

**THE IMPACT OF INFORMATION AND COMMUNICATIONS
TECHNOLOGY ON TEACHING AND PERFORMANCE: A
SURVEY OF SELECTED TECHNICAL INSTITUTIONS
IN WESTERN KENYA**

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DECLARATION

This thesis is my original work and has not been presented to any university for any other award.

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DEDICATION

This thesis is dedicated to:

My late mother Elizabeth Ashono and my sister Flora Wangwa

ABSTRACT

In developed countries, there has been an increase in the use of computers in the education sector at all levels. In developing countries, the educational systems have not completely missed the technological revolution, but technology is yet to impact on them in the ways it has in the first world countries. This study was carried out to establish the impact of ICT on teaching in technical institutions in western Kenya. In order to achieve the rationale of the study, the following four specific research objectives were used: To determine the impact of ICT infrastructure on the quality of examination results, to establish the impact of ICT resources used by lecturers on the quality of examinations results, to establish the impact of teaching using ICT and to determine the challenges facing the lecturers using ICT in teaching in technical institutions. The study adopted a survey design. Purposive sampling was done to obtain research raw data, through questionnaires, observations and interviews. The data was analysed using descriptive and inferential statistics. SPSS was used in which T-test; F-test techniques were applied at level of 0.05 significance testing. The findings revealed that ICT infrastructure had a positive impact on examination results; teaching using ICT resources improved the quality of examination results; teaching using ICT had a positive impact on syllabus coverage; there were challenges facing some lecturers in using ICT for teaching. In conclusion: The infrastructure requirements for effective use of ICT for teaching were viewed in terms of the electronic resources, hardware, users, and implementation; lecturers who use ICT for teaching effectively deliver knowledge and skills and accessed more information through internet and library. Challenges that face lecturers in using ICT in teaching were: ICT literacy; inadequate ICT resources; lack of in- service training program for lecturers; unavailability of internet services; and overloaded syllabus. The following recommendations were arrived at: the government of Kenya should develop a policy on the provision of adequate ICT infrastructure at all levels of education and training by bringing together the efforts of all stakeholders, the Ministry of Higher Education, Science and Technology should put in place a well-organized ICT in-service training programme for all lecturers., Lecturers should strengthen their pedagogical use of ICT and exploit the potential of ICT as a catalyst for change to fulfil educational goals and Policy Makers should formulate clear objectives of how to integrate ICT in the classroom.

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LIST OF ABBREVIATIONS

ANOVA:	Anaysis of Variance
AVU:	The African Virtual University
CD-ROMs:	Compact Disc -Read Only Memories
CDs:	Compact Discs
COL:	Common Wealth of Learning
HODs:	Heads Of Departments
ICT:	Information Communication Technology
InfoDev:	Information for Development Program
IT:	Information Technology
IWBs:	Interactive Whiteboards
KTTC:	Kenya Technical Teachers College
LRC:	Learning Resource Centre
MoEST:	Ministry of Education Science and Technology
NEMED:	Network of Multi-grade Education
SPSS:	Statistical Package for Social Sciences
TTCs:	Teachers TrainingColleges
R&D:	Receiver and delivery
TVET:	Technical and Vocational Education and Training
TV:	Television
TTCs:	Teachers TrainingColleges
UK:	Unted Kingdom
UNESCO:	United Nations Educational, Scientific and Cultural Organization

OPERATIONAL DEFINITION OF TERMS

1. **A Computer** is an electronic device that can perform activities that involve mathematical, logical and graphical manipulations. Generally, the term is used to describe a collection of devices that function together as a system. It performs the following three operations in sequence: It receives data & instructions from the input device, processes the data as per instructions and lastly provides the result (output) in a desired form.
2. **Data:** It is the collection of raw facts, figures & symbols.
3. **Effectiveness:** Be able to achieve the intended result
4. **High-end or new technology:** Current or recent computer related technology that is in use but considered to be newer than mature technology.
5. **Information and Communication Technology:** Technologies that facilitate communication and the processing and transmission of information by electronic means. This definition encompasses the full range of ICTs from radio and televisions to telephones (fixed and mobile), computers and the Internet. Education: Encompass formal education at primary, secondary and tertiary levels; and adult education as teacher training, tertiary level, distance learning and non-formal education.
6. **Information Technology:** Is a Technology that merges Computing with high-speed Communication
7. **Information:** It is the data that is processed & presented in an organized manner. Example: When the names of students are arranged in

alphabetical order, total and average marks are calculated & presented in a tabular form, it is information.

8. **Innovation:** An improvement on what already exists on the product.
9. **Internet:** Is an International network connecting smaller networks.
10. **Low or mature technology:** Technological tools that have been around for quite a long time and are familiar to most people, for example slide projectors, film projectors, audio tapes and recorders, posters, television, video, etc.
11. **Motivation:** Is willingness to exert high levels of efforts towards achieving
12. **Multimedia:** This term is used in this study to refer to a combination of technological tools; e.g., television, videos, cameras, overhead projectors, radio, videocassette, etc.
13. **Organizational:** goals and conditioned by the effort/ability to satisfy some individual needs.
14. **Product:** Processed output that can be offered to a market for attention, or use that might satisfy human want or desire.
15. **Program:** Set of instructions that enable a computer to perform a given task.
16. **Western Kenya** - Covers the following Towns; Kakamega, Eldoret, Nakuru, Kitale, Bungoma and Kisumu

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

This section deals with the description of background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, justification of the study, scope and limitations of the study, assumptions of the study and theoretical frame work.

1.2 Background of the problem

1.2.1 The use of ICT in learning institutions

The use of information and communication technology (ICT) systems in learning institutions is built upon an understanding of the link between learning Institutions and ICT. When the potential use of ICT in learning institutions was first established, the predominant conception was that students would be taught by ICT (Lockias, 2009).

Towards the end of the 1980s and into the 1990s, the major rationale for having ICT in learning institutions was to use ICT to improve students' performance (Lockias, 2009).

1.2.2 ICT trends in Developed Countries

Developed countries like America, Russia, Britain, Germany, France, Japan, Canada, and Italy are advanced in technology and industrialization. These highly developed

countries and those seen as developing very fast, for example Korea and China, gave first priority to Science and Technology.

In developed countries, the trend of using ICT for teaching purpose has been on an increase. Condie and Munro as cited in (Gianluca, Simona, Marco, Federica, & Laura, 2015) found that there has been an increase in teachers' time spent using computers at all levels of education between 2005 and 2007. The study also found that there has been an increase in the use of computers, particularly for administrative tasks, preparatory and follow-up work, but a decrease for instruction. The authors observed that in some countries, ICT benefits are emerging. For example, teachers' ICT skills have developed over the years, as have the range of hardware and software available in the classroom. There is evidence that these developments have led to a reduction in teachers' workloads.

In China it was found that ICT has the potential to create job opportunities, improve delivery and access to health and education, facilitate information sharing and knowledge creation, increase transparency, accountability and effectiveness of government, business and non-profit organization; all of which contributing to an enabling environment for socio-economic development (Morawczynski & Ngwenyama, 2007). This was possible because of the setup of their education systems.

1.2.3 ICT Trends in Developing Countries

In developing countries, the educational systems have not completely missed the technological revolution, but technology is yet to impact on them in the ways it has in

the first world countries. These developing countries are also capable of developing very fast industrially, if they can genuinely invest in science and technology.

In Bangladesh, the use of ICT, especially computer literacy and programming, for education has expanded in all sectors of education over the last few years. ICT helps to teach physics through use of software programs (Chris, 2015).

On the African continent, the African Virtual University (AVU) is taking the lead in implementing ICT in education, particularly in teacher education with a grant from the African development Bank and support from NEPAD and other stakeholders. The AVU initiated the teacher education programme. Its main objective among others was to enhance the capacity of teachers in the use of ICTs in teaching and learning.

Through workshops, a curriculum was designed and developed by the ministers of education from 10 participating countries, Kenya being one of them (Dzvimbo et al. 2006)

In Kenya, the Kenya Technical Teachers College (KTTC) was established in 1973 with the primary objective of training technically skilled personnel to teach in technical institutions. At the beginning of 2002, a Learning Resource Centre (LRC) project at KTTC was initiated. Lecturers and students come to teach, learn, and undertake research (Janssens- Bevernage et al. 2005). LRC has an ICT unit, documentation unit, 24-hour Internet access and working space. The LRC offers flexible modes and innovative methods of learning. Training includes basic ICT skills which may be taught / learned with the assistance of self-study CD-ROMs or through workshops which concentrate on specific education-related themes and tasks such as efficient Internet search, the pedagogical rationale for ICT integration, problem-

solving learning and innovative instructional methods such as flexible learning and information literacy.

The objectives of technical and vocational education in Kenya, as a vehicle of technological development, has been to facilitate the interpretation of basic knowledge and understanding of fundamental facts and principles of scientific processes, uses of tools and labour saving devices for production of work. The second objective is to equip students with relevant productivity and entrepreneurial skills that will prepare them for gainful employment or self-employment (Wapukha, 2014).

1.2.4 Education system in Kenya

The 8-4-4 system of education in which a student takes eight years in primary school, four years in secondary school and four years at university, was introduced in Kenya in

1985. The system was established after the Mackay Report of 1983 (Gikungu, Karanja, & Thinguri, 2014) which embodied the new vision of vocational education in the school curriculum after realizing that the society was disillusioned by the previous system of education that was mainly academic oriented (Wapukha, 2014).

Technical and vocational subjects were introduced in secondary school curriculum of education. Later on, computer studies were also introduced. By diversifying the curriculum and encouraging education for self-employment, the 8-4-4 system of education in Kenya could begin the process of reshaping formal education to suit the emerging needs of the country.

1.2.5 ICT Integration in Technical Training Institutions in Kenya

The evolving technology in ICT and globalization has brought up a new way of doing things. The integration of these technologies into education system was widely expected to change the way we live, learn, work and even think about work. The combined impact of globalization and new technology has had dramatic economic and social impacts, creating new opportunities as well as challenges and uncertainty.

According to Gichiraas cited in (Abuya, 2014), looking at the earlier days, Technical and Vocation Education and Training (TVET) has experienced biasness that has far reaching consequences. In Kenya TVET has always been associated with those who could not make it to university education. Today, the notion of TVET being the preserve for the less bright learners still holds and with the new developments of Polytechnics and Technical institutions being nurtured to offer degrees just like universities, it is feared that the government policies may be confirming to this attitude. In the context of TVET, Stevens cited in (Abuya, 2014) pointed out that distance learning is believed by many to hold promise in addressing critical problems facing skills development at present, namely: a lack of qualified instructors, the need to greatly increase the delivery of skills training on a wide scale and the need to deliver training at much lower unit costs owing to constraints of financing.

In affirming to the use of ICT to increase access to education, Haddad and Drexler cited in (Latchem & Jung, 2009) noted that: it is going to be very difficult for developing countries to meet the objective of “effective learning for all anywhere and anytime” with the current curriculum. Nonetheless, in recent years, ICT in Technical institutions is revolutionizing education by removing distance

from education and making knowledge more accessible to all. Many TVET institutions through partnering of the ministry of education with donors have seen more workshops being developed and equipped with latest machines and equipment. This is aimed at improving teaching and learning while integrating ICT in curriculum delivery.

This research study was focused on the impact of ICT systems on teaching, learning and learning environment in technical institutions in Kenya: a survey of selected technical institutions in five counties in Western Kenya.

1.3 Statement of the Problem

According to Trucano(2005) even after over a decade of ICT use in the education sector in developing countries, the ICT for education and development communities are still hard pressed to present satisfactory answers to the following basic question: What is the impact of ICT use in education?

Since the integration of technology into education is an enormous endeavour given the country's poor state of technological infrastructure and manpower, there is therefore, a need for a systematic evaluation of all the activities of ICT in education. Kashorda & Waema (2007) assert that one of the weaknesses of the Kenya's national ICT policy is the lack of explicit targets that could be used for policy analysis and evaluation. From the ICT in education policy paper (MOEST, 2005),it is clear that comprehensive indicators need to be developed to reflect the goals indicated in the ICT in education policy documents. Therefore, a study to investigate the impact of the use of ICT in teaching on the educational outcomes needed to be carried out to shed light on the subject.

1.4.0 Purpose of the study

The purpose of the study was to establish the impact of ICT as an aid to learning and teaching in technical institutions in Kenya. It is focused on initiatives related to measuring and demonstrating the impact of ICT in technical institutions with regard to:

students, learning and the learning environment; teachers and teaching strategies; organizational change; and other areas relevant to teaching and learning in technical institutions in Kenya.

1.4.1 Objectives of the study

The main objective of the study was to investigate the impact of ICT to teaching in technical institutions. The specific objectives were to:

1. Determine the impact of ICT infrastructure on the quality of examination results in technical institutions.
2. Establish the impact of ICT resources used by lecturers on the quality of examination results in technical institutions.
3. Establish the impact of teaching using ICT on syllabus coverage in technical institutions.
4. Determine the challenges facing the lecturers using ICT in teaching in technical institutions.

