the impact of external variables on internal beliefs, attitudes, and intentions.

TAM assumes that beliefs about usefulness and ease of use are always the primary determinants of information technologies adoption in organizations. According to TAM, these two determinants serve as the basis for attitudes toward using a particular system, which in turn determines the intention to use and then generates the actual usage behaviour. Perceived usefulness is defined as the extent to which a person believes that using a system would enhance his or her job performance. Perceived ease of use refers to the extent to which a person believes that using a system would be free of mental efforts (Davis, 1989). However, the original TAM model was created to examine IT/IS adoption in business organizations. Venkatesh, et al (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) model to consolidate previous TAM related studies. In the UTAUT model, performance expectance and effort expectancy were used to incorporate the constructs of perceived usefulness and ease of use in the original TAM study. Although the UTAUT model posits that the Effort Expectancy construct can be significant in determining user acceptance of information technology, concerns for ease of use may become non-significant over extended and sustained usage.

Therefore, perceived ease of use can be expected to be more salient only in the early stages of using a new technology and it can have a positive effect on perceived usefulness of the technology. Venkatesh, et al (2003) has synthesized eight user acceptance and motivation models to propose the Unified Theory of Acceptance and Use of Technology. The eight theories are the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behaviour (TPB), a combined theory of Planned

Behaviour/Technology Acceptance Model (C-TPB-TAM), the Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT).

Derived from the above, UTAUT suggests that four core constructs are direct determinants of technology acceptance (behavioural intention) and use (behaviour): Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. The theory also suggests that the effect of these four constructs is moderated by four other variables: age, gender, experience and voluntariness of use as illustrated in figure 1 below.

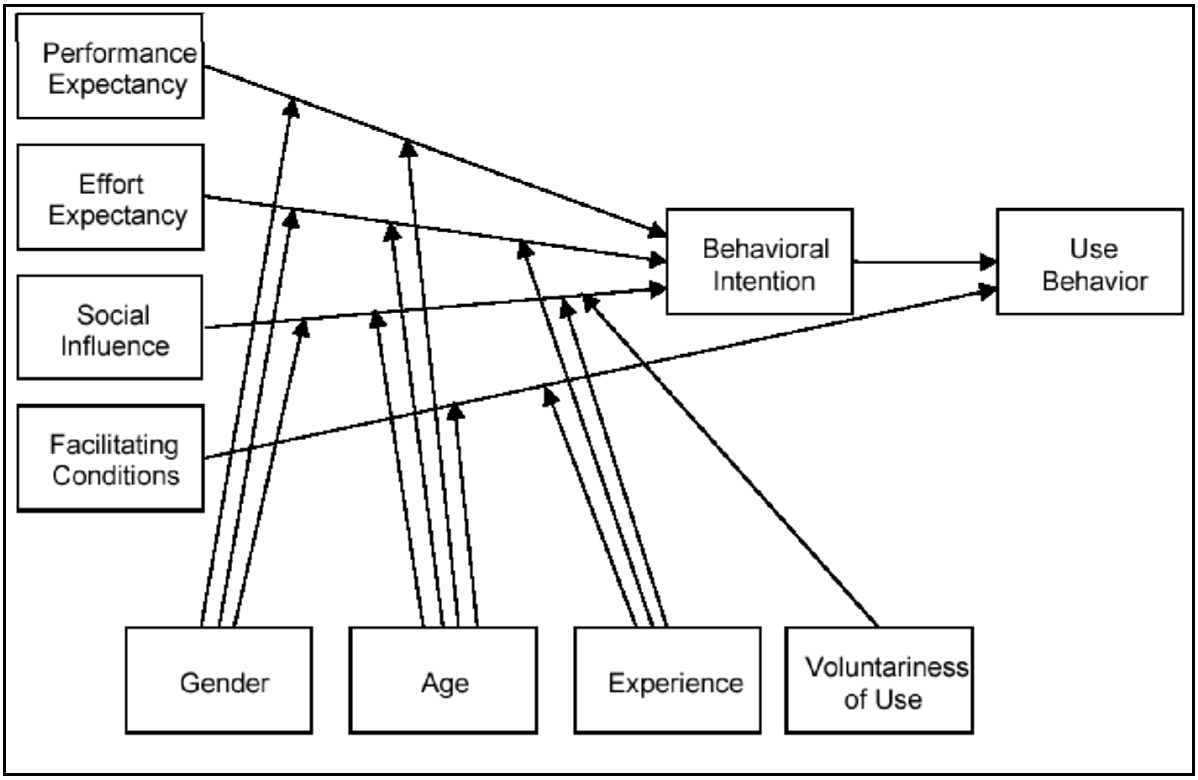


Figure 1: UTUAT Model

The validation of UTAUT in the originating paper (Venkatesh et al., 2003) showed that UTAUT explains 70% of the variation in usage intention (acceptance) of technology which is greater than each of the eight previous models and their extensions. The UTAUT model focuses

on user acceptance of technologies that are newly introduced to capture the user's first perception and how that perception changes with increased experience of using the technology. Tutors in academic institutions use technology to enhance students learning and facilitate the flow of information between the tutor and the students, or among the students themselves. Providing the students with certain technologies is aimed at helping the students achieve a learning outcome. The Unified Theory of Acceptance and Use of Technology is significant because it helps predict students' reaction towards the technology introduced and explains how their perception changes with increased experience. Hence, the theoretical framework can provide recommendations to prepare the right environment before introducing a new technology for students and teachers (Birch & Irvine, 2009).

In their review of the eight prominent IT acceptance and motivation models, the authors of UTAUT found seven constructs to be significant direct determinants of acceptance and use of technology in one or more of the individual models. However, they found that three of these constructs (self-efficacy, anxiety, and attitude) do not have any direct effect on intention to use the technology, therefore, these constructs were dropped from UTAUT while the other four (performance expectancy, effort expectancy, social influence, and facilitating conditions)were kept.

Table 1 shows the definition of each of the aforementioned constructs as reported in the originating UTAUT study (Venkatesh et al., 2003).

Con	Defi

Table 1: Definitions of the constructs

Performance Expectancy (PE)	The degree to which an individual believes that using the system will help him or her to attain gains in job performance.
Effort Expectancy (EE)	The degree of ease associated with the use of the system.
Social Influence (SI)	The degree to which an individual perceives that important others believe he or she should use the new system.
Facilitating Conditions (FC)	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.
Computer self-efficacy (SE)	Judgment of one's ability to use a technology to accomplish a particular job or task. (adapted from the Social Cognitive Theory)
Computer anxiety (ANX)	Evoking anxious or emotional reactions when it comes to performing a behavior (i.e. using the technology) (Adapted from the Social Cognitive Theory)
Attitude towards using Technology (ATUT)	An individual's overall affective reaction to using a system.

1.9 Scope of the Study

For the purpose of this study, the researcher will confine the study to only teachers, students and the principals of the selected public secondary schools. Teachers and students are the end users of the instructional technologies used in teaching and learning process. The study aims at establishing how instructional technologies are utilized by both teachers and students and

which instructional procedures are most suitable for the use of these instructional technologies in conveying content to the learners.

1.10 Limitation of the Study

The main limitations the researcher expected to face was bureaucracy where by one needed to get different approvals before beginning the data collection process, the criteria in choice of the sample of schools, students, teachers and that notwithstanding some interviewees being senior directors in the Ministry, the researcher faced difficulties in arranging the date and the time of the interviews.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter synthesizes the literature on the application of information and communications technology (ICTs) in public secondary schools in Kiambu Sub-County. It focuses on the role of ICT in improving the quality of learning and teaching in schools with reference to technologies appropriate for this context. The review also casts light on the supporting and constraining factors that influence ICT integration in teaching and learning in the region. Teacher factors, physical factors and school related factors are identified.

Technology ushers in fundamental structural changes that can be integral to achieving significant improvements in productivity used to support both teaching and learning., Technology infuses classrooms with digital learning tools such as computers and hand held devices; iPods course offerings, experiences and learning materials; supports learning 24hours a day, 7days a week; builds 21st century skills; increases student engagement and motivation and accelerates learning. Technology also has the power to transform teaching by ushering in a new model of connected teaching. This model links teachers to their students and to professional content, resources and systems to help them improve their own instruction and personalize learning. Online learning opportunities and the use of open educational resources and other technologies can increase educational productivity by accelerating the rate of learning; reducing costs associated with instructional materials or program delivery and better utilizing teacher time (KEMI, 2014).

2.2 Instructional Technology

Quite often educational technology and instructional technology are regarded as synonyms. According to Association for educational communications and Technology (1994) instructional technology is the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning. The best known instructional method is a lecture or traditional classroom on learning.

Traditional classroom is still one of the most common teaching methods in use today. Electronic learning or e-learning has become a promising alternative to traditional classroom learning. It has also become one of the fastest moving trends in Education. According to Zhang et al (2004) e-learning can be defined as technology-based learning in which learning materials are delivered electronically to remote learners via computer networks. E-learning covers a wide set of applications and processes, such as web-based learning, computer-based learning, virtual classrooms and digital collaborations.

2.3 The Availability of Instructional Technology

Jones and Kozma (2003), notes that national ICT policies can serve several important functions. Firstly, ICT policies provide a rationale, a set of goals and a vision of how education system work if ICT is introduced into teaching and learning and they can benefit students, teachers, parents and general population of a given country. Secondly, ICT policies are expected to provide guidance, and failure to do so means that individual school and classroom innovations would unlikely be sustained. The Kenya National ICT policy was adopted in 2006 after several

years of effort in trying to put it in place. The aim of the policy was to improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services as reported in the ICT in education options paper (Kenya MoEST, 2005).

The National ICT policy adopted in 2006 lays the framework for e-learning considered crucial to its development and utilization. Need is expressed to provide affordable infrastructure to facilitate dissemination of knowledge and skill through e-learning platforms; and to promote the development of content to address the educational needs of primary, secondary and tertiary institutions. The level of investment in ICT in education reflects the recognition in the national ICT policy of the need for Public, Private Partnership (PPP) in addressing key development challenges in the country. An ICT unit has been established at the ministry's head office to ensure systematic efforts made towards strengthening adoption and use of ICT in the education sector in general. A main component of this implementation strategy is achieved through the Kenya ICT Trust Fund. Kenya ICT Trust Fund is a registered consortium in the form of an NGO in Kenya that brings together many partners from the public, private and civil society sectors. Its main objective is to mobilize funds for the sole purpose of setting up computer laboratories in all Kenyan secondary schools.

A number of initiatives have delivered ICT infrastructure to schools mainly at secondary level. These include initiatives supported by parents, the government, NGO's or other development agencies and the private sector. Notable among these are Education Management Information Systems (EMIS), Computers For School Kenya (CFSK), NEPAD e-schools imitative and the Microsoft partners in Learning program. Others include Network Initiative for computers in schools (NICE) which coordinates member activities related to computer equipment sourcing, refurbishment, distribution, installation, training, maintenance, networking,

connectivity and use of ICT as a tool within the formal and informal sectors. The Economic Stimulus Program (ESP) was introduced as a catalyst to jumpstart or fast tract ICT integration in education in line with Kenya Vision 2030 "to produce a highly skilled human resource to transform Kenya into a middle income, knowledge based economy." The ESP-ICT program has been quite successful as at least seven public secondary schools in every constituency acquired a basic ICT infrastructure to enable them integrate ICT in the management of schools and in the teaching and learning. The government continues to increase every year the number of secondary schools with ICT equipment. (KEMI, 2014).

The government has promised to put more schools on the information communication technology (ICT) highway as it integrates sector in education. Dr. Belio Kipsang', the principal Secretary in the Ministry of Education, recently said that the move will improve the quality of education that leans heavily on academics. The Ministry is in the process of reviewing the curriculum in line with the constitution to meet the demands of the job market. Already, 3,500 computer labs have been installed in secondary schools countrywide. Countries in the African region have also taken ICT initiatives in the provision of infrastructure to spearhead integration of ICT in the teaching and learning. In the Gambia, for example, the Ministry of Education in conjunction with World Bank equipped half of the state secondary schools with state of art networked computer labs, but internet access remained a major obstacle to using these to their full potential (Mangesi, 2007).

In Ghana ICT initiatives have included equipping schools with ICT, networking amongst schools, schemes awarding teachers who excel in using ICT, capacity building for teachers and email communication between students and teachers. If sustained those could lead to advanced use of ICT in schools. There is also a computer literacy

programme for training school teachers and principals on keyboarding, word, processing, basic trouble shooting and maintenance (Mangesi, 2007). Mauritius is at the forefront of digital development and worth a mention. ICT initiatives there are modelled on the Singaporean experience as a cyber island and focus on becoming a hub within the Southern Africa region with a substantial segment of its ICT policy being dedicated to educational in 2006, Mauritius approved the universal ICT Education Programme (UIEP) which aimed at providing hardware. Internet connectivity and computer proficiency skills to students and other target groups through ICT skills courses in 59 centres located within schools across the country. Significantly, the programme target was to train all the 5400 primary school teachers to be able to use ICT as a pedagogical tool by 2006. The need for this kind of training in order to make classroom use of new technologies effective is often unrecognized in both developed and developing countries.

The Rwanda government identifies ICT as central to its achievement of Vision 2020 which looks towards the building of a modern and prosperous nation. The Government of Rwanda in 2001 released the first National Information and Communications Infrastructure (NICI) plan which was an Integrated ICT-led Socio-Economic Development Policy and Plan for Rwanda aimed at development of ICT in the nation between 2001 and 2005 (Harrison, 2005).

A number of action items or strategies have been identified by Farrell (2007) as set out in the education sub-plan of the NICI 2010. These are associated planned actions that include time frames, budget estimates, and expected benefits which are assigned to the Ministry of Education in collaboration with other agencies. Whereas some of these planned actions are new, others the author notes, are related to planned actions in the NICI 2005 and

have been updated and revised. In the strategies, training is mentioned in two ways; that of primary and secondary school teachers on ICT in education, as well as training of a critical mass of computer literate teachers to oversee the implementation of ICT. To support this training, the policy sets out the establishment of a national library network and a regional information training and research institute to serve Rwanda and the sub-region. Also suggested is the development of a national computer curriculum for primary and secondary schools and coordination of its implementation.

