

**EDUCATION AND INFORMATION COMMUNICATION TECHNOLOGY**

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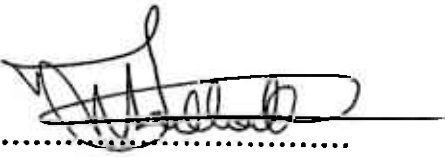
**A Research Project Report Submitted to the Department of Psychology in Partial Fulfillment  
of the Requirements for the Master of Education in Measurement and Evaluation Degree in  
the School of Education of the University of Nairobi.**

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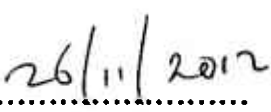
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**DECLARATION**

This research proposal is my original work and has not been presented for a degree or any other award in any university.

Signed.....

**JOSPHAT MWATHA WAITHAKA**  
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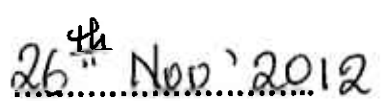
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Date

This research proposal has been submitted for examination with my approval as university supervisor.

Signed.....

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.....

Date

## **DEDICATION**

**This project is dedicated to all my family members for their prayers, understanding and for being incredibly supportive in all of my endeavors.**

**My special tribute goes to my loving parents, my mum Purity Mumbi Waithaka and my late dad Peter Waithaka Mwatha.**

## **ACKNOWLEDGEMENTS**

I would especially like to thank Dr. Karen Odhiambo who has served as an excellent advisor and has provided me consistent support in my research journey, enabling me to complete this project.

I express my deep gratitude and appreciation to the Kagumo Teachers' Training College administration and tutors for agreeing to participate in this research, for their time expended and courage in sharing their insight with the researcher.

## **ABSTRACT**

Information Communication and Technology (ICT) which includes digital technology such as computer and the internet are potentially powerful tools for extending assessment opportunities in education. Computer-based testing, online testing, automated scoring, and online registration are some of the areas where ICT is being used globally to improve efficiency and effectiveness in assessment. The purpose of the study was to examine the preparedness of tutors for the integration of ICT into the educational assessment practices in teacher education. The study was based on Diffusion of Innovations theory by Rogers which describes how new ideas or technologies are incorporated into a given population and the Technology Acceptance Model by Davis which provide an explanation of the determinants for predicting the acceptance, adoption, and use of information technologies. A descriptive case study of Kagumo Teachers' Training College in Nyeri County, Kenya, was designed to investigate preparedness of tutors for integration of ICT into assessment. Both qualitative and quantitative techniques were used for realization of research objectives. To ensure that the sampled tutors accurately represent the target population, quota sampling was used to select the desired forty respondents. The study adopted the data triangulation technique which use a combination of data sources namely questionnaire, an interview schedule and an observation checklist. Validity of instruments was ensured before its administration by giving it to experts in Measurement and Evaluation, School of Education, University of Nairobi. Reliability was enhanced through piloting of the questionnaire and improving the items on the basis of the calculated Cronbach alpha coefficient. Descriptive statistics and content analysis were used to analyze the collected data. The findings of the study indicate tutors have moderate ICT skills, positive attitude towards ICT, and are able to access some ICT infrastructure in college and consider assessment practices with ICT beneficial. However adoption and acceptance of ICT in education and particularly in assessment may be hampered by inadequate training, lack of appropriate software and modern hardware. The researcher recommends systematic training for tutors, improvement of availability of ICT infrastructure and digitization of past and current assessment tools. This study is significant in that its findings may give insight to Ministry of Education on the current situation in terms of teacher education tutors' preparedness to integrate ICT into educational assessment. The information obtained could be used in shaping ICT related assessment practices and guide policy in Kenya.

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## **ABBREVIATION AND ACRONYMS**

<b>CAST</b>	<b>Chinese Computer Attitude Scale for Teachers</b>
<b>CBA</b>	<b>Computer-Based Assessment</b>
<b>CBAS</b>	<b>Computer-Based Assessment Systems</b>
<b>CBT</b>	<b>Computer-Based testing</b>
<b>CRE</b>	<b>Christian Religious Education</b>
<b>DBMS</b>	<b>Data Base Management System</b>
<b>DTE</b>	<b>Diploma in Teacher Education</b>
<b>EFA</b>	<b>Education for All</b>
<b>EMIS</b>	<b>Education Management Information System</b>
<b>ERSWEC</b>	<b>Economic Recovery Strategy Paper for Wealth and Employment Creation</b>
<b>FPE</b>	<b>Free Primary Education</b>
<b>IBT</b>	<b>Internet-Based Training</b>
<b>ICT/ICTs</b>	<b>Information and Communication Technology/Technologies</b>
<b>IPN</b>	<b>Interactive Personal Networking</b>
<b>ISPs</b>	<b>Internet Service Providers</b>
<b>IT</b>	<b>Information Technology</b>
<b>KESSP</b>	<b>Kenya Education Sector Support Programme</b>
<b>KNEC</b>	<b>Kenya National Examination Council</b>
<b>MDGs</b>	<b>Millennium Development Goals</b>
<b>MoE</b>	<b>Ministry of Education</b>
<b>MoEST</b>	<b>Ministry of Education, Science and Technology</b>
<b>NEPAD</b>	<b>New partnership for Africa</b>
<b>NGOs</b>	<b>Non Governmental Organizations</b>
<b>NICE</b>	<b>Network Initiative for Computers in Schools</b>
<b>OER</b>	<b>Open Educational Resources</b>
<b>PPT</b>	<b>Paper-and-Pencil Testing</b>
<b>PTRs</b>	<b>Pupil Teacher Ratios</b>
<b>TCP/IP</b>	<b>Transmission Control Protocol/Internet Protocol</b>
<b>TTCs</b>	<b>Teacher Training Colleges</b>
<b>UNESCO</b>	<b>United Nations Educational, Scientific and Cultural Organization</b>
<b>USA</b>	<b>United States of America</b>
<b>WWW</b>	<b>World Wide Web</b>

## **CHAPTER ONE**

### **1.0 INTRODUCTION TO THE STUDY**

#### **1.1 Background to the Study**

As technology advances and teachers become more proficient in the use of technology, there would be increased opportunities for teachers and administrators to use computer-based techniques, Internet resources, and more complex, detailed ways of reporting results. Internet connectivity continues to be a powerful force in education, with the technology being integrated more fully in education process. The computer revolution has gone to school, and more and more students are writing and doing school assignments and research on computers. Educators are using the technology for instructional purposes and it's clear that the assessment process can be enhanced through the use of technology.