1.4.2 Research Questions

To address the above objectives, the following research questions were used;

1. Does ICT infrastructure have an impact on the quality of examination results in technical institutions?
2. What is the impact of the use of ICT resources by lecturers on the quality of examination results in technical institutions?
3. What is the impact of teaching using ICT on syllabus coverage in technical institutions?
4. Are there challenges facing lecturers using ICT for teaching in technical institutions?

1.5 Assumptions of the study

1. The selected respondents were a representative of the total population.
2. That all respondents were honest and responded to all the issues in questionnaires and interviews.
3. Respondents have had some exposure to ICT

1.6 The Scope of study

The study covered the national polytechnics, institutes of science and technology and technical training institutes in five counties of Western Kenya. The findings of the study were generalized to all national polytechnics, institutes of science and technology and technical training institutes in Kenya.

1.7 Limitations of the study

The study was limited to the following:

1. Even though ICT technology has a wide variety of tools to offer education, one limitation of this study was that the research questions focused on use of computer technology only.
2. The study was limited to government institutions.
3. The study was limited to two national Polytechnics, three Technical training institutes and one institute of science and technology in five counties of Western Kenya. The five counties are: Kisumu, Bungoma, Trans-Nzoia, Nandi and Uasin-Gishu.

1.8 Significance of the study

This study aims at providing findings that can be useful to:

1. Management of technical institutions to improve on their ICT infrastructure and resources in order to enhance efficiency and effectiveness in teaching.
2. The government to develop policies that could enhance the usage of ICT for teaching in technical institutions.
3. Lecturers to enhance their skills in ICT and remain current in ICT technology.

1.9 Justification of the study

The relevance of computer on educational outcomes is inconclusive. According to Cawthera (2005) there are two main justifications for the provision of computers in school-based education: can improve either the quality or the quantity of education in a cost-effective way, ICT is likely to play an important part in the future of any economy.

While evidence indicates that giving computer access to students can and often does improve performance, there has been no systematic research carried out in developing countries, which compares the impact of this provision against the alternative use of resources such as text books, basic furniture, or teacher training (which may also improve) for educational attainment(Cawthera, 2005).

The learning outcomes from computers may be different from those achieved with other inputs. When the cost-effectiveness equation is considered, the costs of ICT provision can be high in comparison to the costs of other equipment. ICT equipment can make high demands on well-resourced institutions. In under resourced institutions, often farther away from the electricity grid and with increased travel costs for essential maintenance; these costs can still be higher. However, in the long term, use of ICT is more economical to the society. This is because ICT has the potential to create job opportunities, improve delivery and access to health and education, and facilitate information sharing and knowledge creation. All of which contributing to an enabling environment for socioeconomic development (Morawczynski & Ngwenyama, 2007)

1.10 Theoretical framework

This study adopted the systems approach as a theoretical framework. The system approach regard an organization as a social system consisting of individuals who operate within a framework, drawing resources from their environment and putting back into that environment their products or services (William & Waldemar, 2006). According to David cited in (William & Waldemar, 2006), system approach look at the different parts of an interacting set of activities as a whole and considers the best way for the whole to function.

The aim of a system approach is to use an abstract view of the total system and then to operate each sub-system according to the defined best way for complete system. The System theory was developed in 1960's alongside management science and derived from the work being done on mechanical, electrical and biological systems. It is also systems (Ben-Ali, 2007). The basic concept can be illustrated diagrammatically as follows;

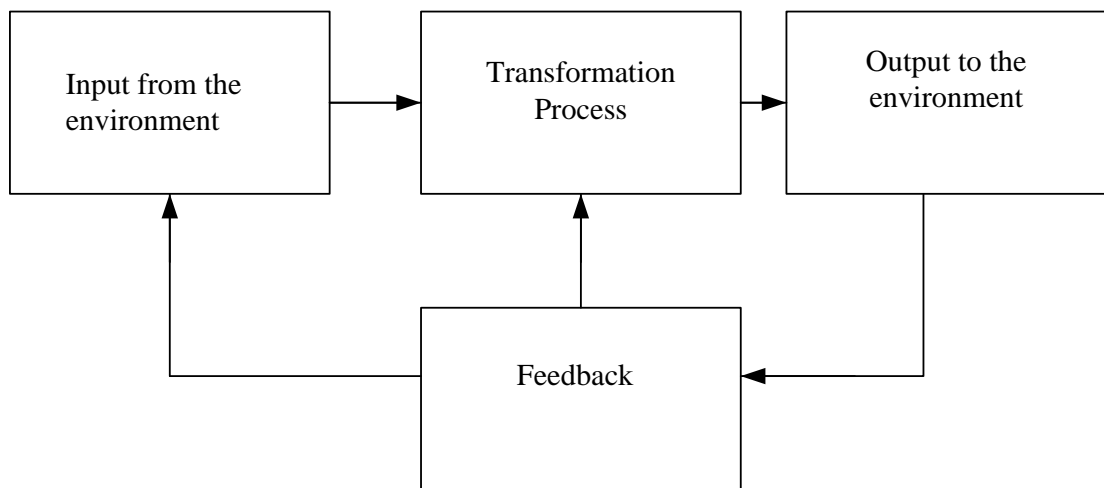


Figure 1.1: The Four Part of a System

(Source: System approach by Ben-AI 2007)

1. **Inputs** - These may include capital, raw materials, people, information, money, equipment, managerial technical skills, knowledge and materials required produce an organization's goods and services. Whatever goes into a system is an input.
2. **Transformation Processes** - These are organization's capabilities on management and technology that are applied to convert inputs into outputs. It is the duty of managers to transform the inputs using managerial functions of planning, organizing, staffing, leading and controlling.

3. **Outputs** -These are products, services, profits or losses that are produced by the organization. Whatever comes out of the system is an output.
4. **Feedback** - This is information about the reaction of the environment to the outputs that affect the inputs. Thus feedback control loop is introduced to measure, analyse and modify the inputs. If an organization is to survive and thrive in its environment, it needs information about its output - for example, how well are its products meeting customer needs, or, are its by-products or emission causing environmental problems?

In this system approach, organizations are systems of inter-related activities. The focus is what actually goes on, the activities including aspect of technology employed, the people in the company, the relationship and roles, as well as the interaction into the environment. Important elements of the system or sub-systems are the ways in which the business provides for co-ordination, monitoring and feedback of its activities.

The system approach is relevant to the study because the systems viewpoints see organizations as a system either open or closed with inputs, outputs, transformation processes and feedback. The importance of this approach is: It best equips the decision maker to determine which alternative actually maximizes the realization of the goals of the organization; it helps to have a balanced perspective concerning organization's components; and it helps to view an organization as a component, or subsystem of the environment in which it exists.

Technical institutions in Kenya do not exist in a vacuum. They depend on their environment and are part of larger systems, such as a society. By adopting this point of
of

view, the researcher looks at education programme and curriculum of technical institutions as a collection of sub-systems and part of the large environment, which must function together for the system to work. If a sub-system fails, the whole system is put in jeopardy.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Information and Communication Technology (ICT) can provide an enabling environment for physical infrastructure and service development for generation, transmission and processing, storing and disseminating information in all forms.

ICT includes computers, the Internet, and electronic delivery systems such as radios, televisions, and projectors among others, and is widely used in today's education field. ICT is being applied successfully in instruction, learning, and assessment. It is considered a powerful tool for educational change and reform. A number of previous studies have shown that an appropriate use of ICT can raise educational quality and connect learning to real-life situations (Lowther, Inan, Strahl, & Ross, 2008).

Based on ICT, learning and teaching no longer depend exclusively on printed materials. Multiple resources are abundant on the Internet, and knowledge can be acquired through video clips, audio sounds, and visual presentation. Current research has indicated that ICT assists in transforming a teaching environment into a learner-centered one (Castro & Alemán, 2011). Since learners are actively involved in the learning processes in ICT classrooms, they are authorized by the teacher to make decisions, plans, and so forth (Lu, Hou, & Huang, 2010). ICT therefore provides both learners and instructors with more educational affordances and possibilities.

Since ICT plays an important role in society and considering that all youngsters move through compulsory education, then education sector is the appropriate place to develop crucial ICT competencies (Tondeur, Braak, & Martin, 2007).

This chapter is going to review literature on the impact of information and communication technology on teaching. To shed light on what the topic entails, the researcher has conducted a critique of previous authors and has identified the research gaps. This chapter has been subdivided into sub-sections that follow.

2.2 Knowledge Economy

According to Debra cited in (Bunhlua & Chan, 2011) the world is embarking upon the Knowledge Economy and the future is just beyond the end. How is each country equipped to take advantage of the opportunities. Debra outlined the future as an asset, which goes well beyond the traditional forms of management. According to her, we are at a historical choice point - a defining moment in determining the kind of world our children will inherit. Her assumptions are based upon a new Knowledge Value Proposition beyond cost, quality and time. Our future always begins with an

investment into what is called the “hidden value” of the firm; the core of the knowledge economics is knowledge innovation.

In the Sessional Paper No. 1 of 2005 the government of Kenya appreciates and recognizes that an ICT literate workforce is the foundation on which Kenya can acquire the status of a Knowledge economy. Education is seen as the natural platform for equipping the nation with ICT skills. The successful introduction and use of ICT in education and training institutions is seen to play a major role in disseminating skills to the wider society and thus create positive impacts on the (MoEST, 2005)

2.3 Benefits of Technological Investment

Major IT powerhouses such as Hewlett Packard, IBM, Microsoft, Cisco and Intel have achieved significant cost savings by outsourcing their high-end technology function network security and research and development (Anonymous, 2009).

India has succeeded by embracing a technological investments policy that not only attracts routine tasks like call-centre services, but also R&D in the pharmaceutical, information technology and telecom industries (Were, 2006).

These technology investments are of great benefit to the host countries resulting not only in job creation, but also in technical skills transfer, innovation and increased

entrepreneurial activity that further bolsters a nation’s competitiveness in the global economy. Currently, Taiwanese patents now rank among the highest in the US market (Anonymous, 2009).

The challenges facing Kenya’s development as a technological hub today are no different from those that countries like India and Thailand faced twenty years ago.

These countries recognized the role of innovation as a key driver of competitiveness in business, investment and new venture creation in their economies (Mansell, Samarajiva, & Mahan, 2002)

2.4 National ICT Policies

National ICT policies have reached an established position in both developed and developing countries. A study funded by the Australian Department of Education, Science and Training revealed that most national ICT policies focus on the educational

sector (Tondeur, Braak, & Martin, 2007) .Education is put forward as the central sector to pursue and attain the objectives of the ICT policy; other sectors are expected to benefit indirectly from this approach. Educational ICT policies have been designed in a variety of ways, depending on the dominant rationales that drive curriculum development.

As early as fifteen years ago, Hawkrige as cited in (Tondeur, Braak, & Martin, 2007) discerned four different rationales that drive policies related to the integration of ICT and the use of computers in education: an economic rationale; that is, the development of ICT skills is necessary to meet the need for a skilled work force, as learning is related to future jobs and careers, a social rationale; this builds on the belief that all pupils should know about and be familiar with computers in order to become responsible and well-informed citizens, an educational rationale; ICT is seen as a supportive tool to improve teaching and learning, finally a catalytic rationale; ICT is expected to accelerate educational innovations. National policies identify ICT literacy as a set of competencies needed to participate in society (Plomp, Ronald, Law, & Andreas, 2009). The ICT policies of the Flemish government illustrate the

search for a more holistic approach to respond to the rationales for introducing ICT in education. Achieving the goals of the educational and catalytic rationale will, according to the Ministry of the Flemish Community, (Tondeur, Braak, & Martin, 2007) automatically lead to the accomplishment of the goals of the economic and social rationale.

2.5 Policy Framework for ICT use in Kenyan Education System

The initial policies on ICT were comprehensive and included all sub-sectors of the education system. The formation of the policies has been a long and complicated process. In Kenya, for example, the earliest known ICT policy dates back to the 1980s and by 2000 it had not been completed as noted by Nduati and Bowman cited in (Hennessy, et al., 2010). In 2005, the Ministry of Education developed a Kenya Education Sector Support Program (KESSP) that featured ICT as one of the priority areas with the aim of mainstreaming ICTs into the teaching and learning process.

The policy was then adopted in January 2006. In June 2006, the Ministry introduced the National ICT Strategy for Education and Training. This document is referred to as the ICT policy for the education Sector. The aim of the policy was to improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services (MoEST, 2006).

Although the national ICT policy has several sections, objectives and strategies regarding ICT in education are spelt out in the information technology section (Hennessy, et al., 2010). In this section, the objective regarding the use of ICT in schools, colleges, universities and other educational institutions to improve the quality of teaching and learning is spelt out as documented by Farrell in the Survey of ICT in Africa (Faso & D'Ivoire, 2007). One important strategy outlined in this report is the

promotion and development of specific e-learning resources that would address the educational needs of primary, secondary and tertiary institutions.