Another strategy is the development of e-learning content; however, the policy suggests a translation of educational software into the local Kinyarwanda language so that it is appropriate for Rwanda. It suggests converting the existing computer-based training and e-learning content to Kinyarwanda too. Mentioned also is the development of programmes to promote the acquisition of computer equipment by educational institutions and a National SchoolNet that will help provide access to the internet for schools, facilitate sharing and learning resources and a comprehensive policy to regulate computer education. In addition, the SchoolNet programme is expected to link Rwandan schools with other schools internationally. Implementation of the Education Management Information System (EMIS) is also suggested for the purpose of enhancing the use of ICT in schools and colleges. To speed up the deployment and use of ICTs is the development of a national electronic distance education and training programme that will supplement and complement campus-based education at all levels. This should also facilitate lifelong learning and encourage in-service training both in public and private sectors.

2.4 The Application of instructional technology in teaching and learning process

Information and communication technologies (ICTS) are central to the changes taking place throughout the world. Digital media has revolutionized the information society and advances in ICTs have dramatically changed the learning and teaching process. This has opened up new learning opportunities and provided access to educational resources well beyond those traditionally available (Asmal, 2003 P.4). With lots of changes going on worldwide, education is also not left behind. There is a need to meet these changes in education. Haddad and Draxler (2002), states that in order to meet these changes in education, there is need for paradigm shifting as exemplified below.

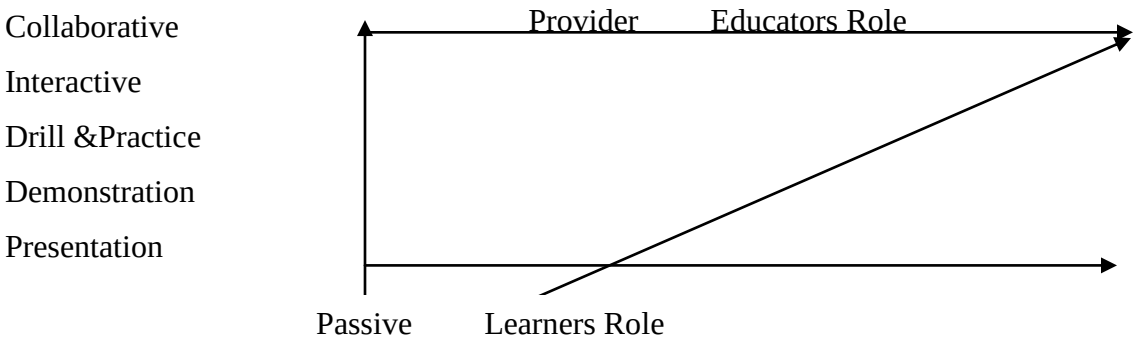
The new schooling paradigm

From	To
A school building	A knowledge, infrastructure (schools, labs, radio, television, internet)
Classrooms	Individual learners
A teacher (as a provider of knowledge)	A teacher (as a tutor and facilitator).
A set of textbooks and some audiovisual aids	Multimedia materials (print, audio, video, digital…)

Source: Haddad & Draxler (2002, p8)

Haddad and Draxler (2002) add that teaching and learning practices need to be reviewed and realigned for accommodating meaningful use of ICTs in teaching and learning. Below is a diagram taken from Haddad and Draxler indicating how changed teaching and learning practices could be reviewed.

Figure 1.0: use of ICTs for different roles of educators and learners.



Source: Haaga & Draxiere 2002, p13.

The bottom x-intercept indicates the learners' roles as they change from the educator centred approach, to the learner centred approach. The top x-intercept indicates the educators' role as they change from the educator-cantered approach to a learner-centred approach. The Y-intercept indicates the different use of ICTs, which are more dependent on the teaching, and learning practices starting from an educator centred role to a learner-cantered role. It is evident that moving from a provider to a facilitator role does not come automatically because ICT resources are available in schools. It is also the responsibility of the educator to ensure that learners also move from a passive role to a more active role in the learning environment.

Wheeler (2000) indicates the following as reasons for the new changed roles in the ICT learning environment; There will be management of distributed learning environments from the diagram,, the educator requires to engage learners in more collaborative activities, which are in essence learner-centred and do promote the learners active participation in the learning environment. Learners need to be encouraged to develop their critical thinking skills, advance their information literacy and nurture their collaborative working practices so as to prepare them for the information which is more competitive than ever. The policy framework for ICT

integration is anchored on Kenya vision 2030, the national ICT policy and the e-government strategy. The social pillar of vision 2030 mandates the Ministry of Education to provide quality education that 'produces a highly skilled human capital with the requisite ICT skills to competitively participate in knowledge based economy'.

ICT is identified as the catalyst to drive socio-economic transformation of Kenya into a middle-income country. (KEMI, 2014). Reforms related to ICT integration in the education sector include: a) development of an ICT integration model which emphasizes four key pillars critical to effective implementation of ICT initiatives. These are: teacher capacity development, relevant digital content, deployment of ICT infrastructure and robust policy and strategy. b) Creation of specialized units namely:-The ICT for Education (ICT4E) which is mandated to spearhead the pedagogical use of ICTs. It provides the secretariat for ICT integration and is charged with the responsibility of coordinating all ICT integration activities of MOEST. National ICT innovation and integration centre (NI3C) is mandated to carry out the testing of technical solutions submitted for consideration by firms in order to establish their appropriateness and use in curriculum delivery. The ICT integration team made up of members from MOEST, KEMI, KNEC, ICT4E, NIBC, KICD play the roles of coordination, harmonization on all ICT initiatives in the sector and an ICT unit based at the Ministry of Education's headquarters which has the following responsibilities: - Implementation of e-government strategy in the MOEST, ICT technical support and advice, technical support and systems for EMIS and make reports to the principal secretary on ICT matters. (KEMI 2014)

The newly founded ICT for Education (ICT4E) concentrates on the pedagogical aspects of ICT integration in the learning and teaching process. The National ICT innovation and integration centre (NI3C) focuses on research and monitoring of technology integration in

education. The ICT integration team is perceived as a driving force responsible for the coordination and harmonization of all ICT initiatives within KESSP (Kenya Education Sector Support Programme). In order to appropriately integrate ICT for an improved education quality, technology and pedagogy must go hand in hand. Gradually pedagogical considerations will become the guiding and driving force (KEMI, 2014). The government through the minister of information and communication has asked learning institutions to increase ICT uptake to enhance innovation in curriculum delivery. In order to produce innovative learners that are able to undertake initiatives, learning institutions need to develop the students' needs. Schools should therefore increase the students' capacity to adapt and respond to change.

Joy Town School in Thika, Kiambu County has designed and implemented ICT supported education curriculum. The curriculum is to help promote acquisition of knowledge and skills by average secondary school students to excel in national examinations. The school's director of studies noted that when ICT is used appropriately especially in computer and internet technologies it opens up new ways of teaching and learning for teachers and students alike. ICT has enabled slow learners in the last three years to better understand and appreciate abstract concepts in Mathematics and Sciences. Using teacher generated power point presentation slides lesson are now easier to present in class and has boosted the school's effort to adequately cover and finish the secondary school syllabus in time before the students sit for their Kenya Certificate of Secondary Education (KCSE) examinations.

The development is in line with the government's 2006 National Information and Communication Technology Policy that encourages the use of ICT in schools to improve the quality of teaching and learning. The school's teachers received training from volunteers from Australia and England in a bid to make class lessons visually appealing, interesting and easy to

interpret concepts that ordinarily appear too technical to be easily understood. The director disclosed that the use of ICT has helped to support new instructional approaches and make hard to implement teaching methods such as simulation or interactive learning more interesting to learners.

A study by (Newby et al. 2006) on use of instructional technology in American schools indicated that technology cannot become a meaningful support for students work if they have access to it for only a few minutes a week. The kind of technology supported project-based instruction described requires a high level of access to the sorts of technology tools that researchers and other professionals use in a daily basis to support their work. According to IJEDICT (2007), Gyorgy Katona used instructional technology (ICT in teaching Physical Education (PE) and it increased pedagogical effectiveness in schools and the University of West Hungary in Hungary. In the state of Illinois in the United State of America, ESTRELLA a collaborative effort among five states and key partners have demonstrated how technology can be used to improve the achievement of migrant students especially those from high school who had difficulties in transferring credits from one school to another and from one state to another. These students are assisted on available career and educational opportunities too. In addition, ESTRELLA also provides professional development for teachers working with participating students to further their own technological skills, observes Pessin as a scholar of IJEDICT (2007) journal.

Waema (2005) did a study on the impact of ICT revolution throughout the world which cannot be ignored where he cites that most countries have gotten computer literacy. He cites India as the country with the largest scientific management in the world whereby the country is able to provide computer education through television and via internet. Australia also prioritizes

ICT education. Malaysia is another country which too gives priority to ICT education. The government grants a tax exemption on import of multi-media equivalent as incentive to one of its ICT city referred as cyber Taya. Korea is one of the most advanced countries in terms of technological infrastructure. Korea has embraced e-learning at every level of teaching and learning. Each school uses internet in other subject areas as well as in science and mathematics classes. Teachers have their own home page and students exchange their ideas of group projects at the home page. The teacher announces homework or projects and students submit their assignments electronically. Most of the students have at least one internet connected computer at home. There are many public cyber cafes where students can access computers (KEMI, 2014: 57.) In the teacher education program, e-learning is usually introduced early in the training using the internet activated computers; the trainees are able to watch the instructor's lessons anytime and anywhere. The Ministry of Education has introduced "ubiquitous" type of tools in teaching and learning. A teacher and students use their cellular phones and notebook computers to communicate with each other. In this type of learning, students are able to communicate anytime and anywhere.

2.5 Instructional Technologies and Interactive Teaching

Part of the rationale for this study is to highlight interactive teaching as a means of enhancing students learning. Learners develop understanding inside interactive social situations backed with knowledge through collaboration with others, who receive knowledge of cultural value and seek new learning (Burns & Myhill, 2004). Interactive teaching exists where teachers integrate with their plans as well as with knowing their students, provided that teachers believe

that the correct use of students' inputs will take place only within a framework of specific criteria based on the plans that precede the lesson they intend to provide.

Hargreaves et al (2010) suggests that effective interactive teaching, which is distinguished by constant mutual interaction between the teacher and the learner, involves the exchange of thoughts and not traditional methods of 'dictation, response and feedback' which results from teachers questions. Using ICT effectively can lead to a more positive educational ethics in the classroom and in effect a more communicative classroom. Effective use of ICT by the teacher can offer greater interactivity at both a deep and surface level. ICT offers a range of key features including speed, automating, capacity, range, provisionality and interactivity (Beauchamp, 2012). Interactivity has been defined as the ability of ICT to respond contingently to a pre-defined set of responses (Beauchamp, 2012, p7). Teachers get bored quickly with providing negative or positive feedback across all lessons. Computers never tire their feedback or in summative assessment, yet they cannot provide the detailed and individual levels of feedback that teachers can. Hargreaves et al (2010, p224) depicts interactivity as being of two types; the first is a 'gimmicky' or surface form. This type can entertain but it is not necessarily educational in function. It relates to factual recall type learning. It contracts with 'deep interactivity', which engages students' comprehension and promotes a deeper level of response. It promotes greater thinking skills when coupled with dialogical teaching.

In interactive teaching the role of the teacher is to support students in every aspect of their learning. However, their effort interaction and participation play on important role in the acquisition and comprehension of knowledge. Consequently, they become ready to implement the method of learning constantly while they are at work. This is because in their practical life they will encounter problems other than the ones they encountered in their academic life, and so

they will be ready to learn without anybody's help. In effect, this is very important in today's job market for the worker or employee to be educated and if it is not so, he will not be useful for the employer. If he does not go beyond what he has achieved in his academic study, in the medium term he will lag behind society and scientific advancements (Beauchamp, 2012).

2.5.1 E-Learning

E- Learning refers to the use of electronic media and ICTs in education. It includes numerous types of media that deliver texts, audio, images animation and streaming video, and includes technology applications and processes such as audio or video tape, satellite TV, CD-ROM, and computer -based learning, as well as local intranet or extranet and web- based learning. E- Learning can occur in and out of the classroom. It can be self-paced, asynchronous learning or may be instructor –led, synchronous learning (KEMI, 2014). According to Zhang et al; (2004) e-learning can be defined as technology based in which learning materials are delivered electronically to remote learners via computer networks. Trends in e-learning are becoming very technology driven and heavily dependent on ICT developments including extended broadband access, wireless computing and the coverage of digital devices. Electronic learning or e-learning has become a promising alternative to traditional classroom learning. It has also become one of the fastest moving trends in education.

The advantages of e-learning include the facts that: It is a self paced, flexible, accessible, convenient learning process, offers savings in cost and time (particularly for students. It is focused on learning through more active participation and has easier content management simpler data management and is easy to update. It also offers the possibility of linking the content with other learning resources and integrated assessment and testing facilities. Its

disadvantages are the facts that E-learning cannot happen without supporting technologies and secondly these technologies and tools are not always sufficiently reliable.

2.5.2 Blended Learning

Blended learning opportunities incorporate both face to face and online learning opportunities. The degree to which online learning takes places and the way it is integrated into the curriculum can vary across schools. The strategy on blending online learning with school based instruction is often utilized to accommodate students' diverse learning styles and to enable them to work before or after school in ways that are not possible with fulltime conventional classroom instruction. Online learning has the potential to improve educational productivity by accelerating the rate of learning, taking advantages of learning time outside of school hours, reducing the cost of instructional materials, and better utilizing teacher time. These strategies can be particularly useful in rural areas where blended or online learning can help teachers and students in remote areas overcome distance (KEMI, 2014).

