TEACHER ADOPTION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SECONDARY SCHOOLS IN TAITA TAVETA COUNTY, KENYA

MWAWANA CHRISPIN MWACHONGO

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF PHILOSOPHY IN EDUCATIONAL COMMUNICATION TECHNOLOGY, DEPARTMENT OF CURRICULUM, INSTRUCTION AND EDUCATIONAL MEDIA, MOI UNIVERSITY

AUGUST, 2014

DECLARATION

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

………………………………………… Date ………………………

Mwawana Chrispin Mwachongo

EDU/PGCM/1001/10

DECLARATION BY SUPERVISORS

This thesis has been presented for examination with our approval as supervisors

…………………………… Date ……………………….

Prof. Jackson K. Too

Department of Curriculum, Instruction and Educational Media

School of Education

Moi University

…………………………… Date ……………………….

Prof. Chris W. Mukwa

Department of Curriculum, Instruction and Educational Media

School of Education

Moi University

DEDICATION

My special dedication to my wife Agnes and our children Brightone, and Desmond for their strong support throughout the time I labored to complete this thesis. Much more appreciation to our youngest son Jakub for being an inspiration to work harder every time he curiously looked at what I was doing.

ACKNOWLEDGEMENT

ABSTRACT

The use of Information and Communication Technology (ICT) in the classrooms is paramount for providing opportunities for students to learn to operate in the information age. The purpose of this study was to investigate the extent to which the teacher is adopting ICT in the classroom. This is with a view to enabling them to adopt it where they do not and bring to the awareness of all the stakeholders of the enablers and the barriers around the teachers regarding ICT use in education in the Taita Taveta County. The study was guided by the following objectives: firstly, to assess the teachers' competence level in the adoption of the ICT; secondly, to identify the specific impediments to ICT integration in education; thirdly, to identify the existing strategies to fast track ICT adoption and lastly to highlight the benefits of ICT integration in the classroom in the Taita Taveta County secondary schools. This study was guided by the Activity Theory and conducted using the Survey Research Design. It was carried out in the Taita Taveta County which at the time had a total of 515 teachers in the public secondary schools which had already presented candidates for K.C.S.E. The target population was teachers in public secondary schools and using simple random sampling procedure a sample of 155 teachers were selected to participate in the study. Data was collected using questionnaires; analyzed using descriptive statistics such as percentages, means and standard deviations and presented through tables, graphs and figures. The study found out that the teachers' ICT incompetence in integrating ICT in teaching may be one of the strong barriers impeding the teachers' adoption of ICT in the classroom. The findings showed that ICT produces significantly better results in the teaching/learning outcomes in secondary schools. Moreover, the findings of this study also indicate that teachers have a strong desire for the integration of ICT in teaching their subjects but encounter many barriers. The study recommends that schools need to employ a trained ICT teacher and facilitate subject- customized in-service trainings for the teachers. It is also hoped that the findings will empower the teacher to adopt ICT in teaching and in turn make learning effective and line with the demands of the twenty first century.

TABLE OF CONTENTS

The chapter tried to analyze, interprets and discuss the findings of the data collected. Data was collected using questionnaires; analyzed using descriptive statistics such as percentages, means and standard deviations and presented through tables, graphs and figures. The study found out that the teachers' ICT incompetence in integrating ICT in teaching may be one of the strong barriers impeding the teacher's adoption of ICT in the classroom. The findings showed that ICT produces significantly better results in the teaching/learning outcomes in secondary schools. Moreover, the findings of this study also indicate that teachers have strong desires for the integration of ICT in teaching their subjects but encountered many barriers. The next chapter presents the conclusions, summary of the findings and recommendations for the study

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

CDRom: Compact Disc-Read Only Memory

CEMASTEA: Centre for Mathematics, Science and Technology Education in Africa

ICT: Information and Communications Technology

K.C.S.E: Kenya Certificate of Secondary Education

KICD: Kenya Institute of Curriculum Development

MoEST: Ministry of Education, Science and Technology

NEPAD: New Partnership for Africa's Development

NESSP: National Education Sector Support Programme

USAID: United States Agency for International Development

WiMAX: Worldwide Interoperability for Microwave Access

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Overview

This chapter outlines the background of the study, problem statement, purpose, objectives and research questions of the study, justification and significance of the research. It has also discussed scope and limitations of the study, the theoretical framework and definition of terms.

1.1 Background of the Study

Sharma (2005) reckons that national planning and the nation's effective growth are based on efficient human resources. Investment in education is therefore reciprocal to investment in human resources development. According to an article from www.trizinnovation.com/about-us/overview.html globalization and technological change -processes that have accelerated in tandem over the past fifteen years - have created a new global economy 'powered by technology, fueled by information and driven by knowledge.' The emergence of this new global economy has serious implications for the nature and purpose of educational institutions.

The Ministry of Education Strategic Plan: 2006-2011 takes cognizance of the fact that in the current globalised economy, a country requires an Information and Communication Technology (ICT) literate workforce that will enhance the country's participation in the knowledge–based economy. ICT education is, therefore, the national platform for equipping nations with ICT skills for dynamic and sustainable economic growth. The Strategic Plan warns that any country that fails to integrate ICT into its educational system risks serious marginalization on the global scene. The

Economic Commission for Africa has indicated that the ability to access and use information is no longer a luxury, but a necessity for development. Unfortunately, many developing countries, especially in Africa, are still low in ICT application and use, (Aduwa-Ogiegbean and Iyamu, 2005).

The idea that ICT can help developing countries is intriguing to many, because of the benefits that have apparently been realized in the West (Avgerou, 1990). Ironically, Avgerou (1990) notes that 'literature sometimes contains a naive taken-for-granted assumption that the success of the West is attributable to ICTs, and therefore bringing the benefits of this development to poorer countries is simply a matter of delivering ICT'. Motivated by the prospect of greater economic, social, educational and technological gains, both developing and developed countries, are bringing about education reform, with a clear focus on ICT integration in education' (Jhurree, 2005, p.468). Although ICT is now at the centre of education reform efforts, not all countries are currently able to benefit from the developments and advances that the technology can offer. Significant barriers that are often referred to as "the Digital Divide" limit the ability of some countries to take advantage of these technological developments (Kozma & Anderson, 2002). The digital divide is defined as the disparity in ICT diffusion and use between industrialised and developing countries or, indeed, between the rich and the poor, men and women, urban and rural areas, between and within individual countries. Wachira (2005) notes that in the developing countries where less than 1% of the population has access to ICTs, the digital divide is largely a rural-urban divide with those in the urban areas being on a vantage point. Thus, developing countries like Kenya are faced with challenges related to access, pedagogy or assessment when using ICT to improve and reform in education. It is worth noting that 85% of the Kenya's population lives in the rural area.

Currently, the government has stepped up teacher in-sets through workshops like those being done by CEMASTEA and through the district ICT champions. However, on the ground, this educational reform is still a 'chick yet to be hatched' in many schools. Perhaps, majority of the stakeholders' nerves may be steadied by the encouragement from the article appearing in http://mahidachintan.com/documents

> 'the experience of introducing different ICTs in the classroom and other educational settings all over the world over the past several decades suggests that the full realization of the potential educational benefits of ICTs is not automatic. The effective integration of ICTs into the educational system is a complex and a multifaceted process that involves not just technology—indeed, given enough initial capital, getting the technology is the easiest part—but also curriculum and pedagogy, institutional readiness, teacher competencies and long-term financing, among others' (Retrieved on February, 15th 2013)

More light is shed by Ertmer (1999), who attests that two levels of barriers have been categorized for hampering teachers' ICT adoption efforts: external (first-order) barriers and internal (second-order) barriers. External barriers include those that are often seen as the key obstacles, for example, the issues of inadequate access to the technologies, training, and support without which it is almost impossible to talk about technology adoption. However, as Ertmer (1999) documented, even if the first-order (external) barriers were resolved, teachers would not automatically use technology to achieve the kind of meaningful outcomes advocated.

The snail-paced ICT adoption in teaching is apparently beyond infrastructural domain and hence it becomes imperative to look into the internal barriers stalling ICT integration in teaching by teachers. Internal barriers are related to, according to Ertmer (1999), a teacher's philosophy about teaching and learning which is veiled and deeply rooted in his/her daily practices. Researchers state that the ways in which teachers integrate ICT into classroom instruction are powerfully mediated by their interrelated belief systems. Teachers' beliefs play an important and pervasive role in

the nature of classroom instruction and in the professional lives of a teacher. All said and done, the role and support of the teacher in integrating ICT in the classroom cannot escape being put under scrutiny so as to put this debate to rest once and for all. Accordingly, therefore, the researcher felt obliged to undertake this study to critically assess the extent to which the teacher is adopting the ICT in the class room.

Young people have been recognized by the Kenya National ICT Policy as the future workforce, leading creators and early adaptors of ICT. Therefore, they must be empowered as learners, developers, contributors and future entrepreneurs in this important sector (World Summit on the Information Society, 2003). Kenya indeed concurs with the fact that it is imperative for the schools to fully embrace ICT as the national platform for equipping the nation with ICT education and skills. More than ever, global technological trends are pressurizing out the youths to be equipped with skills that will enable them handle issues that affect them after school, including: career choice and progression, interaction with the web and internet materials for research, inter alia.

In line with the global technological demands, Kenya through the Ministry of Education Science and Technology (MoEST) is striving to fast track integration of ICT in education, albeit a myriad of challenges. The Ministry has in collaboration with the private sector, mobilized resources to promote ICT access to schools. Such resources have been channeled to a number of schools to acquire ICT equipment especially computers. Currently, the MoEST through the Kenya Institute of Curriculum Development (KICD) under NESSP is undertaking the digitization of curriculum. KICD has to date managed to digitize the Secondary School Curriculum up to form two. Further, the Ministry with the support of NEPAD is implementing

connectivity in six schools to serve as a demonstration for future roll out to other schools. In addition, ICT has now been integrated in the syllabus for pre-service teacher-training and capacity–building to equip serving teachers with ICT skills (Farrell, Shafika & Trucano, 2007).

ICT integration in education is an educational change like many others that preceded earlier educational reforms. The arrival of ICT itself is a revolution but unlike the agrarian and industrial revolutions, its impact on the global scene is unprecedented. Schlechty (1997) puts it that when a radical technological change occurs, choice regarding the new technology is limited. Organisations that refuse to use the new technology, that cannot afford it or that cannot adapt to it will be replaced by organisations that can.

According to Anjana (2011) in an article titled 'Emergence of ICT in the 21st Century' from http://www.indianjournals.com reckons that "as the half-life of information continues to shrink and access to information continues to grow exponentially, schools cannot remain mere venues for the transmission of a prescribed set of information from teacher to student over a fixed period of time. Rather, schools must promote learning to learn, that is, the acquisition of knowledge and skills that make possible continuous learning over the lifetime". The illiterate of the 21st century, the article foresees, "will not be those who cannot read and write, but those who cannot learn, unlearn and relearn" (Retrieved 3rd March 2012).

However, as the government strives to manage the educational change occasioned by the advent of ICT, 'educational change depends on what teachers do and think-it is as

simple and as complex as that ...' (Sarason, 1971) cited by Fullan, (1991). All in all, as time goes, the teacher seems not to have much choice but to adopt ICT for 'when technological change goes to the core of the way work is done in an enterprise, resistance to the change will only lead to extinction.

The teachers' support in integrating ICT in the classroom hinges on a variety of factors, amongst them being: attitude, competence, working environment, inter alia. Nzuve (1999) defines 'attitude' as a persistent tendency to feel and behave in a particular way towards some object. Attitude of teachers towards an innovation plays a vital role towards its success. Attitude formed towards a change in an organisation is influenced by a number of concerns amongst them being: increased burden on the worker and a threat to job security. Many teachers may feel that integrating ICT in the classroom means more work or is a threat to their job. As Adeya (2002) quotes in his paper "ICTs and Poverty" from Barlow (1998): 'Common perceptions of the potential of the digital age are limited by the habits of mind one develops in an industrial society. These habits are different for those who have grown up in poverty with no television sets for instance to shape their world view'. However, Adeya (2002) also notes that the basis of this argument is weak since Barlow has no empirical evidence to support his assertion, apart from his experiences in the countryside of a developed country.

The second factor affecting teachers' adoption of ICT in the classroom is competency. According to the Encarta Dictionary, competence means the ability to do something well, measured against a standard, especially ability acquired through experience or training. According to Gilster (1997), digital literacy is the ability to understand and

use information in multiple formats from a wide range of sources when it is presented via computers. Majority of teachers can hardly go beyond typing on the computer. It has been advocated that 'if a teacher is to be able to translate curriculum intentions into reality, it is imperative that the teacher understands the curriculum document or syllabus well in order to implement it effectively' (University of Zimbabwe, 1995).

Stressful teachers' working environment is yet another factor that hinders the adoption of ICT in the classroom. With the current constraints faced by the education sector such as inadequate staffing, limited finances, over enrolments, amongst others; teachers work under stressful environments that may make them not receptive to a curriculum innovation. The government may be trumpeting the need for ICT integration in teaching and learning but without commensurate motivation and mitigating measures, the support of the teachers in this noble call may be a cosmetic one. The many computers provided to a number of schools through various initiatives such as the Slovak –Kenya Cooperation for modern schools, dubbed sote ICT may end up gathering dust as Abbreau, (1982) alludes that many of the organizations have equipment which is rarely used. Money spent on this equipment could have been used more profitably to extend library facilities This study therefore intends to examine the extent to which the teacher is adopting the ICT in the classroom with a view of coming up with the enablers and removing the barriers of the same in the Taita Taveta County and by extension the entire country. It is envisaged that a more intensified ICT adoption in the classroom will address to a significant degree the county's challenge of unimpressive performance in the national examinations.

1.2 Statement of the Problem

Effective use of ICT in education has been a focus of research for decades (Ertmer, 1999, 2005; Loveless, 2004). The Government of Kenya in her quest to actualize the Vision 2030 appreciates and recognizes that an ICT literate workforce would be a foundation on which the country can acquire the status of a knowledge-based economy. The government through the ICT Trust Fund and in partnership with the private sector and international organisations has been able acquire and provide ICT equipment to many secondary schools, those in Taita Taveta County included. It is perturbing, however, to realize that, relatively few teachers use ICT regularly in their teaching. The impact of ICT on curriculum, therefore, is still very limited. This fact is supported by CEMASTEA (2012) which points out that 'there has been a tendency to focus more on infrastructure, (model e-schools and computer laboratories) in lieu of professional teacher development, yet the teacher is at the centre of teaching and learning in the schools'. 'There is need, therefore, to re-focus attention to teachers' professional development so as to bring a shift in pedagogy through ICT', (CEMASTEA, 2012).