A significant step in this direction is the digitization of the curriculum which is ongoing at the Kenya Institute of Education (Ratemo, 2009). For successful use of ICT in education, a number of strategies are proposed, among them being; to Work with stakeholders to develop a strategy on ICT that addresses its use in all educational institutions and neighbourhoods, incorporating access, content, training of teachers and supply of ICT to the institutions(MoEST, 2005).

2.6 Requirement for Effective use of ICT in Education

Research has consistently shown that few institutions and teachers implement computer support to a degree where the potential benefits are likely to be realized. There are a number of significant problems which impede and prevent teachers from achieving the full advantage offered by computer applications (Kumari, 2012).

Cradler as cited in(Kumari, 2012) gave seven requirements for effective use of ICT in education: Suiting technology to education goals and standards; having a vision for the use of technology to support curriculum; providing for both in-service and pre-service training; ensuring access to appropriate technology; providing for administrative support for technology use; providing time for teachers to plan and learn how to integrate technology and providing for on-going technical support for technology use.

Frankel and Wallen as cited in (Lumadi, 2013), stipulated some general requirements for effective use of ICT in education. These are: Providing the infrastructure of hardware and software; Providing curriculum and technical support for teachers and school organization, designed policies and practices.

2.7 Supporting Teachers in the use of Technology

Trucano, Farrell and Isaacs, as cited in (Faso & D'Ivoire, 2007), asserts that while technicians can be employed to fix and maintain computers, teachers and educators must know how to exploit ICT for what it does best - opening learners up to the world of knowledge. The author also noted that investment into upgrading computer labs and building ICT capacity at the Teacher Training Colleges (TTCs) is an intervention which can quickly yield high returns. By providing adequate access to ICT, the TTCs can use it to achieve learning objectives at various levels.

This point is also noted in the ICT in Education Options Paper (MoEST, 2005) in which large-scale capacity building workshops for teachers have been suggested. The paper observes that teacher training should be built on existing structures that support quality development for teachers. The paper further notes that the training of teachers should focus on increasing efficiency in the teachers and integrating ICT to improve teaching and learning objectives.

Noeth and Volkov (2004) claimed that the level of effectiveness of educational technology is influenced by the specific student population, the software design, the educator's role, and the level of student access to the technology. Because of the critical role played by teachers, education systems need to take account of the needs of teachers first. Problems teachers have with the use of computers may be seen in terms of: access to adequate infrastructure and support to use that infrastructure.

The infrastructure requirements may be viewed in terms of the electronic resources, hardware, users, and implementation. The use of inappropriate hardware, the lack of useful software and the difficulty in gaining adequate access to computer systems were noted as major obstacles to the use of computers by teachers and students. The

choice and distribution of hardware and software are crucial to the success of computer use in the learning institutions. According to Lankshear, Snyder and Green as cited in (Lee, 2006), selection of software should meet the needs of the teachers as well as the students.

2.8 The Impact of Technology in Education

While the literature regarding the impact of technology in education is extensive, it is not conclusive. Magambo (2007) found that most teachers had much to say about the positive impact of technology on education. In his study, one teacher said that technology was the best thing that ever happened to instructional programs. Between September and December 2006, Magambo (2007) carried out a case study on the Use of Information and Communications Technologies (ICTs) in teacher education in Sub-Saharan Africa. In this study, he found that ICT has a significant added value in teacher training, although it was optional and not integrated in the curriculum. Lecturers cited some of the following benefits of ICT: ICTs enable gathering, organising, and finding information; ICTs encourage and enable students to do independent research work and to do course work on their own; ICTs widen teachers' knowledge horizon; as ICTs are interactive they make learning and teaching very interesting, holding students attention and supplementing learning resources such as textbooks. Furthermore, as there is too much and too many to teach, ICTs help cover the curriculum much faster.

According to one female lecturer, ICT eases teaching; instruction is much faster; it gives students flexibility in learning and also with lecturer/teacher flexibility in giving instructions. With the introduction of ICT, significant changes in learning and teaching were observed. Students' learning was said to have become much easier.

Students are faster with their assignment, express ideas from different sources, and do not have to rely on lecturers most of the time for their knowledge. Students no longer hand in hand-written assignments and lecturers find it easier to read and probably “award better marks.

According to Means and Osin as cited in (Momanyi, Norby, & Strand, 2006) said that technology amplified what teachers were able to do with students and what they expected from the students. Technology also provided an entry point to content areas that might have been otherwise inaccessible until much later in an academic career.

2.9 The role of Computers in Education

Computer systems provide tools for collecting, organizing, processing and communicating information. Students and teachers have to learn to use the tools effectively. (Obonyo, 2013). Teachers need support in making use of new technologies to enhance their personal work before learning to use them in their teaching (Neville, 2010)

Allan Collins and his colleagues as cited in (Magambo, 2007) found that technology could be used in disciplines because it addressed what students learn cognitively and what they apply in terms of actual skills. He pointed out that the way we perceive and understand the world, the manner in which we learn, is not independent of the situation in which we do this. Situations might be said to co-produce knowledge through activity. The view that cognition and learning are situated has had an impact on instructional design. Collins proposed an instructional approach which he called “cognitive apprenticeship”. He considers learning as a process of enculturation and suggests that it may occur in a way that is similar to learning a specific trade. To view the acquisition of knowledge and skills as a process of cognitive apprenticeship

implies a three-stage model as follows. These models are: (modeling), there is a master or expert who models authentic activities which the learner is to acquire; (coaching) ,the learner will start to participate in these activities, but under the supervision of the expert; and (fading), the learner will work on his own but the expert will still be there to provide help should it be needed

A Bulgarian study by (Totin, 2006) found that there had been significant change regarding ICT in Bulgarian education, with a significant increase in teachers' computer

skills. It concludes that ICT must be used as a tool across subjects, not simply as a subject in its own right.

Friedheim and Jaffee as cited in (Momanyi, Norby, & Strand, 2006) noted that media changed the architecture of the classroom. Powerful search engines enabled students to access voluminous amounts of data, bringing unimagined experiences into the classrooms. The Web and CD-ROM provided entries to galleries of images and sounds and to archives of scholarly data preserved by diverse organizations such as museums, universities, National Archives and the Library of Congress. The authors further stated that electronic discussions extended classroom space, pushed dialogue into the hours beyond the actual scheduled class meeting.

2.10 Computers as Tools for Learning Experiences

Computer systems provide a wider range of motivating situations in which students can

develop and apply these higher level thinking skills and provide opportunities to develop deep knowledge (Lincoln, 2009). Computer systems are being used to provide learning experiences when and where they are needed (Abbas & Seyedeh,

2011) It is not necessary for all students to do the same thing at the same time. Teachers may provide students with access to software allowing students to select different learning experiences. The class does not have to be treated as one group. Individuals or groups of students may consider learning topics independently of the teacher. This is often discussed in terms of lifelong learning or learner-driven learning (Essays, 2013).

ICT is a mediator of learning; it is a component of the learning environment. While it is difficult to measure and directly demonstrate the impact of ICT on learning, it is possible to suggest possible impacts by connecting ICT as a mediator with well researched theories of learning and strategies for providing learning opportunities.

2.11 Computers as Support Tools for Goal-Directed Learning

Many classification systems have been devised to describe the roles of computers in Learning and teaching. Schanks and Cleary cited in (Westera, 2011), focus on what they call, goal-directed learning. They discuss the need to develop active learning environments in which students are encouraged to pursue intrinsically motivating goals which are related to intended learning outcomes. They suggest that computer software can be used to support this scenario. For example, they created a simulation, Sickle Cell, of a medical counselling situation which includes a blood laboratory where the goal is to "identify the clients' gene types" which is related to the intended outcome of learning about red cells and haemoglobin. They recommend a range of software tools to support goal-directed learning with scenarios. These includes: Simulation-based learning by doing tools, this are tools that will enable

people to "learn by doing" by placing them within simulated situations that replicate real world environments; and tools to enhance thinking. Computer has the power to serve as a real thinking aid by asking pertinent questions that help the user clarify his thoughts.

2.12 Networking of Technology Resources

According to Cradler and Bridgforth cited in (Kumari, 2012) networking of educational technology resources benefits students, teachers and learning institutions by: facilitating information technology, learning activities, giving ready access to software, allowing a variety of communications, increasing processing power and facilitating the management of student teaching. Networking supports the development of broader learning communities and has been shown to lead to general improvements in learning and teaching. A network may include optic fibre cable, telephone and radio (wireless) connections. It may also include audio-visual networks (e.g. digital TV) (Louis, Lawrence, Keith, & Wyse, 2010). The three categories of network scenarios to be considered in learning institutions are: Intra- networks, Inter-networks and external networks (Internet). Intra-networks (intranet) could link together classrooms with the library, staffrooms and administrative area. Inter-networks could be attached to the intra- network by use of the telephone system. Such networks would allow teachers and students to communicate between learning institutions. Some areas of education such as distance education are using network teleconferencing. The opportunity to access external networks makes a wide range of resources and data available to students and teachers (Punie, Zinnbauer, & Cabrera, A review of the impact of ICT on learning, 2006).

2.13 Problems Related to the use of Computers in the Classroom

In the ideal classroom environment, the central problems are those concerning student-

learning and the associated teaching strategies. If every class was an ideal classroom, then findings from a good deal of research would lead us to believe that computers would find an important place in most classrooms (Kumari, 2012).

The problems teachers have with the use of computers may be seen in terms of access to adequate infrastructure and support to use that infrastructure (Hennessy, et al., 2010). In a study to determine the utilization of computers in management of secondary schools in Kenya, a case of West Pokot County, Kenya, Merireng (2013) established that use of computer in school management had improved the quality of information and made the school more efficient while performing its tasks. The study revealed that accessibility by the teachers to computers resources was hampered by the number of computers. From the analysis done in chapter four, it can be concluded that computers were few and the ones available lacked adequate software programmes.

2.14 Impact of ICT on Teachers

Teachers are a key component in the learning environment and therefore the impact of ICT on teachers and the strategies they employ to facilitate the environment are critical. The impact on teachers is varied. Some general areas of impact may be identified as: Teachers have perceived risk of reduced influence on students (Cradler & Bridgforth, 2002) use of ICT requires more collaboration and more communication with administrators and parents. It requires more planning and energy requires the development of skills and knowledge of ICT and more time to engage with students,

leading to greater productivity (Ojugo, Osika, Iyawa, & Yerokun, 2013). The impact on pedagogy can be summarized as being strategies that are; more learner-centered, more collaborative, more active learning and greater access to information.

2.15 Teachers' Attitude towards ICT

Several studies provide evidence that teachers have a positive attitude towards ICT and believe in its benefits for teaching and learning. A study conducted to explore teachers' skills, perceptions and practices about ICT in second-cycle institutions in Ghana, Buabeng-Andoh (2012) found that teachers' perceptions in terms of using ICT were positive. In Slovenia, teachers think that students are more motivated using ICT in the classroom and that students' interest in subject content increases (Gerlic, 2006). Teachers in Slovenia believe that ICT offers more options for personalized and differentiated learning. In the UK, where personalizing learning with technology is high on the policy agenda, teachers also believe that ICT is strongly associated with personalized learning and are committed to the personalized learning agenda, although many find it difficult to put this concept into practice (Underwood, 2007). The French study (Société, 2006) reveals that teachers have a positive perception of ICT, and recognize its value in creating motivational frameworks and increasing pupil autonomy. A smaller numbers of studies from France (Société, 2006) reveal more reluctant teacher attitudes towards ICT.

The French study shows that positive attitudes towards ICT are linked to use and experience. The use of ICT was considered by some teachers as a threat to their profession. Those teachers who used Interactive whiteboards (IWBs) and mobile classes had a more positive attitude towards ICT. However, within this group of teachers, IWBs were being used more in traditional rather than innovative ways. In

general teachers feel that ICT plays a positive role in regard to motivation, attitude and engagement in learning, but a minority of teachers think that some specific uses of ICT (e.g. playing electronic games) distracts from the reality of the school's task. Teachers also saw the use of ICT as a time-consuming process which requires much of their free time. In Estonia study (Reiska, 2008) on the integration of ICT for teaching and learning shows that teachers rate subject skills and knowledge as most important and ICT skills as less important. Many teachers believe that the old methods are best and provide good results.

Another study looked into teachers' attitudes to the use of the Internet for their professional development. The study Charalambous cited in (Newton, Leonard, Evans, & Eastburn, 2012) revealed that Teacher considered training in the use of the internet as the most important requirement for its effective implementation in the classroom. Although the training has a great impact on the personal and professional views of a teacher, this has not translated into gains in students' learning and achievement. This is because teachers need continuous training and support for constant internet use in classroom instruction, access to resources, and provision of time, a relevant and more flexible curriculum, a national action plan, a supportive curriculum, and a quality infrastructure.