2.5.3 Virtual Classroom

A virtual classroom provides the opportunity for students to receive direct instruction from a qualified teacher in an interactive environment. Learners can have direct and immediate access to their instructor for instant feedback and direction. The virtual classroom provides a structured schedule of classes which can be helpful for students who may find the freedom of asynchronous learning to be overwhelming. In addition, the virtual classroom provides a social learning environment that replicates the traditional 'brick and mortar' classroom. Most virtual classroom applications provide a recording feature. Each class is recorded and stored on a serve,

which allows for instant playback of any class over the course of the school year. This can be extremely useful for students to review material and concepts for an upcoming exam. This provides students with the opportunity to watch any class that they may have missed so that they do not fall behind. Parents and auditors have the conceptual ability to monitor any classroom to ensure that, they are satisfied with the education the learner is receiving. (KEMI, 2014)

2.5.4 Classroom 2.0

This refers to online multi-use virtual environments (MUVES) that connect schools across geographical frontiers known as "etwinning". Computer Supported Collaborative Learning (CSCL) allows learners in one school to communicate with learners in another that they would not get to know otherwise. (Trentin, 2010). Enhancing educational outcomes and cultural enhancing integration. Examples of classroom 2.0 applications are Blogger and Skype. Nowadays the term "virtual education" may be used as an umbrella term. Virtual education is associated with features such as; a learning process based on some technology partly or entirely replacing a human teacher, a teacher and a learner can be separated by time and place but they are able to communicate freely and a student can choose time, pace, place and amount of learning by him/herself .

2.5.5 Interactive White Boards

The whiteboard is a Web-based tool that is becoming an important and popular course management software application in teaching and learning. It provides a number of learning tools, including an online discussion board, course content management, a course calendar, information announcement, electronic mail, reviews, auto marked quizzes and exams, navigation

tools, access control, grade maintenance and distribution, student progress tracking, etc. (Hutchins, 2001). Students can access the course materials and engage collaborative learning as long as they have an Internet connection. The whiteboard has been predicted to be the future of all types of distance learning (Lu, Yu, & Liu, 2003). A number of the white board benefits include a high level of interactivity, a greater level of learner enthusiasm, and a high level of satisfaction.

More importantly, the white board is designed to support collaborative learning, knowledge building, and multiple representations of ideas and knowledge structure. The literature indicates that cooperation, coordination, and collective approaches are all desirable characteristics. Learners in a cooperative environment have been found to outperform other work groups. Moreover, a positive relationship between cooperative learning and learning effectiveness has also been found, while student learning and satisfaction can be significantly enhanced when collaborative assessment approach is taken (Landry, Griffeth, & Hartman, 2006). Interactive whiteboards are used in schools as replacements for traditional white or black boards and provide a way to allow students to interact with material on the computer. In addition, some interactive whiteboards software allows teachers to record their instruction and post the material for review by students at a later time. Interactive whiteboards are other ways that technology is expanding in schools.

Things can be quickly relocated, deleted, or rearranged so speedily both remotely and in physical locations. Pedagogic materials can be created or destroyed at immense speed. The process of learning is seen to be more important than the product, but both are integrated during skillful use of ICT in the classroom. According to Smith et al (2005), teachers have provided the following reasons for their use of the interactive whiteboard: Flexibility and multi-functionality,

presentation of multimedia and the use of the different senses, saving the task and printing it out, interactivity, lesson preparation and saving and teaching ICT. Pedagogic beliefs significantly impact levels of interaction and communication. Traditional, transmission based models of teaching are inherently less reliant upon interactivity than constructivist modes, but interactivity must be promoted.

2.6 Benefits of the use of instructional technologies in classrooms

Application of instructional technologies is becoming part and parcel of the teaching and learning process in the face of these rapid technological changes in the world. Use of instructional technologies increases individual learner interactivity (Burns & Myhill, 2004). Learning is a social activity. It is suggested that the learning process can be enhanced through the use of technology, which adapts to the presentation of user needs, preferences and request. Due to the interactive nature of Internet, it is well situated for a creative learning approach in which experimentation and critical thinking are emphasized.

These technologies provide the necessary concrete experiences and also help students integrate prior learning experiences. Newby et al (2006) emphasizes that concrete experiences facilitates learning and the acquisition, retention and use ability of abstract symbols. It enhances student level of understanding and attainment in other subjects. This is because real education technology is more about thinking skills and, if you like, systems analysis then about mastering particular software applications. These technologies provide both resources and pedagogical framework for enabling students to become effective independent learners. This places learners on an oral footing thus given the right hardware, software and curriculum activities, even the severely disabled pupils can achieve the same degree of success as anyone else.

Student engagement is defined as "the amount of time and effort students invest in educational activities that are linked to learning outcomes." (Junco, et al 2012, p2.). The amount of engagement a student has with academics can play a crucial role in their academic success. A decrease in student engagement can lead to unsuccessful achievement of learning outcomes and a decrease in grades. Studies have shown that student academic engagement plays an integral role in academic success. Instructional technologies have the ability to better engage with students and meet them where they are students today are digital natives and hence instructors look to technology to mediate and enhance their instruction as well as promote active learning for students. Use of instructional technologies motivates students. As a motivational tool it fosters students' participation in the learning process.

Teachers should plan lessons very carefully so as to create really interactive environments. Students need to be exposed to the various tools to aid in the educational process. They should be taught the strengths and weakness of these tools and has the opportunity to use them. Students need to learn that they can gather information from many sources print resources, online resources, experts in person and online and fellow classmates. Cox (1997) studied elementary and secondary school students' use of technology and their attitudes towards ICT. The study was grounded in an analysis of the literature relating to motivation, as it indicates that the regular use of ICT for various topics can have a stimulating and beneficial effect on students' learning. Students 'responses showed their increasing commitment to the learning task, reinforcing enjoyment, benefit and feeling of achievement in learning when using ICT, and emphasizing their self-esteem. Over 75% of secondary school students stated the response, I agree‟ or „I strongly agree‟ to the statement that the use of computers made the school subjects more exciting. Also, over 50% of the students showed agreement that the use of ICT helped them

understand their topics in a better manner (Cox, 1997). Bullock (2001) carried out a case study about the effect of ICT use on the students' motivation and achievement in English. Results showed a great improvement in the motivation of the great majority of students. In particular, students were more enthusiastic to start the tasks, and this zeal continued over the period of the task. The questionnaires responses for 88% of the class showed that the use of a various collection of ICT during this year made English lessons more exciting and interesting than was expected.

2.7 Teacher Competency in using Instructional technologies

In order to clarify the teacher's role in implementing ICT in the classroom, some researchers considered the teacher's competencies related to ICT, for example, Nico, Ruttena and Wouter (2012) demonstrated that the use of computer simulations while teaching in the classroom will not be successful unless teachers have the necessary skills and information to implement them effectively. In addition, they reported that if teachers don't have the skills, the potential learning from computer simulations will remain out of reach. As an alternative, they may be used as demonstration experiments or be totally controlled by the teacher. In other words, the role of the teacher should focus on founding a pedagogical framework necessary for implementing computer simulations during teaching science. Some researchers investigated the difficulties that teachers may encounter while implementing ICT. They revealed that the difficulties in the use of ICT are related to the weakness of a teacher's knowledge about what technologies are available and how they can be used in the educational process in the classroom. In addition, teachers should know how to use ICT in relevant ways to help them in the delivery of the curriculum.

A solution for this problem, it is necessary that teachers need to feel confident in their skills to assist student learning with technology, to incorporate technology into their classrooms. Therefore this needs to become a more qualified development to increase a teacher's skills. Other research has focused on the advantages that teachers gain from implementing ICT. For example, Hennessy et al., (2007) argues that teachers will benefit from the available technology in supporting students to build links between scientific theory and empirical evidence. Greene (2008) found that teachers need to have the appropriate training on how to use ICT in teaching and learning. Nevertheless, teachers need to make the shift from traditional to the interactive pedagogies in a non-ICT context before being able to be familiar with the benefits offered by ICT.

By considering the features related to teacher's skills in ICT, Figg and Jaipal-Jamani (2011) found that ICT pedagogical skills are important for teaching with ICT, across all topic areas. Some studies addressed that the teacher is a key to the organisation and orchestration of ICT in the classroom since both components have an enormous impact upon how a student learns and can influence the students' perception of ICT in the classroom. Furthermore, this source raises the argument that teachers' attitudes should be challenged. The evidence from reviewing the previous literature shows a clear relationship between the teacher role in terms of the ways in which ICT has been used and the resulting attainment of students or their attitudes. This suggests that the crucial component in the use of ICT within learning is the teacher and his pedagogical approaches.

2.8 School leaders as agents of change in ICT integration

School leadership is important in supporting ICT integration. School effectiveness, school improvement and change emphasizes that leadership is important in achieving successful change (Afshari et al., 2008) Lack of technology leaders could therefore be one of the factors influencing the integration of ICT in education. Flanagan (2003) observes that principals who are not prepared for technology leadership struggle to develop the resources required for ICT integration. Therefore in schools where principals are not prepared to handle the complex issues around ICT integration, decision making is based more on financial and technical consideration than pedagogy.

As key leaders of change in the teaching- learning processes, school leaders can facilitate the decision to integrate ICT into teaching, learning and school administration. To achieve that, school leaders need to understand, support and practice the idea that ICT integration is not about the ICT but about a change in the teaching and learning processes. (Afshari et, al; 2008). The demands on schools to integrate ICT into teaching and learning processes should therefore come with a demand for leadership to lead the development. The introduction of any new strategy should also consider the improvement of the capacity of school leaders to lead the change. Head teachers are crucial in leading the integration of ICT not the school curriculum. If school leaders do not apply ICTs in their management practices, they may not be able to lead the integration of ICT in the classroom. Therefore education in the information age requires school leaders to not only update their skills and knowledge, but also work towards the transformation of their roles as educational leaders.

2.9 Physical and other related external factors affecting the use of ICT use schools.

Affordability of technology in schools could be limited by the high cost of putting infrastructure in place and is linked with issue of poverty. At the individual or organizational level, expensive hardware and software as well as high cost of communication and services restrict access to ICT. Most schools in Africa do not have the means to purchase expensive computers and hardware and provide training for their staff. A number of important physical factors hinder the use of ICT by teachers and students in schools. These include lack of electricity and frequent power outages, poor technology infrastructure overcrowded computer labs and low bandwidth, high costs of (mainly satellite) internet connectivity, software licenses and equipment maintenances, insufficient and inappropriate software (Hawkins, 2002). Geographic and demographic factors include population density and dispersion, linguistic and political factors. Wider socio economic factors such as extreme poverty and increasing HIV/AIDS levels exacerbate the situation and political will is needed to alleviate the situation through devising an integrated framework to improve standards of living, education and health provision, along with ICT infrastructure enhancement.

2.10 Factors contributing to using ICT in the classroom

Cox et al (1999) observes that use of ICTs by teachers helps making the lessons interesting, easier, more diverse, more motivating for the students and more enjoyable. For many teachers, technology can give them a license to experiment and 'take risks' thus stimulating teachers to think about the processes of learning, particularly when the distinction between what students do and what teachers do is weakened. When teachers bring a new technology in their classrooms, they model the learning process for students while at the same time they gain new

insights on teaching. McCormick and Scrimshaw (2001) argue that in this way ICT can make some aspects of teacher pedagogy more efficient, and that it also has the potential to extend and transform the process of teaching and learning itself.

A number of studies have looked at why teachers choose to use ICT. Tella, Toyobo, Adika & Adeyinka, (2007) examined Nigerian secondary school teachers uses of ICT and implications for further development of ICT use in schools using a census of 700 teachers. The findings showed that most teachers perceived ICT as very useful and as making teaching and learning easier. It was recommended that professional development policies should support ICT related teaching models, in particular those that encourage both students and teachers to play on an active role in teaching activities. Additionally, emphasis should be placed in the pedagogy underlying use of ICTs for teaching and learning

The real challenge for educationist is, therefore how to harness the potential of ICT to complement the role of a teacher in the teaching and learning process. Teachers who do not have a chance to develop professionally in the use of emerging technologies and acquire modern computer literacy and skills are under threat. In summary, ICT enables teachers to demonstrate the understanding of the opportunities and implications of the uses for learning and teaching in the curriculum context; plan, implement and manage learning and teaching in open and flexible learning environments (UNESCO, 2004). ICT facilitates enhanced learning in subject areas and learning at home on one's own.

2.11 Summary

With benefits and opportunities that ICT tools are offering in the learning environment, it is important to focus on their meticulous use in order to realize these benefits and opportunities they offer. The path from the benefits and opportunities to their effectiveness is not implicit. Cuban, Kirkpatrick and peck (2002) indicate that there is an assumption that putting ICTs tools in schools will lead to "abundant use" by both learners and educators, and the use of these tools will therefore result improved teaching and learning. Whole ICT tools can be used for different purposes.

The relevance of a teacher in the 21st century is determined by their willingness to develop professionally in the use of modern ICT. The main challenge to do with mainstreaming ICT curriculum delivery is the scarcity of human and financial resources. Development of digital content is skills-intensive and there is a shortage of ICT specialists as the education sector has to compete for these professionals with the better paying private sector. Similarly, the high cost of purchasing and maintaining electronic equipment and materials needed to meet the goals of ICT integration is another major constraint. The internet is too costly for most schools and also mostly available in a narrow bandwidth that slows down access (KEMI, 2014).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the research focused on the methodological approach and philosophy that are the basis for the research itself. Here, the researcher considered the mixed methods approach. The researcher discussed the target population and sample and the reasons for selection of specific data collection tools. For this purpose the researcher developed two questionnaires and interview schedule which are explored here; discussing the reliability and validity and also the analysis techniques associated with both methods.

3.2 Research Design

Mixed research methods of both quantitative and qualitative approaches were used in this study. As Creswell and Plano Clark (2007, p5) state: "Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a method, it focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative in approaches in combination provides a better understanding of research problems than either approach alone." A mixed research methodology was employed in this study, because it balanced the strengths and weaknesses of both quantitative and qualitative research (Creswell & Plano Clark 2007). This mixed method approach provided the best opportunities for answering the important research questions of this study, the answers of which relied upon a variety of forms of data. The

quantitative section, which included two questionnaires, addressed the research question related to how ICT is applied to teaching method in the classroom. The qualitative section included interviews with principals.

Adopting the mixed methods approach allowed the researcher to effectively triangulate the data. Triangulation is the process whereby two methods are used to check the results of a piece of research, (Cohen & Manion, 2000). The notion is that increasing the number of methods (and achieving the same results from those methods) means the researcher can be more confident of the results achieved. The quantitative element of the research was the questionnaires associated with the teachers and students in Kiambu Sub-County schools, the qualitative element focused upon interviews with the principals.