Assessment should match the expected learning outcomes and occur throughout a course rather than just at the end. Assessment procedures are essential to make sure that teaching is more effective with a particular technological tool than without. However there is need to accommodate the multifaceted and multimodal nature of technology in assessment. ICTs have the potential to enhance classroom assessment practices through the provision of additional modes of representing, recording, and reviewing information on student learning process and products. Technology today offers many new opportunities for innovation in educational assessment through rich new assessment tasks and potentially powerful scoring, reporting and real-time feedback mechanisms. The exponential advances taking place in technology promise to revolutionize assessment practices and education reform.

Assessment systems exemplify the goals and values of education. As ICT become more and more integrated in curricular activities this integration should be reflected in the type of assessment tools adopted to evaluate learning. New and innovative ways of planning for assessment can enrich learning environment and enhance student success. Effective integration of ICT into assessment can yield many benefits to tutors in areas such as administration of assignments, management of tests, marking of scripts, Computer-Based Tests and online testing among others.

Assessment is a crucial in the learning process. Tests are important part of the learning process and can be used for assessment, self evaluation or be part of mandatory exercises in a learning programme. With increased computers and internet connectivity in schools, assessment may see a steady growth in use of ICT during exams. Online automated test and exams based on CD-ROM can play an important role in learning. The possibility of automated feedback and grading, as well as reuse of existing tests, increases the efficiency for teacher. Online tests provide more flexible learning environment and can also motivate and guide the student, due to immediate feedback. At present the overall assessment is partly paper based, however there is need to consider plan to update the whole process so that every aspect is digitized, from the work of examination committee, to the assignment and exam papers , and the delivery of student results.

In Kenya, the ICT has been adopted by educational institutions, including Kenya National Examination Council (KNEC) to perform various tasks. KNEC uses ICT to disseminate examination results to Form four students and standard eight pupils. Candidates have also been registering for public examinations online through the KNEC website for the last two years. In 2011, KNEC anticipated to register four hundred thousand candidates and provide their details through its online system.

With this emergence of ICT, there is need to consider use of the technology in preparation, storage, analysis and dissemination of examinations in educational institutions. With changing technological innovation, there is need to integrate testing with ICT, in all the stages of test cycle. Currently, assessment in teacher training colleges in Kenya, just like in majority of other educational institutions is mostly by the traditional paper and pen testing. However, there is need to adopting Computer-based testing and online tests as modes of assessing learners so as to improve learning, hence the need for this study to analyze preparedness of educators to accept and adopt use of ICTs in assessment.

The success of student assessment with computer technology depends largely on the attitudes of teachers, and their willingness to embrace the technology. The teachers' knowledge and skills in the use of information and communication technology, in particular, their pedagogical ICT competence, are very crucial determinants. The teacher is key to effective implementation of the use of computers in the educational system and given that teachers have tremendous potential to transmit beliefs and values to students. The integration of ICTs into the education remains a distant goal unless there is reconciliation between teachers and



ICTs. Hence it is important to carry out this study to understand the preparedness of the teachers to integrate ICTs into assessment and analyze the factors that act as barriers to teachers' positive computer usage.

### **1.2 Statement of the problem**

Assessment is crucial in the learning process and ICTs today offers many new opportunities for innovation in educational assessment through rich new assessment tasks and potentially powerful scoring, reporting and real-time feedback mechanisms. Although the technological advances bring about opportunities for change in assessment practice, assessment in educational institutions in Kenya is at present more often than not paper based. The ways in which ICTs are used in education depends on the pedagogical competence and technical skills of the teachers. Tutors, being the curriculum implementers in Kenyan colleges should be ready to embrace new methods of evaluating student's progress so as to improve learning, yet little research has been done to measure their preparedness to integrate ICTs in educational assessment, hence the need for this study. The researcher also anticipated that tutors who are prepared to integrate ICTs would be more willing to overcome ICT related barriers that they may encounter in their professional tasks. The study also sought to determine if a relationship exist between tutors' preparedness regarding ICT integration into assessment, and whether there are differences across gender, age, teaching subjects, and teaching experience.

### **1.3 Purpose of the Study**

The purpose of the study was to examine the preparedness of tutors for the integration of Information and Communication Technologies into the educational assessment processes.

### **1.4 Objectives**

- a) To analyze the level of tutors' ICT skills that would facilitate them integrate the technology into assessment.
- b) To evaluate the attitude of tutors in TTCs towards integration of ICT into educational assessment.
- c) To establish the kinds of ICT infrastructure accessible to the tutors in TTCs for integration of ICT into educational assessment.

- d) To evaluate of the views on the usefulness of ICT integrated assessment practices in education.

### **1.5 Research Questions**

- a) Are tutors in TTCs having required ICT skills for use in their educational assessment practices?
- b) How are the attitudes of tutors in TTCs towards use of ICT in educational assessment?
- c) Have the tutors in TTCs been provided with the requisite ICT infrastructure for use in assessment practices?
- d) Which ICT integrated assessment practices do tutors in TTCs deem useful in enhancing performance of professional task?

### **1.6 Significance of the Study**

The goal of this research was to gain insights on tutors' preparedness to integrate Information and Communication Technologies into the educational assessment processes. These insights can serve as a beginning frame of reference and assist teacher education programmes in designing developmentally appropriate training in ICTs integration. The research would also raise tutors awareness on the emerging ICTs related assessment practices and thus, encourage them to adopt them.

The findings of the proposed study would help Teacher Training Colleges improve teaching and learning processes by integrating ICTs into their assessment practices. The findings would be of benefit to many stakeholders in education including the colleges' managements, the Ministry of Education, the Kenya National Examination Council (KNEC), the Teachers Service Commission, the Kenya Institute of Education, the parents and students. The information obtained could guide policy on ICTs for educational assessment.

### **1.7 Justification**

Information and Communication Technologies have become indispensable tools in today's information age, making a dramatic impact on the lives of people globally and this effect is most significant in education. The effectiveness of educational technology on student learning depends how the technology is integrated into instruction and also on how teachers

assess student performance in classrooms and adjust instruction accordingly. Teachers are under pressure to respond to state and national standards, meet specific criteria for state testing, and continue to diversify instruction and appropriately integrate technology experiences.