1.3 Purpose of the Study

The purpose of this study was to investigate the extent to which the teacher is adopting ICT in the classroom with a view of enabling them to adopt it where they do not and bring to the awareness of all the stakeholders the enablers and the barriers around the teachers regarding ICT use in education in the Taita Taveta County.

1.4 Objectives of the Study

a) To assess the teacher competence level in adopting the ICT integration in the classroom in the Taita Taveta County secondary schools.

b) To highlight the benefits of ICT integration in the classroom in Taita Taveta County secondary schools.

c) To identify the specific impediments to ICT integration in the classroom in the Taita Taveta County secondary schools.

d) To identify the existing strategies to fast track ICT integration in the classroom in the Taita Taveta County secondary schools.

1.5 Research Questions

a) What is the teacher competence level in adopting ICT in the classroom in the Taita Taveta County secondary schools?

b) What are the benefits of ICT integration in the classroom in Taita Taveta County secondary schools?

c) What are the specific impediments to ICT integration in the classroom in the Taita Taveta County secondary schools?

d) What are the existing strategies to fast track ICT integration in the classroom in the Taita Taveta County secondary schools?

1.6 Justification of the Study

Taita-Taveta County has been amongst the poorest economically and in the national examinations performance in Kenya. As mentioned earlier, the current economy is one which is 'powered by technology, fuelled by information and driven by knowledge, therefore the concern as to whether the teachers have adopted ICT in the classrooms in the County cannot just be wished away. The concern is in tandem with the assertion that ICT has been a key player in all the sectors in developed nations. This study therefore is intended to provide data on the extent of the teachers' adoption

of ICT in the classroom with a view of moving the secondary schools in the county up to the next higher level.

1.7 Significance of the Study

Glister (1997) puts it that: 'Not only must you acquire the skill of finding things, you must also acquire the ability to use these things in your life' (p. 1-2). The findings of the proposed study, it is hoped, will inspire and enable the teachers in secondary schools in the County to not only like and access computers, but also acquire the ability to use them in the teaching and learning and even in their daily lives. Glister (1997) alludes that the skills of the digitally literate are becoming as necessary as a driver's license. The internet's growing universality will create priceless resources for learning and self advancement (Glister, 1997). Therefore, it is envisaged that the findings of the proposed study will revolutionise the teaching and learning in the county. This will narrow greatly the gap that exists in academic performance between the secondary schools in this county and those in other counties in Kenya. It is also envisaged that the findings of this study will facilitate the empowerment of the teacher for a more active role in the integration of ICT in the classroom. Subsequently, the increased role of the teacher in the process will in turn strengthen the ICT integration in the classroom and hence translate to better academic performance in the county. The study will contribute to knowledge on ICT adoption in secondary schools which is a current topical issue in education in Kenya.

1.8 Scope and Limitation of the Study

The study covered the ICT integration factors in the classroom in secondary schools in the Taita Taveta County. All types of digital technology are included in the term

"ICT". The study also covered the available ICT related teaching and learning equipment, technologies and software programmes and the accruing benefits of ICT integration in education.

Taita Taveta County is a geographically varied area characterized by hills, plains and low population density. Accordingly, the secondary schools are scattered and located over long distances from each other and most of them are not served with good transport and communication network making their accessibility time consuming and expensive. Getting the teachers to spare their time to fill in the questionnaires within a reasonably short time required patience and a lot of public relations on the side of the researcher. The researcher resides far from the university and his supervisors making frequent consultations difficult and expensive.

More so, the county lacks libraries that contain materials that match the researcher's demands occasioning his heavy reliance on the internet which is slow and expensive. It is also worth noting that the researcher was carrying out the study while still teaching and discharging administrative duties all of which were tricky to balance and time constraining. Overcoming the stated challenges necessitated the researcher's extra-mile financially and in time management.

1.9 Theoretical Framework

This study was informed by the Activity Theory (AT), a conceptual approach that provides a broad framework for describing the structure, development and context of computer-supported activities by Engeström (1987). The theory is a philosophical framework that allows the study of different forms of human practices. The practices

can be viewed as developmental processes where both individual and social levels are interlinked.

Activity theory (AT) is a general framework for studying different forms of human activity as development processes (Kuutti, 1996). Within this general context, Engeström (1987) proposed a model that conceptualises all purposeful human activities as the interaction of the elements: subject, object, tools, community, rules and division of labour. This study will use Activity Theory to examine complex pedagogical, social, and technological issues in ICT integration process at the classroom level.

In this model, according to Engeström (1987), the *subject* implies the individual or a group of people whose views are taken during the analysis of an activity. The *object* (or objective) is the target of the activity within the system. *Tools* refer to internal or external mediating artifacts which enable the *outcomes* of the activity. The *community* comprises one or more people who share the objective with the subject. *Rules* refer to the explicit and implicit regulations, norms and conventions that constrain actions and interactions within the activity system. The *division of labour* discusses how tasks are divided horizontally between community members as well as referring to any vertical division of power and status (Center for Activity Theory and Developmental Work Research, 2003).

Using this model to analyse ICT integration in education, we can map the elements as follows:

a) *Subject:* teacher, teaching experience, teaching approach, the personal, administrational and instructional use of ICT, the place of ICT in daily life, the necessity of knowledge and skills related to ICT.

b) *Objective*: the goals of using ICT in teaching-learning process (knowledge and skills acquisition and problem solving.

c) *Activity:* ICT integration in teaching and learning.

d) *Tools:* ICT equipments and soft ware applications.

e) *Rules*: School teaching policy, teachers and students' access to ICT equipment protocol

f) *Division of labour:* the roles and responsibilities of students and teachers, cooperation amongst the teachers.

g) *Outcome:* the benefits of the use of ICT in the teaching-learning process.

In conclusion ICT integration in education is, after all, both the tools and the methods used in teaching (Li & Bratt, 2004). To understand how teachers integrate ICT into the teaching-learning process necessitates an analysis of the activity systems in which they are embedded and an analysis of the contradictions inherent within these activities. Therefore, by adopting an activity theoretical approach to the study, not only can we understand the various processes within and between the elements of activity system, but also we can pinpoint problem areas to be addressed and construct potential effects of contradictions in ICT integration process. In this study, the researcher has used an activity theory framework for understanding and describing

experiences of students and teachers when using ICT and the contradictions that occur in the ICT integration process.

1.10 Conceptual Framework
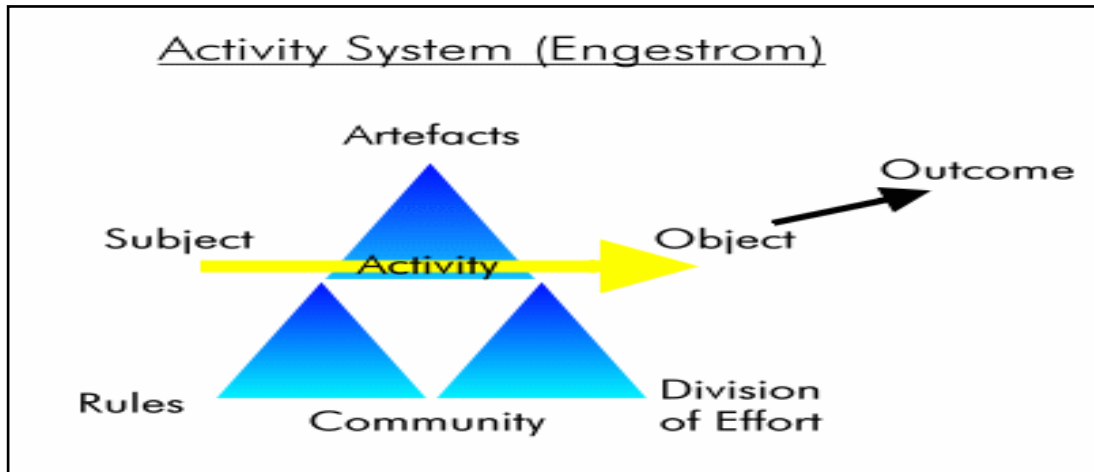
Figure 1.1 Conceptual Framework

Author: Engestrom, (1987)

Engestrom's model above is useful for understanding how a wide range of factors work together to impact an activity. In order to reach an *outcome* it is necessary to produce certain *objectives* for instance experiences, knowledge, and physical products. Human activity is mediated by artifacts, that is, tools used, documents, recipes, among others. Activity is also mediated by an organization or community. Also, the community may impose rules that affect activity. The subject works as part of the community to achieve the objective. An activity normally features a division of labour.

1.11 Definition of Operation Terms

Connectivity:	Linkage of two or more schools through networking so as to be able to share and exchange data.
Digital Literacy:	Ability to manipulate communication through technology in order to effectively communicate or solve a problem.
ICT Infrastructure:	Physical conditions or requirements that make the use of ICT in teaching and learning possible
ICT Literacy:	Ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers.
Impediments:	Difficulties in adoption of ICT in teaching and learning in schools
Integrate:	To merge, incorporate, mix, or fuse something into another to make one whole.
Internet:	A vast computer network linking computers worldwide.
Technology Adoption:	The act of embracing technology in the process teaching and learning

1.12 Chapter Summary

The chapter has presented the background to the study, statement of the problem, the objectives and research questions, justification and significance of the research. It has also discussed scope and limitations of the study, the theoretical framework and definition of terms. This gives the introduction required which leads to the literature review to be discussed in the next chapter for the purpose of supporting the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of some of the existing literature on teacher adoption of ICT in secondary schools. It places the study in the context of other similar studies and reviews that have been previously carried out. The main aim was to bring out relevant concepts to support the study and existing gaps and perspectives that require further understanding and analysis.

2.1 Information and Communications Technology

Pelgrum and Law (2003) state that near the end of the 1980's, the term 'computers' was replaced by 'IT' (information technology) signifying a shift of focus from computing technology to the capacity to store and retrieve information. This was followed by the introduction of the term 'ICT' (Information and Communication Technology) around 1992, when e-mail started to become available to the general public (Pelgrum and Law, 2003). According to Pelgrum and Law (2003) Information and Communications Technology (ICT) has been emerging from the concepts of Information Technology (IT), basically meaning computers and communications technology tools such as television sets, satellite communication equipments, mobile phones, e-pads, *inter alia*- digital data networks being the latest phase of development. Due to a trend of different merging technologies (all technologies seem to merge together in one way or another), there was a reason to start speaking of ICT as opposed to IT. ICT captures all the latest technologies used for communication, data processing and data storage.

In simple terms, Information and Communications Technology (ICT) refers to the use of communication tools such as mobile phones, computers and technology such as internet network or multimedia to pass across information. The information can be personal, general, for marketing, news or educational. According to Dictionary.com, ICT is the phrase used to describe a range of technologies for gathering, storing, retrieving, processing, analysing, and transmitting information. ICT integration in education is the use of ICT to enhance teaching and learning. The use of education technology is closely related to ICT integration in education. According to Aggarwal, (2004), cited by Otunga, Odero and Barasa (2011), educational technology is a system of 5M's, that is, "... a system in education in which machines, materials, media, men and methods are interrelated and work together for the fulfillment of specific educational objectives. According to Otunga, Odero and Barasa (2011) further argues that educational technology refers to modern instructional equipment that is used in the instructional process in the classroom. It is worth noting that 'the role of technology in the learning process has evolved from being an optional or add-on resource for the enrichment of learning to an essential tool for all learners, and when intensively used to enhance learning, we then talk of technology integration (Otunga, Odero and Barasa, 2011).

2.2 Benefits of Integrating ICT in Education

According to Hepp, Hinostroza, Laval and Rehbein (2004) the following reasons justify the application of ICTs in education:

a) *That a new society requires new skills:* Due to the fact that ICTs are the preeminent tools for information processing, the new generation needs to become competent in their use, should acquire the necessary skills, and therefore must have access to computers and networks during their school life.

b) *Productivity enhancement:* Schools are knowledge-handling institutions; therefore, ICTs should be fundamental management tools at all levels of an educational system, from classrooms to government ministries.

c) *A quest for quality learning:* Schools should profoundly revise present-day teaching practices and resources to create more effective learning environments and improve life-long learning skills and habits in their students.

Kozma (2005) in his support for the use of ICTs in education put forth the following arguments that ICTs are used to improve the delivery of and access to education. They can improve education margin by increasing the efficiency by which instruction is distributed, but it need not involve fundamental change. Also, ICTs are the focus of learning. By learning ICT skills, students become better prepared for work that increasingly involves the use of ICTs. ICTs can be used to improve student understanding, increase the quality of education and thereby increase the impact of education on the economy. ICTs facilitate knowledge creation. Technology, technological innovativeness and knowledge-sharing can contribute to the transformation of the education system and to sustained economic growth and social development.

Moreover, Papert (1997) identified the following positive effects of ICTs in education on students which include enhanced motivation and creativity when confronted by the new learning environments, a greater disposition to research and problem-solving focused on real social situations, more comprehensive assimilation of knowledge in the interdisciplinary ICT environment, systematic encouragement of collaborative work between individuals and groups and ability to generate knowledge, capacity to

cope with rapidly changing, complex and uncertain environments, new skills and abilities fostered through technological literacy.

Furthermore, Kozma and Anderson (2002) claim that ICTs are transforming schools and classrooms by bringing in new curricula based on real world problems. ICTs also provide scaffolds and tools to enhance learning, give students and teachers more opportunities for feedback and reflection. Further more, ICTs provide opportunities for building local and global communities that include: students, teachers, parents, practicing scientists and other interested parties. Similarly, Hepp, Hinostroza, Laval and Rehbein (2004) state that the roles ICTs play in the educational system can be pedagogical, cultural, social, professional and administrative.

a) *Pedagogical Tool Role:* ICTs provide a new framework that can foster a revision and an improvement of teaching and learning practices such as collaborative, project-based and self-paced learning.

b) *Cultural, Social and Professional Roles:* The cultural, social and professional roles of ICTs are exercised primarily through an effective use of the vast amount of information sources and services available today via Internet and Compact Disc-based content for the entire educational community: students, teachers, administrators and parents.

c) *Administrative Roles:* ICTs have important roles to play in making school administration less burdensome and more effectively integrated to the official information flow about students, curricula, teachers, budgets and activities through the educational system information pipelines.