.

3.3 Variables

A variable is a quantitative or qualitative entity, which can take on different values or levels. (Nkpa 1997). Variables interact to bring about an outcome. There two types of variables used in this included the independent variables which were gender, school category whether boarding or day school, classroom grade, age, the academic qualification of teachers and years of teaching experience, while the dependent variable was the application of instructional technologies in the classrooms.

3.4 Location of the study and target population

The study was carried out in Kiambu Sub- County in Kiambu County in Central Kenya. Kiambu Sub- County has thirty-two secondary schools; twenty public secondary schools and ten private secondary schools. The county has a high population density and thus if they have to

improve their living standards, they have to embrace ICT. The target population for this study comprises twenty public secondary schools in Kiambu Sub- County. The researcher targeted all teachers and students in the twenty schools. The principals of the selected secondary schools were also part of the target population.

3.5 Sampling Procedure and sample Size

Sampling is the process of selecting individuals for study. A sample is any group on which information is obtained (Fraenkel and Wallen 1993) or part or section of a population (Nwana, 1981). The target population was twenty public secondary schools which were clustered into day and boarding. Purposive sampling was employed in the choices of schools included in the sample. According to Patton (1990), purposive sampling is a sampling technique that allows the researcher to use cases that have the required information to meet the objectives of the study. It helps a researcher to use triangulation, flexibility and meet multiple interests and needs. A sample of six schools was selected to represent the entire population. The researcher used all the students, subject teachers and the principals of the six schools as part of the study. The schools chosen are the ones, according to MOE records, have adopted ICT in the teaching and learning process and in management. The researcher was interested in having a deeper understanding of the phenomena being studied and how teachers differed in using instructional technologies. Data was collected from three schools in each category using simple random sampling. The researcher collected data from ten teachers in each school. At least two teachers from each school represented the five subject clusters in the school. These are languages, mathematics, sciences humanities and applied sciences. A total of sixty teachers were used in the

study. Twenty students from each of the six schools were randomly sampled. A total of one hundred and twenty students were used.

3.6 Data Collection Instruments

According to Wellington (2000) a researcher should use methods which provide high accuracy, generalisability and explanatory power with minimum management demands. Mwiria and Wamahiu (1995) note that: "the qualitative researcher uses multi-techniques for data collection in order to obtain holistic view of the respondent". Data was collected using two instruments namely; the questionnaire and interview schedule. The instruments supplemented each other to close the gap which would have been left if one instrument only was used. The researcher was guided by the study objectives when constructing these instruments.

3.6.1 Questionnaire

Questionnaires were the main instruments for data collection in the study. These questionnaires were divided into three categories, one for the teachers, principals and students. These questionnaires had three sections: Biographical information closed ended questions weighted on a Likert scale of 1-5 with questions on Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree and Open ended type of questions. The questionnaires were developed to address specific objectives.

3.6.2 Interview Schedule

The researcher chose interview technique because it gives an opportunity for in-depth-data, ensuring high response rates and it encourages naturalness (Nkpa 1997) thus, ensuring that more information is obtained. These were for the principals of selected public secondary schools.

3.6.3 Validity of the instruments

In terms of the validity of questionnaires, Gray (2009) states that this can be affected by the wording of the question it contains, and that even if individual questions are valid, poor sequencing of questions or a confusing organization or design of the questionnaire can all threaten its validity, and thus the validity of the entire study. Mugenda and Mugenda (1999, p99) ".Validity is the accuracy and meaningfulness of inferences, which are based on the research results. In other words, validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. Validity therefore has to do with how accurately the data obtained in the study represents the variables of the study." For the instrument to be valid the content selected and included in the questionnaire and interview must be relevant to the variable being investigated. For this study, validity refers to the content validity. Validity also refers to the extent to which differences found with a measuring instrument reflects a true difference among those being tested. According to Mugenda and Mugenda (1999), content validity is a measure of the degree to which data collected using a particular instrument presents a specific content of a particular concept; whereas construct validity is a measure of the degree to which data obtained from an instrument accurately and meaningfully reflects a theoretical framework (concept). To validate the test items, the questionnaires and interview schedule were submitted to the supervisor for verification.

3.6.4 Reliability of the instruments

Reliability is the ability of the tools to return same responses after repeated administration. This is concerned with the degree to which a particular measuring procedure gives similar result over a number of repeated trials (Orodho, 2004). According to Best and Kahn (2000), reliability of an instrument is the degree of consistency that an instrument demonstrates;

that is, the accuracy of the test scores which are free of choice errors. As Orodho (2008) says, the researcher uses test-retest strategy that involves administering the instruments in one of the schools that are not be used in the final study. After waiting for two weeks the researcher re-administers the instruments.

3.7 Data collection Procedures

Before going to the field, the researcher obtained permission from the university authorizing her to carry out the research. The researcher then visited the sampled schools to establish rapport, got permission from the school principals and arranged with subject teachers and class teachers when to give out the questionnaires. The researcher administered the questionnaires and agreed on the time to collect them with the teachers. As for the students' questionnaire the researcher sought permission from the school's administration. Once permission was granted, the researcher discussed with the teachers on the venue and time to administer the questionnaires. The researcher came on the agreed date and time, met with the students in the agreed venue; explained the purpose of the study, went through the instructions and let the students fill the questionnaires. The researcher then collected the questionnaires. The same procedure was followed in each school for the six selected schools for the study. The researcher then made appointments with the principals of the six schools for the interview schedules.

3.8 Data Analysis

Data was analyzed using the Excel spreadsheet and SPSS software. This has descriptive statistics features that assist in variable response comparison and gives a clear indication of response frequencies (Mugenda and Mugenda, 2003).The SPSS software also offers extensive

data handling capabilities and numerous statistical routine that can analyze small to very large data statistics. The analysis was systematically done as per the objectives of the study. Quantitative data collected using questionnaires for the students and teachers was processed by coding the closed ended questions and entering the data into the computer to run descriptive analysis including frequencies, percentages and graphs. In the case of open ended questions in the questionnaires and data collected from the interview schedules for principals, the data was categorized, themes established and data analysed around the theme areas.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 **Introduction**

The purpose of this chapter is to analyze the variables involved in the study. In these sections, data description, discussion and data analysis is presented. The data collected in this study is compiled from principals, teachers and students. An analysis of the variables used in the study has also been presented. Data collected was collated and reports were produced in form of tables and charts.

4.2 **Response Rate**

The research targeted 60 respondents in category one (teachers) and 120 respondents in category two (students). All of them were supplied with questionnaires. 51 questionnaires administered were filled and returned in category one and 115 in category two. This indicates a response rate of 85% and 96% respectively. This is corroborated by Orodho (2004) who noted that any response of 50% and above is adequate for analysis. Thus from the research point of view, the response was good and representative to the target population. The response rate of the respondents that participated in the survey is as illustrated in table 4.1.

Table 4.1: Response rate

Sample	Distributed Questionnaires	Returned Questionnaires	Percentage returned
Teachers	60	51	85
Students	120	115	96

4.3 **Background information of category one respondents**

4.3.1 Gender

The respondents were requested to indicate their gender. Majority of the respondents (53%) were male while 47% were female. This is shown in figure 4.1

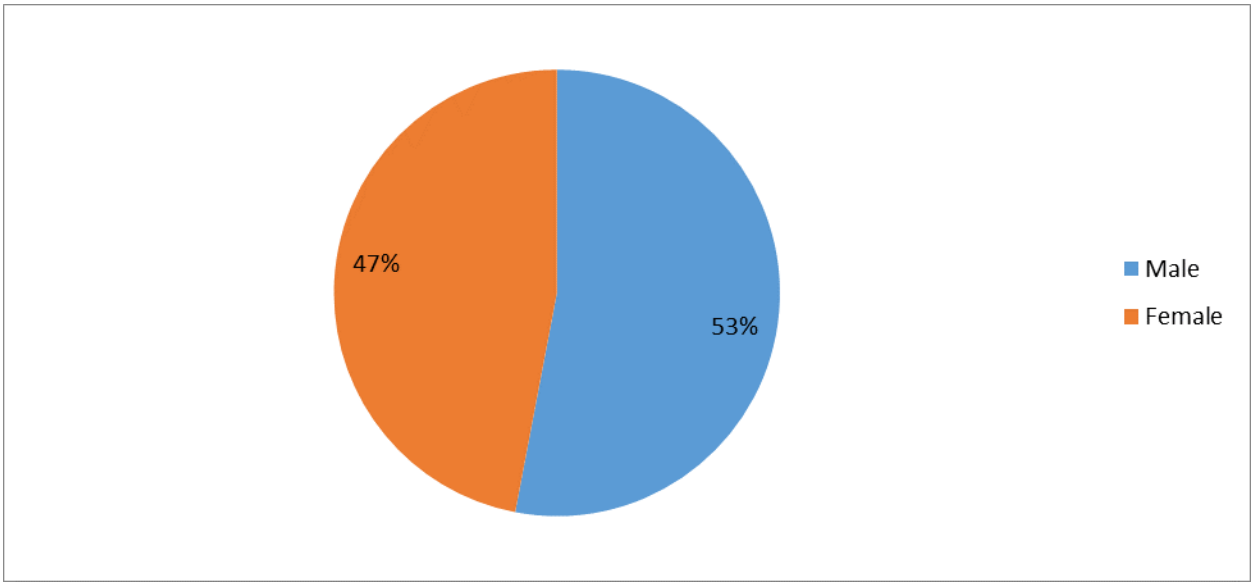


Figure 4.1 Gender of the respondents

4.3.2 Age of the Respondents

Results indicate that majority of the respondents were 41-50 years which accounted for 41% of the total respondents. 27% of the respondents indicated they are between 20-30 years,

25% of the respondents indicated they are between the ages of 31-40 years while 6% of the respondents indicated that they are between the ages of 51-60 years. This is shown in figure 4.2.

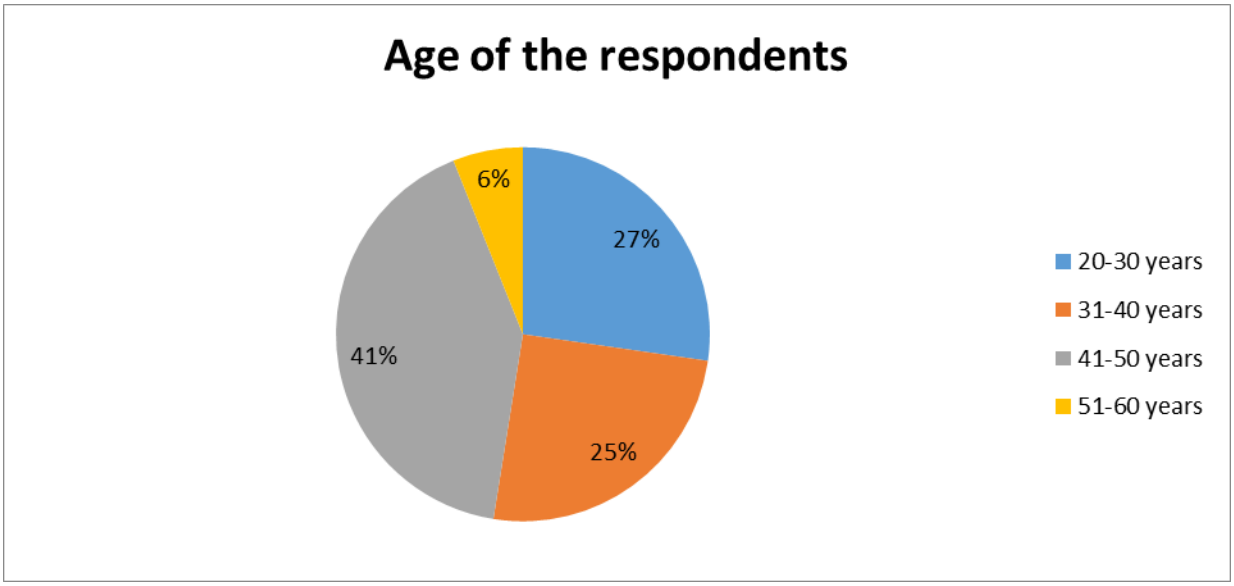


Figure 4.2 Age of the respondents

4.3.3 Experience of the Respondents

The study sought to find out the experience of the respondents. This information was important because it was assumed that more experienced respondents had sufficient knowledge of instructional technologies in teaching and learning and therefore offer credible information for the study. Results show that (39%) have taught between 1-10 years, 35% have taught between 11-20 years, 20% have taught between 21-30 years, 4% have taught for less than 12 months while 2% of the respondents indicated that they have taught for 31 years and above. This is illustrated by figure 4.3. The research established that most of the respondents had worked for a considerable period of time and hence the information they gave was credible and reliable.