2.16 Teachers' use of ICT

In Slovenia (Gerlic, 2006) teachers mainly use ICT for lesson preparation and less for teaching purposes. In Ireland, ((Inspectorate, 2008) majority of teachers make use of ICT in lesson planning and preparation. Newly qualified teachers are more likely to use ICT for this purpose than their more experienced colleagues. However, fewer teachers were found to plan for the use of ICT in teaching and learning.

Arnseth(2007) found that there has been an increase in teachers 'time spent using computers at all levels between 2005 and 2007.

The study also found that there has been an increase in the use of computers, particularly for administrative tasks, preparatory and follow-up work, but a decrease for instruction. A Slovenian quantitative study (Gerlic, 2006) shows that teachers reported having insufficient competence to use available educational technology in classrooms. However, in some countries ICT benefits are clearly beginning to emerge. Evidence from the UK (Condie & Livingston, 2007) shows that; teachers' ICT skills have developed over the years, as have the range of hardware and software available in the classroom, Less time is needed for lesson preparation and also, ICT has had the biggest impact on teaching and learning when there are clear educational goals.

2.17 Impact of ICT on Teachers and Pedagogy

According to Omwenga (2006) ICT literacy is very different from being able to integrate technology into teaching to enhance learning. In other words, being digitally fluent means not only knowing how to use the technological tools, but also knowing how to construct things of significance with those tools. Teachers do not need to learn about technology; they need to learn how to use technology to enhance their learners' understanding and critical thinking skills.

Muriithi (2005) has argued that in Kenya like most developing countries, ICT usage is still limited to computer literacy training. She contends that the present ICT curriculum merely deals with teaching about computers and not how computers can be used to transform the teaching and learning in our learning

institutions. In her study, she says that integration should consider learning pedagogy, the pattern of student use of ICT, and the extent use of teaching and learning program. A wide range of learning technologies should be selected and incorporated into the teaching and learning program.

The Learning Resource Centre (LRC) project at Kenya Technical Teachers College was initiated in 2002 as a learning centre. The LRC focused from “learning how to use” to “using to learn”, thus allowing learners to set priorities in their learning. Whereas training in basic skills is available to all, some participants, mostly lecturers, prefer to focus on very little ICT skills (e.g. save and print) .They do not feel the need to learn how to use some software but rather use the available technology intensively to integrate the results into daily work, and acquire basic ICT skills as they become more confident and independent learners (Janssens-Bevernage, Cornille, & Mwaniki, 2005)

Lessons learned from this project indicate that it is essential to localize training materials and programmes to include a large number of local examples that are subject-related so that users can refer to practical examples for ICT-integrated teaching and learning.

According to Janssens-Bevernage, Anouk; Cornille, Bart and Mwaniki, Nyaga cited in (Magambo, 2007) in providing training for teachers, there is a need to mainstream ICT appropriately in all subject curricula. ICT should be made a priority, thereby modernising training and the curricula. This gives learners the opportunity to become critical thinkers, problem solvers, information literate citizens, knowledge managers, and team members proficient in collaborating with others. The authors further recommend that, unless teacher educator’s model effective use of technology in their

own classes, it will not be possible to prepare a new generation of teachers who effectively use the new tools for teaching and learning.

2.18 Impact of ICT on the Role of Teachers

While it is important that the role of teachers will continue to be critical, the composition of that role is likely to change. Teachers need to be more skilled in directing students through the huge quantities of rich information. If the aim is to use ICT to involve students in more cross-discipline project-based learning, this requires teachers to have an understanding of a wider range of disciplines and learning within those disciplines. Students will continue to need guidance and assessment by skilled teachers (Essays, 2013).

Student teachers are concerned about the impact of ICT on the pupil–teacher relationship, where there is a reduction in the perception of the teacher as expert and, in turn, on his or her status. Some experienced teachers have expressed similar concerns, particularly in relation to pupils being more confident and skilled in ICT than they felt themselves to be (Condie and Munro as cited in (Gianluca, Simona, Marco, Federica, & Laura, 2015).

Schacter, as cited in (Kumitta & Davis, 2004) noted that the impacts on teaching strategies will lead to changes in the composition of the role of teachers. For example, high level access to computer support for learning tends to encourage teachers to use more cooperative group work and less teacher stand-up lecturing. For the teacher wanting to facilitate the use of computers, there are two broad sets of tasks: The integration of the application into the teaching/learning program and the implementation into the classroom which involves management of the classroom environment (Essays, 2013). In integrating the application into the curriculum, the

teacher needs to make the application meaningful for the students. Lifelong learning is increasingly becoming important and will in the future occur in non-academic learning environments (Steffens, 2006). Rapid development in the field of ICT has made it possible to develop highly sophisticated technology enhanced learning environments (Steffens, 2006) Ultimately, the power of ICTs will be determined by the ability of teachers to use the new tools for learning to create rich, new, and engaging learning environments of their students.

2.19 Teachers' Skills and Competencies

It can be argued that the computer permits a much richer exploration of experience, but

demands a high level of competence on the part of the teacher to permit students to fully benefit from this experience. Teachers therefore need to determine the situations in which the computer is best able to support their programme of instruction, considering short and long term goals (Richards, 2001).

The potential of computers disturbs some teachers who are concerned about their own role and influence in the classroom (Loveless, Bryant, Margaret, Evan, & Sullivan, 2014). To help teachers to avoid developing a resistance on the use of computers, it is important that they be encouraged to reflect on the impact of ICT on their role and on that of the students. This may lead them to consider changes in their teaching practices to incorporate computer use more readily into their classrooms.

Teachers who use ICT in classrooms have to demonstrate high levels of energy, hard work and perseverance. They are required to be resourceful and overcome many barriers to make things work (Hennessy, et al., 2010). Planning learning experiences involving computers takes considerable time and demands complex scheduling and

resourcing. Teachers need to have access to resources which will supply ideas and material for different classroom applications. Institutions of learning need to subscribe to relevant journals and have publications which will enable teachers to gain ideas for classroom use (Hennessy, et al., 2010).

Török, (2008) identified key components that influence the integration of ICT by teachers. These are: Competence of ICT-use and attitude towards ICT-use; ;increased emphasis on the application of ICT in teaching and learning in teacher education ; and teacher education colleges to provide student teachers with the skills necessary to effectively use ICT in teaching and foster in them a culture of using ICT in their work.

2.20 Low Cost Resources for Teachers

According to Perraton and Creed cited in (Cawthera, 2005) providing a single computer and printer with web connectivity could be an effective tool through which to improve the quality of education by enhancing teacher effective Even where full connectivity is not possible, the provision of data casting or of information on CDs could be a low cost option which greatly enhances the resource base of teachers. While such provision must also include training and maintenance, it is likely to be cost effective in comparison to the current state of zero resource provision experienced by many teachers in rural institutions.

There are many ranges of software tools which can be used to support the development of higher level thinking skills such as application, analysis and synthesis .According to Committee on Developments in the Science of Learning (Bransford, Brown, & Cocking, 2000), tools can be used to analyses data, present data, link data or information, present information in different formats, simulate environments and

conditions and support interactive communications .This enables teachers to consider providing a range of activities to assist students to become critical thinkers, designers and problem solvers.

2.21 Impact of ICT on the Curriculum

The impact of ICT on curriculum content may be looked at in terms of: Declarative knowledge ‘knowing that’, and Procedural knowledge ‘Knowing how’. The quantity of declarative knowledge is growing rapidly, fuelled by the efficiency of ICT. The skills and knowledge required in society and workplaces is different now from when institutions were first established. Rather than students requiring specific bodies of declarative knowledge, they require very flexible and general sets of procedural knowledge (Punie, Zinnbauer, & Cabrera, A review of the impact of ICT on learning, 2006).The use of ICT impacts on both the ‘what’ and the ‘how’ of the curriculum, a typical example of dual impact.

New technologies challenge the traditional conceptions of both teaching and Learning.ICT is transforming the present teacher-centered and text-bound classrooms into student-centered interactive knowledge environments. It is therefore recommended for schools and learning institutions to move toward a new paradigm of learning that can accommodate and utilize the new technologies in learning / teaching process as UNESCO cited in (Magambo, 2007). However, as UNESCO notes, most teaching/learning institutions still lack a general theoretical framework from which to develop criteria and guidelines for improving teacher education.

Impact of ICT on Learning

Using ICTs in teaching and learning have created changes in the education and training for both the educator and the learner. Education systems worldwide are calling for a revision of the learning and teaching processes so as to accommodate the new media as well as optimise learning in a fast changing world. Traditional forms of teaching and learning are changing to incorporate new concepts and lifelong learning (Magambo, 2007). There is relation between using ICT and student teaching.

Research findings of positive impacts when ICT is used appropriately are; differences in attainment associated with the greater use of ICT were clearly present in More than a third of all comparisons made between students expected and actual scores. Given the right conditions for access and use, significant gains in student learning are recorded with ICT. Study findings have shown that effectiveness in the use of ICT to support learning is a function of the curriculum content and the instructional strategy. When appropriate content is addressed using appropriate strategies, students and teachers will benefit (Punie, Zinnbauer, & Cabrera, 2006).

2.23 The Relevance of Technology on Learning

Most educators in the US use technology with the main aim of creating puzzles, delivering instructions, assessing student's progress and producing reports. The responsibility for realizing the potentials of technology to improve education practice was placed on the classroom teacher; however, the success of the integration of technology did not lie with the teacher alone but teachers with technology (Momanyi, Norby, & Strand, 2006). The authors observed that teachers and educational reformers rarely recognized that innovative uses of technology required a revision of educational policy and practice if technology was going to have an impact on the

education system. They noted that using technology could change the way teachers taught.

Technology supported more student-centred approaches to instruction so that students conducted their own inquiries and engaged in collaborative activities while the teacher assumed the role of a facilitator (Jill, Sharon, & Peter, 2014)

2.24 Impact of ICT on Learning Outcomes

An Italian study (Nesler, 2004), a Dutch study (Grimshaw, Dungworth, McKnight, & Morris, 2007) and research from the UK (Somekh, 2007) are among the few studies which provide concrete evidence, based on using control groups, of the impact of ICT on learning outcomes. The Italian study (Nesler, 2004) on a curricular proposal for the introduction of ICT, based on a sample size of 1000 teachers and 3000 pupils, identifies the positive impact of ICT in the curriculum on performance and skills. The study found that ICT improves pupils' performance, provided software is used appropriately and coherently in terms of curriculum objectives.

The study on ICT in Hungary (Grimshaw, Dungworth, McKnight, & Morris, 2007) proves that in ICT-rich learning environments with developed teaching programmes, significant developments in student's performance could be achieved, even for those starting from a very poor level.

The research from the UK (Somekh, 2007) found that interactive whiteboards can help pupils grasp abstract ideas through visual representation. These visuals also hold pupils' attention in lessons, and work well for learners who find

interpreting text difficult. The more experience the teacher had of using the interactive whiteboard, the greater the likelihood of positive attainment.

In other studies, Network of Multi-grade Education (HEMED) project (Kárpáti, 2007) revealed that there are improved skills levels, improved student motivation and attendance when ICT is used for learning purposes. ICT is perceived to have a positive impact on the learning situation, resulting in better understanding and more active and differentiated learning. The e-learning Nordic study showed that pupils participate more actively in learning when ICT is used (Balanskat & Kefala, 2006)

2.25 Barriers to the use of Technology in Education

There are a number of barriers hindering access and use of technology in Kenya including: high levels of poverty; limited rural electrification; costs associated with ICT equipment; high cost of internet services; and inadequate infrastructure (Kafu, 2006). A number of important physical, cultural, socioeconomic and pedagogical factors hindering the use of ICT by teachers and students in sub-Saharan Africa include: poor technology infrastructure and insufficient and inappropriate software (Hennessy, et al., 2010). Norton and Gonzales cited in (Momanyi, Norby, & Strand, 2006), noted that the integration of technology did not lie with the classroom teacher alone, but that difficulties in integrating technology centred on the inadequacy of traditional teaching models that had existed for decades. Means and Olson cited in (Essays, 2013) argue that an important neglected reason why computers have not altered curriculum in the manner predicted by some educators is the influence of traditional teaching methods and routines of practicing teachers.

Barriers to effective technology integration from a teacher perspective include: Low teacher expectations and a lack of clear goals for ICT use in schools; A lack of teacher collaboration and pedagogical support, as well as a lack of experience among cooperating teachers; Insufficient time to master new software or integrate ICT during a class period; A lack of specific knowledge about technology and how to combine it with the existing pedagogical content knowledge to support student learning; Pressure to improve scores on national examinations; A lack of recognition and encouragement of the timely and effective use of ICT; A lack of in-service training on the use of ICT ; Classroom management with large class sizes ; A lack of motivation, and technical and financial support ; and Lack of specific and definite ideas about how integrating technology into instruction will improve student learning as noted by Hutchison and Reinking cited in (Schulze, 2014).