As Wagner and Kozma (2003) claim, ICTs can affect the pace at which the learning gap is bridged in developing countries, both domestically and in relation to other nations. The great challenge is to harness the advantages of those technologies, in order to improve the delivery and quality of educational services as well as to accelerate the rate at which knowledge is distributed and learning chances and outcomes are equalised throughout society

Integrating ICT in education has many other benefits. It enables e-knowledge and the reinvention of e-knowledge processes. Knowledge is information that is presented within a particular context, yielding insight on application in that context by members of a community. e-knowledge is networked Information and Communications Technology (ICT) (Wagner, & Kozma, 2003). One important aspect of e-knowledge is being able to unbundle content in ways that facilitate subsequent editing and recombination. Another aspect is being able to identify other contexts in which content might be relevant if it can first be generalized from its original form then repurposed to suit the new context.

The use of ICT in teaching and learning promotes constructivism. 'If we look at education today we see that there is a lot of attention given for the constructivist approach to teaching. The essence of constructivism is that learners individually build and discover their own knowledge. Learners are seen as active participants in their learning and not as passive recipients of information (Duffy & Cunningham in Jonassen, 1996). In practice, it means that students learn through experiencing things and reflecting on those experiences. Constructivism approach explains that children construct their own knowledge and learning takes places in a social context.

The use of ICT in teaching and learning allows greater use of multimedia. Multimedia's ability to combine images, sound and motion, offers stimulus variation, making teaching and learning effective and enjoyable, bringing about an emerging discipline called 'edutainment'. Using ICT one can generate or access captivating images on a particular subject. According to the Information Processing Theory by Feden and Vogel (2003), images are economical as they take less space in our working memory than a written text hence making information retrieval easier.

According to Bruner (1977) ICT can help to let students see the relevance of a topic or issue, to reinforce and enhance teacher activity (not replacement), to make the content of the teacher richer and to have a dynamic representation enabling the understanding of the complex concepts.

Otunga, Odero and Barasa (2011), points out that 'when learners are exposed to the use of instructional technologies in solving meaningful, real life problems, then different forms of technologies become instrumental for gathering, manipulating, synthesizing and presenting information during the instructional process' (p.113). In such cases, so Otunga, Odero and Barasa (2011) reports, the learners constructs their own learning environments and design their own tailored learning activities. The learner therefore becomes in charge of his/her learning and is able to navigate a wide range of knowledge to discover facts, principles and concepts hence assimilating information that is personally relevant to them. This is in line with the much lauded Constructivism Approach to learning.

The assertion by Pelgrum and Law (2003) that technology has the potential of bringing educational opportunities to more remote areas but that the introduction of ICT into schools becomes constrained in developing countries due to the demands on infrastructure investment, should not be taken for granted. This assertion points to the fact that the divide between urban and rural areas may be widened and consequently it might introduce a digital divide to the existing economic and educational divides (Pelgrum and Law, 2003). Accordingly, it is critical to ensure that the digital divide between developing and developed countries is bridged through the introduction of ICTs into elementary school systems where early learning begins. In Bracey (2005) point of view, the challenge for all is to make use of new technologies in meaningful ways to maximize their value to learners, teachers and others involved in the dissemination of the uses of technology (Bracey, 2005).

2.3 Process of ICT Integration in Education

When it comes to ICT integration in education teachers tend to think of only one or two forms which may not be within their reach and may not take advantage of the wide range of forms of ICT tools around them. According to Otunga, Odero and Barasa (2011), 'there are wide ranges of instructional technology the teacher can use and they include: computers, internet, videoconferencing, teleconferencing, telephone (mobile), broadcast video, net meeting, voice-mail, videocassette, audio cassette, e-mail, and internet chat.' (p. 112). Facebook and twitter are also coming up very strongly as ways of disseminating educative information.

Itzkan (1994) cited by CEMASTEA examined the didactical implementation of ICT in education by paying attention to three questions how is the education actually like

during such a process? What is the role of the teacher during such a process? And which products do teachers make?

Starting from these questions Itzkan (1994) came to the conclusion that there are three phases in ICT integration in education.

a) Substitution

According to Itzkan (1994), 'teachers make a copy of the existing learning process, so the core does not change. There can be some additional improvement or enrichment like the introduction of ICT in some cases.'

b) Transition

Itzkan posits that 'gradually there is an improvement of the existing didactics. Mostly this is the start of the introduction of several changes. ICT is no longer seen as just an information tool but rather as a learning tool.

c) Transformation

'There is a change in the conception of the learning and teaching process. Learners can control their own learning process and the role of the teacher shifts from being a leading figure to a facilitator or coach (Itzkan, 1994). CEMASTEA also cites Bruner (1977) who introduced a framework that can easily be used to infuse ICT in teaching and learning that takes cognizance of three steps in learning that he identified enactive step where learners need to 'do' or 'experience.' This is the 'doing stage' Iconic Representation where learning goes beyond seeing and doing. Rich representations are needed. This is the 'understanding stage 'and Symbolic representation-Abstract concepts should be made symbolic.

Bruner (2006) advocates that it is vital to consider the above stated three steps in learning when developing a lesson for the students. The use of ICT in teaching and learning will be instrumental in achieving this. He however cautions that 'integrating ICT can never replace the enactive step. It remains always important for a student to have a real experience. What a student gains through the experience is an understanding of the relevance of a topic. ICT fills the gap between the enactive step and the symbolic representation step which more often than not, teachers miss during a lesson presentation.

According to Bruner (2006) iconic representation helps learners to remember because they are activating two senses at the same time: the **hearing** and **seeing**. The role of the teacher is very important in the organization of the seeing and hearing. The teacher, therefore, has to prepare the students so they see and hear the right things. The dynamic and interactive nature of ICT makes it possible for teacher and students to manipulate images. In a nutshell, the role of the teacher is testing the knowledge, applying the knowledge and evoking learning while that of ICT is representation, manipulation, exercising and application. While adopting ICT in education, it is worth noting that ICT can never invoke learning on its own but rather it needs to be put in context and guided by the teacher. Teachers and educators must know how to exploit ICT for what they do best – opening learners up to the world of knowledge.

2.4 Specific Impediments to ICT Integration in the Classroom

The lack of ICT in classrooms, lack of knowledge, technical support, and insufficiency of in service training can explain why teachers do not use ICT in their courses. However, the integration of ICT into teaching and learning processes is a

complex and multidimensional task including many dynamics such as ICT tools, teachers, students, school administration, educational programs and school culture (Sutherland, 2004; Lim, 2002; Kennewell, 2001**).**

2.4.1 Teacher's ICT Skills.

Drawing from Otunga, Odero and Barasa (2011), 'technology per se is not educational in nature but is a piece of equipment which is used in a variety of fields for different purposes. The teacher should, therefore, be in a position to take the forms of technology and make them educational; to positively impact on the leaning process because these tools do not have inherent content.' (p.111). It is clear therefore, the teacher's ICT redundant skills are imperative in ICT integration in education.

2.4.2 Teacher's Willingness to Embrace ICT in Teaching and Learning

There are widespread fears that ICT is fast replacing the teacher. The teacher, therefore, who is supposed to be the agent of change, is thinking twice before adopting ICT in education. These are, however, unfounded fears as Otunga, Odero and Barasa (2011), puts it, that 'face to face interaction between the teacher and learners remains the most indispensable ingredient of the learning process. The teacher is able to directly observe the learners and correctly guide them according to their performance at any given time and is able to communicate non-verbally. Such kind of interaction cannot be traded with technology'. ICT use in teaching and learning will only change the role of the teacher from that of a sage on stage to guide on the side.

The willingness of the teacher to embrace ICT in teaching and learning is closely related to the attitude he/she has towards ICT. Some teachers who are expected to be

in the forefront in integrating ICT in instruction have negative attitudes towards the ICT and a number are, as Otunga, Odero and Barasa (2011), puts it, technophobic, that is, they take learning ICT to be too complicated and sophisticated for them. All this puts a great barrier to the use ICT in instruction.

2.4.3 Learner's Ability

Otunga, Odero and Barasa (2011) takes cognisance of the fact that for learners to be able to use effectively the various forms of technology, they require specialized knowledge and skills. This means that before instruction the learners have to undergo training and induction to empower them to benefit from the instructional process.

2.4.4 e-Content Development

CEMASTEA posits that computers themselves do not come pre-packaged with relevant teaching content. Although the Internet provides a vast number of resources, most are in English and may need to be modified in order to be relevant for Kenyan students and curriculum needs for curriculum is contextual. Investments in customised digital materials with highly relevant content for Kenyan classrooms in rural and urban contexts are vital if the MoEST wants to tap into the real potential of ICTs for learning. Building capacity in Kenya to create instructional materials for an increasingly digital world is an investment that will pay dividends for improving the quality of education.

2.4.5 Interdisciplinary Collaboration

Studies carried out by Usluel, Mumcu and Demiraslan (2007) in the Turkish schools ICT integration in education reveals that there was lack of adequate communication and collaboration among the teachers in the school over the use of ICT. It is

noticeable from the interviews that there was not any interdisciplinary collaboration among the teachers with regard to the use of ICT in the courses. For effective functioning of the integration process it is vital that there be interdisciplinary endeavors which require collective participation of all units in the school. The efforts of only one teacher to use ICT in her courses will not ensure the institutionalisation of the process, but remains as an individual initiative. Hence, it can be concluded that the support of the administration and collaboration among teachers play an important role in the institutionalisation of the ICT integration process (Usluel, Mumcu and Demiraslan, 2007).

The implementation of any educational innovation, including ICT is a responsibility for the schools. However, many studies conducted in different schools revealed that the use of computers varied due to the differences in school and teacher characteristics (Usluel, Mumcu and Demiraslan, 2007; Askar and Usluel, 2003)**.** Interestingly, despite the provision of a significant number of computers in Turkish schools, one common point found in these schools was that teachers mostly used ICT in administrative tasks such as preparation of lectures and unit plans, organising scores and reports of students, but not in instructional tasks such as using a presentation tool during class or using computers for experiments, (Usluel, Mumcu and Demiraslan, 2007; Askar & Usluel, 2003). It is supported by literature that although ICT has entered teachers' lives, their use of ICT for instructional purposes is insufficient (Martins, Steil & Todesco, 2004; Askar & Usluel, 2003; Suen & Szabo, 1998).

According to Veenstra (1999), the factors determining the ICT integration in education can be characteristics from the school or teacher level. Big differences arise between teachers and between schools considering integrating ICT in their teaching and learning. Moreover, Veenstra (1999) distinguishes contextual and cultural school characteristics, structural and cultural teacher characteristics as main players in ICT integration in the classroom. Veenstra (1999) explains that the structural and contextual characteristics cannot be changed overtime but cultural characteristics depend on the culture at that specific time hence is changeable overtime. The characteristics can be elaborated thus: firstly contextual school characteristics are parameters like: school size, teacher's gender, student to computer ratio, internet access, among others. Secondly, cultural school characteristics such as ICT- plan, ICT- support, evaluation policy, teamwork, inter alia. Also, structural teacher characteristics include such variables like: gender, age and computer experience, to mention a few and lastly cultural teacher characteristics oscillate between: ICT profile, attitudes, innovativeness, ICT- training among others.

Veenstra (1999) further explains that the characteristics cited here above are interdependent and predict the ICT integration in education. Structural development of a school can be seen as a reflection of its culture. Interestingly, a school with an innovative culture towards ICT integration in teaching and learning will automatically gain the structural conditions necessary for the successful integration of ICT in education. This finding underscores the importance of the belief a school or a teacher has about the usefulness of an innovation.

Diagrammatically Veenstra's factors influencing ICT integration in education can be shown as below.
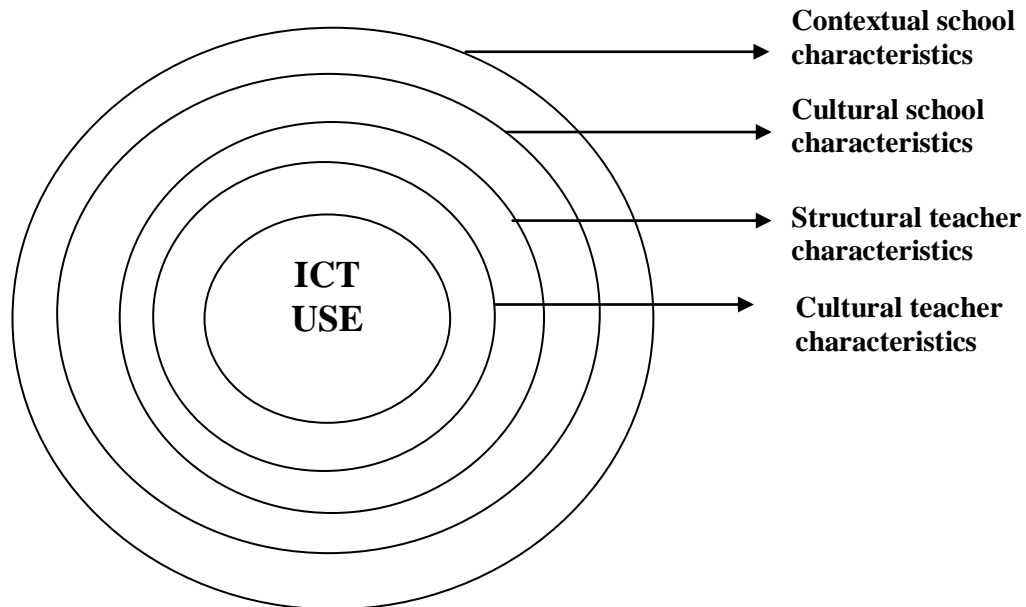
Figure 2.1 Veenstra's Model of ICT Integration Teaching and Learning

2.5 Challenges of Integrating ICT in Education

Although ICTs hold great potential to support ongoing educational as well as national development efforts, several challenges have affected its large-scale deployment and utilization for educational purposes and these have very much reduced its capacity to do the nation good, (Fouth, 2005). To begin with, as a related study undertaken by Akbaba- Altun (2006) states, there are general computer integration issues such as too few computers, slow Internet connections, insufficient software in the native language and lack of peripheral equipment at schools.

Otunga, Odero and Barasa (2011), points out that he cost of instruction in the initial stages is high due to the buying and installing the new technology, training of the teachers, other staff and students on the use of ICT and maintenance of the equipment. Also, many practicing teachers are not conversant with technology utilization in education hence find it cumbersome or frightening, many classrooms in the

developing world are ill equipped to adapt the use of technology-in some areas it is difficult to access telecommunication networks yet these are paramount for the integration of technology in instruction and the use of ICT in instruction is quite demanding in terms of time of lesson preparation and lesson presentation while teachers operate within tight time schedules due to teacher shortages.