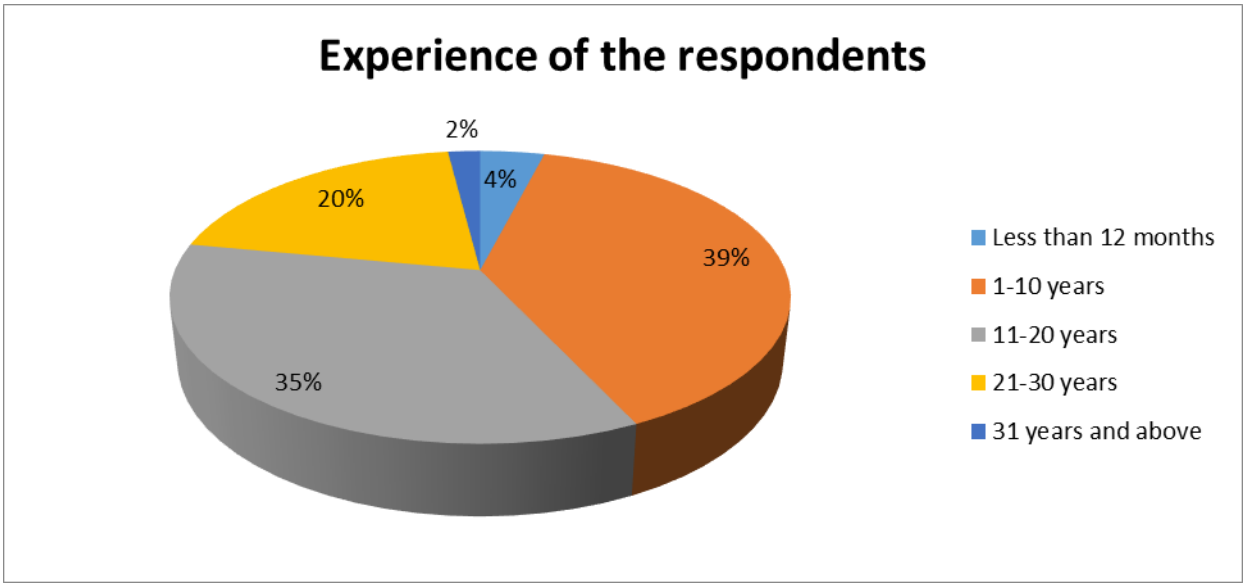


Figure 4.3 Experience of the respondents

4.3.4 Specialisation

Specialisation of the respondents in their specific subject areas was sought to find out the extent of application of instructional technologies in teaching and learning. Results show that (26%) teach Sciences, 21% teach languages, 21% teach mathematics, 17% of the respondents teach humanities while 14% teach technical subjects. This is as shown in figure 4.4

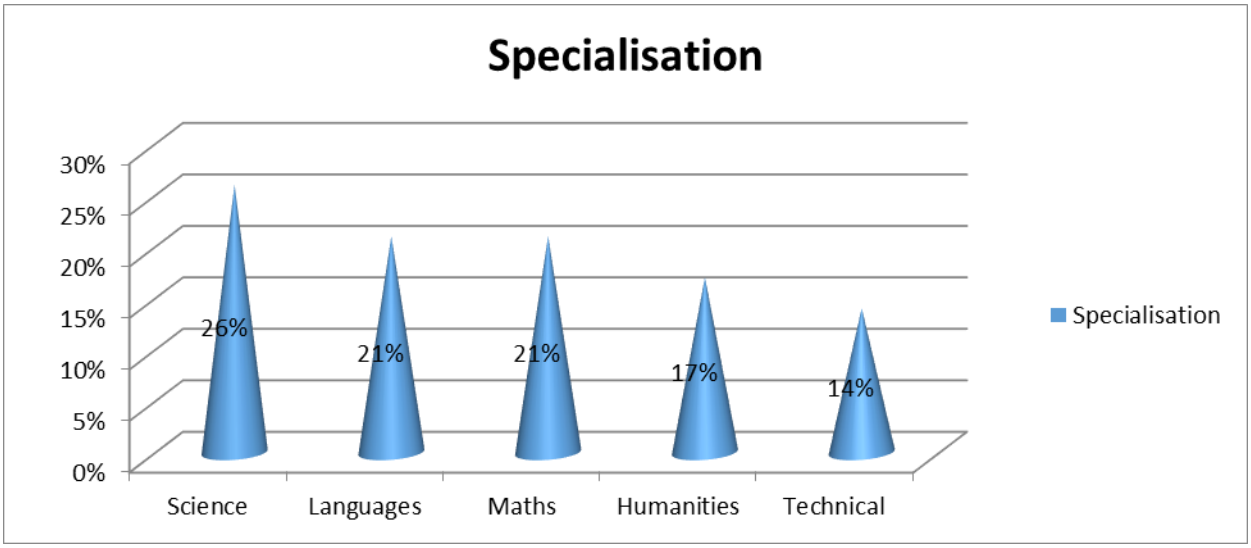


Figure 4.4 Subject Specialisation

4.3.5 Attendance of any IT Training Course (e-learning)

Professional training in IT was sought from the respondents.80% of the respondents indicated that they had attended an IT training course in e-learning while 20% indicated that they had not attended an e-learning IT course. It is significant to note that a majority of the respondents have undergone training courses. These findings are in line with the national ICT policy adopted in 2006 that emphasize on teacher capacity development. A teacher is a key to the organisation and orchestration of ICT in the classroom and hence has an enormous impact upon teaching and learning. Teachers' competencies related to ICT play an important role in the application of instructional technologies in the classroom. Greene (2008) found out that teachers need to have the appropriate training on how to use ICT in teaching and learning. According to the Kenya Management Institute (KEMI, 2014), teachers who lack the chance to develop professionally in the use of modern ICT feel under threat. The relevance of a teacher in the 21st century is determined by their willingness to develop this way. Nico, Rutena and Wouter(2002)

demonstrated that the use of computer simulations while teaching in the classroom will not be successful unless teachers have the necessary skills and information to implement them effectively. They also reported that if teachers don't have the skills, the potential of learning from computer simulations will remain out of reach. This is as shown in figure 4.5

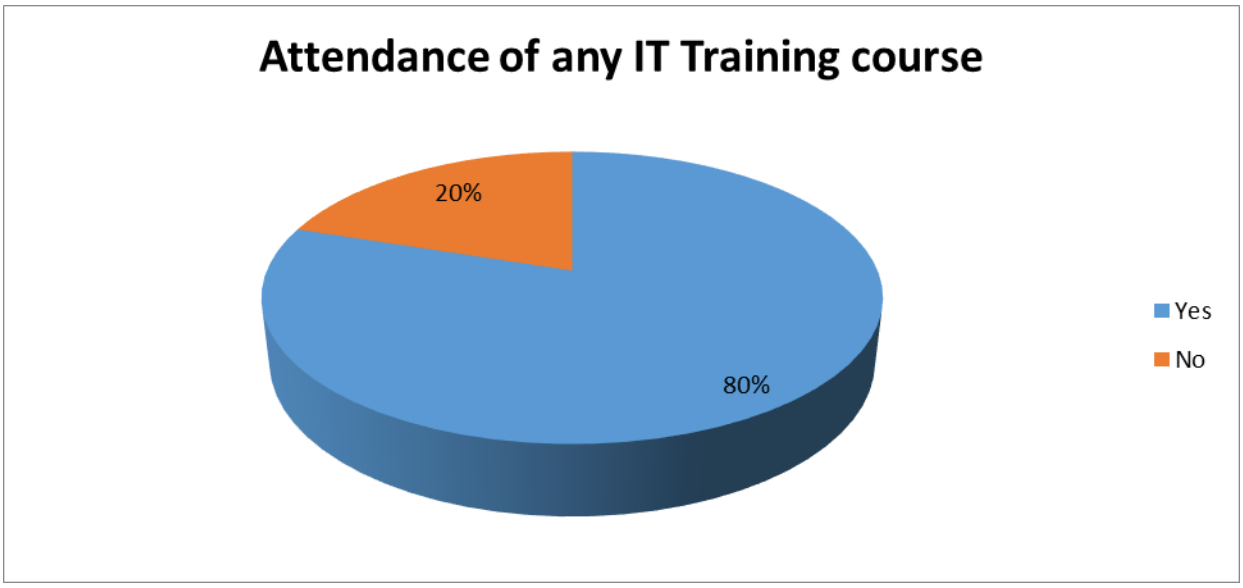


Figure 4.5 Attendance of any IT Training course.

4.4 **Background Information on category two respondents (Students)**

Students in the 21st century are digital natives and thus they immensely contributed to the study findings. Thus irrespective of their gender and age, the researcher sought their views on the extent of application of instructional technologies in teaching and learning. The respondents were requested to indicate their gender. 58% of the respondents indicated that they are males while 42% of the respondents indicated they were females. The findings are consistent with the expectations since more questionnaires were issued to boys' schools than girls' schools. The respondents were also asked to indicate their age group. Majority of the respondents (91%)

indicated that they are between 14-18 years while 9% indicated that they are between 19-23 years. The findings are consistent with the expectations of the study since the respondents were drawn from form one up to form four. These findings are as shown in table 4.2.

Table 4.2: Description of students' sample according to Gender and Age

Variable	Category	Frequency	Percentage
Gender	Male	67	58
	Female	48	42
Age	14-18	105	91
	19-23	10	9

4.5 **Instructional technologies availability**

4.5.1 Type of Instructional technologies used for learning and teaching

Availability of instructional technologies is instrumental in the teaching and learning process. The study sought to find out the type of instructional technologies available in their institutions. Majority of the respondents (18%) indicated that computers are the most available type of technology, 17% of the respondents indicated the overhead projector, 13% indicated laptops, 10% of the respondents indicate the internet while VCR/DVD, TV, Radio, Educational software, Smart phones, Digital camera, films, interactive white boards and electronic dictionary were the least available technologies used in learning and teaching process. These findings indicate that desktop computers, projectors, laptops and internet are the most available instructional technologies in schools. These findings are also similar to Cohen (2001) who noted that computers are gradually regarded as indispensable in classroom and form part of the student learning experience. (Macchiusi et al, 2000) noted that ICT in education today encompasses a

great range of rapidly evolving technology such as desktop, note book and handheld computers, digital cameras, local area networking, the internet and world wide web, CD-Roms and DVDs, application such as word processors, spreadsheets, tutorial simulations, electronic mail (email), digital libraries, computer aided instructions, video conferencing and virtual reality. The findings are also in line with the Sessional Paper No. 14 of 2012 which has laid greater emphasis on ICT integration by training of trainees and building computer labs and providing computers (laptops) to support development of digital literacy. The interactive whiteboards are among the least available technologies yet according to (Lu, Yu, & Liu, 2003) these have been predicted to be the future of all types of distance learning. These boards promote a high level of interactivity, satisfaction and a greater level of learner enthusiasm and therefore these are technologies that are worth investing in. The findings are as shown in table 4.3

Table 4.3 Type of technology used in learning and teaching process

Technologies existing in school	Percentage
TV	8
VCR/DVD	9
Overhead Projector	17
Radio	7
Digital camera	3
Computer	18
Educational Software provided by ministry	4
Laptop	13
Interactive White Boards	3
Electronic Dictionary	1
Smart Phones	4
Films	3
Internet	10

4.5.2 Adequacy of Instructional Technologies

Available and adequate technologies enhance any teaching environment. The respondents were requested to indicate whether the instructional technologies used in the learning and teaching process were adequate. Majority of the respondents (86%) indicated that the instructional technologies they use are not adequate in teaching their subject. 14% of the respondents indicated that the technologies they use for learning and teaching process are adequate. Some of the reasons cited for this include; unavailability of funds to buy instructional technologies, student-computer ratio overwhelming, old machines which break down often, lack of support from the stakeholders and thus instructional technologies are not given a priority. The

inadequacy of the instructional technologies is ultimately a hindrance to the pedagogical application of ICT in the teaching and learning process. These findings are in contrast with the Kenya National ICT Policy of 2006 of ensuring the availability of accessible, efficient, reliable and affordable ICT services as reported in the ICT in Education Options Paper(MOEST, 2005). The findings are as indicated in figure 4.6.

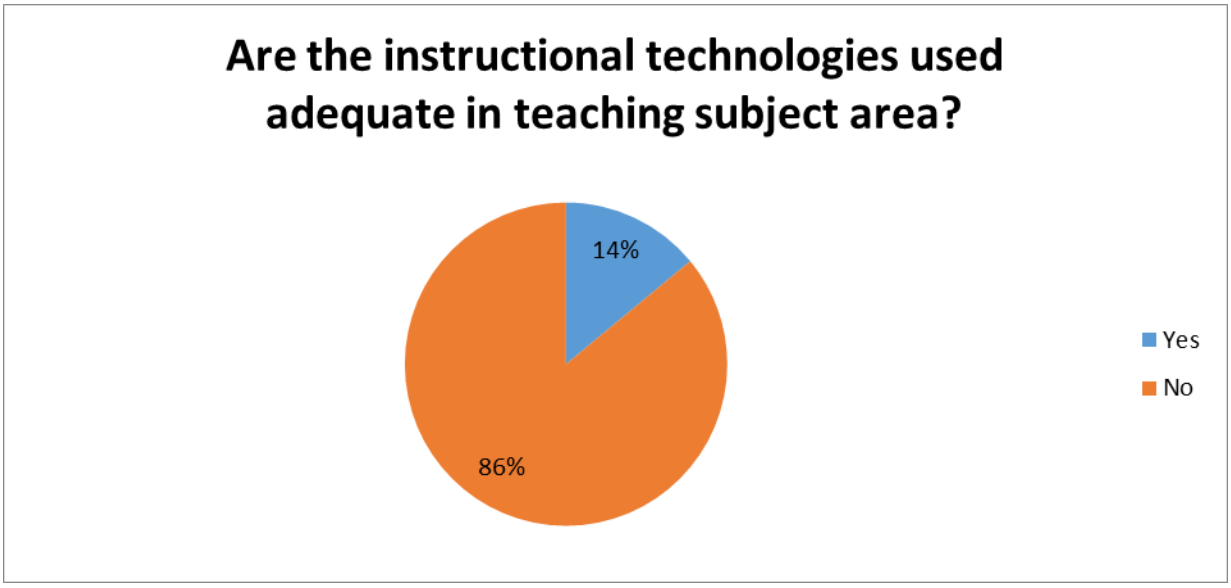


Figure 4.6 Adequacy of instructional technologies used.

4.6 **Application of Instructional Technologies in teaching process**

4.6.1 Teachers' ICT application in teaching process

The study sought to establish the pedagogical application of ICT in teaching and learning. The findings are as shown in table 4.4. According to the findings, the application of instructional technologies by teachers in the learning process is low. The findings indicate that the highest rated skill or application of ICT in the teaching process is the use of information contained on the hard drive or compact disks' where the majority of the respondents (51%) indicated that they occasionally use the skill in the teaching process. The second most applied skill in the teaching

process according to 49% of the respondents is the use of internet to obtain teaching resources. The respondents also indicated that they use ICT in the teaching process by creating lessons that incorporate simulation software with 48% of the respondents indicating that they use ICT to do so occasionally. The findings also indicate that the lowest rated skill or application in the teaching process was using email to communicate with students' with 83% of the respondents indicating that they never use it Results clearly show a sporadic application of instructional technologies in teaching and learning. This does not correlate the earlier findings of this study that observed an 80% competency levels among the teachers. This implies therefore that there exists a gap between possessing these skills and application in teaching and learning. This means that the skills that the teachers possess are not adequate and there is need to retrain them in the pedagogical application of ICT in teaching and learning. Kennewell and Beauchamp(2007) observes that in order to integrate ICT into teaching and learning, teachers need to tailor their teaching strategy to suit the new trend of education from a traditional style, teacher dominated way of teaching to a more interactive method with the help of ICT tools. Cuban, Kirkpatrick and Peck (2002) who indicate that there is an assumption that putting ICTs tools in schools will lead to "abundant use" by both learners and educators, and the use of these tools will therefore result in improved teaching and learning. The real challenge for educationists is therefore how to harness the potential of ICT to complement the role of a teacher in the teaching and learning process.