As teacher training colleges seek to fulfill their mandate of training teachers, they would benefit from knowing how prepared their tutors are for ICT integration into educational assessment. This study bridges the present gap where there is lack of comprehensive information on teachers' readiness to integrate ICTs for educational assessment in Kenya. This study would be very important in that it would determine if the current status of tutors' preparedness would result in better adoption and acceptance of use of ICT in educational assessment.

### **1.8 Basic Assumptions**

The selected TTCs have the required capacity to support the use of ICTs in enhancing Diploma in Teacher Education (DTE) curriculum implementation and that the tutors would co-operate in the study.

### **1.9 Limitations of the Study**

The sample size of the study is small resulting in reduced generalizability. Furthermore, ICTs use in education is at a particularly dynamic stage in Kenya, which means that there are new developments and announcements happening on a daily basis somewhere in the regions.

The competences of tutors could change in a short span of time making the finding obsolete. Also tutors may give responses that would tend to cover up their weakness in using ICTs for the purpose of safeguarding their self- interests.

### **1.10 Delimitations of the Study**

The study was focusing on Teacher Training Colleges (TTCs) in Kenya and a case study of Kagumo Teachers Training College was carried out. The other Teacher Training Colleges, which also have a significant input in the service of training teachers, were precluded in the study and the findings therefore, would not reflect the overall situation of tutors' preparedness towards ICT integration for educational assessment in TTCs.

The research focused only on the integration of the newer digital technology such as

computers and the internet into assessment, and information about other technologies like television, radio, etc. was not be sought in this inquiry.

### **1.11 Operational Terms**

#### **Attitude towards ICT**

Attitude towards ICT is an enduring evaluation of a person or other emotional reactions to Information and Communication Technology. Attitude towards ICT provide the internal beliefs and thoughts about the technology. It causes one to behave in a particular way toward the ICT.

#### **Education Assessment**

Educational assessment is a term which includes all the processes and products that describe the nature and extent of learning, its degree of correspondence with objectives and its relationship with the environments which are designed to facilitate learning. Assessment tools include public examinations, assignments, teacher-made tests, projects and laboratory reports. Assessment includes every stage of the measurement and evaluation processes from planning, development of examinations, administration of examinations, results and post results.

#### **Electronic Assessment (e-assessment)**

Electronic assessment is as a method of using computers and Internet to deliver assessment tools to remote students in which the responses are electronically recorded, assessed, or both. E-assessment also refers to Computer-Based Testing, Computerized Testing, Computer-Based Assessment and Computer-Administered Testing.

#### **Hardware**

Hardware is the physical electronic components that make up a computer system.

#### **Information and Communication Technology (ICT)**

Information and Communication Technology in education is a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include computers, the Internet, broadcasting technologies, and telephony. Basically ICT is a tool. It can be hardware, software, or both.

### **ICT Infrastructure**

ICT infrastructure comprises ICT hardware, Software, Networks - local area network (LAN) and wide area network (WAN) and Internet Connectivity.

### **ICT Preparedness**

In this study ICT preparedness means the “state or condition of being prepared; readiness”, and emphasizes the attitudinal and skills aspect of being prepared to integrate ICTs into education assessment practices.

### **ICT Skills**

The ICT skill is the knowledge of and ability to use communications technology for a specific purpose in an effective, critical and efficient manner. Thus ICT skills involve the ability to receive, store, and retrieve digital data.

### **Integration of ICT into Assessment**

Integration of ICT is the infusion of technological tools and services, such as computer systems and the Internet, into a part of assessment practices in the educational environment within various subject areas.

### **Internet**

The internet is a global data communication system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide. It is a network of networks that are linked by a broad array of electronic and optical networking technologies.

### **Software**

Software is set of instructions and data used by computers, also referred to as programs that operate the computer system.

### **Teacher Education**

Teacher Education refers to the policies and procedures designed to equip prospective teachers with the knowledge, attitudes, behaviour and skills they require to perform their tasks effectively in the classroom, school and community.

## **CHAPTER TWO**

### **2.0 REVIEW OF LITERATURE**

#### **2.1 Review of Previous Research Findings**

Providing some insight into the issue of teacher preparedness to use ICTs for learning and teaching, Granger, Morbey, Owston & Wideman (2002, p. 487), explain that the “relationship between teachers’ ICT skills and successful implementation is complex.” The results of their study of schools suggests that there are a range of contributing issues including teacher “attitudes, philosophies, communication, and access to skills training”, in addition to having the necessary equipment, support, and education. Baskin and Williams (2006, p. 10) posit that human factors are “... the most critical in nurturing the ICT culture and growing the critical mass of teachers able to sustain the use of ICTs effectively in their teaching”.

To investigate the factors hindering teachers’ readiness and confidence in using ICTs, Tella, et al. (2007) found that inadequate knowledge to evaluate the role of ICT in teaching and learning, lack of skills in the use of ICT equipment and software had resulted in a lack of confidence in utilising ICT tools. This is consistent with Preston (2000) who concluded that lack of technical support to be key inhibitor to the use of ICT in classroom. It has been shown that recurring faults and the expectation of faults occurring during teaching sessions have reduced teachers’ confidence and caused teachers to avoid using technology. It is therefore predicted that teachers with a lower ICT rate of adoption demand more ICT training.

Teachers’ computer knowledge and experience are especially important for effective usage of ICT in their classroom. Because, generative learning begins at the knowledge stage of diffusion, which is the first stage (Rogers, 2003). Clyde (1997), notes that, to be able to use a computer, one requires “the knowledge and skills which are related to the hardware, the system, the software, the information source and the information itself.” She categorizes these skills as:

- Hardware or equipment-related knowledge and skills, including the ability to use a mouse and keyboard.
- System knowledge and skills, including knowledge of network procedures, and of the DOS or Windows system interfaces.

- Application software knowledge and skills, including word processing, electronic mail software and Internet software
- Knowledge and skills associated with the use of the information system itself-storage and search procedures, as well as access techniques.

Kitschner and Davis (2003) identified the following competencies required by lecturers in ICT application in education. These include: competence to make personal use of ICT, competence to master range of educational paradigms that make use of ICT, sufficient competence to make use of ICTs as mind tools, competence to make use of ICT as a tool for teaching, competence in mastering a range of assessment paradigms which make use of ICT, competency in understanding the policy dimensions of the use of ICT for teaching and learning.

During the process of combining ICT with education, teachers' attitude towards using knowledge besides their talent and desire are crucial point affecting the results of application. The success of any initiatives to implement technology in an educational program depends strongly upon the support and attitudes of teachers involved. It has been suggested that if teachers believed or perceived proposed computer programs as fulfilling neither their own or their students' needs, they are not likely to attempt to introduce technology into their teaching and learning. Among the factors that affect the successful use of computers in the classroom are teachers' attitudes towards computers (Huang & Liaw, 2005).