Available literature further pegs the challenges faced by the schools in integrating ICT in teaching on the following:

2.5.1 ICT Educational Policy and Planning

Education is one such sector which has been affected by dwindling economies and subsequent poverty not only in Kenya but in most of the Sub Saharan Africa. Faced with these and many other challenges, the East African countries are keen to embrace technology which is seen as a panacea for development. This is because of the positive effects of ICT use in the developed countries that were continually noted, making it imperative for developing countries of Africa to embrace technology. 'The role of technology in national development in developed countries was undeniably significant' (Minishi-Majanja, 2007).

To replicate this development in Africa, there was a proliferation of ICT use which Ochuodho and Matunga (2004) refer to as "electronics burst". However, this emergence and use of ICTs was rather hasty and haphazard as noted by Waema (2005) and thus necessitated streamlining. At the turn of the millennium, most of the East African countries, with the aid of donor agencies, formulated ICT policies to curb the anomalies. The earliest of these reforms was referred to as the "Draft National Informatics Policy" in Kenya (Ochuodho and Matunga, 2004).

ICT policies in the East African Community began taking shape in the early 2000s. As noted before, there had been an increase in unregulated use of ICTs that prompted the need for governments to offer direction in the use of these technologies. According to the infoDev report, quoted in Farrell and Isaacs (2007), the initial ICT policies were comprehensive and included all sub-sectors of the education system. However, the formulation of the policies has been a long and complicated process. In Kenya, for example, the earliest known ICT policy dates back to the 1980s but by the year 2000 it had not been completed as noted by Nduati and Bowman (2005). The Kenya National ICT Policy was adopted in 2006 after several years of efforts in trying to put it in place-mostly pressured by the readiness for donor funding. The aim of the policy was to improve the livelihoods of the Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services as reported in the ICT in Education options paper (MOEST, 2005).

The Nigerian Federal Government's 1988 Policy introduced computer education to the high schools, (Okebukola, 1997). The only way this policy was implemented was the distribution of computers to federal government high schools, which were never used for computer education of the students. No effort was made to distribute computer to state government or private schools. Although the government planned to integrate ICTs into the school system and provide schools with infrastructure, concerted efforts have not been made to provide facilities and trained personnel. Thus, most schools do not yet offer ICT training programmes (Goshit, 2006).

All in all elaborate ICT policy and planning is lacking at various levels. Very few schools have an ICT policy but rather work on ad hoc basis and heavily rely on the erratic donations that come by (MOEST, 2005). Teachers are expected to be the

curriculum implementers in the classroom and it is expected that their sound knowledge of 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. However, while the ICT policies are indeed comprehensive statements of intention, the implementation of such ambitious intentions is a cause for concern (MOEST, 2005).

2.5.2 Infrastructure

Appropriate rooms or buildings available to house the technology are usually lacking in many schools. The ICT classrooms at schools were placed in existing older classrooms that were not designed according to the needs of ICT classrooms at schools, so there is a need for future schools designed with adequate wiring, ergonomics and security in IT classrooms (Akbaba- Altun, 2006). Unavailability of electricity and connectivity are major barriers of ICT integration in education in many developing countries. It has been reported by Southwood (2004) in a study conducted in Nigeria that more than 40 percent of the population of Africa is in areas not covered by telecom services. Schools located in such areas will experience ICT connectivity problems.

2.5.3 Capacity Building

Teacher anxiety over being replaced by technology or losing their authority in the classroom as the learning process becomes more learner-centered is an acknowledged barrier to ICT adoption in education. Since teachers lack the understanding of ICT they do not appreciate their value hence does not give them the drive they require. According to the study of Akbaba- Altun (2006), insufficient in-service training courses for teachers, especially in content areas is one of the setbacks in ICT integration in education. Training courses are provided by unqualified trainers and are not appropriate for teachers' needs and levels; besides these in-service training

courses also lack hands-on activities and are not offered for school principals and teachers.

Leadership plays a key role in ICT integration in education. Many teacher- or student-initiated ICT projects have been undermined by lack of support from 'above'. For ICT integration programs to be effective and sustainable, administrators themselves must be competent in the use of the technology and they must have a broad understanding of the technical, curricular, administrative, financial and social dimensions of ICT use in education.

Many schools do not have technical support specialists with the general competencies that are required in the installation, operation, and maintenance of technical equipment (including software), network administration and network security. Without on-site technical support, much time and money may be lost due to technical breakdowns. According to Isaak, (2005) it is the people not the programming codes or processing speeds that really matter in any ICT implementation. It is imperative that an intensive capacity building of teachers and school administrators in the use of ICT in teaching and learning is undertaken with the seriousness it deserves.

2.5.4 Financing

One of the mind-boggling challenges in the use of ICT in education is balancing educational gains with economic realities. High cost of ICT facilities has been reported as one of the factors which influences the provision and use of ICT services. The cost of computers is too high for many to afford. Monthly Internet rates are exorbitant and the charges for satellite television are unaffordable for most people in Africa (Adomi, 2006). ICTs in education programmes require large capital investments hence the developing countries need to be prudent in making decisions

about what models of ICT use will be introduced and to be conscious of maintaining economies of scale. Ultimately, it is an issue of whether the value added of ICT use outweighs the cost relative to the cost of alternatives.

2.6 Strategies to ICT Integration in the Classroom
2.6.1 Teacher ICT competencies

According to the Ministry of Education (2005), large-scale ICT capacity building workshops for in-service teacher training should be built on existing structures that deliver quality ongoing professional development for teachers. Instructional goals and activities should be highly conceptualised to address educational outcomes and teachers' realities. Introduction to computers should discuss the constraints and opportunities of using ICTs for education. Activities should focus on increasing efficiency in the teacher's workload and integrating ICTs to improve teaching and learning objectives. The distance learning material developed under the School Based Teacher Development (SbTD) program and any new materials developed for the School Empowerment Program could be put on CDROM and on a website to be available to all teachers with computer access at any time.

2.6.2 ICT Infrastructure

Drawing from the ICT in Education Options Paper for the Ministry of Education a number of key issues can be considered for ICT equipment and other related infrastructure. Computer leasing programmes for teachers and other education officials as well as options for developing computer labs at centralised Teacher Advisory Centres and other centrally-located support institutions in the districts should be considered. Refurbishment centres already exist in Kenya for the delivery of adequate ICTs to schools. The Ministry of Education should strongly consider

assisting Computers for Schools Kenya to expand their refurbishment capacity as well as create other refurbishment centres around the country. These can be done in association with Computers for Schools Kenya, School Net Kenya, Microsoft or other development partners. These centres can primarily employ volunteers. The volunteer model has proved very successful in Namibia by School Net Namibia, where young women were brought into the ICT field. Computers for Schools Kenya are already employing a similar model in Kenya.

2.6.3 Adoption of National ICT Policy

The success of ICT integration in Education oscillates around a coordinated approach to ICTs in education. These include the adoption of the draft National ICT Policy to ensure a consistent framework to be utilised for ICTs in educational activities, development of ICTs in Education Steering Committee to develop and revise quality assurance guidelines for programs and the accreditation of commercial institutions for the delivery of distance education and development of guidelines based upon the Community Learning Centre, particularly to reach out-of-school girls and the implementation of an "e-rate" (education rate) to ensure that the cost of basic connectivity is affordable.

Hepp, Hinostroza, Laval and Rehbein (2004) note that in order to have long lasting effects, an ICT policy should preferably not be designed in isolation. Rather, it should be part of a more comprehensive effort towards improving the equity and quality of an educational system. Similarly, Levine (1998) emphasises the importance of having a plan that is based on real school needs and one that is realistic, achievable and effective. The plan should be produced not for the sole purpose of putting technology in the classroom but to reflect the real needs of schools in order to make effective

technology deployment and to produce enhanced learning environments (Levine, 1998).

2.6.4 Improving Quality and Equity through Connectivity Growth

ICT in Education Options Paper for the Ministry of Education takes cognizance of the fact that most of the available options for the effective use of ICT in support of education are much more powerful when the activity is linked in a communication network that permits Internet access for email, administrative communication, file transfer and web site browsing. This element of the system adds value at every level of the educational system: it enhances the performance of the traditional work of the Ministry by greatly accelerating internal communication and it brings new dimensions to what can be accomplished under new objectives by bringing access to instruction and information resources to groups that otherwise would be excluded.

There are several potential approaches for leveraging the advantages that an extensive WiMax network could offer to the Ministry of Education's goal of bringing all secondary schools online. Just what would be appropriate would depend on certain regulatory issues as well as on the availability of resources, willing donors or private sector partners to participate. Three levels of option can be considered Level 1: A small, single tower program serving the schools within the broadcast radius, designed primarily as a demonstration model to allow the Ministry of Education to learn from a pilot activity distributing classroom support and in-service teacher training; Level 2: An operational system located in strategic rural or geographic areas and Level 3) A national network developed through a commercial partner to build out and operate a WiMax system that would serve not only the schools but also all other commercial, governmental or residential who desires the service.

2.6.5 Financing

Whyte cited by *en.wikibooks.org*, suggests the following potential sources of funding for ICT use programmes: grants from the Government; non- governmental organisations and/ or individuals, private donations, fund-raising events; in-kind support for example: equipment, volunteers and technologies; community support as in providing for the infrastructure; membership to or partnerships with organisations that support ICT provisions; revenues earned from core business, or from auxiliary activities: business services (word-processing, spreadsheets, budget preparation, printing, and reception services), educational services (distant education, training courses), community services (meeting rooms, social events, local information, remittances from migrant workers) and sales (stationery, stamps, refreshments, etc.).

It is worth noting that the financial litmus test of ICT-based programs is survival after donor money has run out. Many ICT-based education programs funded by aid agencies or by corporations could not be sustained because government failed to step in with the necessary financing nor were the local communities in a position to generate the resources needed to continue these programs. This was the case with some of the Interactive Radio Instruction projects initiated by USAID. Therefore, a two-fold strategy is key: government support and local community mobilization.

2.6.6 Capacity Building

Findings in all studies about the integration of ICT into school programs show that the common point is that teachers should be equipped with the required knowledge and skills to ensure the effective integration of ICT into the teaching-learning process (Galanouli, Murphy & Gardner, 2004; Jedeskog & Nissen, 2004; Cope & Ward, 2002)**.** In other words, to be able to use ICT in the classroom effectively, teachers should: be aware of its potential, be able to select tools and methods which are

appropriate for the needs of their students, design their teaching methods effectively and develop new teaching strategies. Furthermore, it is essential for the teachers to know and apply classroom management rules in order to cope with problems encountered in technology aided learning environments (Herzig, 2004; Gobbo & Girardi, 2001). This can only be possible through an intensive well coordinated capacity building for teachers. The teacher training colleges and universities should equip the teacher trainees with sufficient ICT skills to enable them use it in curriculum delivery.

2.7 Summary

The literature of this study was reviewed in line to the objectives of the study thus giving support to the key variables. The literature review provides direction for the study in that it helps in delimiting the research problem through portraying what has already been and what would be useful to focus in the current study. Literature review has helped in developing an analytic framework or a basis for analyzing and interpreting the data, as well as exposing the researcher to variety of approaches of dealing with the research issues. Finally the literature review enabled the researcher to know the kind of additional data needed in the study to avoid duplication. The next chapter three presents the research design and methodology adopted during the study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introduction

This chapter delves into the description of the research design, the study population, sampling procedure used, sample size, instruments used in the study and methods used to collect and analyse data. The chapter gives reasons for picking on the research design, the target population, the instruments and methods of data analysis and the procedure used in arriving at the sample. It gives a step by step procedure of how the reliability and validity of the research instruments were established and explains how ethical considerations were incorporated.

3.1 Research Design

Schindler (2003) defines research design as the blueprint for fulfilling objectives and answering the research questions. According to Kombo and Tromp (2006) it is thought of as a structure of research while Orodho (2003) describes it as the scheme, outline or plan that is used to generate answers to research problems. It is a plan and structure of investigation so conceived as to obtain answers to the research questions. It expresses both the structure of the research problem and the plan of investigation used to obtain empirical evidence on the relations of the problem. This study was conducted using a survey research design. A survey research deals with the incidences, distribution and relationship of educational variables. According to Robson (1993) a Survey Research can be conducted at local and national levels as well as on a smaller scale or rather at an individual level and surveys involve collecting data from a group of respondents over a short period of time.

3.2 Study Area

This study was carried out in Taita Taveta County. This county whose two-thirds of the area is semi-arid, mainly occupied by the Tsavo National Park is characterised by high levels of poverty. The other parts are on steep rugged terrains rendering the schools located there remote. This often occasions poor performance in the national examinations in the mostly poorly equipped remote schools. Minishi-Majanja (2007) attests that the role of technology in national development is undeniable whereas Pelgrum and Law (2003) agrees that technology has the potential of bringing educational opportunities to more remote areas. Accordingly, therefore, Taita Taveta County qualified as an area of study to investigate the extent of the teacher adoption of ICT in the secondary schools.

3.3 Target Population

The target population was 515 teachers in public secondary schools in Taita Taveta County which had already administered KCSE examination. ICT adoption in the classroom being an educational innovation and the secondary school teachers having been exposed to the process of curriculum implementation in their undergraduate studies are better placed to comment on the adoption of ICT in the classroom.

3.4 Sampling Procedures and Sample Size

A sample is a part of statistical population where properties are studied to gain information about the whole. According to Mugenda and Mugenda (2003), 30% of the population is a good representative number. Sampling is the procedure a researcher uses to gather people, places or things to study. It is a process of selecting a number of individuals or objects from a population such that the selected group

contains elements representative of characteristics found in the entire group, (Orodho & Kombo, 2002). The county had a total of 515 teachers. To arrive at the sample size of the teachers to participate in the study, 30% of the total population was selected through simple random sampling making a sample of 155 teachers. Simple random sampling procedure was used in this study as according to Yates, Moore and Starnes (2008), it allows each person an equal opportunity to participate in the study.