Table 4.4 Teachers' application of ICT in teaching process

		Percentages				
	Application of ICT	**Daily**	**Weekly**	**Monthly**	**Occasionally**	**Never**
a)	Create a document using a word processor	2	16	10	39	33
b)	Manipulate graphics or images using graphics software.	0	0	16	31	53
c)	Look up information on a hard disc drive or compact disc.	4	17	9	51	19
d)	Use the internet to obtain teaching resources.	16	22	8	49	4
e)	Create lessons that incorporate simulation software	0	10	4	48	38
f)	Create lessons that use presentation software	0	7	7	48	39
g)	Set computer based homework	0	4	7	33	57
h)	Create lessons that incorporate students use of a digital video, graphics or sound editors	0	10	10	28	52
i)	Use email to communicate with other teachers.	8	4	8	43	37
j)	Use email to communicate with your students	0	2	4	11	83
k)	Use email of communicate with your students' parents	0	2	2	28	68
l)	Participate in an online interactive discussion or bulletin board with students	0	4	4	10	81

		Percentages				
	Application of ICT	**Daily**	**Weekly**	**Monthly**	**Occasionally**	**Never**
m)	Use software to monitor the students' scores	8	4	31	37	20
n)	Use interactive white boards	6	2	4	13	74
o)	Use subject-specific software	2	2	6	47	43

4.6.2 Students' ICT application in the learning process

Students' application of ICT in the learning process is in cognisance of the 21st century demands that require students to acquire the 21st skills. This is achieved through effective application of ICT in the learning process. The findings indicate that the use of ICT in the learning process by the students is very low. This is because majority of the respondents indicated that they never use ICT in the described tasks. It was notable from the table 6 that the level of using ICT by students at schools was very low. Results show that the highest level application of ICT was the use of educational software to learn some lessons where 30% of the respondents indicated they do this weekly. The findings also indicated that the second highest application of ICT in the learning process was the use of internet to look up for information where 29% of the respondents indicated that they do this weekly.

The findings indicated that the lowest application of ICT among the respondents in the learning process is designing websites where 95% of the respondents indicated that they never do

it. These results imply that learning is still teacher centred despite advances in information technology that have the potential to transform teaching for example by providing alternatives to the standard lecture format and giving students immediate access to a wealth of high quality interactive resources and tools (Haddad and Draxler, 2002). The use of ICT at school by students can be a reflection of the skills they possess in ICT use or the use of ICT applications. It can also be a reflection of how far teachers promote the use of ICT facilities or indeed to what extent ICT facilities are available in the schools. Haddad and Draxler (2002 pointed out that teaching and learning practices need to be reviewed and realigned for accommodating meaningful use of ICTs in teaching and learning. Wheeler (2002) indicates the teacher requires to engage learners in more collaborative activities, which are in essence learner-centred and to promote the learners' active participation in the learning environment. Learners need to be encouraged to develop their critical thinking skills, advance their information literacy and nurture their collaborative working practices so as to prepare them for the information which is more competitive than ever. The findings are as shown in table 4.5

Table 4.5 Students' application of ICT in the learning process

		Percentage			
	Application of ICT in Learning process	**Never**	**Monthly**	**Weekly**	**Everyday**
a)	I look up for information hard disk and compact discs (CD – ROMS)	63	12	22	4
b)	I use educational software to learn some lessons	42	20	30	8
c)	I use some spread sheets	66	13	13	8

		Percentage			
	Application of ICT in Learning process	**Never**	**Monthly**	**Weekly**	**Everyday**
d)	I use / create pictures/and animals	71	11	15	4
e)	I watch DVDs / videos on the computer	62	15	21	3
f)	I use computer for writing	49	9	22	20
g)	I design websites	95	4	2	0
h)	I download music files or software from the web	78	6	11	5
i)	I send and receive emails	85	8	6	0
j)	I use the internet to revise for exams	66	14	18	2
k)	I watch TV/listen to radio/ music on the internet	80	7	7	5
l)	I create / record sound files on the computer	84	7	5	4
m)	I play games on the computer	67	7	18	7
n)	I browse the internet for fun	68	5	20	7
o)	I use the internet to look up information	45	12	29	14

4.6.3 Teachers' instructional technology competency

The study sought to examine the overall competency levels of the respondents in the application of ICT methods. The findings indicated that the respondents' competency of ICT was satisfactory especially for the most basic IT skills. The findings indicated that majority of the respondents have high skills in; basics of operating personal computers (51%), using word processor (49%), searching for saved data on hard disk or compact disk (48%) and searching for information on the internet where 46% of the respondents indicated that they have very high skills on. Respondents are least competent in designing web pages or personal sites where 40% of the respondents indicated that their skill is very low. According to the findings, majority of the respondents indicated that they have high competency in over half of the skills listed. Teacher competency in ICT is in tandem with Kenya National ICT Policy (2006) initiatives of developing teacher capacity in the ICT skills for effective curriculum delivery. An ICT competent teacher is confident in his or her skills to assist students learning with technology and to incorporate technology into their classrooms. The findings are as listed in table 4.6

Table 4.6 Teachers' competency in instructional technology

		Percentage				
		Very Low	**Low**	**Medium**	**High**	**Very High**
a)	Basics of operating PC(using keyboard, mouse…etc	0	0	12	51	37
b)	Managing files (delete, move to….etc	0	4	22	41	33

		Percentage				
		Very Low	Low	Medium	High	Very High
c)	Using word processor (such as word program)	0	2	18	49	31
d)	Use spread sheet processor (such as excel program)	2	18	39	24	16
e)	Creating or using data base processor (such as access program)	9	32	38	15	6
f)	Combining files from different resources (sound or video files) to create presentation	10	31	31	14	14
g)	Producing learning software	33	20	27	12	8
h)	Using PowerPoint software	4	20	29	24	22
i)	Searching for saved data on hard disk or compact disc	4	6	13	48	29
j)	Internet browsing	4	0	20	35	41
k)	Publishing a personal blog.	28	22	24	13	13
l)	Using chat rooms and forums (Facebook, twitter)	6	19	30	19	26
m)	Designing webpage or personal site	40	21	23	15	2
n)	Using email reading and sending mails.	0	6	26	36	32
o)	Using digital camera	12	14	29	31	14

		Percentage				
		Very Low	Low	Medium	High	Very High
p)	Deleting or editing pictures, animations or movies.	2	16	35	27	20
q)	Searching for information on the internet.	4	6	17	27	46
r)	Downloading files from internet.	4	2	20	31	43

4.6.4 Students' confidence levels in instructional technologies

Students' confidence in the use of ICT coupled with teacher competency facilitates effective application of instructional technologies in teaching and learning. The researcher noted that students' confidence in their ICT abilities is a good indicator of the skills they have in various aspects of ICT and its application. The findings indicated that the level of students' confidence in ICT and its applications is high. They also showed that most of the respondents were very confident in the following ICT applications; searching for information on the internet (55%), browsing the internet (54%) while 50% of the respondents indicated that they are very confident in basics of operating personal computers. However it was noted that the students are less confident in designing WebPages or personal sites with 42% of the respondents indicating very low confidence levels and also publishing personal blogs where 36% of the respondents indicated very low confidence. Results show that a majority of the students are confident in their use of ICT and its applications. It is therefore upon the teacher to harness his/her skills together with those of the students to enhance teaching and learning. Junco et al, (2012) who observed

that students today are digital natives and therefore teachers should plan lessons very carefully so as to create real interactive environments. Students need to be exposed to the various tools to aid in the educational process. They should be taught the strengths and weaknesses of these tools and have the opportunity to use them. Students need to learn that they can gather information from many sources; print resources, online resources, experts in person and online fellow classmates. The findings are as shown in table 4.7.

Table 4.7 Students' confidence levels in instructional technologies

		Percentage				
	Students' confidence level in terms of the following computer skills or applications	**Very Low**	**Low**	**Not confident**	**Confident**	**Very confident**
A	Basics of operating PC (using keyboard, mouse….. etc	3	4	4	40	50
B	Managing files (delete, move to……etc	4	7	11	34	44
C	Use word processor such as word program	17	14	16	22	31
D	Use spread sheet processor(such as excel program	18	17	20	25	18
E	Creating or using database processor(such as access program	16	18	22	27	17
F	Create and design presentation	16	19	18	25	22
G	Searching for saved data on hard disk or compact disk	12	11	14	31	32
H	Using different designing programs (Photoshop, Flash)	15	17	17	29	22
I	Deleting or editing pictures animations or movies	10	11	14	28	38

		Percentage				
	Students' confidence level in terms of the following computer skills or applications	**Very Low**	**Low**	**Not confident**	**Confident**	**Very confident**
J	Using digital camera.	8	11	16	25	40
K	Internet browsing	14	6	8	18	54
L	Searching for information on the internet	6	6	7	25	55
M	Downloading files from the internet	9	9	10	23	49
N	Using Email (reading and sending mails)	18	13	14	34	21
O	Using chat rooms and forums (Facebook, twitter)	18	7	6	23	45
P	Publishing a personal blog	36	19	32	10	4
Q	Designing webpage or personal site	42	22	21	8	8
R	Using data slow basis on PC as projection tool.	32	29	18	14	7
S	Producing learning software.	29	28	18	17	7
T	Combining files from different resources (Sound or video files) to create presentations	23	25	27	12	14

4.7 **Benefits of application of instructional technologies in teaching and learning**

4.7.1 Teachers perceptions about application of ICT in teaching and learning

Teachers' attitude towards the modern use of ICT in teaching and learning determines the outcomes of curriculum delivery. The respondents were requested to indicate their level of agreement with the listed benefits of instructional technologies application in teaching and learning. Majority of the respondents showed a strong positive perception about ICT use in teaching. 66% of the respondents strongly agreed that educational technology stimulates learners' curiosity implying convergence amongst the respondents. 63% of the respondents strongly agreed with the assertion that educational technologies engage learners' attention and motivate them. 40% of the respondents strongly disagreed with assertion that computers will gradually replace teachers. The findings show a strong positive perception by the teachers in that use of ICT stimulates learners' curiosity and innovation, engages learners' attention and motivates them. They also enable more practical hands- on- approach to learning, specifically in relation to providing real life examples through the use of educational software. In addition, the use of ICT offers increased opportunities for participatory group activities and constructive, real life examples. The findings clearly show that the application of instructional technologies enhaces learning experiences. This agrees with Cox et al (1999) who observed that use of ICTs by teachers helps make the lessons interesting, easier, more diverse, and more motivating for the students and more enjoyable. It is this realization of the benefits associated with ICT use that the government has endeavoured to integrate ICT across all levels of subjects. The findings are as shown in table 4.8.

Table 4.8 Teachers perception about application of ICT in teaching and learning

		Percentage				
	Teachers' perception about instructional technology	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
a)	Educational technologies engages learners attention and motivate them	63	31	2	2	2
b)	Educational technologies improves learners test and end term results	23	58	8	4	6
c)	Educational technology stimulates learners' curiosity.	66	30	0	2	2
d)	Educational technology encourages learners to develop their problem solving strategies.	29	46	17	2	6
e)	Educational technology provide models and images which aid learners in concept formation	55	36	2	0	6
f)	Educational technology improves the teachers' efficiency.	40	40	9	9	2
g)	Educational technology reduce the teachers administration burden	28	43	4	20	4
h)	Educational technology provide better records of learners progress	58	33	6	0	2
i)	Educational technology improve leaders approach and understanding of teaching	38	40	13	4	4
j)	Educational technologies create a platform for teachers to communicate with other teachers sharing common problems.	40	44	6	6	4
k)	Educational technologies support co-operative	35	46	10	4	4

		Percentage				
	Teachers' perception about instructional technology	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
	learning.					
l)	Educational technologies support individualized learning	48	33	8	4	6
m)	The internet has proved to be a source of ideas and inform for teachers	52	35	8	2	2
n)	Using educational technology is an important aspect of teachers work	35	48	4	10	2
o)	Technology assisted instruction is more effective than the traditional method of instruction	35	31	15	15	4
p)	Computers will gradually replace teachers.	6	15	8	31	40

4.7.2 Students' perceptions about application of ICT in teaching and learning

Students' perception to use of ICT in class determines the level of motivation and achievement of objectives in the classroom. The findings indicate that the respondents agreed with the benefits listed while also strongly disagreeing with negative statements on ICT. 67% of the respondents strongly agreed that they enjoy lessons with a computer. 59% of the respondents indicated that they strongly agreed that they feel comfortable working with computers. Majority of the respondents (72%) disagreed with the assertion that they wish ICT was not used in teaching. 70% of the respondents strongly disagreed with the statement that they are tired of

using a computer. The results indicate a positive convergence in the use of ICT in learning. Students perceive ICT as very useful and make learning easier and foster students' participation in the learning process. They are therefore positive about the application of ICT in the classroom and its impact on their learning. The findings are as listed in table 4.9

Table 4.9 Perceptions of students on ICT application in teaching and learning process

		Percentage				
	To what extent do you agree or disagree with the following statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
a)	I enjoy lessons with a computer	67	24	3	3	4
b)	I feel comfortable working with computers	59	29	6	4	1
c)	Using computers at school improves my learning	48	24	18	5	5
d)	I make good use of email at school	6	9	20	29	37
e)	I make good use of internet at school	18	22	9	23	29
f)	I am tired of using a computer	1	4	3	23	70
g)	I need help from teachers to learn with ICT	34	40	10	10	6
h)	Computers are difficult to use	3	4	6	38	49
i)	I find it fine consuming using ICT in learning	31	30	11	13	15

		Percentage				
	To what extent do you agree or disagree with the following statements	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
j)	Working with computers makes me nervous	1	6	7	40	46
k)	I know how to use ICT but am not interested in using it to learn.	2	4	5	31	59
l)	I wish ICT was not used in teaching.	2	3	2	22	72

4.8 **Findings on the interview data**

The following section presents the analysis and findings of the conversations with principals with respect to application of instructional technologies in teaching and learning in public secondary schools in Kiambu sub-county.