Attitude, in turn, constitutes various dimensions. Some examples of these are perceived usefulness, computer confidence, training, gender, knowledge about computers, anxiety, confidence, and liking. Positive teacher attitudes towards computing are critical if computers are to be effectively integrated into the school curriculum. A major reason for studying teachers' attitude towards computer use is that it is a major predictor for future computer use in the classroom (Myers & Halpin, 2002).

Studies on pre-service teachers and found a significant relationship between computer attitude and its use in the institution. This finding was corroborated by Yuen and Ma (2001) who, using the Chinese Computer Attitude Scale for Teachers (CAST), found that 216 secondary teachers in Hong Kong had reported the instructional use of computers and their results revealed that affective attitudes, general usefulness, behavioural control, and pedagogical use to be significant in determining the use of ICT.

On the part of teacher educators, there is a need to understand the dimensions that influence pre-service teachers' attitudes towards computers as a means for effective development of teacher training curriculum that would prepare teachers to face the challenges in the information age (Fisher, 2000). In order to use of technology in the classroom effectively, teachers' attitude toward technology should be positive and they should be trained in using the modern technologies in the field of education. From the review of literature, it would seem clear that human factors such as attitudes and beliefs have a significant influence on teacher behaviours, and consequently their preparedness to use ICTs for learning and teaching.

In a study by Jennings and Onwuegbuzie (2001), teachers of younger age were found to be associated with more positive attitudes towards ICT. This is in agreement with the report by the U.S. National Center for Education Statistics (2000) which indicated that younger teachers score higher on their perception of ICT, and have translated their positive perception into higher degree of ICT use in education. Thus, the researcher has hypothesized that teachers of younger age make more use of ICT in schools, compared to the elderly counterparts.

For the age variable, many studies indicate that there is no significant relationship between age and attitudes. However some studies address that teachers' age have important effects on the attitudes. A study carried out by Chio (1992) revealed that older teachers in the study had more positive attitudes toward computers, had less computer literacy than the younger teachers. Some studies indicate that teachers' age was significantly related to teachers' attitudes. The literature indicates that there are no consistent results on the gender issues. While some studies suggest that male teachers tend to show slightly more favorable attitude toward computer use than do females, other studies, however, report little or no differences in teacher attitudes on the basis of gender (Koszalka, 2001).

While some studies have found no gender differences in attitudes towards computers, the results of other studies found that females manifested higher levels of anxiety in relation to computers than males. According to North & Noyes (2002), using ICT tools is widely perceived as a masculine activity and their research provided evidence for a linkage between gender and technophobia. Female teachers have been found to be more anxious and less confident computer users in most of the studies. In addition, male teachers have been found to have more prior experience with computers and to be much more likely to implement



computer use in their classrooms than female teachers. Jackson, Ervin, Gardner and Schmitt (2001) indicated that female users, compared with males, are more inclined to hold negative reactions to computers and such differences may have resulted in the different ways of using computers.

According to research on higher institutions lecturers' attitudes towards integration of ICT into teaching and research in Nigeria by S.A. Onasanya, R.A. Shehu, R.O. Oduwaiye and L.A. Shehu (2010), science subject lecturers are more interested in the use of ICT facilities/equipment for teaching and research work than their counterparts. Atan et al. (2002) found that users exhibit greater competence computer when they made frequent use of it. Hence, it was predicted that teachers who make daily use of ICTs are more competent in ICTs compared to those with a lower rate of adoption. Other studies revealed that teachers' computer literacy level is related to their computer use. And also computer literacy level of the teachers increases their integration of computer applications in their teaching. In the study, most of the teachers use Internet, email, and educational software CDs as computer applications in the classrooms.

### **2.1.1 Summary of Research Findings**

From the review of literature, it is evident that human factors such as attitudes and beliefs have a significant influence on teacher behaviours, and consequently their preparedness to use ICTs for learning and teaching. Access to skills in ICT equipment and software influences tutors confidence in utilizing ICT tools. Tutors computer knowledge and experience are also important for effective integration of ICTs in education. Other issues that influence adoption and acceptance of ICTs in educational assessment include having the necessary equipment and required technical support. Competencies required by tutors in ICT application in education include understanding the policy dimensions of the use of ICTs in education and mastering a range of assessment paradigms which make use of ICTs.

## **2.2 Review of Concepts and Theories**

### **2.2.1 Information Technology**

Information Technology (IT) refers to an entire industry that uses computers, networking, software and other equipment to manage information. Generally, IT departments are responsible for storing, processing, retrieving and protecting digital information of the company. For achieving these tasks, they are equipped with computers, Data Base Management Systems (DBMS), servers and security mechanisms, etc. Professionals working in IT departments range from system administrators, database administrators to programmers, network engineers and IT managers. When executing a business, IT facilitates the business by providing four sets of core services. These core services are providing information, providing tools to improve productivity, business process automation and providing means to connect with customers.

Knowledge in IT has become essential to succeed in the workplace. Typically, IT professionals are responsible for a range of duties including simple tasks such as installing software to complex tasks such as designing and building networks and managing databases. Information Technology is the design, development, implementation, support, and management of computer hardware and software applications. IT is therefore a term that encompasses the relationship between hardware, software, networks, and technical support provided to user. The term IT is a term widely used in the industry whereas, ICT is widely used in the context of education.

### **2.2.2 Information and Communication Technology**

The term Information Communication Technology (ICT) has had a long history in its evolution process. According to Pelgrum and Law (2003), towards the end of the 1980s, the term 'computers' was replaced by 'IT' (information technology). This signified a shift of focus from computing technology to the computer's enhanced capability to store and retrieve information. This was followed by the introduction of the term 'ICT' around 1992, when e-mail started to become available to the general public.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) use the term *ICTs*, or information and communication technologies, to describe:

"...the tools and the processes to access, retrieve, store, organise, manipulate, produce, present and exchange information by electronic and other automated means. These include

hardware, software and telecommunications in the forms of personal computers, scanners, digital cameras, phones, faxes, modems, CD and DVD players and recorders, digitised video, radio and TV programmes, database programmes and multimedia programmes” (UNESCO Bangkok, 2003, p.75, in Anderson, p.5).