3.5 Validity and Reliability of Research Instruments

3.5.1 Validity

Validity is the degree to which the research instruments measures what it is supposed to measure (Gay, 1976; Mugenda and Mugenda 2003). Validity is the accuracy and meaningfulness of inferences of the results. Therefore, validity refers to the extent to which an instrument has to measure what it ought to measure accurately on the variables of the study, produce data which can be used to explain the phenomenon and give meaningful inferences. Content validity of the questionnaire was established by consulting the two supervisors and experienced researchers in the department, as well as colleagues in the department. This was done through careful examination of the questionnaire and removing from it all those elements that may elicit ambiguous participant's responses. Any recommended advice emanating from them was dully effected.

3.5.2 Reliability

According to Mugenda and Mugenda (2003), Gay (1976) reliability is a measure of degree to which a research instrument yields consistent results or data after repeated trials. The reliability of the instruments was tested through a pilot study, which was conducted out of the population of study The test-retest technique was applied that is,

questionnaires were administered and after two weeks the same questionnaires were administered to the same respondents and instrument was considered to be reliable upon yielding a reliability co-efficient (r) of 0.74 using Pearson's Product Moment Co-efficient which shows that they are highly correlated indicating a strong relationship and hence high stability of the achievement test instrument

3.6 Data Collection Method

Before proceeding to the field, the researcher sought permission from the Ministry of Higher Education (National Council of Science and Technology), the respective District Education Officers and the District Commissioners of the area of study. The researcher administered the questionnaires personally. He also ensured that instructions to respective respondents were made clear to them. A period of three days was given to respondents to fill the questionnaires, after which the researcher collected them.

3.6.1 Questionnaires

According to Mugenda and Mugenda (2003), questionnaires are commonly used to obtain important information about the population and each item in a questionnaire addresses a specific objective and research question of the study. According to Kothari (2004), use of questionnaires has the following advantages: They are easier to administer, analyze and economical in terms of time and money; there is low cost even when the universe is large and widely spread geographically; are free from the bias of the interviewer; answers are in respondent's own words; respondents have adequate time to give well thought answers; respondents who are easily approachable can also be reached conveniently and large sample can be made use of and thus the results can be made more dependable and reliable. This tool was used because it

enabled the researcher to collect data from a large number of respondents sparsely spread geographically within a short period of time. The questionnaires consisted of mostly closed-ended and a few open-ended items.

3.7 Ethical Considerations

The respondents were informed prior to the administration of the questionnaires of the relevance of the research and were assured of and the researcher maintained confidentiality in any confidential information that they shared with the researcher.

3.8 Data Analysis and Presentation

Data was collected using questionnaires. The information gathered was processed and analyzed through: pre processing, coding, classification and tabulation. The responses from the questionnaire were analyzed using Statistical Package for Social Sciences (SPSS). The data was analyzed using descriptive statistics through calculations of frequencies, percentages, means and standard deviations. The data was presented through tables and figures.

3.9 Summary

This chapter focused on various details concerning research design and methodology that were employed. Details concerning location of the study and research designs have been discussed. The target population, sampling procedure and sample size have also been taken care of. The study variables, instruments of data collection have been identified. The chapter has also looked at the study's reliability and validity. Data collection procedures, data analysis and ethical issues have also been outlined. The next chapter thus deals with data presentation, discussion and interpretation of the findings.

CHAPTER FOUR
DATA PRESENTATION ANALYSIS, DISCUSSION AND
INTERPRETATION

4.0 Overview

This chapter presents and discusses the findings of the study. The study was to investigate the extent to which the teacher is adopting ICT in the classroom. The study was guided by the following objectives to assess the teacher competence level in adopting the ICT integration in the classroom, to identify the specific impediments to ICT integration in the classroom, to identify the existing strategies to fast track ICT integration in the classroom and to highlight the benefits of ICT integration in the classroom in Taita Taveta County secondary schools. The research yielded a number of findings from the data that was compiled and presented in tables and charts. The data was collected using questionnaires. The chapter opens with a demographic description of the participants involved in this study.

4.1 Demographic Characteristics

Before embarking on the main objectives of the study, it was important to find out the background information of the respondents. This was measured by looking at the gender of the respondents, age, working experience, teaching subject, existence of computers and the period of existence of computers in schools. The researcher considered the background information meaningful to the study as it helped to understand the logic of the responses of the various respondents; it laid a basic foundation on which the interpretation of the study was to be based and it was to enable both the researcher and the readers to have confidence in the results of the study.

4.1.1 Gender of the Respondents

It was also important to find out the gender of the respondents so as to incorporate all the genders' views during the stud y. Results shows that majority (62.2%) of the respondents were male while 37.4% were female indicating that most of the teachers in Taita Taveta were male. These show that there was no bias in the research because all gender had participated.

Figure 4.1 Gender of the Respondents
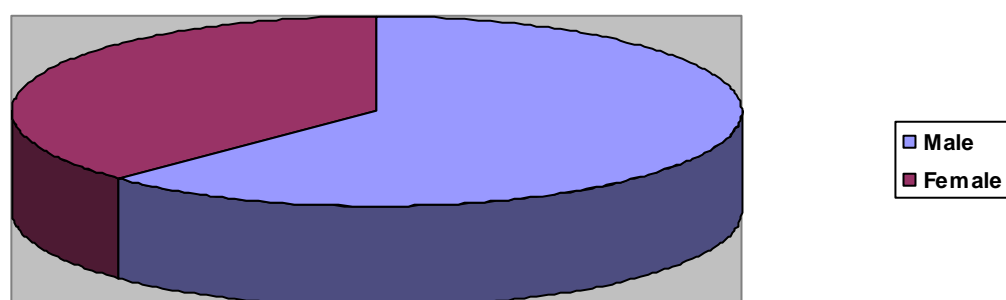
4.1.2 Age of the Respondents

Moreover, it was also prudent to find out the age of the sampled respondents. Data show that most of them (27.1%) were between 25-30 years, 25.8% were between 31-35 years, 16.8% were 41-50 years, 14.8% were 36-40 years while 15.5% were below 25 years. The age of the respondents was relevant to the study since it is assumed that those respondents who are mature have adequate knowledge hence are in a position to state the position of teacher support in the integration of ICT in Taita Taveta County.

Figure 4.2 Age of the Respondents
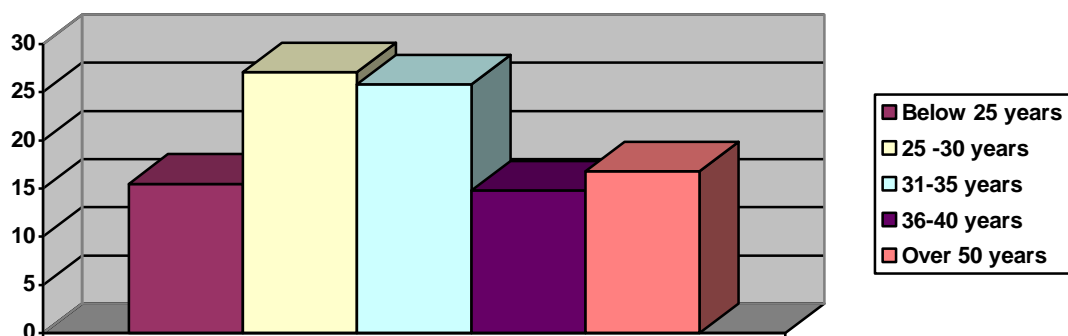
4.1.3 Working Experience of the Respondents

The researcher also sought to find out the working experience of the teachers upon which results show that 38.1% had taught for less that 5 years, 21.9% had worked for 15-19 years, 15.5% had worked for 5-9 years, 14.8% for over 20 years while 9.7% between 10-14 years. This implies that more than half of the total number of respondents had a teaching experience of more than 5 years hence are able to provide information on status of ICT integration in secondary schools.

Figure 4.3 Working Experience of the Respondents
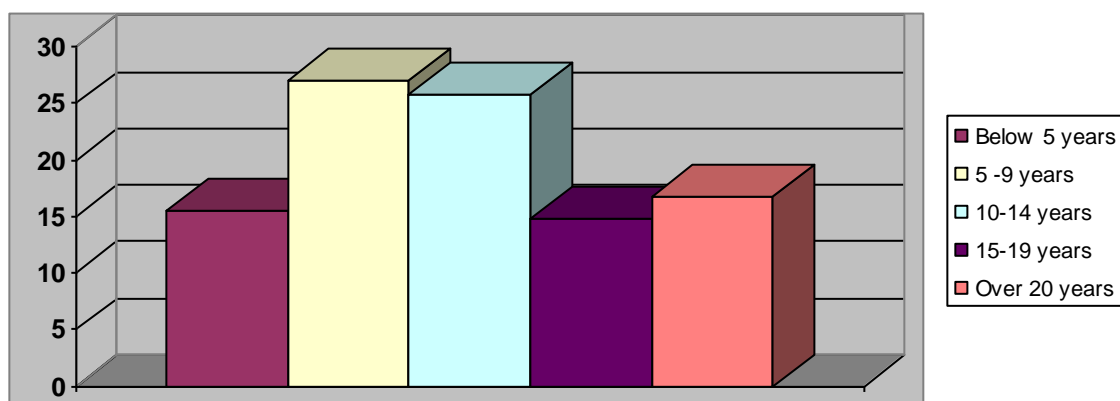
4.1.4 Teaching Subject and Schools Category

Still on the demographic characteristics, the researcher looked at the teaching subject. This was intended show if the subject that the teachers teach had any relationship with ICT integration in teaching.

Table 4.1 Teaching Subject and School Category

Teaching subject	F	%
Mathematics	40	25.8
Sciences	28	18.1
Languages	25	16.1
Humanities	20	12.9
Technical and applied sciences	26	16.8
Computer studies	16	10.3
Total	**155**	**100**
Schools category		
Sub-County	102	65.8
County	53	34.2
Total	**155**	**100**

Results indicate that 25.8% taught mathematics, 18.1% taught sciences, 16.8% taught technical and applied science, 16.1% taught languages, 12.9% taught humanities while 10.3% taught computer studies. These findings indicate that majority of the teachers teach mathematics. Looking at the category of the schools, 65.8% were sub-county schools while 34.2% were county schools.

4.1.5 Existence of Computers

While looking into the purpose of the study which was to find out the teachers adoption of ICT in secondary schools in Taita Taveta County, it was important to find out if the schools had computers facilitate ICT integration in the classroom. Results in the Figure below indicate that 73.5% agreed that they had computers while 26.5% disagreed. This shows that most of the schools had computers as shown in the Figure 4.4.

Figure 4.4 Existence of Computers

Yes
No

4.1.6 Period of Existence of Computers in Schools

The researcher also sought to establish the period to which the computers were in existence in the schools. Results show that majority (46.5%) had computers in the schools for less than 1 year, 23.9% said 1-5 years. Similarly, 14.2% said 5-10 years while 15.5% said over 10 years. This shows that most schools which had computers had them for less than 1 year reflecting the recent zeal of the government to actualize ICT integration in Kenya. However 26.5 % is still a very big proportion of schools to lack computers in this information age in Figure 4.2.

Figure 4.5 Period of Existence of Computers in Schools
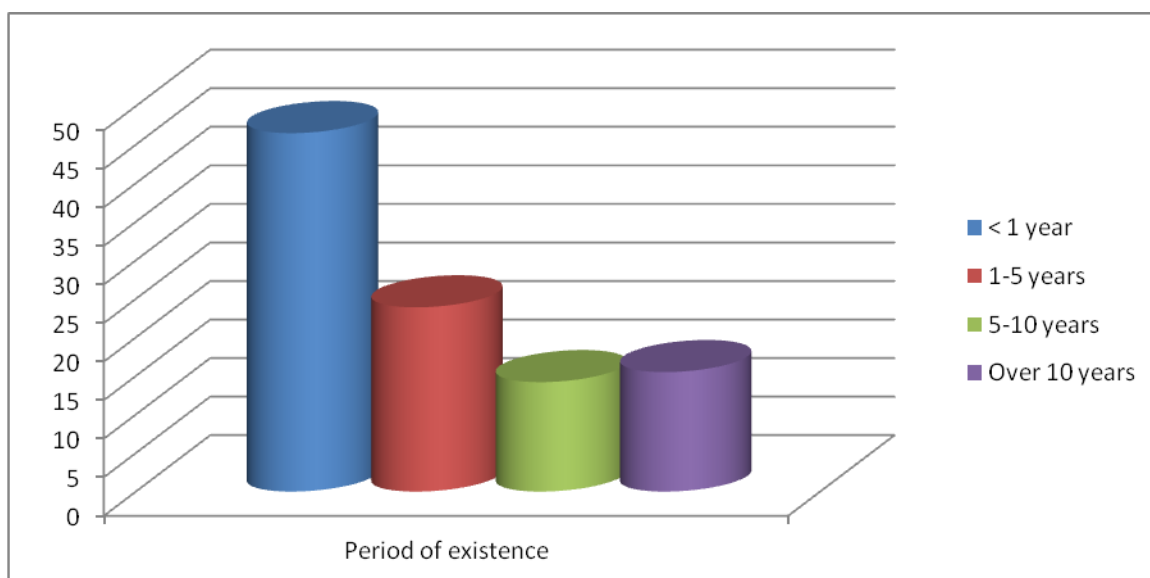
The researcher further sought to find out if the computers were loaded with any educational software that teachers could use in the teaching of their various subjects. Most of the schools (73.5%) indicated that the computers were not loaded with any educational software. This implies that most of the computers are used in the offices for administrative tasks like printing and typing but not for teaching the students. This is a very strong indicator that ICT integration in teaching is dismally being actualized.

4.1.7 Integration of ICT

It was also important for the researcher to find out if the teachers integrate ICT in teaching.

Table 4.2 Integration of ICT

Integration of ICT	Frequency	Percentage
Yes	104	67.1
No	51	32.9
Total	**155**	**100**

Table 4.2 shows that a significant number of teachers (67.1%) agreed that they integrate ICT in their instructional programmes; while some (32.9%) disagreed. This shows that the teachers support the use of ICT in schools because they integrated them while teaching the students.

Moreover, it was important for the researcher to find out how active the students were in class where teachers integrated ICT in class.

Table 4.3 Teachers' Perspective of Concentration of Students

Concentration of students	Frequency	Percentage
Very active	50	32.3
Active	95	61.3
Not active	10	6.5
Total	**155**	**100**

Most respondents (61.3%) said that students were active, 32.3% said that students were very active while 6.5% maintained that in students were not active in class where and when they used ICT in their classes. The 6.5% of respondents could represent the many teachers who struggled with the use of ICT in class to the extent that it became counterproductive. This section of teachers represented the one highlighted by Yelland (2001) who pointed out that educational environments do not seem to be suitable for preparing learners to function or be productive in the workplaces of today's society. She claimed that schools which do not incorporate the use of new technologies in schools cannot seriously claim to prepare their students for life in the twenty first century.