4.8.1 Instructional Technologies available and their application in Secondary Schools

The data received indicated that there is a variety of instructional technologies available in schools. Some of the highly cited technologies include computers, educational software, internet, projectors, e-books, ICT based record management and ICT based time scheduling. These findings are consistent with the findings of the other groups of respondents. The respondents were also requested to indicate how the schools acquired the available technologies. Majority of the respondents indicated that the technologies were acquired through the Economic Stimulus Programme of MOEST, through Parents Teachers Association Account (PTA) and from private companies. Availability of the instructional technologies reflects the government's

commitment of integrating ICT in education by training of trainees, providing computer labs and equipping them. The Kenya Institute of Curriculum Development (KICD) has also digitised the curriculum and distributed the e- learning material to schools.

4.8.2 Benefits of using Instructional Technologies in Teaching and Learning process

The respondents were requested to indicate the potential benefits of using instructional technologies in learning and teaching process. Majority of the respondents indicated that the application of instructional technologies in teaching and learning improves learners' participation. The respondents also indicated that the students enjoy the lessons; they generate curiosity among students making the students attentive in class. The respondents also noted that the use of technologies present the opportunity to provide real-life, applied examples of theoretical concepts applied in learning thus enhancing the learning process.

The respondents noted that application of instructional technologies in teaching and learning improves learner participation by collaboration. It provides a hands-on/practical approach to learning and lastly it improves problem solving and analytical skills. A common answer to the interview was that the use of instructional technologies improves both the education standards and achievement. The common denominator was that the use of ICT in learning and teaching process can be used as a method of improving education standards and outcomes for students. These findings corroborate Khan, Hassan and Clement, (2012) who observed that the adoption and use of ICT in schools can promote collaborative, active and lifelong learning, increase students' motivation, offer better access to information and shared working resources, deepen understanding, help students think and communicate creatively.

4.8.3 Factors contributing to the application of Instructional Technologies in schools

The respondents indicated teachers' literacy in ICT is one of the major factors contributing to the application of instructional technologies in the teaching process. The respondents indicated that about 80% of teachers in their schools are ICT literate while 20% were not ICT literate. The respondents indicated that the teachers had undergone training through workshops organized by MOEST, private institutions and self-sponsorship. The respondents also indicated that the facilities associated with ICT – improvement in the infrastructure of educational technologies in schools and the provision of educational or subject specific software are other factors contributing to the application of technologies in learning. Three respondents also stated that the administration interest and supervision of these technologies have also improved application of ICT in teaching and learning. The willingness by the administration to take an active role in supervision of application of technologies in teaching and learning has also had a positive impact on learning. This has created interest among the teachers in discovering the use of technology. These findings agrees with Figg and Jaipal Jamani (2011) who noted that teachers' ICT pedagogical skills are important for teaching with ICT across all topic areas. Afshari et al, (2008) also observed that school leaders need to understand, support and practice the idea that ICT integration is not about the ICT but about a change in the teaching and learning process. The demands on schools to integrate ICT into teaching and learning processes should therefore come with a demand for leadership to lead the development.

4.8.4 Barriers hindering effective application of Instructional technologies in schools

Barriers identified included high costs of internet. They noted that this has slowed down the application of instructional technologies especially when there are no funds in the school to pay for the internet. Repair and maintenance costs of old computers were also cited as a huge barrier derailing the application of ICT teaching. Other barriers cited include; dogmatic pedagogy practices among the teachers who are still unwilling to embrace new methods of instruction hampering effective use of ICT in the classroom, inadequate ICT educational materials and computers translates to a high student computer ratio that ultimately does not meet the teachers' objectives in the classroom, additional cost of securing the computers has also been a challenge as a result of high instances of theft. The respondents noted that this has posed a big burden to the administration because learning is temporarily halted to facilitate replacement of these ICT tools.

The respondents were also requested to suggest the possible ways of overcoming the noted challenges in the use of instructional technologies in teaching and learning process. Some of the ways proposed includes; installation of cctv cameras and digital alarm systems, use of local teachers in the field of developing the technology for e-learning because the accuracy of the content available from the internet may not be 100%, provision of cheaper internet connectivity for schools, continued upgrade of available teaching and learning materials, enhance training of teachers by the ministry of education, improvement in the infrastructure of educational technology in schools and development of educational or subject specific software. The findings correlate those of Hawkins, (2002) who observed that a number of factors hinder the use of ICT by teachers and students in the use of ICT by teachers and students in schools. These include

lack of electricity and frequent power outages, low bandwidth, high costs of internet connectivity and equipment maintenances.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents conclusions and recommendations for practice and further research on the problem. The study aimed at examining the extent of application of instructional technologies in teaching and learning process in Secondary schools in Kiambu sub-county. The study also sought to; determine the instructional technologies available and their application in public secondary schools, examine the perceived benefits and outcomes of using the instructional technologies in teaching and learning process, explore factors contributing to the application of instructional technologies in teaching and learning process and identify the barriers that hinder effective application of instructional technologies in teaching and learning in Kiambu Sub-County. The chapter ends with recommendations and suggestions for future research.

5.2 Conclusion

The crux of this study was to examine the application of instructional technologies in teaching and learning in Kiambu sub-county public secondary schools. The study established that the available instructional technologies are inadequate. Some are too old and often break down. Need is expressed to provide affordable infrastructure to facilitate dissemination of knowledge and skills through e- learning platforms The study findings indicate that there is sporadic application of ICT in teaching and learning process in secondary schools despite existence of capacity in terms of teachers' ICT skills. There remains a significant gap between possessing these skills and applying them in class. Schools therefore remain at a level where they

are they are simply not employing enough ICT to make a difference. Students on the other hand are both very positive about ICT use in class and are confident about its applications in learning. The fact that students are not effectively applying ICT in learning yet they are confident in its use highlights a potentially wasted opportunity that needs to be addressed.

The study findings clearly show that the application of instructional technologies enhances teaching and learning experiences in that they captivate the learners' minds leading to high motivation. Use of ICT in learning motivates students and fosters students' participation in the learning process. The research also established that there are many barriers hindering effective application of instructional technologies in learning and teaching process. Some of these barriers are institutional based while others are external factors. The output from the study indicated that teachers' willingness in the applications of instructional technology is a big contributing factor to its success.

The research implies both a failure of government and the teaching profession itself to effectively implement ICT in the classroom. The government strategy implemented in 2005 sought to decrease the gap between everyday use of ICT and its application in teaching and learning. To this point, this study shows little indication that this has been successful and points to radically needed reform to ensure this aim is achieved.

5.3 Recommendations

Based on the findings and conclusions, the study recommends the following:

The Ministry of Education, Science and Technology should work hand in hand with parents, sponsors and other stakeholders in the education sector to prioritize the provision of adequate instructional technologies to ease the problems of inadequacy of instructional

technologies in public secondary schools. The Ministry through Quality Assurance and Standards officers should conduct regular visits to the schools to assess the availability, state and utilization of instructional technologies.

The government should ensure that teachers are sufficiently skilled and motivated to apply instructional technologies. Teachers should be subjected to an audit test of ICT knowledge with a "gap" analysis used to develop a national programme or training to sufficiently deal with the weakest areas. The government should also explore ways to motivate teachers to adopt ICT in teaching and learning. The government should embark on delivering ICT on entry. This is by devising a programme of training and education on entry to the profession for teachers. Teachers will be trained on ICT use, benefits for it and be tested on their skills at the onset. Further, the school administration should be sensitized on the importance of instructional technologies to allocate increased resources for both physical infrastructure and acquisition of these technologies.

5.4 Recommendations for further research

From the study and related conclusions, the researcher recommends further research in the area. The researcher recommends that more research be carried out on whether application of ICT in teaching and learning varies between subjects. This is key to successfully embed ICT into the curriculum and altering pedagogical beliefs of the teachers implementing it. A study could also be conducted to establish whether there are discernible differences between male and female teachers and students in terms of ICT/digital competence in schools. These studies will also establish whether there is both a gender and digital gap in ICT skills and usage.

REFERENCES

Afshari, M., Abu Bakar, K., Luan, W. S., Abu Samah, B., & Fooi, F. S. (2008). School leadership and information communication technology. *The Turkish Online Journal of Educational Technology - Tojet, 7*(4).

Asmal, K. (2003). Foreword by the minister of Education.Draft White paper on e- Education. Transforming Learning and Teaching through Information and Communication Technologies,Pretoria: Department of Education

Beauchamp, G. (2012) 'ICT in the Primary School', in Pedagogy to Practice, Upper Saddle River, NJ: Pearson Education Ltd.

Best, J.W. & Kahn J.V. (2000). Research in education. Sixth Edition. New York

Birch, A., & Irvine, V. (2009). Preservice teachers' acceptance of ICT integration in the classroom:applying the UTAUT model. *Educational media international,46*(4), 295-315.

Bullock, J. Evaluating the impact of using ICT upon student motivation and attainment in English,[Online],Available:HYPERLINK http://www.educ.cam.ac.uk/research/projects/tips/bullock.pdf

Burns, C. and Myhill, D. (2004) 'Interactive or Inactive? A consideration of the nature of interaction in whole class teaching', Cambridge Journal of Education, vol. 34, no. 1, pp. 35-49.

Chen, J. L. (2011). The effects of education compatibility and technological expectancy on e-learning acceptance. Computers & Education, 57(2), 1501-1511.

Cox, M.J. (1997) The Effects of Information Technology on Students Motivation, London, UK: King's College, London. Final Report.

Cox, M., Webb, W., Abbot, C., Blakeley, B., Beauchamp, T., & Rhodes, V. (2004). ICT and Pedagogy: A Review of the Research Literature. London: Department for Education and Skills.

Cox, M. J., Preston, C., & Cox, K. (1999, 2-5 September). What motivates teachers to use ICT? Paper presented at the British Educational Research Association (BERA), University of Sussex, Brighton.

Cuban, L., Kirkpatrick, H., and Peck. C. (2001). High Access and Low Use of Technologies in High Classrooms. Explaining an apparent paradox .American Educational Research Journal, Vol.38, no 4 pp 813-834

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS Quarterly 13(3), pp. 319–340.

Farrell, G. (2007). Survey of ICT in Education in Rwanda. Washington DC: infoDev/World Bank.

Figg, C. and Kamini, J.J. (2011) 'Exploring teacher knowledge and action supporting technology-enhanced teaching in elementary schools: Two approaches by pre-service teachers', *Australasian Journal of Education Technology*, vol. 27, no. 2, pp. 343-360

Flanagan, L., & Jacobsen, M. (2003). Technology leadership for the twenty-first century principal. Journal of Educational Administration, 41(2), 124-142.

Fraenkal, J.R.& Wallen, N.E.(1993).How to Design and Evaluate Research in Education. McGraw-Hill, Inc.

Gray, D.E. (2009) Doing Research in the Real World, California: Sage Publications Ltd.

Greene, C.N. (2008) 'The Impact of Information Communication Technologies (ICTs) on Diverse Students and Teachers at Second Level', *ICCHP '08 Proceedings of the 11th international conference on Computers Helping People with Special Needs*, pp. 207-214.

Haddad, W.D.,& Draxler, A.(2002). The dynamics of Technologies for education. In W. D. Haddad and Draxler (Eds), Technologies for education: Potentials, Parameters and Prospects (pp2-19) washington D.C: Academy foe Educational Development.

Haddad, W.D.,& Jurich, S. (2002).ICT for Education, Potential and Potency. In W. D. Haddad and Draxler (Eds), Technologies for education: Potentials, Parameters and Prospects (pp28-41) Washington D.C: Academy foe Educational Development

Hargreaves, L., Moyles, J., Merry, R., Paterson, F., Pell, A. and Esarte-Sarjnries, V. (2010) 'How do primary school teachers define and implement 'interactive teaching' in the National Literacy Strategy in England', Research Papers in Education, vol. 18, no. 1, pp. 217-236.

Harrison, B. (2005). Information communication Technology Policy in Rwanda

Hawkins, R. J. (2002). Ten lessons for ICT and education in the developing world. In G. Kirkman, P. K. Cornelius, J. D. Sachs & K. Schwab (Eds.), Global Information Technology

Report 2001-2002: Readiness for the Networked World (pp. 38-44). New York: Oxford University Press.

Hennessy, S., Deaney, R., Ruthven, K. and Winterbottom, M. (2007) 'Pedagogical strategies for using interactive whiteboard to foster learner participation in school science', The Interactive Whiteboard Phenomenon: Reflections on teachers' and learners' responses to a novel classroom technology, vol. 32, no. 3, pp. 283-301.

Hennessy, S., Wishart, J., Whitelock, D., Deaney, R., Brawn, R., La Velle, L., McFarlane, A., Ruthven, K. and Wintebottom, M. (2007) 'Pedagogical approaches for technology integrated science teaching', Computers and Education, vol. 48, no. 1, January, pp. 137152

Hutchins, H.M. (2001). Enhancing the business communication course through WebCT, Business Communication Quarterly, 64, 87-94.

International Journal of Education and development using Information and Communication Technology (IJEDICT) 2007, Vol. 3, pp 2-4.Article by Mary Daniels Brown. Archived Information

Jones, R., & Kozma, R. (2003). Local and national ICT policies. In Technology, innovation, and educational change: A global perspective: International Society for Technology in Education.

Kennewell, S.H., Tanner, S.J. and Beauchamp, G. (2007) Analysing the use of interactive technology to implement interactive teaching, Swansea, UK: Swansea School of Educationm Swanseas Institute of Higher Education.

Kennewell, H., Tanner, S.J. and Beauchamp, G. (2012) 'Analysing the Use of Interactive Technology to Implement Interactive Teaching', Journal of Computer Assisted Learning, no. 24, pp. 61-73.