Several strategies for dealing with these barriers have been suggested by Hutchison and Reinking cited in (Schulze, 2014). These are; Schools are encouraged to: Provide professional development activities related to technology to update teachers' skills and knowledge, and offer technical support when needed; Support partnerships that help teachers share effective technology practices and experiences ; Provide workshops that allow teachers to reflect upon effective strategies for technology integration into instruction and unveil issues that are central to understanding the process of technology integration into instruction; Augment curricula with technology-enhanced materials; Provide enough freedom for teachers in selecting and covering curriculum materials; Provide effective, timely, and continuous training to improve ICT skills and manage a technology-rich classroom; Encourage positive attitudes about the significance of integrating ICT into instruction ;and Provide adequate technical support.

2.26 Challenges Facing Teacher Education in the 21st century

There has been no attempt to make teacher education responsive to the emerging trends

in the society in general and education in particular. One of the challenges facing the teacher education in the 21st Century, in Kenya, is to produce a teacher who can apply modern information technologies in teaching (Kafu, 2006). Lecturers need to be competent enough to operate in this digital era so as to benefit from these innovations and the resources for developing, adopting and adapting to these emerging technologies in teaching.

The Commonwealth of Learning (COL) report (Hennessy, et al., 2010) pointed out that the high cost of training teachers to use ICT and the shortage of public funds to devote to this are fundamental challenges to be overcome before ICT is fully integrated into the education system. Borg, (2005) reviewed how teachers use ICT across the curriculum. The study revealed that most teachers still require further training in order to master enough confidence to take up the ICT challenge on their own initiative and that some form of monitoring is required to ensure proper use of ICT by each and every class teacher. In the light of these findings, range of ICT support initiatives was proposed as follows: one to one In-Class Teacher Training Programme to train teachers in the use and application of ICT across the curriculum; creation of Resource Centres to provide hardware, software and pedagogical support to learning institutions.

2.27 Challenges Facing Teachers in the use of ICT in Teaching

Having ICT-literate and confident teachers is clearly a prerequisite for integrating any form of ICT into schooling. Teachers' ICT proficiency and knowledge for supporting

teaching and learning has remained limited in sub-Saharan Africa (Hennessy, et al., 2010).

A study in Singapore by Teo cited in (Ahmed Ghazi, Hafeez, & Safdar, 2013), based on the observations of ICT-mediated lessons and face-to-face interviews with teachers, ICT heads-of-department and school principals, identified six major barriers to teacher ICT-integration: inadequate appointment of technical support staff; inadequate appointment and training of student ICT helpers; lack of sufficient time for teachers to prepare for ICT-mediated lessons; insufficient collaboration among teachers in preparing ICT-mediated lessons; lack of support provided by school leaders in addressing teachers' ICT concerns; and insufficient training, demonstrations or advice for teachers on how to incorporate ICT into classroom instruction.

Tremendous efforts were exerted putting computers in classrooms across America with little focus on training teachers to use them (Momanyi, Norby, & Strand, 2006). According to the authors, a substantial number of teachers reported that they did not use computers regularly for instruction because a majority felt they were inadequately prepared to use technology resources. Even though using technology could change the way teachers taught, teachers lacked understanding of curricular uses of technology.

Kaisti, Hämäläinen and Järvelä(2007)looked at the impact of educational use of ICT. The study found that teachers use ICT daily in the planning and preparation of lessons but most of them lack the pedagogical vision to integrate it effectively in the teaching process. A small number of teachers do not even consider ICT as part of the learning process. They describe ICT as an alternative way of organizing teaching,

completing tasks that can be carried out using traditional methods or as an entertainment tool when other tasks are complete. Similar findings from the French study (Société, 2006) reveals that for the majority of teachers, ICT helps to organize work but ICT is pedagogically under used, and teachers have no clear vision of how ICT can support the learning process.

Ndibalema (2014) in his research done to establish teachers' attitudes towards the use of ICT as a pedagogical tool in secondary schools in Tanzania, he established that that teachers had positive attitudes towards the use of ICT as a pedagogical tool but they did not integrate it in their teaching effectively. Also, low familiarity with ICT use as a pedagogical tool among teachers was found to be a problem. Karagiorgi and Symeou(2006) established certain barriers to ICT implementation. These barriers include overloaded syllabus that burdens teachers and restricts time for ICT use in subject teaching, lack of clear objectives for how to integrate ICT in the classroom and lack of training in ICT for teachers.

2.28 ICT in Education in Sub-Saharan Africa

According to Information for Development program (InfoDev) as cited in (Magambo, 2007), research on Use of Information and Communications Technologies (ICTs) in teacher education in Sub-Saharan Africa: case studies of selected African universities, the researcher notes that, in recent years, there have been numerous efforts and resources directed at improving teachers' competence and confidence in using ICT effectively in classroom teaching and learning. Ministries of education are developing policies on ICT in education and running in-service programmes for practicing teachers. Teacher-training institutes are incorporating ICT education in their pre-service programmes.

The Tanzania ICT policy envisages that curricular review should go hand in hand with

development of content, hence transforming the educational content to e-content. The policy for ICT in education in Tanzania goes beyond the level of infrastructure and access to the realms of integration of content and instruction. The Survey of ICT and Education in Tanzania by (Hare, 2007) indicated that only a few private institutions around urban settings especially in Dar- es -Salaam had access to ICT by then.

The Ministry of Education, Science and Technology in Kenya, has stressed the government's commitment in promoting the usage of ICT in education. According to the report in the ICT in Education options paper(MoEST, 2005) the vision of MoEST is to facilitate ICT as a universal tool for education and training. In order to achieve this vision, every educational institution, teacher, learner and the respective community should be equipped with appropriate ICT infrastructure, competencies and policies for usage and progress. It calls for transforming teaching and learning to incorporate new pedagogies that are appropriate for the 21st century.

2.29 Importance of ICT in Technical Institutions in Kenya

The use of ICT in Technical and Vocational Education and Training (TVET) can provide opportunities for developing more innovative ways to bridge the gap between institutional laboratories and the real practice of the workplace (Latchem & Jung, 2009). In essence, ICT are engines for growth and tools for empowerment and they can have profound implications for education change and socio-economic development (Hooker, 2010). In Kenya, Technical education and training is seen as the core strategy for building human capital for socio economic development, and for enhancing its ability to create employment, innovation and wealth. The Government

of Kenya is aware of the potential benefits of ICT use in Education. This is evident from the official statements in national plans and policy documents (GOK, 2007) and the National ICT for development policy 2006. The improvement of educational systems and increased educational attainment are primary to countries' preparation for global technology-based changes in all sectors (Hennessy, et al., 2010).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the methodology, procedures and modalities used in data collection. It also covers research design, determination and identification of the population sample size, sampling design, sampling procedure, the instruments of data collection, validity and reliability of data collected, sources of data, methods of collecting data and methods of analysing the data.

3.2 Rational for the Methodology

The researcher embraced mixed-method approach (Creswell & Garrett, 2008). Such methodology was suitable for the study because of its nature of inquiry that it sought to find. Attributes of this method favourable to this research are: Allows data collection to involve any technique available to researcher; interpretation is continual and can influence stages in the research process; multiple ways can be used to explore the research problems and thus overcome the limitations of a single design; research problems can become research questions; qualitative data can be easily generalized; and this method is helpful in designing and validating research instruments.

3.3 Research Area

This study was conducted in technical institutions in Western Kenya. The Western Kenya covers the following towns: Eldoret, Kisumu, Bungoma and Kitale. The technical training institutions included: Kisumu Polytechnic, Eldoret Polytechnic, Rift

Valley Technical Training Institute, Sangalo Institute of Science And Technology, Kaiboi Technical Training Institute and Kitale Technical Training Institute.

3.4 Research Design

Survey design was used to conduct this study. According to (Kothari R. , 2004) surveys are used to systematically gather factual quantifiable information necessary for decision making. Surveys are efficient methods of collecting descriptive data regarding the characteristics of populations, current practices and conditions or needs (Kothari C. R., 2005). They are also helpful in gathering information from large cases by employing use of samples hence reduces the costs.

The descriptive survey approach was chosen for the present study, because it seeks to gain insight into a phenomenon as a means of providing basic information in an area of study (Addo, 2006). The strength of the survey method is also evident in its ability to study, describe, explore and analyse relationships among geographically gathered subjects. Kerlinger as cited in (Manyali, Obara, & Joash, 2015) supports the use of surveys in educational fact finding because they provide a great deal of information which is accurate. Furthermore Cohen and Manion as cited in (Korpel, 2005) stated that the intention of survey research is to gather data at a particular point in time and use it to describe the nature of existing conditions. Since the aim of this study was to investigate the effects of information and communication technology for teaching purposes in technical institutions, a survey design was found to be most suitable for the study.

This Research design is the overall strategy for achieving the research objectives. It is a blue print for conducting the research (Vilakati, 2009). It is a conceptual structure within which research is conducted. It formed the arrangement of conditions for the

collections and analysis of the data in a manner that aims to combine relevance to the research purpose (Kothari R. , 2004). Therefore, it focused on the impact of ICT in technical institutions with regard to: students, learning and the learning environment; teachers and teaching strategies; organizational change; and other areas relevant to teaching and learning in Technical training institutions in Kenya.

3.5 Study Population

There are two levels of population, namely target population and accessible population. Target population refers to the number of subjects (Willis, Morral, Kelly, & J, 2005). Accessible population is part of the target population which the research can reach (Willis, Morral, Kelly, & J, 2005). The target population for the study comprised of administrators, lecturers and Technicians of technical institutions. There are over thirty formal technical institutions in Kenya. The western region covered in this study has about ten technical institutions. Systematic random sampling technique was used to select six technical institutions from the western region. Therefore, the study population targeted 308 respondents from the six technical institutions. The study area is purposively selected after considering factors such as accessibility and the significance of the study information to the researcher and other stakeholders. Therefore it is expected that these target population would provide the required sample size for the study. This is shown in table 3.1

Table 3.1 Target population

	Category	Target population
1	Lecturers of technical institutions	200 out of 482
2	Administrators of technical institutions	74 out of 100
3	Technicians of Technical Institutions	34 out of 72
	Total	308 out of 654

3.6 Sampling Procedure and Sample Size

Sampling is a procedure of selecting a part of population on which research can be conducted, which ensures that conclusions from the study can be generalized to the entire population. The researcher made use of stratified random and Systematic random sampling technique. Stratified random sampling is the process of selecting a sample in such a way that identified subgroups in the population are represented in the sample in the same proportion as they exist in the population (Omare & Erickson, 2015) Stratified Random sampling technique was used to select samples of 200 lecturers, 74 administrators and 34 technicians from the six technical institutions chosen. Assuming that, on average there are 482 lecturers, 100 administrators and 72 Technicians from the six technical institutions. Systematic random sampling technique involves a random start and then proceeds with the selection of every k^{th} element from then onwards. In this case k is the population size or sample size. This type of probability sampling is easy to implement and stratification induced is efficient (Omare & Erickson, 2015). Systematic random sampling technique was used to select six technical institutions. In view of the large number of population, this work selected a sample size that was adequately representing the target population.

3.7.0 Research Tools and Instruments of Data Collection

The research tools used to collect the data for the study were questionnaires, interviews, observations and document analysis since the data is both qualitative and quantitative. The selection of these tools was based on the nature of the data to be collected, the objective of the study and the time available.

3.7.1 Questionnaires

The construction of questionnaires was based on the research objectives. Questionnaires are justified on the basis that they are free from the researcher's bias, they allow respondents to answer in their own words and they give enough time to the respondent to go through the questions and can reach as many respondents as possible. The method also enables the researcher to sample respondents who are not easy to approach.

Since the research design is a survey, the researcher used questionnaires presented in the likert scale method for lecturers, administrators and Technicians. In social science research, the most commonly used instruments are questionnaires (Orodho & Mwaniki, 2014). The questionnaires were used to collect information from the population. Yes and No responses provided direct answers to the closed ended questions while questions that required detailed opinions were left open ended to enable respondents to provide their detailed opinion. Different scoring formats were used depending on the nature of items on the questionnaire of five point likert scales: Strongly Agree (SA), Agree (A) Undecided (U), Disagree (D) and Strongly Disagree (SD), alternatively, Very good (VG), Good (G), Not sure (NS), Bad (B) and Very bad (VB). These were awarded 5, 4, 3, 2 and 1 respectively. 5 and 4 indicates positive attitude, 3 indicates neutral attitude and 2 and 1 indicates negative attitude. Questionnaires were used to gain general picture of effects of ICT for teaching purposes in technical institutions. 234 questionnaires were administered. Participants in this study comprised of lecturers, administrators and Technicians of technical institutions.