The fact that 93.6 % agreed that their students were active or very active during the lessons integrated with ICT is in line with Becta (2003) who argued that use of ICT in the classroom is essential for providing opportunities for students to learn to operate in an information age.

Looking at how regular the teachers taught using their own prepared digital instructional materials

Table 4.4 Digital Instructional Material Digital Instructional Material

Digital Instructional Material	Frequency	Percentage
Never	130	77.2
Rarely	27	17.4
Often	8	5.4
Total	**155**	**100**

As shown in Table 4.4 such as lessons on power point, documentaries, photo story or lessons recorded in video, most of them (77.2%) said they never used their own digital instructional material, 5.2% often used, 17.4% rarely used their own digital instructional material. This quite perturbing that majority of the teachers and by extension the schools were still heavily blackboard and text book reliant despite the governments zealous effort to provide computers and other ICT equipments in our schools. This is a strong indicator that a paradigm shift in the teaching and learning has not taken place. The big question then is to what extent have our teachers been prepared to actualize the alignment of education and training to the Kenya's new constitution 2010 and the Kenya Vision 2030?

The researcher further sought to find out if the teachers used the internet while planning for their lessons.

Table 4.5 Lesson Planning through the Internet

Lesson planning through the Internet	Frequency	Percentage
Never	54	34.8
Rarely	49	31.6
Often	30	19.4
Always	22	14.2
Total	**155**	**100**

Results show that most of the respondents (34.8%) never use the internet while lesson planning, 31.6% rarely used, 19.4% oftenly used and 14.2% always used the internet in lesson planning. This shows that most of the teachers do not enrich their lesson with up to date information but heavily relied on the text books, shown in Table 4.5.

Finally, the researcher also found out if the teachers send assignments to the student using the internet.

Table 4.6 Sending Assignments through Internet

Sending assignments through internet	Frequency	Percentage
Never	96	61.9
Rarely	23	14.8
Often	17	11.0
Always	19	12.3
Total	**155**	**100**

It is seen in Table 4.6 that most of the teachers (61.9%) never used the internet to send assignments, 14.,8% rarely used, 12.3% always used while 11.0% often used the internet in sending assignments to students. This shows that the teachers still confined

their teaching and learning to classroom and within the time tabled time against the demands of the twenty first century that teaching and learning be extended beyond the classroom and beyond the time table. This scenario is again occasioned by the absence of internet connectivity and where it was available could be too costly for the learners and teachers.

4.2 ICT Competence level

The researcher's first objective was to find out the teachers' competence level in the integration of ICT in secondary schools in Taita Taveta. To put insight into the objective the researcher had to look at the computers basics that the teachers should be knowledgeable in order to integrate ICT into their teaching. ICT competence level was ranked from very competent, competent and not competent. The mean and standard deviations are as shown in the Table 4.7.

Table 4.7 ICT Competence level

	Mean	Standard deviation
Sending and receiving e-mails	2.6645	0.66720
Downloading data	2.5355	0.69579
Typing	2.4645	0.80806
Fixing simple ICT technical problems	2.4516	0.73142
Working with excel, publisher, presentation and databases	1.8968	0.76595
Using their own prepared digital instructional material	1.8194	0.80155

In the teachers' competence level sending and receiving e-mails was ranked first with a mean of 2.6645, downloading and uploading data was second with a mean of 2.5355, typing being was third with 2.4645 as mean, fixing simple ICT technical problems fourth with a mean of 2.4516. Working with excel, publisher, presentation and databases came fifth with a mean of 1.8968 and preparation of their own digital

instructional material was sixth with a mean of 1.8194 on the likert scale. As a result, it was established that sending and receiving messages was the skill that the teachers are competent in and this influenced their integration of ICT in education. This finding is in line with Newhouse (2002) who found out that many teachers lacked knowledge and skills to use computers in their teaching hence were not enthusiastic about the using computers into their teaching practices. This authoritatively puts lack of competence as one of the barriers to the integration of ICT in education.

4.3 Impediments to ICT Integration in the Classroom

The researcher's second objective was to identify the specific impediments to ICT integration in the classroom in the Taita Taveta County secondary schools. Responses were given which they ranged from technophobia amongst some teachers, age of the teachers and learners' ability among other factors that affect the ICT integration in education in Taita Taveta County.

Table 4.8 Impediments to ICT integration in the classroom

	SA		A		UD		D		SD	
	F	%	F	%	F	%	F	%	F	%
Technophobia amongst some teachers	46	29.7	48	31.0	21	13.5	25	16.1	15	9.7
Age	40	25.8	56	36.1	28	18.1	14	9.0	17	11.0
Teacher's Willingness to Embrace ICT in Teaching and Learning	47	30.3	71	45.8	18	11.6	7	4.5	12	7.7
Teacher's teaching subjects	52	33.5	42	27.1	16	10.3	17	11.0	28	18.1
Learner's ability	39	25.2	51	32.9	19	12.3	28	18.1	18	11.6
Availability of e-Content relevant to our curriculum	36	23.2	90	58.1	16	10.3	7	4.5	6	3.9
Interdisciplinary collaboration amongst teachers	33	21.3	57	36.8	26	16.8	16	10.3	23	14.8
Lack of ICT infrastructure in school	49	31.6	61	39.4	14	9.0	18	11.6	13	8.4
Lack of technical support for teachers	38	24.5	64	41.3	20	12.9	14	9.0	19	12.3
Insufficiency of in- service training	16	10.3	80	51.6	22	14.2	17	11.0	20	12.9
Support from the school Administration	57	38.9	45	29.1	6	3.9	23	14.8	24	15.5
ICT Policy in the school	29	18.7	79	51.0	2	1.3	29	18.7	16	10.3
Proximity of the school from a major town centre	62	40.0	53	34.2	33	21.3	33	21.3	7	4.5

Results in Table 4.8 shows that majority of the teachers (60.7%) agreed that technophobia among teachers was a factor affecting ICT integration in education, 25.8% disagreed while 13.5% were undecided. Looking at the age of the teachers as a factor affecting ICT integration in education, 61.9% agreed, 18.1% disagreed while 20% were undecided. Finding if teachers willingness' to embrace ICT in teaching and learning was also as a factor, 76.1% agreed to that, 12.2% disagreed and 11.6% were undecided this shows that teacher willingness to embrace ICT in teaching and

learning was a factor that affects ICT integration in education. On learners' ability to understand use and ICT, 58.0% agreed, 29.7% disagreed and 12.3% were undecided. Education research becomes quite simple if electronic content (e-content) is available (Allen, 2003). It was therefore, necessary to investigate the availability of electronic materials (e-materials) through the presence say of the e-libraries in the study schools. The presence of e-learning would enable teachers in the schools to train their learners in their personal study through research. In this way the schools would be having teachers and learners who are in a position to use electronic materials in research. Looking at availability of e-content relevant to curriculum as a factor, 81.3% agreed to that, 10.3% were undecided while 8.4% disagreed. This indicates that the availability of the e-content relevant to curriculum is a significant factor affecting ICT integration to education.

Moreover, interdisciplinary collaboration amongst teachers was seen as factor with 68% agreeing to that, 25.0% disagreeing and 16.8% being undecided. Despite the teacher's support in ICT integration in class, lack of ICT infrastructure was seen as a crucial factor for integration with 71.0% agreeing, 20% disagreeing and 9.0% being undecided. In addition, the research revealed that lack of technical support is a factor in integration of ICT, with 65.8% agreed, 21.3% disagreed and 12.9% were undecided. The researcher also found out whether insufficiency of in-service training was factor that affects the teachers in the integration of ICT in education and most of the sampled teachers in Taita Taveta (61.9%) agreed, 23.9% disagreed and 14.2% were undecided. This shows that lack of in-service training is a significant factor affecting ICT integration in education.

Further on the factors affecting ICT integration in education, support from the school administration was found to be a factor and 65.9% of the sampled population agreed that the support of school administration affects ICT integration in education, 30.3% disagreed while 3.9% were undecided. This indicates that the school administration and its support to ICT use in education is paramount. Still majority of the respondents (69.7%) agreed that the ICT policy in the school affects the integration of ICT in education in the school, 29.0% disagreed and 1.3% were undecided. This shows that the ICT policy in schools as a factor affecting the integration of ICT to education cannot be wished away.

Finally, looking at proximity of the school from a major town centre as a factor to the integration, 74.2% agreed that the nearness of the school to the town centre was a factor affecting ICT integration in education in the schools, 21.3% were undecided while 4.5% disagreed as summarized in the Table 4.9. This finding corroborated by Ndiku (2003) cited by Wims and Lawler (2007) who discovered that insufficient numbers of computers and peripheral devices inhibit deployment of ICT by teachers. Plante and Beattie (2004) who observed that inadequate ICTs is a challenge to integration of technologies in Canadian schools also adds strength to this finding. Similarly, Okwudishu (2005) discovered that unavailability of some ICT components in the schools hampered teachers' use of ICTs. This problem may be due to under funding (Enakrire and Onyenenia, 2007).

4.4 Strategies to Improve ICT Integration

On the third objective which was to find out the strategies that could be put in place to improve ICT integration in the classroom in the Taita Taveta County secondary

schools. Several strategies were given out as to improve ICT integration as shown in Table 4.9 below.

Table 4.9 Strategies to Improve ICT Integration

Strategies to Improve ICT Integration	F	%
Adequate school staffing to reduce the large teaching loads	16	10.3
Provision of adequate ICT equipments such as laptops, projectors	26	16.8
Availing faster and cheaper internet to schools	33	21.3
Step up capacity building in ICT integration in teaching of specific subjects	13	8.4
Provisions of ICT environment in the classrooms	8	5.2
Putting in place school ICT policies that guide and promote the use of ICT in teaching and learning	10	6.5
Availing more e-content relevant o the curriculum	8	5.2
Schools and the government to step up funding towards ICT	20	12.9
Teachers handbooks to incorporate activities for integrating ICT	10	6.5
Provision of wide area wireless networks in schools for accessibility by teachers	11	7.1
Total	**155**	**100.0**

Result in Table 4.9 shows that 10.3% were on the opinion that adequate school staffing to reduce the large teaching loads should be done, 16.8% suggested provision of adequate ICT equipment such as laptops, projectors. Similarly, 21.2% recommended availing faster and cheaper internet to schools whereas 8.4% insisted on the stepping up capacity building in ICT integration in teaching of specific subjects. 10.4% recommended putting in place school ICT policies that guide and promote the use of ICT in teaching and learning, 5.2% advised on availing more e-

content relevant to the Kenyan curriculum while 20.8% suggested that the government should step up funding towards ICT. 10.4% of teachers added that the teachers' subject handbooks should incorporate activities for integrating ICT while 7.1% said provision of wide area wireless networks in schools for accessibility by teachers is a good strategy as shown in Table 4.10.

4.5 Benefits of Using ICT in Teaching and Learning

The last objective was to find out the benefits on ICT in teaching and learning in the classrooms Taita Taveta County secondary schools. Responses were given on the benefits of using ICT in teaching and learning as shown in Table 4.10 below.

Table 4.10 Benefits of ICT in Teaching and Learning

	SA		A		UD		D		SD	
	F	%	F	%	F	%	F	%	F	%
Students have greater disposition to research and problem solving focused on real social situation	43	27.7	64	41.3	22	14.2	19	12.3	7	4.5
student comprehend and assimilate knowledge in the interdisciplinary ICT environment	48	31.0	66	42.6	17	11.0	12	7.7	12	7.7
new skills and abilities are fostered through technological literacy	78	50.3	41	26.5	13	8.4	14	9.0	9	5.8
use of ICT in teaching and learning promotes constructivism students	54	34.8	71	45.8	14	9.0	6	3.9	10	6.5
Use of ICT in teaching and learning allows greater use of multimedia	53	34.1	50	32.3	14	9.0	6	3.9	10	6.5
ICT enables access to e-knowledge and the and the repackaging of e-knowledge to suit the context	54	34.8	64	41.3	17	11.0	13	8.4	7	4.5

Looking at the benefits of using ICT in teaching and learning the researcher wanted to find out if the students have greater disposition to research and problem solving focused on real life situation 69.0% agreed to that, 14.2% were undecided and 16.8% disagreed as indicated in Table 4.8. Finding out if students comprehend and assimilate knowledge in the interdisciplinary ICT environment as a benefit of ICT in teaching and learning, 73.6% agreed to that, 15.4% disagreed while 11.0% were undecided. On the new skills and abilities are fostered through technological literacy, 76.8% agreed to that, 14.8% disagreed to that while 6.4% were undecided. The researcher also looked at the use of ICT in teaching and learning promotes constructivism in students and 80.6% agreed, 10.4% disagreed while 9.0% were undecided. Looking at if ICT enables access to e-knowledge and the repackaging of e-knowledge to suit the curriculum context, 76.1% agreed to the opinion, 12.9% disagreed and 11.0% were undecided that is they were not sure if ICT enables the access to e-knowledge and repackaging to suit the context.

Moreover, 66.4% of the respondents agreed that the use of ICT in teaching and learning allows greater use of multimedia, 9% were undecided and 10.4% disagreed. The findings above indicate that ICT play various roles in learning and teaching processes. According to Bransford, Brown and Cocking (2000), several studies have concluded that ICT has a great potential to enhance students achievement and learning. Wong et al (2006) also states that technology can play part in supporting face-to-face teaching and learning in the classroom.

4.6 Summary

The chapter tried to analyze, interprets and discuss the findings of the data collected. Data was collected using questionnaires; analyzed using descriptive statistics such as percentages, means and standard deviations and presented through tables, graphs and figures. The study found out that the teachers' ICT incompetence in integrating ICT in teaching may be one of the strong barriers impeding the teacher's adoption of ICT in the classroom. The findings showed that ICT produces significantly better results in the teaching/learning outcomes in secondary schools. Moreover, the findings of this study also indicate that teachers have strong desires for the integration of ICT in teaching their subjects but encountered many barriers. The next chapter presents the conclusions, summary of the findings and recommendations for the study

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a detailed summary of the findings. In addition, the implications and policy recommendations derived from the study are also stated together with suggestions for further research on teacher's adoption of ICT secondary schools.