Kenya Education Management Institute (KEMI). (2014). Diploma in Education Management: Curriculum Management. KEMI, Nairobi, Kenya.

Kenya Education Management Institute (KEMI). (2014). Diploma In Education Management Education Law, Policy and Reforms. KEMI, Nairobi, Kenya.

Kenya. Ministry of Education. (2005). ICT in Education options paper. Retrieved from http://www.pdf.usaid.gov/pdf_docs/PNAIDI898.pdf

Kenya. Ministry of Education. (2006). National information and communication technology ICT strategy for education and training. Retrieved from www.education.go.ke/ICTstrtegy.htm.

Kozma, R. B. (2005). National policies that connect ICT-based education reform to economic and social development. An Interdisciplinary Journal on Humans in ICT Environments, 1(2), 117-156.

Landry, B.J., Griffeth, R., and Hartman, S. (2006). Measuring student perceptions of blackboard using the technology acceptance model, Decision Sciences Journal of Innovative Education, 4(1), pp. 87-99

Leach, J. (2008). Do new information and communications technologies have a role to play in the achievement of education for all? British Educational Research Journal, 34(6), 783-805

Lu, J., Yu, C.S., and Liu, C. (2003). Learning style, learning pattern, and learning performance in a WebCT-based MIS course, Information & Management, 40(6), pp. 497-507

Mangesi, K. (2007). Survey of ICT in Education in The Gambia. Washington, DC: infoDev/World Bank.

Mangesi, K. (2007). Survey of ICT in Education in Ghana. Washington, DC: infoDev/World Bank

McCormick, R., & Scrimshaw, P. (2001). Information and communications technology, knowledge and pedagogy. Education, Communication and Information (now published as: Learning, Media and Technology), 1(1), 37-57.

Ministry of Education, Science and Technology (2005).Sessional paper No.1 of 2005, A policy Framework for Education, Training and Research, Nairobi Government printers

Mugenda, O.M & Mugenda, A.G. (1999). Research Methods: Quantitative and Qualitative approaches. Africa centre for technology studies (ACTS) press Nairobi Kenya

Mwiria, K. & Wamahiu, S.P. (1995). Issues in Educational Research in Africa.

Nwana,O.C.(1981).Introduction to Educational Research. Heinemann Educational Books Ltd, Ibadan

Newby, T. J., Stepich, D. A., Lehman, J. D. & Russell, J.D.(2006).Educational Technology and Learning for Teaching and Learning. Pearson Merrill Prentice Hall, New Jersey

Nkpa, M. (1997). Educational Research for Modern Schools; fourth edition: fourth dimension publishing company. Enugu-Nigeria

Organization for Economic Co-operation and Development [OECD]. (1999). Human capital investment. Retrieved from linkinghub.elsevier.com/retrieve/pii/S0272775799000709

Orodho, J.A (2004). Techniques of Writing Research Proposal and Reports in Education and Social sciences fifth edition Mosola publishers, Nairobi (2008 edition). Techniques of Writing Research Proposal and Reports in Education and social sciences fifth edition Mosola publishers, Nairobi

Patton, M.Q. (1990). Qualitative evaluation and research methods safe publications, Newbury Park, California

Pelgrum, W. J. (2002). The effectiveness of ICT in schools: Current trends and future prospects discussion paper. Paper presented at the OECD Japan Seminar: Teachers, teacher policies and ICT.

Rutten, N., Van Joolingen, W.R. and Van Der Veen, J. (2012) 'The learning effects of computer simulations in science education', Computers and Education, vol. 58, no. 1, January, pp. 136-153.

Smith, H., Higgins, S., Wall, K. and Miller, J. (2005) 'Interactive Whiteboards: Boon or Bandwagon? A Critical Review of the Literature', Journal of Computer Assisted Learning, no. 21, pp. 91-101

.Tella, A., Tella, A., Toyobo, O. M., Adika, L. O., & Adeyinka, A. A. (2007). An Assessment of Secondary School Teachers Uses of ICTs: Implications for Further Development of ICT's Use in Nigerian Secondary Schools. Online Submission, 6(3).

Trentin G. 2010. Networked collaborative learning: social interaction and active learning, woodhead/chandos publishing limited, cambridge, UK

UNESCO. (2002). Information and Communication Technology in Education – A Curriculum for Schools and Programme for Teacher Development. Paris: UNESCO.

UNESCO. (2004). Information and communication technologies in schools: A handbook for teachers. Paris: UNESCO

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS quarterly, 425-478.

Waema, J.M. (2005). In ETA, F.E and Elder, L. (ed). A Brief History of the DVI of ICT policy in Kenya. At crossroads; ICT policy making in East Africa. East Africa Educational publishers Ltd. Nairobi, Kenya

Wellington, J. (2000).Educational Research: Contemporary Issues and Practical Approaches. London: Continuum

World Bank (2004) Contribution of ICT to economic growth: Washington DC teachers' Education; A planning guide.(online) http://www. World bank.org/economic growth.

Zhang, D., Zhao, J.L., Zhou, L., and Nunamaker, J.F. Can e-learning replace classroom learning? Communications of ACM, vol.47, no.5, pp.7579, 2004.

APPENDICES

APPENDIX 1: Letter of Introduction

Dear Respondent,

I am currently a Masters student at University of Nairobi carrying out a field research. The research is on "The Application of Instructional Technologies in Teaching and Learning in Secondary Schools in Kiambu Sub-County". In this regard, I kindly request for your help by answering the questions listed in the questionnaire attached.

All the responses will be treated with utmost confidentiality.

Salome Wangui Mwai

Researcher

APPENDIX 2: Teachers' Questionnaire

Welcome and thank you for sparing time to fill this questionnaire. I am undertaking a Masters Degree in Communication Studies at the University of Nairobi. The purpose of this questionnaire is to find out the extent of the application of instructional technologies in teaching and learning in secondary schools. Please complete each section as instructed. All information provided will be highly confidential.

SECTION A: Teachers Biographical Data

Please tick your chosen response **( )** where appropriate.

1) **Sex:** Male [ ] Female [ ]

2) **Age:**
   a) 20 – 30 years [ ]
   b) 31 – 40 years [ ]
   c) 41 - 50 years [ ]
   d) Over 50 years [ ]

3) Which primary cluster subjects do you teach (choose one that you identify with)? (Languages, Maths, , Sciences, Humanities, Technical)

   a) _____

   b) _____

   c) _____

4) For how long have you taught that subject**?**

   a) Less than 12 months

   b) 1-10 years

   c) 11-20 years

   d) 21 -30 years

e) 30 years or more

SECTION B: Availability of Instructional technology

1. Which of the following technologies exist in your school for teaching and learning?

a)	TV	[ ]	h)	Laptop	[ ]
b)	VCR/DVD	[ ]	i)	Interactive White Boards	[ ]
c)	Overhead Projector	[ ]	j)	Electronic Dictionary	[ ]
d)	Radio	[ ]	k)	Smart Phones	[ ]
e)	Digital camera	[ ]	l)	Films	[ ]
f)	Computer	[ ]	m)	Internet	[ ]
g)	Educational Software provided by the Ministry				[ ]

2. a) Are the instructional technologies you use adequate in teaching your subject?

   Yes [ ] No [ ]

   b) Give reasons for your answer in 3 (a) above.

   i _____

   ii _____

   iii _____

3. (a) In your opinion, what are some of the challenges facing you as a teacher in the use of instructional technology?

   i _____

   ii _____

   iii _____

   iv _____

4. (b) Suggest ways in which the above challenges can be overcome.

i _____

ii _____

iii _____

iv _____

SECTION C : Use of Educational Technology in the classroom

1. How often do you use each of the following with your learners?

	Tick the option	Daily	Weekly	Monthly	Occasionally	Never
a)	Create a document using a word processor					
b)	Manipulate graphics or images using graphics software.					
c)	Look up information on a hard disc drive or compact disc.					
d)	Use the internet to obtain teaching resources.					
e)	Create lessons that incorporate simulation software					
f)	Create lessons that use presentation software					
g)	Set computer based homework					
h)	Create lessons that incorporate students use of a digital video, graphics or sound editors					
i)	Use email to communicate with other teachers.					

j)	Use email to communicate with your students					
k)	Use email of communicate with your students' parents					
l)	Participate in an online interactive discussion or bulletin board with students					
m)	Use software to monitor the students' scores					
n)	Use interactive white boards					
o)	Use subject-specific software					

SECTION D Teachers perceptions about Instructional Technology

Choose only one in each:

1. Strongly agree
2. Agree
3. Undecided
4. Disagree
5. Strongly disagree

	Please tick one box only that indicates the appropriate choice in each row	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
a)	Educational technologies engages learners attention and motivate them					
b)	Educational technologies improves learners test and end term results					
c)	Educational technology stimulates learners' curiosity.					
d)	Educational technology encourages learners to develop their problem solving strategies.					
e)	Educational technology provide models and images which aid learners in concept formation					

f)	Educational technology improves the teachers' efficiency.					
g)	Educational technology reduce the teachers administration burden					
h)	Educational technology provide better records of learners progress					
i)	Educational technology improve leaders approach and understanding of teaching					
j)	Educational technologies create a platform for teachers to communicate with other teachers sharing common problems.					
k)	Educational technologies support co-operative learning.					
l)	Educational technologies support individualized learning					
m)	The internet has proved to be a source of ideas and inform for teachers					
n)	Using educational technology is an important aspect of teachers work					
o)	Technology assisted instruction is more effective than the traditional method of instruction					
p)	Computers will gradually replace teachers.					

SECTION E: Teachers' Instructional Technology Competency

How would you rate your competency level in terms of the following computer skills or applications?

	Please tick one box only that indicates the appropriate choice in each row	**Very Low**	**Low**	**Medium**	**High**	**Very High**
a)	Basics of operating PC(using keyboard, mouse…etc					
b)	Managing files (delete, move to….etc					

c)	Using word processor (such as word program)					
d)	Use spread sheet processor (such as excel program)					
e)	Creating or using data base processor (such as access program)					
f)	Combining files from different resources (sound or video files) to create presentation					
g)	Producing learning software					
h)	Using PowerPoint software					
i)	Searching for saved data on hard disk or compact disc					
j)	Internet browsing					
k)	Publishing a personal blog.					
l)	Using chat rooms and forums (Facebook, twitter)					
m)	Designing webpage or personal site					
n)	Using email reading and sending mails.					
o)	Using digital camera					
p)	Deleting or editing pictures, animations or movies.					
q)	Searching for information on the internet.					
r)	Downloading files from internet.					

APPENDIX 3 : The Students' Questionnaire

Indicate class: ----------

The following questionnaire seeks to obtain information on the extent to which instructional technologies are used in teaching and learning process kindly tick { } your response where appropriate. Information provided will be strictly confidential. You may not sign your name.

SECTION A: Biographic Data

1. **Sex:** Male **[ ]** Female **[ ]**

2. **Age**
   a) 14-18 years **[ ]**
   b) 19-23 **[ ]**
   c) 24-28years **[ ]**
   d) Don't know **[ ]**

SECTION B: Availability and use of instructional technology

1. How often do you use ICT at school for completing those tasks?

	AT SCHOOL	**Never**	**Monthly**	**Weekly**	**Everyday**
a)	I look up for information hard disk and compact discs (CD – ROMS)				
b)	I use educational software to learn some lessons				

c)	I use some spread sheets				
d)	I use / create pictures/and animals				
e)	I watch DVDs / videos on the computer				
f)	I use computer for writing				
g)	I design websites				
h)	I download music files or software from the web				
i)	I send and receive emails				
j)	I use the internet to revise for exams				
k)	I watch TV/listen to radio/ music on the internet				
l)	I create / record sound files on the computer				
m)	I play games on the computer				
n)	I browse the internet for fun				
o)	I use the internet to look up information				

SECTION C:

Your opinion about using computer in the teaching / learning process

1. To what extent do you agree or disagree with the following statements:

	Please tick one box on each row	**Strongly agree**	**Agree**	**Undecided**	**Disagree**	**Strongly disagree**
a)	I enjoy lessons with a computer					
b)	I feel comfortable working with computers					
c)	Using computers at school improves my learning					
d)	I make good use of email at school					
e)	I make good use of internet at school					
f)	I am tired of using a computer					
g)	I need help from teachers to learn with ICT					
h)	Computers are difficult to use					
i)	I find it fine consuming using ICT in learning					
j)	Working with computers makes me nervous					
k)	I know how to use ICT but am not interested in using it to learn.					
l)	I wish ICT was not used in teaching.					

SECTION D: Students' confidence level in terms of the following computer skills or applications.

	Please tick one box only that indicates the appropriate choice in each row	**Very Low**	**low**	**Not confident**	**Confident**	**Very confident**
a)	Basics of operating PC (using keyboard, mouse….. etc					
b)	Managing files (delete, move to……etc					
c)	Use word processor such as word program					
d)	Use spread sheet processor(such as excel program					
e)	Creating or using database processor(such as access program					
f)	Create and design presentation					
g)	Searching for saved data on hard disk or compact disk					
h)	Using different designing programs (Photoshop, Flash)					
i)	Deleting or editing pictures animations or movies					
j)	Using digital camera.					
k)	Internet browsing					
l)	Searching for information on the internet					
m)	Downloading files from the internet					
n)	Using Email (reading and sending mails)					
o)	Using chat rooms and forums (Facebook, twitter)					
p)	Publishing a personal blog					
q)	Designing webpage or personal site					
r)	Using data slow basis on PC as projection tool.					
s)	Producing learning software.					
t)	Combining files from different resources to create presentations					

APPENDIX 4: Principals Interview Schedule

The purpose of this interview is to find out the extent to which instructional technologies are applied in teaching and learning process. All information provided will be highly confidential.

SCHOOL DATA:

i). Number of students_____

ii). Number of teachers_____

1. Which instructional technologies exist in your school?

2. How did the school acquire these technologies?

3. To what extent are your teachers trained to use the instructional technologies in teaching and learning?

4. What are your views on the use of instructional technologies for classroom teaching and learning of students?

5. What factors have facilitated the use of instructional technologies in your schools?

6. What are the administrative challenges you are experiencing in your school as regards the use of instructional technologies?

7. Suggest the possible ways of overcoming the challenges you are facing in the use of instructional technologies