3.7.2 Interviews Schedules

The researcher employed interview methods on areas where questionnaires would not have captured the responses to satisfactory level. They were also used to strengthen the information from the questionnaires (Kothari C. R., 2005). The people interviewed were mostly administrators. Most of the questions that were captured in the questionnaires were also used in the interview schedule.

Interview protocols

The technique calls for contact between the researcher and the study subject (Kothari R. , 2004) the researcher used the following interview techniques:

1. Short introduction
2. Explain the purpose of the study
3. State the usefulness of the information collected
4. Re-affirm confidentiality of the information and anonymity of the names

3.7.3 Observation Schedule

The observation was done to compliment the information that was captured by the questionnaires. Observation schedule focused on information that is different from interviews or questionnaires. As a technique for gathering information, the observation method relies on a researcher's seeing and hearing and recording these

observations, rather than relying on respondents' self-reports responses to questions (Erradu, 2012). Therefore these involved observations of classrooms learning activities, ICT laboratories and the environmental setting in each selected technical institutions. The researcher was able to make high inference observations, where judgments were made basing on observed behaviours. Objective of this exercise was

to

check for the adequateness of various ICT resources used in teaching. These were used to provide feedback on how ICT influenced teaching in various technical institutions.

Observation forms were prepared with characteristics/parameters to be observed about

the ICT resources. The observation was made during lesson in which the researcher rechecked and marked against the characteristic investigated on the observation form.

In this case, the researcher obtains first hand data. The researcher liaised with the subject lecturer via HODs for permission into the computer laboratories and lecturer rooms during the lesson.

3.8 Validity and Reliability of the Research Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda & Mugenda, 2003) .To verify reliability of the instrument, the questionnaires were tested for reliability by using Cronbach's coefficient alpha (α) to determine the internal consistency of the items. This is a method of estimating reliability of test scores by the use of a single administration of a test.

Cronbach coefficient alpha provided good measures of reliability because holding other factors constant, the more similar the test content and conditions of administration are, the greater the internal consistency of reliability. The items were considered reliable if they yielded a reliability coefficient of 0.70 and above. This figure is usually considered respectable and desirable for consistency levels (Momanyi, Norby, & Strand, 2006).

In this study, the reliability was established through the pilot-test whereby some items were adding and some were dropping to enable modification of the instrument. After the modification, their instruments were again pilot-tested in Olessos Technical Training Institute in order to determine the questionnaires internal consistency and to highlight on any difficulties that the respondents were likely to face when responding to the questions. Split half technique was used to obtain X and Y scores. X distribution took even numbered items, while Y distribution took odd numbered items. The interview schedules were pilot tested by using two teachers from two different Technical institutes. This was meant to establish the construct validity of the schedules. Generally, the purpose of piloting the instruments was to establish the clarity of meaning and comprehensibility of each item in the research instruments. In addition, the researcher and the supervisors assessed the relevance of the content in the research instruments. The comments and suggestions of the supervisors were incorporated in the improvement of the validity of the instruments.

3.9 Data Collection Procedures

Data collection was conducted using questionnaire as the main data collection tool. The questions were subdivided into sections to capture the response and details that were required as per the objectives. The researcher collected data from the selected respondents after receiving permission from the Moi University authority to carry out research in the identified area of study. In addition, the researcher obtained an official government research permit from the Office of The President. She was issued with an introduction letter from the District Commissioner's office seeking to carry out a research within the selected districts. The researcher thereafter notified the Principals

of the selected technical institutions the intention to conduct the study and the intended dates.

The researcher took the questionnaires personally to the selected respondents where the purpose of the study and its potential benefits to them were explained. Finally the researcher assured them that the information provided was only used for the purpose of the study and would be maintained in strict confidence. After familiarization, data was then collected from the respondents using the three mentioned instruments. The completed instruments were verified and collected from the respondents within a period of ten days from the day of distribution.

3.10 Data Analysis

After data collection, responses from all items were crosschecked to facilitate coding and processing for analysis using Statistical Programme for Social Sciences (SPSS v.11.10) computer package. Statistical analyses of data were done by descriptive statistics employing the measures of central tendencies, frequency distributions, difference between a set of observed frequencies and a corresponding expected frequency. Other models such as cross tabulations and one-way analysis of variance (ANOVA) were used to analyse the variation both within and between various groups. Descriptive statistics gave a summary of the characteristics of the populations from which samples were drawn.

3.11 Ethical Considerations

Permission to carry out the study was sought from the School of education in the Department of Technology Education of Moi University and the target population/group. This was done through letters which were written to technical

institutions that were to take part in the research. The nature and the purpose of the research were explained to the respondents by the researcher. The participants were assured of anonymity and confidentiality. They were free to withdraw from the study at any time if they wished. No names or person identification numbers were reflected on the questionnaires except the numbering of questionnaires, which was done for purposes of identification of data during data editing. The results of the study would be available to technical institutions in western Kenya, Ministry of Education Science and Technology (MoEST) and also to those participants who are interested in knowing the results.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The chapter presents and analyses data gathered from the three categories of respondents; lecturers, administrators and technicians of technical institutions using the tools discussed in the previous chapter.

4.2 Characteristics of the Participants

This sample included participants equally distributed from the technical institutions of western Kenya. The results are presented in table 4.1

Table 4.1: Statistics of the participants training experience

Number of participants	Minimum years	Maximum years	mean	Std. dev
200	2	21	12.000	3.903

An evaluation of the participants training experience indicated that the minimum training experience was two years with a maximum teaching experience of 21 years. The average teaching age was 12 years with a standard deviation of 3.903.

The ICT Infrastructure

To determine the adequacy of ICT infrastructure in technical institutions, the researcher examined the questionnaire responses pertaining to ICT infrastructure from each of the 200 participants. The results are presented in table 4.2

Table 4.2: The ICT Infrastructure

Type of infrastructure	Number of respondents	Percentage response
Instructional	117	38%
Communication	77	25%
Computing	62	20%
Institutional	52	17%
Total	308	100

The result shows that the main ICT infrastructure was the instructional infrastructure with 38% responses. This was followed by communication (25%); computing (20%); and institutional (17%).

4.4 Uses of ICT for Teaching in Technical Institutions

To determine the uses of ICT for teaching, questionnaire responses pertaining to the use of ICT for teaching in technical institutions for each of the 200 participants (lecturers) were examined. Results are shown in table 4.3

Table 4.3: Responses on the uses of ICT to accomplish various objectives

Uses of ICT to accomplish various objectives	Number of respondents	Percentage response
To create instructional materials	65	32.5%
To gather information	35	17.5%
To access modern teaching materials	25	12.5%

To communicate with colleagues	25	12.5%
To carry out a research	20	10%
For multimedia presentations	20	10%
For administrative record keeping	10	5%
Total	200	100%

The result shows that a large proportion (32.5%) of the lecturers indicated that ICT is used to create instructional materials; 17.5% said that it is used to gather information; 12.5% said it is used to communicate with colleagues; another 12.5% indicated that it is used to access modern teaching materials; 10.0%, said that it is used to access research and best teaching practices for training; another 10.0%, for multimedia presentations; and finally, 5.0% of the lecturers indicated that ICT is used for administrative record keeping.

4.5 Indicators of ICT Effectiveness in Technical Institutions

An examination of the participant's responses pertaining to the indicators of ICT effectiveness in technical institutions revealed the results presented in table 4.4

Table 4.4: Responses on indicators of ICT Effectiveness in Technical Institutions

Indicators of ICT effectiveness	Number of respondents	Percentage response
Increased grades and test scores	77	25%
Reduced failure rate	55	18%
Storage of fundamental/essential information	49	16%

Increased satisfaction of the lecturers	43	14%
Increased opportunity for exchange of information between lecturers and trainees	37	12%
Revelation and correction of misconceptions	31	10%
Trainee evaluation	16	5%
Total	308	100%

The results show that the main indicator of ICT effectiveness is increased grades and test scores (25.0%). Other indicators identified includes: reduced failure rate (18%); storage of fundamental/essential information(16%); increased satisfaction of the lecturers (14%); increased opportunity for exchange of information between the lecturers and trainees (12%); revelation and correction of misconceptions (10%); and trainee evaluation (5%).

4.6 The impact of ICT on the Training process in Technical Institutions

An examination of the questionnaire responses pertaining to the impact of ICT on the training process in technical institutions for each of the 200 participants (lecturers) revealed the results shown in table 4.5.

Table 4.5: Responses on the Impact of ICT on the training process

Training process item	Number of respondents	Percentage response
Access to worldwide resources	60	30%
Ease of communication, generation and presentation of data	50	25%
Analysis and modelling of realistic examples	10	5%
Capability to visualise, organise and analyse data	30	15%
Provision of immediate feedback to the trainer	50	25%

Total	200	100%
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From the result it is clear that a high percentage of respondents (30% and 25%) indicated that users to are trained in ease of communication, generation and presentation of data and to access worldwide resources. Few respondents (5%) indicated that users are trained in analysis and modelling of realist examples.

4.7 Challenges Facing Lecturers in the use of ICT for Teaching in Technical Institutions

To determine if there where challenges facing lectures in the use of ICT for teaching, an examination of the questionnaire responses pertaining to some of the challenges that could be facing lectures in the use of ICT in teaching was analysed .The results are shown in table 4.6.

Table 4.6: Challenges facing lecturers in the use of ICT for teaching

Challenges facing lecturers in the use of ICT for teaching	Number of respondents	Percentage response
Most lecturers are not computer literate	22	16.42%
Inadequate ICT resources	24	17.91%
unavailability of internet services	33	24.63%
Lack of qualified Technicians to man computer	6	4.48%
lack of in- service training program for lecturers	15	11.19%
Overloaded syllabus	34	25.37%
Total	134	100%

From table 4.6, it shows that majority of the respondents (25.37%) think that Lecturers do not use ICT for teaching because of overloaded syllabus, (24.63%) because of unavailability of internet services, (17.91%) because of inadequate ICT resources, (16.42%) because most lecturers are not computer literate.

4.8 Research Question One:

Does ICT infrastructure have an impact on the quality of examination results?

In investigating this research question, the researcher sought to establish if ICT infrastructure of a particular technical institution has an impact on the quality of examination results. Responses from lecturers, administration officers and Technicians to the various questions are reflected in table 4.7

Table 4.7: Responses on the research question one

Participates	Frequency			Total
	Yes	NO	Undecided	
Lecturer	140	50	10	200
Administrators	60	10	4	74
Technician	20	8	6	34
Total	220	68	20	308

Table 4.8: Descriptive statistics for lectures

		Frequency	Percentage	Cumulative Percentage
Valid	Yes	140	70.0	70.0

No	50	25.0	95.0
Undecided	10	5.0	100.0
Total	200	100.0	

From the 200 sampled lecturers, 140 (70 %) of them were of the opinion that ICT infrastructure has an impact on the quality of examination results while 50 (25%) of them disagreed and 10 (5 %) were undecided .From the responses, it implies that ICT infrastructure has an impact on the quality of examination results.

Table 4.9: Descriptive statistics for administrators

	Frequency	Percentage	Cumulative Percentage
Yes	60	81.1	81.1
No	10	13.5	94.6
Undecided	4	5.4	100.0
Total	74	100	

From the 74 sampled administrators, 60 (81.1%) of them were of the opinion that ICT infrastructure has an impact on the quality of examination results while 10 (13.5%) of them disagreed and 4 (5.4%) were undecided .From the responses, it implies that ICT infrastructure has an impact on the quality of examination results.

Table 4.10: Descriptive statistics for technicians

	Frequency	Percentage	Cumulative
	Frequency		Percent
Yes	20	58.8	58.8

No	8	23.5	82.4
Undecided	6	17.6	100.0
Total	34	100.0	

Technicians were 34 in total. 20 (59%) of them were of the opinion that ICT infrastructure has an impact on the quality of examination results while 8 (24%) of them disagreed with it and 6 (18%) were undecided. From the responses, it means that ICT infrastructure has an impact on the quality of examination results.

From the findings, Lecturers, administrators and Technicians had similar opinions that

ICT infrastructure has an impact on the quality of examination results in technical institutions.

4.9 Research Question Two:

What is the impact of the use of ICT resources by lecturers on the quality of examination results in technical institutions?

In investigating this research question, Data from questionnaires, observations and interviews were analysed using T-test. Responses on the impact of the use ICT resources by lecturers on the quality of examination results are reflected in table 4.11

Table 4.11: Responses on the research question two

Groups	1	2	3	4	5	6	7	8	Total
Teaching Without using ICT	11	11	10	12	10	6	7	7	74
Teaching with ICT	17	10	19	15	18	19	18	10	126
Total	28	21	29	27	28	25	25	17	200

Table 4.12 : t-Test: Paired Two Sample for Means

	TEACHING WITHOUT ICT	TEACHING WITH ICT
Mean	9.25	15.75
Variance	5.071428571	14.21428571
Observations	8	8
Pearson Correlation	-0.143018826	
Hypothesized Mean Difference	0	
Df	7	
t Stat	-3.945350361	
P(T<=t) one-tail	0.002782527	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.005565054	
t Critical two-tail	2.364624252	

At $\alpha = 0.05$

From table 4.12, the critical value is 1.895

Since $1.895 > -3.945$; There is enough evidence to show that the use of ICT resources for teaching has a positive impact on quality of examination results. Lecturers who teach using ICT and those who teach without ICT resources had the same opinion that teaching using ICT resources has appositive impact on the quality of examination results.