5.1 Summary of the Findings

The purpose of this study was to investigate the extent to which the teachers were adopting ICT integration in the classroom. On the first objective which was to find out the teachers competence level in adopting ICT in the classroom in the Taita Taveta County secondary schools. The study found out that regarding teachers' ICT competence level sending and receiving messages was ranked first with a mean of 2.6645. It implies that the teachers had very basic ICT skills which are a limitation in ICT integration in education. This finding is also in line with Newhouse (2002) who found out that many teachers lacked knowledge and skills to use computers in class.

The researcher's second objective was to identify the specific impediments to ICT integration in the classroom in the Taita Taveta County secondary schools. Responses given ranged from technophobia amongst some teachers, age of the teachers and learners' ability among other factors that affect the ICT integration in education in Taita Taveta County. On technophobia of some teachers, 60.7% agreed that technophobia among teachers was a significant factor impeding ICT integration in education. Sixty one point nine percent agreed that the age of the teachers was a factor affecting ICT integration in education. 76.1% agreed that the teacher's willingness to

embrace ICT in teaching and learning greatly impacted on the ICT integration in teaching. On learners' ability to use and understand ICT as an impediment to ICT integration in the classroom in the Taita Taveta County secondary schools, 58.1% agreed. Looking at availability of e-content relevant to the Kenyan curriculum as a factor, 81.3% agreed to that. This points out that many teachers willing to use ICT in their teaching lacked content compatible with the Kenyan curriculum. Moreover, interdisciplinary collaboration amongst teachers was seen as factor with 68% agreeing to that, 25.0% disagreeing and 16.8% being undecided. In addition, inadequate ICT infrastructure was cited by 71.0% as a factor hindering ICT use in the class. 61.9% agreed pointed out that insufficiency of in-service training was a crucial factor that affecting the teachers in the integration of ICT in education.

The third objective on existing strategies to fast track ICT integration in the classroom in the Taita Taveta County secondary schools, several responses were given majority 21.2% recommended availing faster and cheaper internet to schools, others were on the opinion that adequate school staffing to reduce the large teaching loads should be done, provision of adequate ICT equipments such as laptops, projectors. Similarly, insisted on the stepping up capacity building in ICT integration in teaching of specific subjects, putting in place school ICT policies that guide and promote the use of ICT in teaching and learning, more e-content relevant to the Kenyan curriculum among other strategies can be put in place.

On the last objective which tackled the benefits of ICT integration in the classroom in Taita Taveta County secondary schools. It is seen that majority 69.0% of the students agreed that using ICT in teaching and learning makes students have a greater

disposition to research and problem solving focused on real social situation. Finding out if student comprehend and assimilate knowledge in the interdisciplinary ICT environment, 73.6% agreed to that. On the new skills and abilities fostered through technological literacy, 76.8% agreed to that. The researcher also looked at if the use of ICT in teaching and learning promotes constructivism in students where 80.6% agreed to that, 10.4% disagreed while 9.0% were undecided. Finally looking at if ICT enables access to e-knowledge and the repackaging of e-knowledge to suit the curriculum context, 76% agreed. The findings above indicate that ICT can play various roles in learning and teaching processes. According to Bransford, Brown and Cocking (2000), several studies have concluded that ICT has a great potential to enhance students' achievement and teacher learning. Wong et al., (2006) also states that technology can play a part in supporting face-to-face teaching and learning in the classroom. The study also found out that there are other myriad of challenges faced by the teachers in integrating ICT in education ranging from frequent power outages, resistance to change and technophobia amongst the teachers.

5.2 Conclusions

The study concludes that lack of ICT competence may be one of the strong barriers to the integration of ICT into education. Teachers who are competent in ICT can identify that ICT's are helpful in their teaching and personal work and hence they need to extend their use further in the future. The adoption and use of ICTs in schools have a positive impact on teaching, learning and research. Despite the roles that ICTs can play in education, secondary schools in Taita Taveta County have yet to extensively adopt them for teaching and learning. The study revealed that the use of computers amongst the teachers was low, thereby corroborating earlier researches (e.g.

Nassanga, 2001) that came to a similar finding. Thus, the study is in accordance with Fedorowicz and Gelinas (1998), Mwanja (2001) and Wakanyasi (2002), who found that adaptability to technological advances, is a function of training. Problems such as poor policy, project implementation strategies and limited or poor information infrastructure militate against the many earlier efforts geared towards implementing ICT use in the teaching and learning in our schools.

Presence of ICT in schools would enable teachers to train their learners in personal study through research. In this way the schools would be having teachers and learners who are in a position to use ICT. The findings showed that ICT produces significantly better results in the teaching/learning outcomes in secondary schools. Specifically, the results from this study indicated that the teachers have strong desires for the integration of ICT into education but they encountered many barriers in their endeavours. The major barriers were lack of confidence, lack of ICT competence and lack of access to the ICT resources. Since confidence, competence and accessibility have been found to be critical components for technology integration in schools, ICT resources including software and hardware, effective professional development, sufficient time and technical support need to be provided to teachers. No one component in itself is sufficient to produce good teaching. However, the presence of all ICT components increases the likelihood of excellent integration of ICT in learning and teaching opportunities.

5.3 Recommendations

The study recommends that:

  i.   Schools need to employ an ICT teacher and subject- customized in-service trainings for teachers to overcome the poor ICT skills and negative attitude towards its adoption and use.

 ii.   Government should institute a specific department within the Ministry of Education, Science and Technology right from the headquarters to the sub county level to oversee and facilitate the adoption of ICT in the schools.

iii.   Ministry of Education, Science and Technology should come up with ICT policy to direct teachers adopt ICT while teaching.

 iv.   There should be funded bench marking teachers' visits to schools excelling in ICT integration in education within and without Kenya.

5.4 Suggestions for Further Studies

  i.   A similar study should be done on other counties but the scope of the study be widened to capture levels of administrative support, both technical and financial.

 ii.   Longitudinal study on the same area so as to establish the long-term relationship between ICT integration and academic performance.

REFERENCES

Adeya, N. C. (2002) *"ICTs and Poverty: A Literature Review"* UNESCO. Accessed 7 January 2007 from http://www.idrc.ca/en/ev-24718-201-1-DO_TOPIC.html.

Adomi, E.E. (2006). Mobile phone usage patterns of library and information science students at Delta State University, Abraka, Nigeria. Electronic *Journal of Academic and Special Librarianship* 7 (1). Available: http://southernlibrarianship.icaap.org/v7n01/adomi-e01.htm

Aduwa-Ogiegbean S. E. & Iyamu, E. O. S. (2005). Using information and communication technology in secondary schools in Nigeria. *Educational Technology and Society* 8 (1), 104-112.

Aggarwal, J.C. (2004). *Teacher and Education in a Developing Society*. Vikas Publishing House Pvt. Ltd, New Delhi.

Akbaba-Altun, S. (2006). Complexity of Integrating Computer Technologies into Education in Turkey. *Educational Technology & Society*, 9 (1), 176-187

Allen, M. W., (2003). *Guide to e Learning: Building Interactive, Fun and Effective Learning Program for any Company*. New Jersey: John Wiley and Sons.

Anjana, B., (2011). Emergence of ICT in the 21st Century: *An International Journal of Educational Technology*, Volume 1, Issue: 1(105-116). http://www.indianjournals.com/ijor.aspx?target=ijor:tle&volume=1&issue=1&article=01

Askar, P. & Usluel, Y. K. (2003). A Longitudinal Study Related to the Rate of Adoption of Computers: Comparison of Three Schools. *Hacettepe University Journal of Education,* 24, 15-25

Avgerou, C. (1990) *"Computer-Based Information Systems and the Modernisation of Public Administration in Developing Countries"*. In S. Bhatnagar, Bjorn-Andersen, N. "Information Systems for Development" (London, Falmer) pp. 70-85

Barlow, J. P., (1998). Africa Rising: Everything you Know about Africa is Wrong, Wired, http://www.wired.com/wired/archives/6.01/barlow (Accessed 3-3 2005)

Bracey, G. W., (2005). Computers in Education: What the Research Shows. *Electronic Learning*, *2* (3), 51-54.

Bransford, J., Brown A. L., & Cocking, R. R., (eds) (200) *How People Learn: Brain, Mind, Experience and School* (2nd Ed.) Washington D.C. National Academy Press.

British Educational Communication and Technology Agency (BECTA) (2003) Primary schools –ICT and Standards. Retrieved June 13, 2008 from http://www.becta.org.uk

Bruner, J., (1996). *The Culture of Education*. Cambridge, MA: Harvard University Press

Center for Activity Theory and Developmental Work Research (2003). The Activity System   from: http://www.edu.helsinki.fi/activity/pages/chatanddwr/activitysystem).

Demiraslan, Y., (2005). *Analyzing the Integration of Information and Communication Technologies into Teaching-learning Process According to Activity Theory*. Unpublished Dissertation. Ankara: Hacettepe University

Duffy, T. M. & Cunningham, D. J. (1996). *Constructivism: Implications for the design and Delivery of Instruction.* In D. H. Jonassen (Ed.), Educational Communications and Technology (pp. 170-199). New York: Simon & Schuster Macmillan.

Enakrire, R., Onyenenia, O.G. (2007). Factors Affecting the Development of Information Infrastructure in Africa. *Library High Tech News 24* (2):15-20. Engeström, Y. (1987). Learning by Expanding: An Activity-Theoretical Approach   to   Developmental   Research   from: http://communication.ucsd.edu/LCHC/MCA/Paper/Engestrom/expanding/toc.html.

Ertmer, P. A. (1999). Addressing First- and Second-order Barriers to Change: Strategies for Technology Integration. *Educational Technology Research and Development*, 47 (4), 47-61.

Farrell, G., & Isaacs, S. (2007). *Survey of ICT and Education in Africa. A Summary Report, Based on 53 Country Surveys*. Washington, DC: infoDev/ World Bank.

Farrell, G. Shafika I. & Trucano, M., (2007) *The NEPAD e-Schools Demonstration Project*: A Work in Progress A Public Report. A Publication Prepared for the commonwealth of Learning & Infodev. ICT and Education Series: The World Bank Washington DC

Feden, P. & Vogel. R., (2003). Methods of Teaching: Applying Cognitive Science to Promote Student Learning, McGraw Hill Higher Education. *Implementing active learning*. Available at www.ncsu.edu/felder-public/Columns/Active.pdf, (Accessed on 21/06/2009).

Fedorowicz, J., & Gelinas, U. J. Jr. (1998). Adoption and Usage Patterns of COBIT: Results from a Survey of COBIT purchases. [Information systems] *IS Audit and Control Journal* 6, 45-51.

Fouth, J. C., (2005). "ICT in Education: A Practical Approach". In Bracey, B., Culver, T. (eds.) *"Harnessing the Potential of ICT for Education- A Multi-stakeholder Approach"* [Internet] United Nations ICT Task Force. Available from: <http://www.digitaldivide.net/comm/docs/view.php?DocID=199

Fullan, M. G., (1991). *The New Meaning of Educational Change*, Teachers College Press, New York

Galanouli, D., Murphy, C. & Gardner, J., (2004). Teachers' Perceptions of the Effectiveness of ICT Competence Training. *Computers & Education*

Gay, L. R., (1976). *Educational Research*. Ohio: Charles E. Merrill.

Gilster, P., (1997). *Digital Literacy*, Wiley Computer Publishing, New York

Gobbo, C. & Girardi, M. (2001). Teachers' Beliefs and Integration of Information and Communications Technology in Italian schools. *Journal of Information Technology for Teacher Education from:* http://www.informaworld.com/smpp/content~content=a751267195~db=all~order=page)

Goshit, T., (2006). Nigeria's Need for ICT: SP. 259 Technology and Policy in Africa. Available:http://ocw.mit.edu/NR/rdonlyres/Special-Programs/SP-259Spring-2006/891209EE-E63B-4617-BA9D7635A63C754B/0/goshit.pdf

Hepp, P., Hinostroza, E., Laval, E. & Rehbein, L. (2004). *Technology in Schools: Education, ICT and the Knowledge Society*. Washington: The World Bank.

Herzig, R. G. M. (2004). Technology and its Impact in the Classroom. *Computers & Education.*

Itzkan, S. J. (1994). Assessing the Future of Tele-computing Environments: Implications for Instruction and Administration. *The computing Teacher*, 22(4), 60-64

Jonassen, D. H. (1996). *Computer in Classroom:* Mind Tools for Critical Thinking. New Jersey: Prentice Hall.

Jedeskog, G. & Nissen, J. (2004). ICT in the Classroom: Is Doing More Important Than Knowing? *Education and Information Technologies*

Jhurree, V., (2005). Technology Integration in Education in Developing Countries: Guidelines to Policy Makers. *International Education Journal*: Mauritius Institute of Education, Mauritius 6 (4) 467-483

Kaptelinin, V., Kuutti, K., & Bannon, L. (1995). Activity Theory: Basic Concepts and Applications. In Blumenthal et al. (Eds.) Human-Computer Interaction. Lecture Notes in Computer Science. Springer.

Kennewell, S. (2001). Using Affordances and Constraints to Evaluate the use of Information and Communications Technology in Teaching and Learning. *Journal of Information Technology for Teacher Education from:* http://www.informaworld.com/smpp/content~content=a739086211~db=all~order=page.

Kothari, C. R., (2004) *Research Methodology:* Methods and Techniques. New Age International Publishers, New Delhi

Kombo, D. K. & Tromp, D.L.A (2006) *Proposal and Thesis Writing:* An Introduction. Pauline Publications Africa, Nairobi

Kozma , R., (2005) "National Policies that Connect ICT-Based Education reform to Economic and Social Development" *Human Technology* [Electronic], 5(4): 358-367.

Kozma, R. & Anderson, R. E., (2002). Qualitative Case Studies of Innovative Pedagogical Practices Using ICT. *Journal of Computer Assisted Learning*, 18, 387–394.

Kuutti, K., (1996). Activity Theory as a Potential Framework for Human-Computer Interaction Research. In B. A. Nardi (Ed.), *Context and Consciousness: Activity Theory and Human-Computer Interaction.* Cambridge, MA: The MIT Press, 17-44.

Li, J. Z., & Bratt, S. E., (2004). Activity Theory as Tool for Analyzing Asynchronous Learning Networks (ALN). In W. Liu, Y. Shi & Q. Li (Eds), *Advances in Web-Based Learning, ICWL 2004: Proceedings Third International Conference*. Beijing, 8-11 August. Berlin: Springer

Lim, C. P., (2002). A Theoretical Framework for the Study of ICT in Schools: A proposal. *British Journal of Educational Technology*

Loveless, A., (2004). The Interaction between Primary Teachers' Perceptions of ICT and their Pedagogy. *Education and Information Technologies,* 8(4), pp. 313-326.