In the literature, while there are many definitions of ICT, it can be broadly defined as “technologies that facilitate, by electronic means, the acquisition, storage, processing, transmission, and disseminating of information in all forms including voice, text, data, graphics and video” (Michiels & Van Crowder, 2001). This definition mainly focuses on the importance of the intersection of information technology, information content and telecommunications in enabling new forms of knowledge production and interactivity.

ICT allows many people to generate and disseminate information, thus playing an active role in the process of interaction between professionals, learners, policy makers, peers and etc. In the definition of the ICT in education, four main elements can be taken into consideration; ICT as an object that refers to learning about ICT, an assisting tool, a medium for teaching and learning and finally a tool for organisation and management in schools.

ICT in education encompasses a great range of rapidly evolving technologies such as desktop, notebook, and handheld computers; digital cameras; local area networking; the Internet and the World Wide Web (WWW); CD-ROMs and DVDs; and applications such as word processors, spreadsheets, tutorials, simulations, electronic mail (email), digital libraries, computer-mediated conferencing, videoconferencing, and virtual reality. ICT programme implementation in a developing country relies on various facets such as infrastructure, government policy, cultural factors, organizational and human resources. Human resources are one of crucial factors to help diffuse the ICT programmes.

### **2.2.3 Information and Communication Technologies Impacting on Education**

The following issues have a major impact on education and training in future years and include open source software and open content, social networking, collaboration and sharing, mobile technologies, new scholarship and peer to peer technologies.

#### **a) Open source & open education resources**

Open source software is a development method for software that harnesses the power of distributed peer review and transparency of process. The promise of open source is better quality, higher reliability, more flexibility, lower cost, and an end to predatory vendor lock-

in. The development of an open source operating system by Torvalds (1996) spurred the development of open content that users could access free of charge, especially for educational purposes. Examples include *Open Educational Resources (OER)* and *Wikipedia*

**b) Social networking**

Social networking has been variously described as Web 2.0 technologies, relational technologies and interactive personal networking (IPN). Social networking or Web 2.0 sites such as *MySpace*, *Facebook*, *Flickr*, *YouTube* and *Twitter* have reached wide acceptance and high user access. These services are about networking and sharing and offer for educational use a host of unique tools such as *Google Maps*, *Google Earth*, and *Zotero* (bibliography tool).

**c) Collaboration**

Web 2.0 tools such as *Google Apps* and *Zoho Office* enable people to collaboratively write documents, construct presentations, develop budgets and build stories and research; that is share and work together to build content. The results whether they be documents, photos, videos, slideshows, presentations, data, audio narrations or other rich media can then be stored on the WWW for access globally or in a closed community.

**d) Mobile technologies**

The use of mobile communication has increased exponentially in the last decade. Mobile phones are expected to make a significant impact on education and learning. Mobile phones are connected devices of convenience, that is, they are used for communicating, messaging, and quick information access.

**e) Scholarship**

Changes in the way that the WWW operates have brought about a wider array of choices for scholars in undertaking research, writing, reviews and collaboration. There is little debate that searching scholarly databases has been made easier through web based searches where access has been permitted. Examples include included *Google Scholar* and *Google Books*.

**Web 2.0 social network tools for educational use**

Web-based software tools enhance collaboration, creativity, and information sharing. Many of these tools are used to transform how teachers teach and how students learn. The chart below identifies and describes some of the most popular categories of Web 2.0 tools

**Table 1 Web 2.0 Tools**

<b>Web 2.0 Tool category</b>	<b>Function</b>
<b>Blogging</b> (blogger, live journal, type pad, word press, etc)	A simple Weblog is typically operated by an individual who regularly posts comments and news, often including multimedia files.
<b>Digital Storytelling</b> (Myne, prezi, Piki wiki etc)	Digital storytelling uses digital multimedia to engage in the age-old art of storytelling.
<b>Wikis</b> (wikispaces, Wikipedia etc)	A Wiki is a series of web pages that, once created, can be edited and maintained by multiple users, typically as a long-term knowledge repository or database. It is usually devoted to a specific subject or field of interest.
<b>Online Surveys</b> (survey monkey, survey gizmo, etc)	Online surveys gather opinions easily with minimal technical knowledge.
<b>Podcasting</b> (iPod)	A podcast is a digital media file including audio and sometimes video that is syndicated, subscribed to, and downloaded automatically when new content is added.
<b>Photo and Video Sharing</b> (YouTube)	Photo and video sharing services include archival descriptions with capabilities varying from site to site and often include a tremendous amount of quality educational content.
<b>Learning Management Systems</b> (Moodle, blackboard, dokeos etc)	Learning management systems include free and open-source resources that deliver, track, and manage online learning.
<b>Social Bookmarking</b> (propeller, linksmarker, del.icio.us)	Social bookmarking sites store and allow users to comment on favorite Web resources and share them with others.
<b>Collaboration and Networking</b> (facebook, twitter, yahoo, chat etc)	Collaboration and networking enable dynamic interaction among people when they work together on common goals. Social networks provide a variety of ways for users to interact.

Source: <http://cybersmartcurriculum.org/tools>

#### **2.2.4 Use of Information and Communication Technology in Education**

ICT has the potential to transform learning in and beyond the classroom. It can also in certain circumstances transcend previous limitations of space and time.

##### **a) Instructions in Teaching Learning process**

ICT is used for instructing the students using PowerPoint slides, Word documents or Web pages and using hyperlinks for better concept clarity. It also helps in improving pronunciation of students by using microphones, headphones, speakers, specially prepared software and special dedicated websites. Video conferencing, chat and email helps in better communication, hence better concept clarity. Also concept of E-tutor has given access to teachers instantly and given teachers a better chance to earn.

Current syllabus can be viewed through website of the concerned school board; made available to students if teacher has made a website and uploaded using Internet; and updating-using web could be done easily. ICT can transform education by inspiring students to express their imagination using Paint Brush. It also encouraging the students to surf web pages and gather relevant detailed information through web pages. Readymade software could give practice material to students

##### **b) Learning**

ICT facilitate learning through collecting notes /pictures/videos from web pages for detailed information and projects/assignments. Also used for saving the documents as soft copy for future use. ICT enhances learning through animations, as they are much near to the students. E-books/online libraries/online encyclopedias help to guide in minutes and save precious time and resources. ICT also used for creating videos using images, albums for better power point slides. Simulated Learning gives learners an idea of the real situation. It is also used for publication of pamphlet/brochures for awareness with institution and among community members.

##### **c) Guidance purposes**

ICT is used with reference to collective records of the students maintained year wise, stored in computers. It can also be used for testing for aptitude, interest, psychology using computer data bases and internet.