4.3.3 Research Question Three

What is the impact of teaching using ICT on syllabus coverage in technical institutions?

In investigating this research question, Data from questionnaires, observations and interviews were analysed using Analysis of Variance (ANOVA) (F Test).The respondents were Lecturers, Administrators (HOD, Examinations officer, registrars and principals) and technicians. Responses are reflected in table 4.13

Table 4.13: Responses on the research question three

Groups	Lecturers	Administrators	Technicians	Total
with ICT	15	6	5	N1=26
without ICT	10	6	2	N2= 18
Total	25	12	7	44

Table 4.13 shows the number of respondents factored by the occupation. The total number of those who answered the question on teaching with ICT was 26, while 18 participants answered the question on teaching without ICT.

Using the data in table 4.7 (Statistical analysis -teaching with ICT and teaching without ICT), the results in table 4.14 were computed as follows:

Table 4.14: Statistical Output

SUMMARY					
Groups	Count	Sum	Average	Variance	
lecturers	2	25	12.5	12.5	
administrators	2	12	6	0	
technicians	2	7	3.5	4.5	

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	86.33333	2	43.16667	7.617647	0.066729	9.552094
Within Groups	17	3	5.666667			
Total	103.3333	5				

Since $7.618 < 9.55$, there is enough evidence to support the claim that the variances are different. Teaching using ICT has positive impact on syllabus coverage

4.3.4 Research Questions Four:

Are there challenges facing lecturers using ICT in teaching in technical institutions?

In investigating this research question, Data from questionnaires, observations and interviews were analysed using ANOVA (F Test). Lecturers and administrators were interviewed based on the research question. The results were put in three groups; first group were those who agreed that they face challenges, group two who said that they do not face challenges and third group who were undecided.

Table 4.15: Responses on the Research Question Four

Group of participate	Group (A) Yes there are challenges (x₁)	Group (B) No challenges (x₂)	Group(C) Neutral (x₃)
Electrical dept.	10	6	2
Mechanical dept.	16	4	6
Business dept.	18	10	8
Civil Eng. Dept.	12	12	4
ICT dept.	0	6	2
Entrepreneurship	10	2	6
Total	66	40	28

At $\alpha = 0.05$, is there a significant difference in the mean for possible challenges facing lecturers in teaching using ICT for each group of respondents?

In table 4.15, responses indicates that five of the departments face challenges in the use of ICT for teaching while the ICT department does not face challenges when teaching using ICT.

Statistical output of the ANOVA test is as shown in table 4.16

Table 4.16: ANOVA: Single Factor

SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
X ₁ (there are challenges)	6	66	11.00	39.60		
X ₂ (there are no challenges)	6	40	6.67	13.87		
X ₃ (neutral)	6	28	4.67	5.87		

ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	125.7778	2.000	62.889	3.180	0.071	3.682
Within Groups	296.6667	15.000	19.778			
Total	422.4444	17.000				

Since $3.18 < 3.682$, there is no significant difference among the means. This shows that there are challenges facing some lecturers in the use of ICT in teaching in technical institutions. From the data, these challenges do not affect lecturers in the ICT department.

4.5 Summary of the Findings

- i. ICT infrastructure has an impact on the quality of examination results.

- ii. There is a relationship between the qualities of results produced by lecturers and the use of ICT in teaching. Using ICT resource in teaching has an impact on the quality of examination results.
- iii. Lecturers, Administrators and technicians had similar opinions with regard to the impact of teaching using ICT and teaching without using ICT on syllabus coverage. Teaching using ICT has a positive impact on syllabus coverage.
- iv. There are challenges facing lecturers using ICT in teaching in technical institutions. These challenges do not affect lecturers in the ICT department.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The findings of this study are summarized here and then discussed in line with the research objectives. Conclusions are then drawn based on the findings and recommendations are thus made in view of the conclusion.

5.2 Discussion of Findings

The main purpose of this study was to find out the impact of using ICT in dissemination of knowledge, skills and expertise. This section therefore discusses the research findings presented in chapter four.

5.2.1 The impact of ICT infrastructure on the quality of examination results in technical institutions

The ICT infrastructure identified in this study includes: Instructional, communication, computing and institutional. The research findings revealed that ICT infrastructure has a positive impact on the quality of examination results. This finding concurs with that of Perraton and Creed cited in (Cawthera, 2005) who said that providing a single computer and printer with web connectivity could be an effective tool through which to improve the quality of education by enhancing teacher effectiveness. Interactive whiteboards can help pupils grasp abstract ideas through visual representation (NERF, 2005).

An Italian study (Nesler, 2004) on a curricular proposal for the introduction of ICT found that: ICT improves pupils' performance, provided software is used appropriately and coherently in terms of curriculum objectives. The study on ICT in Hungary (Verhallen, Bus, & De Jong, 2004) proves that in ICT-rich learning environments with developed teaching programmes, significant developments in student's performance could be achieved. Cradler cited in (Hennessy, et al., 2010) noted that for effective use of ICT in education, education system must be committed to providing the infrastructure of hardware and software.

5.2.2 The Impact of ICT Resources used by Lecturers on The Quality of Examination Results in Technical Institutions

The use of ICT resources for teaching has a positive impact on quality of examination results. From the research findings, it was observed that lecturers using ICT resources had better results than lecturers who did not use ICT resources when teaching. Some of

the ICT resources included use of projectors in teaching, extensive use of internet as a research centre by both students and lecturers among other resources. The findings agree with that of (Cawthera, 2005), who noted that providing computers in school based education can improve either the quality or the quantity of education in a cost effective way. He observed that allowing students to use computers does improve their performance.

Research findings of positive impact when ICT is used appropriately are; differences in attainment associated with the greater use of ICT were clearly present in more than a third of all comparisons made between students expected and actual scores (Abbas & Seyedeh, 2011). According to Laferriere cited in (Punie, Zinnbauer, & Cabrera, A

review of the impact of ICT on learning, 2006), given the right conditions for access and use ICT, significant gains in student learning are recorded. Several groups have reviewed the literature on technology and learning and concluded that it has great potential to enhance student achievement and learning, but only if it is used appropriately (Bransford, Brown, & Cocking, 2000).

5.2.3 Impact of Teaching Using ICT on Syllabus Coverage in Technical Institutions

The research findings show that there is positive impact on the syllabus coverage when ICT is used in teaching. From the research findings, it was noted that lecturers who use ICT for teaching are able to expose students to more resource materials.

The findings agree with that (Bransford, Brown, & Cocking, 2000) who observed that many computer applications provide the tools to support students in quickly completing lower-level tasks so that they can focus on the main purpose of the activity. Word processors, graphics packages, database packages, spread sheets and other software do support the performance of students.

It has been observed that students often learn more in less time, that is, their productivity increases when they use computer support appropriately (samlabsky82, 2007). Computer systems do provide the opportunity to create a wide range of interesting learning experiences. This is likely to help maintain student interest (Cradler & Bridgforth, 2002).

5.2.4 Challenges facing lecturers using ICT in teaching in technical institutions

The findings indicate that there are challenges facing lecturers in the use of ICT for teaching in technical institutions. Some of the challenges encountered includes: ICT

literacy; inadequate ICT resources; lack of in- service training program for lecturers; and overloaded syllabus. These challenges only affect teachers with no ICT background. It was observed that teachers in the ICT department faced no challenge. These findings are similar to those of Karagiorgi and Symeou(2006) who established certain barriers to ICT implementation. These barriers include overloaded syllabus that burdens teachers and restricts time for ICT use in subject teaching, lack of clear objectives for how to integrate ICT in the classroom and lack of training in ICT for teachers.

Norton and Gonzales as cited in (Momanyi, Norby, & Strand, 2006) noted that difficulties in integrating technology centered on the inadequacy of traditional teaching models that had existed for decades. Borg, (2005) revealed that most teachers still require further training in order to master enough confidence to take up the ICT challenge on their own initiative and that some form of monitoring is required to ensure proper use of ICT by each and every class teacher.

5.3 Conclusion

ICT infrastructure has a positive impact on the quality of examination results. Infrastructure requirements for effective use of ICT may be viewed in terms of electronic resources, hardware, users, and implementation. The use of ICT resources for teaching has a positive impact on quality of examination results .These results are attributed to use of demonstrations and simulations in teaching. There is positive impact on the syllabus coverage when ICT is used in teaching. Lecturers who use ICT for teaching effectively deliver knowledge and skills and access more information through internet and library. There are challenges facing lecturers with no ICT background in the use of ICT for teaching. These challenges are: ICT literacy;

inadequate ICT resources; lack of in-service training program for lecturers; and overloaded syllabus.

5.4 Recommendations

1. The following recommendations were made based on the findings and the conclusions of study:
2. The government of Kenya should develop a policy on the provision of adequate ICT infrastructure at all levels of education and training by bringing together the efforts of all stakeholders.
3. The Ministry of Higher Education, Science and Technology should put in place a well-organized ICT in-service training programme for all lecturers.
4. Lecturers should strengthen the pedagogical use of ICT and exploit the potential of ICT as a catalyst for change to fulfil educational goals.
5. Policy Makers should formulate clear objectives of how to integrate ICT in the classroom.

5.5 Suggestions for Further Research

The following suggestions for further study were made since they were under scored

- i. To investigate the contribution of new technology to learning and teaching in technical institutions Kenya.
- ii. To investigate the impact of information and communication technologies on student learning and attainment in technical institutions in Kenya.
- iii. To investigate the use of information technology to create new educational situations in technical institutions in Kenya.
- iv. To investigate the impact of IT in education and teacher education in Kenya.

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APPENDIX I

Questionnaire for lecturers in technical institutions

The purpose of this questionnaire is to seek your opinion and views on impact of ICT on teaching in technical institutions. It is designed to allow you express your views freely and also give your suggestions on how to improve on the use of ICT for teaching in Technical institutions. You are therefore requested to complete the questionnaire as accurately as possible and return it. The information given on this questionnaire will be held in strict confidence and will be used only for the purpose of study.

Thank you.

SECTION A: BIODATA OF THE RESPONDENT

1. Gender of the respondent

a. Male

b. Female

2. Technical Institution in which the respondent teach

Kisumu Polytechnic Eldoret Polytechnic R.V.T.T.I

Sangalo institute Kaiboi TTI Kitale TTI

Teaching experience of the respondent in Technical Institution?

(a) 1-5 (b) 5-10 (c) 10-15 (d) 15 and above

SECTION B: ICT training and competence of the respondent

1. Have you be to any training in ICT programme

a. Yes

b. No

2. If yes, which of the listed application software have you been trained in?

Word processing

Spreadsheets

Presentation graphics

- Using the Internet (www)
- Database
- Desktop publishing
- Information skills
- Programming skills
- Others (specify) -----

3. Which of the following systems have you trained in?

- Hardware
- Operating system software
- Networking
- Others (specify) -----

4. Do you use information from the Internet for teaching purposes?

- a. Yes
- b. No

5. If no, why?

- The Internet is often not available
- Often no time to surf the Web
- No enough skills to find information from the Web
- Others (specify) -----

SECTION C: Impact of ICT on teaching in technical institutions

Given below are statements about the impact of ICT on teaching in technical institutions. Respond by ticking in the boxes provided and writing in the spaces provided.