Martins, C. B. M. J., Steil, A. V. & Todesco, J. L., (2004). Factors Influencing the Adoption of the Internet as a Teaching Tool at Foreign Language Schools. *Computers & Education*

Minishi-Majanja, M., (2007). *Integration of ICTs in Library and Information Science Education in Sub-Saharan Africa.* Paper presented at the World Library and Information Congress: 73rd IFLA General Conference and Council. Retrieved from http://www.ifla.org/IV/ifla73/index.htm

MOEST, (2005). *Kenya Education Sector Support Programme 2005 –2010*; Delivering Quality Education and Training to all Kenyans. Nairobi: Government Printers.

Mugenda, O. M. & Mugenda, A.G., (2003). *Research Methods: Quantitative and Qualitative Approaches*. ACTS Press, Nairobi.

Mwanja, J., (2001). *Computerisation in Government Ministries in Uganda.* Unpublished MA Dissertation. Kampala: Makerere University.

Nassanga, G., (2001). *Local Considerations in Formulating ICT Policy in the East Africa Region*: Uganda Case Study. Paper Presented at the Regional Media Convention on Safeguarding the Public Interest, Kampala.

Newhouse, P., (2002). *Literature Review. The Impact of ICT on Learning and Teaching*, Perth Western Australia, Department of Education

Nduati, C., & Bowman, W. (2005). Working from the Sidelines: the Kenya Private Sector Foundation ICT Board Story. In E. F. Etta & L. Elder (Eds.), *At the Crossroads: ICT Policy Making in East Africa* (pp. 56-67). Nairobi: East African Educational Publishers Ltd

Ndiku, L., (2003). *The Problem Encountered by School Personnel in the Implementation of Computer Use in Secondary Schools in Uasin Gishu District.* Unpublished Thesis: Moi University, Eidoret.

Nzuve, S. N. M. (1999). *Elements of Organisation Behaviour*, Nairobi University Press, Nairobi

Ochuodho, S., & Matunga, M. (2004). A National Orchestra? Civil Society Involvement in ICT Policy Making. In E. F. Etta & L. Elder (Eds.), *At the Crossroads: ICT Policy Making in East Africa* (pp. 68-83). Nairobi: E.A.E.P.

Okebukola, P., (1997). Old, New, and Current Technology in Education. UNESCO Africa 14 (15): 7-18. "Application of ICTs in Nigerian Secondary Schools," Dr. Esharenana E. Adomi. Dr. Emperor Kpangban. Library Philosophy and Practice 2010 (March).

Okwudishu, C. H., (2005). *Awareness and Use of Information and Communication Technology (ICT) Among Village Secondary School Teachers in Aniocha South Local Government Area of Delta State.* Abraka: Delta State University. Unpublished B.Sc. (LIS) project.

Otunga, R. N., Odero, I. I. & Barasa, P. L., (2011) *A Handbook for Curriculum and Instruction.* Moi University Press, Moi University-Eldoret

Orodho, A.S., (2003). *Techniques of Writing Research Proposals and Reports.* Meselo Publishers, Nairobi

Pelgrum, W. J., & Law, N., (2003) *"ICT in Education Around the World: Trends, Problems and Prospects"* UNESCO- International Institute for Educational Planning

Papert, S., (1997). *"The Connected Family, Bridging the Digital Generation Gap.* United Kingdom, Long Street Press

Plante, J., & Beattie, D., (2004). Connectivity and ICT Integration in Canadian Elementary and Secondary Schools: First Results from the Information and Communications Technologies in Schools Survey, 2003 – 2004. Available: http://www.stacan.ca/english/research/81-595-MIE200407.pdf

Saleemi, N. A., (2000). *Systems Theory and Management. Information Systems Simplified*, N.A. Saleemi Publishers, Nairobi

Sarason, S. B., (1971). *The Culture of the School and the Problem of Change*. Boston: Allyn and Bacon.

Schlechty, P. C. (1997). *Inventing Better Schools*, Jossey-Bass Publishers, San Francisco

Schindler, P. (2003). *Business Research Methods*. McGraw Hill, Boston.

Sharma, et. al., (2005). An Investigation of the Effectiveness of Electronic Classroom Communication systems in large lecture classes. *Australian Journal of Educational Technology*

Suen, C. & Szabo, M., (1998). A Study of the Impact of a School District Computer Technology Program on Adoption of Educational Technology from: http://www.quasar.ualberta.ca/edmedia/Suenszabo.html.

Sutherland, R. (2004). Designs for Learning: ICT and Knowledge in the Classroom. *Computers & Education.*

Southwood, R. (2004). African Telecom Indicators: What do they use and why? Available:http://www.balanceingact_africa.com/news/back/balancingact_147.html

Usluel, Y., Mumcu, F. & Demiraslan, Y. (2007). ICT in Teaching-Learning Process: Teachers' Views on the Integration of ICT and on the Perceived Obstacles to this Integration. *Hacettepe University Journal of Education*

University of Zimbabwe,(1995). *Curriculum Implementation, Change and Innovation* (module EA3AD 303), Harare: Centre for Distance Education, University of Zimbabwe

Veenstra, R. (1999). Leerlingen-klassen-scholen. (Students-classes-schools). Doctoral dissertation. Amsterdam, the Netherlands: Thela Thesis.

Wachira, E. (2005) "ICT in Education: A Practical Approach". In Bracey, B., Culver, T. (eds.) *"Harnessing the Potential of ICT for Education- A Multi-stakeholder Approach"* [Internet] United Nations ICT Task Force. Available from: http://www.digitaldivide.net/comm/docs/view.php?DocID=199

Waema, M. T. (2005). A Brief History of the Development of an ICT Policy in Kenya. In E. F. Etta & L. Elder (Eds.), *At the Crossroads: ICT Policy Making in East Africa* (pp. 25-43). Nairobi: East African Educational Publishers.

Wagner, D., and Kozma, R. (2003) "*New Technologies for Literacy and Adult Education: A Global Perspective*" The Education for All Initiative, World Summit on the Information Society, and Leave No Child Behind. UNESCO-International Institute for Educational Planning.

Wakanyasi, N., 2002. *Capacity Utilization of Information Technology in Organisations: A Case Study of Nkumba University.* Unpublished MBA dissertation. Entebbe: Nkumba University.

Wong, A. F. L., Quek, C. L., Diraharan, S., Liu, W. C. Peer, J. & Williams, M. D. (2006). Singapore Student and Teachers Perceptions of Computers Supported Project Work Classroom Learning Environment. *Journal of Research on Technology in Education*, 38 (4), 449-479

World Summit on the Information Society, (12 December 2003) "*Declaration of Principles*", Building the Information Society: a global challenge in the new Millennium WSIS-03/GENEVA/DOC/4-E,

Yates, D. S., Moore, D. S., and Starnes, D. S. (2008). *The Practice of Statistics* (3rd ed.), New York: W. H. Freeman and Company.

Yelland, N. (2001). *Teaching and Learning with Information and Communication Technologies (ICT) for Numeracy in the Early Childhood and Primary Years of Schooling*. Australia: Department of Education, Training and Youth Affairs

APPENDICES
APPENDIX I: TEACHERS QUESTIONNAIRE

Dear respondent,

I am Chrispin M. Mwawana a student in Moi University undertaking Masters of Philosophy in Educational Communications and Technology. I am carrying out a research study on *"Teacher Adoption of ICT in Secondary Schools in Taita Taveta County"* Please read the questions hereunder and tick answer. The responses you give will be treated as confidential and shall only be used to improve the teaching and learning in our schools. Do not indicate your name anywhere in this questionnaire.

SECTION A: Background information

1. Gender

    Male ( )   Female ( )

2. What is your age bracket?

    Below 25 years ( )   25-30 years ( )   31- 35 years   ( )

    36-40 years ( )   41-50 years ( )   Above 50 years ( )

3. How long have you taught?

    Below 5 years ( )   5-9 years   ( )   10- 14 years   ( )

    15-19 years   ( )   Over 20 years ( )

4. Which is your teaching subject?

    Mathematics   ( )   Sciences   ( )   Languages ( )   Humanities ( )

    Technical and Applied Science ( )

5. What is your school's Category?

    Sub-County   ( )   County ( )

6. a) Do you have computers in the school? Yes   ()   No ( )

   b) If (6) is yes, how long have they been in school?

        Less than 1 year ( )   1-5 years   ( )   5-10 years ( ) Over 10 years ( )

c) If (6) is yes, are the computers loaded with any educational soft ware such as: e-beam interactive soft ware, Microsoft Student Works or Encarta Reference Library?

Yes ( )   No ( )

7. a) How active are your students during your lessons?

Very active ( ) ( ) Active ( ) Not at all ( )

b) If (6) is yes, how regularly do you teach your subject using your own prepared digital instructional methods such as: documentaries, photo stories or video lessons?

Never   ( )   Rarely ( )   Oftenly ( )   Always   ( )

8. How often do you carry out internet research while planning your lessons?

Never   ( )   Rarely ( )   Oftenly ( )   Always   ( )

9. How often do you send to and receive from your students assignments while they are at home?

Never   ( )   Rarely ( )   Oftenly ( )   Always   ( )

10. How regularly do you assess your students using ICT assessment tools such as: 'hot potato' or 'interactive response'?

Never   ( )   Rarely ( )   Oftenly ( )   Always   ( )

11. a) Do you use ICT for giving feedback of the tests taken by your students?

Yes ( )   No ( )

b) If no. is yes, does ICT enable you to give a more comprehensive and faster feedback than when you do not use ICT?

Yes ( )   No ( )

12. How often do you give your students inter- disciplinary projects to choose, research on the internet and report?

 Never   ( )   Rarely ( )   Oftenly ( )   Always   ( )

13. Do you link your students with their peers in other schools or experts to enrich their learning? Yes ( ) No ( )

14. Do you have a school policy in place for the use of ICT in teaching and learning in your school?

 Yes ( ) No ( )

15. To what extent have you been trained in the use of ICT in teaching and learning?

 Very trained ( ) Trained ( ) Not trained at all ( )

16. How supportive is the school administration in ICT integration in education in your school?

 Very supportive ( ) Supportive ( ) Not supportive ( )

17. Does the school administration lead by example in using ICT in teaching and learning in your school? Yes ( ) No ( )

SECTION B

18. What is your ICT skills competence level?   (Tick as appropriate)

ICT Skill	Very competent	Competent	Not competent
Typing			
Sending and receiving messages(sms and email)			
Can work with spreadsheets			
Can work with database software			
Can create with publisher			
Can download/upload data			
Can create a digital instructional material			
Can use a presentation software to teach			
Can set up and use ICT presentation equipment			
Can deal with simple ICT technical problems while presenting			

19. Benefits of using ICTs in teaching and learning

Please respond by using the following (SA- Strongly Agree, A- Agree, UD- Un Decided, D-Disagree, S-Strongly Disagree to rate how ICT benefits in teaching and learning

Benefits	SA	A	UD	D	SD
Students have greater disposition to research and problem-solving focused on real social situations					
Students comprehend and assimilate knowledge in the interdisciplinary ICT environment.					
Students are able to generate their knowledge when presented with a learning situation.					
Students are capable of coping with rapidly changing, complex, and uncertain environments.					

New skills and abilities are fostered through technological literacy				
The use of ICT in teaching and learning promotes constructivism in students.				
The use of ICT in teaching and learning allows greater use of multimedia.				
It enables access to e-knowledge and the repackaging of e-knowledge to suit our context.				

20. What do you think may be affecting the use of ICT in teaching and learning?

Inadequate or no capacity building in the use of ICT use in teaching and learning ( )

Lack of ICT infrastructure in the schools   ( )

High teaching loads   ( )

21. Factors Affecting the ICT Integration in Education

	SA	A	UD	D	SD
Technophobia amongst some teachers					
Age					
Teacher's Willingness to Embrace ICT in Teaching and Learning					
Teacher's teaching subjects					
Learner's ability					
Availability of e-Content relevant to our curriculum					
Interdisciplinary collaboration amongst teachers					
Lack of ICT environments in classrooms					
Lack of technical support for teachers					
Insufficiency of in- service training					
Support from the school Administration					
ICT Policy in the school					
Proximity of the school from a major town centre					

22. What are the challenges of Integrating ICT in Education?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

23. What strategies can you suggest to improve ICT integration in the classroom?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

THANK YOU VERY MUCH FOR PARTICIPATING IN THIS RESEARCH

APPENDIX II: RESEARCH AUTHORIZATION

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349
254-020-310571, 2213123, 2219420
Fax: 254-020-318245, 318249
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: NCST/RCD/13/012/06/4

Date: 20th February, 2012

Chrispin M. Mwawana
Moi University
P. O. Box 3900
ELDORET

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*The extent to which the teacher is supporting the integration of information & Communication Technology in the classroom in Taita Taveta County*" I am pleased to inform you that you have been authorized to undertake research **in Taita Taveta County, Coast Province** for a period ending *31st December 2012.*

You are advised to report to **the District Commissioners & the District Education Officers in Taita Taveta County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf form** of the research report/thesis to our office.
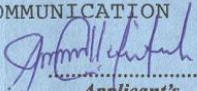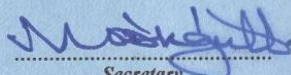
DR. M. K. RUGUTT, PhD, HSC
DEPUTY COUNCIL SECRETARY

Copy to:
The District Commissioners
Taita Taveta County

The District Education Officers
Taita Taveta County

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development."

APPENDIX III: RESEARCH PERMIT

PAGE 2

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss...CHRISPIN..MWACHONGO

.............................MWAWANA..............................

of (Address) ....MOI UNIVERSITY...............

.P.O BOX 3900, ELDORET

has been permitted to conduct research in ....

....Location,

...........................TAITA..TAVETA...........District,

....COAST............Province,

on the topic....THE..ETENT..TO..WHICH..THE.

..TEACHER..IS..SUPPORTING..THE............

INTERGRATION OF INFORMATION AND COMMUNICATION

COMMUNICATIONS TECHNOLOGY IN THE

CLASSROOM IN TAITA TAVETA COUNTY.

for a period ending....30th DECEMBER,20...12

PAGE 3

Research Permit No. NCS/RCD/13/012/06

Date of issue.....20th FEBRUARY 2012.......

Fee received...KSHS.1000.................................

Applicant's
Signature

Secretary
National Council for
Science and Technology