#### **d) Library**

By the use of ICT documents are stored as soft copy for students/faculty members use. Online magazines, journals, brochures, research articles and records of the books/record of the books maintained using special library software. Records of the issues and returns of the books also maintained.

#### **e) School Administration**

The school administrators can use ICT to maintain records of students (personal, academic, financial). It can be used for fees collection and maintenance of fees record. It can also be used to keep records of employees of school and accounts of the institution. ICT facilitates circulation of instruction/notices and getting it in printed form. ICT also enhance decision making process in institutions.

### **2.2.5 Use of Information and Communication Technology in Educational Assessment**

ICT is used in Testing and Evaluation process in keeping records of students for their academic scores. It is also used for keeping records in relation to personal history. ICT facilitates creating question bank for students and using computers for testing by asking questions from question bank. ICT is also instrumental in Online Testing and Evaluation, Analysis and interpretation of the data and management of previous year Question papers and sample papers using web sites.

Effective e-assessment is not simply add-on or replaces existing testing methods. Just as technology is changing not only what is taught, but also how it is taught, decisions that educators make about how to test affect what, and how, to teach. . Ill thought technology integration in assessment would lead to ineffective assessment, and likely ineffective teaching and learning. The possibility of e-assessment is that new and innovative ways of planning for assessment can enrich learning environments and, ideally, enhance student success.

#### **Traditional Paper-Based Testing**

Assessment of what has been learnt has traditionally been done by the use of Paper-and-Pencil or Paper-Based Tests (PPTs). This is the method of test administration in which the responses are written by hand on paper. The assessment tasks in Paper-Based Testing are either essay or objective items. Public national examination and national assessment rely heavily on multiple-choice question types and measure only a portion of the skills and

knowledge outlined in state educational standards.

Test Scoring Machine that use fill-in-the-bubble test score sheets and scanners have remained the dominant technologies used in local, state, and national assessments to mark objective items. Essay questions are commonly used to assess learners in higher institutions of learning and scoring is typically by hand. However just as the style, tidiness, size or any other characteristic of student hand writing can inappropriately influence the scoring assigned by the raters.

### **Computer-Based Testing**

Electronic student assessment can be defined as a method of using computers and Internet to deliver tests or exams to remote students. E-assessment is the use of ICT for any assessment-related activity. Due to its obvious similarity to e-learning, the term e-assessment is becoming widely used as a generic term to describe the use of computers within the assessment process. In recent years substantial and rapid developments have occurred in the provision of stand-alone and Internet-delivered computer based testing. E-assessment can be used to assess cognitive and practical abilities. E-assessment, also known as Computer-Based Testing (CBT), computerized testing, Computer-Based Assessment (CBA), and computer-administered testing, is a method of administering tests in which the responses are electronically recorded, assessed, or both.

The ICT is being used in administering Computer and Internet-based tests. It is estimated that Internet-based testing programs have administered at least several hundred thousand computer-based tests. The interest in the development and in use of Computer-Based Assessment Systems (CBAS) has grown exponentially in the last few years; According to findings (Valenti, Cuc-chiarelli, & Panti. 2002) more than forty commercial CBAS are currently available on the U.S. market. Most of those tools are based on the use of the so-called objective-type questions: i.e. multiple choice, multiple answer, short answer, selection/association, hot spot and visual identification (Valenti et al., 2000). In 2006–2007, 23 states were reported to offer computer-based assessments to measure achievement in USA schools (Bausell & Klemick, 2007). One state, Virginia, offered online tests in over a dozen subjects, administering approximately 1.5 million such assessments that school year (R.Triscari, personal communication, 6/19/07).



### **Computer-Based Testing versus Paper-Based Testing**

There have been some studies that have focused on the comparability of paper-based testing and computer-based testing in some areas such as psychology, mathematics and ergonomics. Some studies have revealed that there is a significant difference between the two testing modes while others have concluded the opposite.

There have been several comparability studies that have examined the impact of transferring a test from paper to screen. Such studies have either focused on the comparability of the product of the tests i.e. scores, or on the processes used to achieve that product. However, studies have not established whether or not past experience with computers affects test performance on a computer-based level two test. There is a scarcity of comparability research on localized language tests needed to detect any potential impact of the test delivery mode when converting conventional paper tests to computerized tests. Sawaki (2001) recommended that this type of empirical work should utilize different methodologies such as eye movement, verbal protocols, post hoc interviews and questionnaires in order to obtain useful results.

Studies have explored the comparability of paper and computer-based testing in a level two reading context and the impact of test takers' characteristics, i.e., computer familiarity, computer attitude, testing mode preference and test taking strategies, on students' performance on computer-based tests, and in comparison with paper-based tests. Studies have not found significant differences between the mean scores on both modes; none of the factors examined had an influence on students' performance when doing the computer-based tests.

### **Differences between Paper-based and Online Tests**

Differences between traditional paper-based practice psychometric tests (i.e. practice psychometric tests taken from books) and online practice psychometric tests include how the items appear visually, how they are ordered, and whether the test offers you the experience of working under real-time limits. The order presentation of online psychometric tests items is predominantly randomised. In contrast, traditional paper-based psychometric tests do not have this functionality.

Additionally, often computerised psychometric test items are presented one by one on separate screens, meaning that examinee are more interactive as they navigate to the next

item. In contrast, traditional paper versions of psychometric tests list multiple questions on each page. Online practice psychometric tests offer you the possibility to practice solving test questions under time limitations. In contrast, traditional practice tests taken from books do not offer this important learning experience.

### **2.2.6 Benefits of Information and Communication Technology in Assessment**

Any of the delivery modes, whether Paper-Pencil and/or computer-based, comprises advantages and challenges which can hardly be compared, especially in relation to estimated costs. The use of CBA includes additional benefits which can be achieved from an organizational, psychological, analytical and pedagogical perspective. Many experts agree on the overall added value and advantages of e-testing in large scale assessments.

The Internet as a medium for psychological testing, nonetheless, has several advantages, some identical to those of personal-computer testing and others that are unique. First, it enables fast, simple, convenient, and highly accessible testing. Second, because the user's responses are made electronically (through mouse clicks on the computer screen); they are ready for scoring (and other statistical use) as soon as the respondent has finished taking the test. Third, scoring is done electronically and, thus, is practically errorless. Fourth, updates of instructions, test items, scoring technique, and norms are easily made at a central location and are active immediately. Fifth, tests may be taken at any time and any place for maximum convenience. Sixth, there is a saving on expendable materials.