Key:

TA- TOTALLY AGREE

A-AGREE

U-UNDECIDED

D- DISAGREE

TD- TOTALLY DISAGREE

1. The following information resources exist in your technical institution.

Computer laboratory ()

Library ()

Multimedia Centre ()

Internet access ()

None ()

Others (specify) -----

2. Which of the following statements best describes the possible ICT infrastructure in your technical institution?

i.) It has adequate Computing infrastructure (computer labs)

(a)TA () (b) A () (c) U () (d) D () (e) TD ()

ii.) It has adequate communication infrastructure (internet services, fax, phones)

(a) TA () (b) A () (c) U () (d) D () (e) TD ()

iii.) It has adequate instructional infrastructure (projectors, laptops)

a)TA () (b) A () (c) U () (d) D () (e) TD ()

3. The following are possible uses of ICT in your Technical institution

i. Create Instructional Material

a. TA () (b) A () (c) U () (d) D () (e) TD ()

ii. Administrative record keeping

a. TA () (b) A () (c) U () (d) D () (e) TD ()

iii. Communicating with colleagues

a. TA () (b) A () (c) U () (d) D () (e) TD ()

iv. Gathering information

a) () (b) A () (c) U () (d) D () (e) TD ()

v. Multimedia presentations

a) TA () (b) A () (c) U () (d) D () (e) TD ()

vi. Carrying out a research

a) TA () (b) A () (c) U () (d) D () (e) TD ()

vii. Accessing modern teaching materials

a) TA () (b) A () (c) U () (d) D () (e) TD ()

Others (specify) -----

4. The following are possible indicators of ICT effectiveness

i. Reduced failure rate

a) TA () (b) A () (c) U () (d) D () (e) TD ()

ii. Increased grades and test scores

a) TA () (b) A () (c) U () (d) D () (e) TD ()

iii. Increased satisfaction of the lecturer

a) TA () (b) A () (c) U () (d) D () (e) TD ()

iv. Storage of fundamental/ essential information

a) TA () (b) A () (c) U () (d) D () (e) TD ()

v. Increased opportunity for exchange of Information between lecturers and trainees

a) TA () (b) A () (c) U () (d) D () (e) TD ()

vi. Revelation and correction of misconceptions

a) TA () (b) A () (c) U () (d) D () (e) TD ()

vii. Trainee evaluation

a) TA () (b) A () (c) U () (d) D () (e) TD ()

Others (Specify).....

5. Rate the following items with and without the use of ICT

With ICT

i. Access to the world TA () A () U () D () TD ()

Wide resources

Without ICT

TA () A () U () D () TD ()

ii. Ease of communication, **With ICT**

Generation and presentation TA () A () U () D () TD ()

Of data

Without ICT

TA () A () U () D () TD ()

iii. Analysis and modeling of

With ICT

realistic examples

TA () A () U () D () TD ()

Without ICT

TA () A () U () D () TD ()

iv. Inquiry and extended

With ICT

Capability to visualize,

TA () A () U () D () TD ()

Organize and analyze data

Without ICT

TA () A () U () D () TD ()

v. Provision of immediate

With ICT

Feedback to the trainees TA () A () U () D () TD ()

Without ICT

TA () A () U () D () TD ()

6. Rate your ability to achieve the following during teaching without and with the use of ICT

i.) Stimulate trainees and engage

With ICT

them with the material such as TA () A () U () D () TD ()

Role playing

Without ICT

TA () A () U () D () TD ()

)

ii.) Illustrate the working of

With ICT

Complex systems by exploration TA () A () U () D () TD ()

Without ICT

TA () A () U () D () TD ()

iii.) Demonstrate hypothetical scenarios

With ICT

TA () A () U () D () TD ()

Without ICT

TA () A () U () D () TD ()

iv.) Encourage collaboration with other

With ICT

Individuals, Teams or institutions TA () A () U () D () TD ()

Without ICT

TA () A () U () D () TD ()

v) Foster development of critical

With ICT

thinking skills, visualization and TA () A () U () D () TD ()

)

Conceptualization

Without ICT

TA () A () U () D () TD ()

vi). Carry out research and

With ICT

Gather teaching information TA () A () U () D () TD ()

)

Without ICT

TA () A () U () D () TD ()

7 The following are possible challenges facing lecturers in the use of ICT in technical institutions

i. Most lecturers are not computer literate

TA () A () U () D () TD ()

ii. Lack of ICT resources in Technical institutions

TA () A () U () D () TD ()

iii. Lack of qualified Technicians to man computer laboratories

TA () A () U () D () TD ()

iv. There is no proper plan for retraining lecturers in ICT

TA () A () U () D () TD ()

v. Lecturers are not able to cope with the cost of ICT resources

TA () A () U () D () TD ()

vi. Lecturers are not trained to use ICT for teaching

TA () A () U () D () TD ()

APPENDIX II

Questionnaire for administrators in technical institutions

(H.O.Ds, Examination officers, registrars, principals/ deputy principals)

The purpose of this questionnaire is to seek your opinion and views on impact of ICT on teaching in technical institutions in western Kenya.

It is designed to allow you to express your views freely and also give your suggestions on how to improve on the use of ICT for teaching in Technical institutions. You are therefore requested to complete the questionnaire as accurately as possible and return it.

Thank you.

Given below are statements about the impact of ICT on teaching in your technical institution. Respond by ticking in the box and writing in the spaces provided.

Key:

TA- TOTALLY AGREE

A-AGREE

U-UNDECIDED

D- DISAGREE

TD- TOTALLY DISAGREE

1. Information resources available in the institution

i. The institution has at least one or more computer laboratory.

TA () A () U () D () TD ()

ii. Internet services are available in the institution and accessible to all lecturers at no cost.

TA () A () U () D () TD ()

- iii. The institution provides lap tops and projectors to lecturers for instructional purposes.

TA () A () U () D () TD ()

2. The following are possible uses of ICT in Technical institutions

- i. Create Instructional Material

TA () A () U () D () TD ()

- ii. For administrative record keeping

TA () A () U () D () TD ()

- iii. To communicating with colleagues

TA () A () U () D () TD ()

- iv. For gathering information

TA () A () U () D () TD ()

- v. For multimedia presentation

TA () A () U () D () TD ()

- vi. For research purposes.

TA () A () U () D () TD ()

- vii. For accessing modern teaching materials

TA () A () U () D () TD ()

Others (specify) -----

3. The following are possible indicators of ICT effectiveness

- i. Coverage of the syllabus by lecturers

TA () A () U () D () TD ()

- ii. Reduced failure rate

TA () A () U () D () TD ()

- iii. Increased grades and test scores

TA () A () U () D () TD ()

iv.Storage of fundamental/ essential information

TA () A () U () D () TD ()

v. Increased opportunity for exchange of Information between lecturers and trainees

TA () A () U () D () TD ()

vi. Increased satisfaction of the lecturer

TA () A () U () D () TD ()

Others (Specify).....

4. The following are statements of the impact of ICT on the instructional process

i. Enhances ease of communication, generation and presentation of data.

TA () A () U () D () TD ()

ii.Provision of immediate Feedback to the trainees

TA () A () U () D () TD ()

iii.Encourage collaboration with other individuals, Teams or institutions.

TA () A () U () D () TD ()

iv.Foster development of Critical thinking skills

TA () A () U () D () TD ()

v.Carry out research and gathering of materials

TA () A () U () D () TD ()

5. The following are possible challenges facing lecturers in the use of ICT in technical institutions

i. Most lecturers are not computer literate

TA () A () U () D () TD ()

ii. Lack of ICT resources in Technical institutions

TA () A () U () D () TD ()

iii. Lack of qualified Technicians to man computer laboratories

TA () A () U () D () TD ()

iv. There is no proper plan for retraining lecturers in ICT

TA () A () U () D () TD ()

v. Lecturers are not able to cope with the cost of ICT resources

TA () A () U () D () TD ()

vi. Lecturers are not trained to use ICT for teaching

(a)TA () (b) A () (c) U () (d) D (e) TD ()

APPENDIX III

Questionnaire for computer laboratory technicians in technical institutions

The purpose of this questionnaire is to seek your opinion and views on impact of ICT on teaching in technical institutions.

It is designed to allow you to express your views freely and also give your suggestions on how to improve on use of ICT for teaching in Technical institutions. You are therefore requested to complete the questionnaire as accurately as possible and return it.

Thank you.

Given below are statements about the impact of ICT on teaching in technical institutions. Respond by ticking in the boxes provided and writing in the spaces provided.

Key:

TA- TOTALLY AGREE

A-AGRE

U-UNDECIDED

D- DISAGREET

D- TOTALLY DISAGREE

1. **The following are statements of the ICT infrastructure in your technical institution.**

i. The institution does not have a well-equipped computer laboratory.

(a)TA () (b) A () (c) U () (d) D () (e) TD ()

ii. The institution has adequate communication structures (Fax, internet services, and phones)

(a)TA () (b) A () (c) U () (d) D () (e) TD ()

iii. Adequate instructional infrastructure (lap tops, projectors) is available to lecturers for teaching.

(a)TA () (b) A () (c) U () (d) D (e) TD ()

2. The following are statements of the use of ICT on teaching

i. The ICT is a possible source of creating instructional material.

(a)TA () (b) A () (c) U () (d) D (e) TD ()

ii. The ICT is mainly used for administrative record keeping.

(a)TA () (b) A () (c) U () (d) D (e) TD ()

iii. The ICT is used for multimedia presentations.

(a)TA () (b) A () (c) U () (d) D (e) TD ()

3. The following are possible indicators of ICT effectiveness

i. Reduced failure rate

(a)TA () (b) A () (c) U () (d) D (e) TD ()

ii. Increased grades and test scores

(a)TA () (b) A () (c) U () (d) D (e) TD ()

iii. Storage of fundamental/ essential information

(a)TA () (b) A () (c) U () (d) D (e) TD ()

iv. Increased opportunity for exchange of Information between lecturers and trainees

(a)TA () (b) A () (c) U () (d) D (e) TD ()

v. Increased satisfaction of the lecturer

(a)TA () (b) A () (c) U () (d) D (e) TD ()

vi. Revelation and correction of misconceptions

(a)TA () (b) A () (c) U () (d) D (e) TD ()

vii. Trainee evaluation

(a)TA () (b) A () (c) U () (d) D (e) TD ()

Others (Specify).....

4. The following are statements of the impact of ICT on the instructional process.

Enhances access to the world wide resources

(a)TA () (b) A () (c) U () (d) D (e) TD ()

Enhance communication; generation; and presentation of data.

(a)TA () (b) A () (c) U () (d) D (e) TD ()

Provision of immediate Feedback to the trainees

(a)TA () (b) A () (c) U () (d) D (e) TD ()

Encourage collaboration with other individuals, Teams or institution.

(a)TA () (b) A () (c) U () (d) D (e) TD ()

Foster development of Critical thinking skills

(a)TA () (b) A () (c) U () (d) D (e) TD ()

Carry out research and gathering of materials

(a)TA () (b) A () (c) U () (d) D (e) TD ()

APPENDIX IV

Interview Guide Questions with administrators (HODs, Examination officers, Registrars, Principals/ Deputy Principals)

1. How is the ICT infrastructure in your technical Institution?
2. Do you have enough computer laboratories in your institution?
3. How do you describe the availability and the condition of the ICT equipment in your computer laboratories?
4. Which ICT instructional facilities do you use in your institution (lap tops, projectors)?
5. Do most lecturers use the facilities for instructional purposes?
6. Does your training institution have infrastructure that enhances ICT?
7. What are the indicators of ICT effectiveness in your technical institution?
8. Does using ICT have any impact on your training process?
9. Does teaching with ICT affect the quality of examination results?
10. Does the ability to use ICT have any impact on the use of instructional facilities in your technical institution?

APPENDIX V

Interview Guide Questions with lecturers in technical institutions

1. Is there any difference in the examination results produced by lectures who use ICT in teaching and those who do not use ICT in teaching?
2. Can the availability of ICT resources in technical institutions affect the results produced by lecturers?
3. What policies would you recommend to be adopted to enhance effective utilization of ICT for teaching in technical training institutions?
4. Can ICT be the best way of storage of information for the purpose of teaching?
5. Can the use of ICT enhance accessibility of information and material?
6. How would you describe the merits and demerits of using ICT in instructional process?
7. What are the challenges facing you as a lecturer in the use of ICT in training?
8. What are the challenges facing other lecturers in using ICT facilities in teaching?
9. How can these challenges be addressed?

APPENDIX VI

Observation check list

Observation	Description of the observed	Judgments
Availability of ICT(computer) Labs		
No. of instructional infrastructure (lap tops, projectors) in each department		
No. of lecturers with personal lap tops		
Sizes of computer labs in relation to the student population		
No. of Lessons seen where lecturers are using ICT apart from an ICT lesson		
Common uses of ICT		
Time lab technicians report and leave the work stations		
Roles of lecturers, Students and Technicians during a lab lesson		
How often is the lab occupied with practical lesson		
Availability of internet services in each department and library		
How often lecturers use the available ICT infrastructure facilities for instructional purposes		

APPENDIX VII


Research Permit

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THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss. JANET
MILEKHANI ISOKA
of (Address) MOI UNIVERSITY
PO BOX 3900 ELDORET
has been permitted to conduct research in.....
.....Location,
.....District,
WESTERN.....Province,
on the topic EFFECTS OF INFORMATION
AND COMMUNICATION TECHNOLOGY FOR
TEACHING PURPOSES IN TECHNICAL
INSTITUTIONS ON EXAMINATION
PERFORMANCE, A CASE OF WESTERN KENYA
for a period ending 30TH SEPTEMBER 2010

PAGE 3

Research Permit No. NCST/RRI/INF/04
Date of issue 05.02.2010
Fee received SHS 1000



Janet Isoka
Applicant's Signature / Secretary
National Council for
Science and Technology

CONDITIONS

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

GPK605543m110/2009



REPUBLIC OF KENYA

RESEARCH CLEARANCE
PERMIT

(CONDITIONS— see back page)