One additional and highly important advantage of Internet-based testing is related to a specific capability of the computer that is impossible in standard testing: the use of three dimensional (3D), virtual reality, and graphical interface. In cases in which perception is to be assessed, such as three-dimensional spatial-ability testing or subjective perceptions of reality (e.g., body image), a computer can be of much use. General advantages of CBA systems over traditional paper-and-pencil testing (PPT) have been demonstrated in several comparative works and include: increased delivery, administration and scoring efficiency; reduced costs for many elements of the testing lifecycle; improved test security resulting from electronic transmission and encryption; consistency and reliability; faster and more controlled test revision process with shorter response time; faster decision-making as the result of immediate scoring and reporting; unbiased test administration and scoring; fewer response entry and recognition errors; fewer comprehension errors caused by the testing

process; new advanced and flexible item types; increased candidate acceptance and satisfaction; evolutionary step toward future testing methodologies.

It is also envisaged that computer-based formative assessment, in particular, would play an increasingly important role in learning, with the increased use of banks of question items for the construction and delivery of dynamic, on-demand assessments. There are a number of other benefits to computer-based testing. One other benefit is faster access to results, with scores available to be seen online just a few weeks after the test. Many students are more comfortable completing a test with a keyboard and mouse rather than paper and pen. Test takers can edit their answers on screen during the exam. The use of headphones for the listening elements of tests means that they can adjust the volume to suit their needs. Online timer and help functions allow candidates to get the best from their exam performance.

### **2.2.7 Barriers to integration of ICT in Educational Assessment**

A number of important physical, cultural, socioeconomic and pedagogical factors hindering the use of ICT by teachers and students in sub-Saharan Africa, particularly in rural schools, emerge from the review. These include lack of electricity and frequent power outages, poor technology infrastructure, overcrowded computer labs and low bandwidth, high costs of internet connectivity, software licences and equipment maintenance, insufficient and inappropriate software

#### **a) Knowledge and Skills of Teachers**

Educational factors including levels of teachers' own education and literacy rates and access to professional development play an important role. Studies on developing maturity in learning technology reveal that the most significant barriers identified are linked to staff attitude and training in the use of ICT, access and ICT skill in general. Their limited ICT knowledge, makes teachers anxious about using ICT in the classroom and thus do not feel confident to embrace new pedagogical practices. The studies on teachers' perspective of the use of computer revealed workload and time management as barriers to implementing computer in classroom instruction.

Further, lack of technical support was reported to be another factor inhibiting the use of ICT in classroom (Preston, 2000). According to Bradley and Russell (1997), recurring faults, and the expectation of faults occurring during teaching sessions, are likely to reduce teachers' confidence and cause teachers to avoid using the technology. On the other hand, literature on

teachers' perception of training needs highlighted teachers' preferences for learning basic computer skills before integrating technology into the curriculum.

Unsuitable teacher training programmes fail to engage teachers in using ICT both during their lessons and also in the preparation of lessons beforehand. The most commonly mentioned cause of this is that training courses focus mainly on the development of ICT skills and not on the pedagogical aspects of ICT. It is interesting to observe that although some teachers have good ICT skills in terms of their own personal use, they are unable to transfer these skills to using ICT in the classroom (Becta, 2004).

**b) Physical infrastructure**

Access to electricity and frequent power disruptions are challenges that continue to hamper adoption of ICTs in most rural parts of Africa and particularly so in education sector. Indeed, a recent survey by Digital International indicated that the proportion of schools without electrical power range from 58% to 96% in some rural areas. This makes the use of available ICTs considerably difficult.

**c) Computer hardware, Software and peripherals**

The lack of high quality hardware and suitable educational software is also considered by the majority of ICT coordinators as an important hindrance to further development of ICT in education. Poorly maintained computers are usually unreliable and likely to cause disruption to even the best planned lessons. Similarly, inappropriate software does not enhance a lesson in any way and rather disengages both teachers and students from the learning process. The high cost of ICT maintenance and software licenses also contributes to further inhibit ICT usage in schools. There are also insufficient ICT peripherals like printers and scanners.

**d) Connectivity and Network infrastructure**

The other challenge is inadequate connectivity and network infrastructure. As reported in the "ICTs in Education Options Paper", one of the main problems is limited penetration of the physical telecommunication infrastructure into rural and low-income areas. Specifically, the main challenge is limited access to dedicated phone lines and high-speed systems or connectivity to access e-mail and Internet resources. Appropriate technologies for access to Internet resources, including wireless systems remain quite expensive. Hindrances to application of ICT include high costs of Internet provision, costs associated with digital equipment, inadequate infrastructure and support. Indeed, a small proportion of learning

institutions have direct access, through Internet Service Providers (ISPs), to high-speed data and communication systems.

#### **e) Policies and Planning**

Schools face the problem of unsuccessful organisational implementation of ICT because ICT is not seen as a part of the general strategy at school level. Even if some schools have developed ICT strategies, these are not integrated into the school's overall strategies. Yet ICT is no longer a goal itself, an isolated phenomenon requiring a special strategy. Instead, it should be used to support whole school development.

#### **f) Challenges related to assessment and testing**

In relation to assessment, there is a danger that technology would contribute to the mindless use of new resources, such as using items on-line developed by some companies without adequate evidence of reliability, validity, and fairness, and crunching numbers with software programs without sufficient thought about weighting, error, and averaging. Many of the groups putting tests on the Internet are composed of IT and sales, but not psychometricians, or other measurement experts.

Some computer systems can't handle questions that are part automatically graded and part manually graded and others may discard answers that contain arbitrary special characters. It may also be easier for students to cheat by communicating with others via the net. Students may use imaginary network problems as an excuse for their own lack of preparation and others may fail to save their work, or accidentally exit the exam.

### **2.2.8 Kenya Education Information and Communication Technology Policy**

The Ministry of Education developed National ICT Strategy for Education and Training (Kenya. MoE, 2006) aimed at guiding the sector in the adoption of ICTs across all levels of education and training. The strategy has been developed taking into consideration the policy environment captured in the National ICT Policy of 2006 and sector policy in Sessional Paper No. 1 of 2005. The strategy has also been developed in line with the E-Government Strategy of 2004 and the wider Economic Recovery Strategy Paper for Wealth and Employment Creation (ERSWEC). This strategy fits into the Kenya Education Sector Support Programme (KESSP) which is the sector investment programme aimed at achieving Education for All (EFA), Millennium Development Goals (MDGs) and Kenya Vision 2030.

The aim of the policy was to improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services as reported in the ICT in Education options paper (Kenya MoEST, 2005). Although the national ICT policy has several sections, objectives and strategies regarding ICT in education are spelt out in the information technology section. In this section, the objective regarding the use of ICT in schools, colleges, universities and other educational institutions to improve the quality of teaching and learning is spelt out as documented by Farrell in the *Survey of ICT in Africa Report (2007)*.

Policy documents in the education sector have given considerable attention to priorities related to access, quality, equity and relevance at all levels. This strategic plan considers and proposes that ICT can contribute substantially towards realization of these objectives. In addition, ICT has considerable potential to support implementation of Free Primary Education (FPE) and to address emerging challenges such as; overcrowded classrooms, high Pupil Teacher Ratios (PTRs) particularly in densely populated and semi-arid areas, shortage of teachers on certain subjects or areas, and relatively high cost of learning and teaching materials.

One important strategy outlined in this report is the promotion and development of specific e-learning resources that would address the educational needs of primary, secondary and tertiary institutions. A significant step in this direction is the digitisation of the curriculum which is ongoing at the Kenya Institute of Education (Ratemo, 2009). Under the subtitle 'E-learning', the ICT policy goes on to outline the strategies that would be used in the promotion and development of ICT in teaching and learning.

In an effort to promote the development of content that would address the educational needs of primary, secondary, and tertiary institutions, the government has come up with two ways of developing the curriculum (Kenya. MoEST ICT in Education options paper, 2005). One, by adapting existing educational materials and distributing them to the schools; and the second, by beginning the process of having schools create their own e-content. Besides, building capacity in Kenya to create instructional material for an increasing digital world is noted as an important aspect of the curriculum that is expected to pay dividends in improving the quality of education.

Farrell (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 (Kenya. 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 ongoing professional development for teachers. The programme should be consistent with the workshops for lecturers and pre-service teachers at teacher training colleges. The paper further notes that the training of teachers should focus on increasing efficiency in the teachers' workload and integrating ICT to improve teaching and learning objectives.

The policy further lays the framework for e-learning considered crucial to its development and utilisation. Need is expressed to provide affordable infrastructure to facilitate dissemination of knowledge and skill through e-learning platforms; and to promote the development of content to address the educational needs of primary, secondary and tertiary institutions. The e-learning framework further seeks to facilitate sharing of e-learning resources between institutions and to exploit e-learning opportunities to offer Kenyan education programmes for export.

The realisation of these intentions is expressed in the national ICT strategy for education and training, the policy document for ICT in education (Kenya. MoE, 2006). These include, among others, (1) equipping education institutions with digital equipment to stimulate integration of ICT in education and (2) supporting initiatives that provide digital equipment to educational institutions, with priority to secondary and primary schools. The expected outcome of these measures was to improve equipping of educational institutions with digital infrastructure up to 80% in secondary schools and up to at least 10% in primary schools. The average access was expected to improve from the prevailing one computer for 150 students to one computer for at least 50 students in secondary schools. The strategy also underscored the need for access and equity by establishing mechanisms to support infrastructural development in remote areas, implementation of policy provisions that are favorable to

special needs groups, and making budgetary provisions for adequate supply of ICT equipment and facilities (Kenya. MoE, 2006).

A main component of this implementation strategy is achieved through the Kenya ICT Trust Fund. Kenya ICT Trust Fund is a registered consortium in the form of an NGO in Kenya that brings together many partners from the public, private and civil society sectors. It is chaired by the Permanent Secretary of the Ministry of Education. Its main objective is to mobilise funds for the sole purpose of setting up computer laboratories in all Kenyan secondary schools in 4-5 years.

A number of initiatives have delivered ICT infrastructure to schools. These include initiatives supported by parents, the government, NGOs, or other development agencies and the private sector (Farrel, 2007). Notable among these are EMIS, Computers for schools – Kenya, NEPAD e-schools initiative, and the Microsoft Partners in Learning program (Microsoft, 2007). Other initiatives worth noting include Network Initiative for Computers in Schools (NICE) which coordinates member activities related to computer equipment sourcing, refurbishment, distribution, installation, training, maintenance, networking, connectivity and use of ICT as a tool within the formal and informal sectors (Wambui and Barasa, 2007).

The E-Government Strategy, which was adopted in 2004, emphasizes transformation of Government services from manual to digital-based operations. It also encompasses provision of online examinations, processing admissions for primary and secondary schools and online dissemination of school and other educational curricula.

### **2.3 Theoretical Background of the study**

Information and Communication Technology research has also yielded many theories and models, with different sets of acceptance determinants. This study focused and discussed two such models. The models reviewed are (i) the Innovation Diffusion Theory (Rogers, 2003), and (ii) the Technology Acceptance Model (Davis, 1989)

#### **a) Technology Acceptance Model**

In the Technology Acceptance Model (TAM), developed by Davis (1989), there are two determinants including perceived ease of use and perceived usefulness. Both are considered distinct factors influencing the user's attitude towards using the technology, though perceived ease of use is also hypothesized to influence perceived usefulness and attitude towards using



the technology. Finally, such attitude towards using the technology determines the behavioral intention to use that technology. The goal of the model is to provide an explanation of the determinants of computer acceptance by tracing the impact of external factors on internal beliefs, attitudes and intentions. Since its introduction by Davis (1989), Technology Acceptance Model has been widely used for predicting the acceptance, adoption, and use of information technologies.

Perceived usefulness is defined as the degree to which a person believes that using a particular technology enhances his or her job performance. People tend to use or not to use an application to the extent they believe it would help them perform their job better (Davis, 1989). Perceived usefulness explains the user's perception to the extent that the technology improves the user's workplace performance (Davis, 1989). This means the user has a perception of how useful the technology is in performing his job tasks. This includes decreasing the time for doing the job, more efficiency and accuracy.

Perceived ease of use refers to the degree to which a person believes that using a particular technology would be free of effort. Users believe that a given application is useful, but they may, at the same time, believe that the technology is too hard to use and that the performance benefits of usage are outweighed by the effort of using the application (Davis and Arbor, 1989). Perceived ease of use explains the user's perception of the amount of effort required to utilize the system or the extent to which a user believes that using a particular technology would be effortless (Davis, 1989).

Two other constructs in TAM are attitude towards use and behavioral intention to use. Attitude towards use is the user's evaluation of the desirability of employing a particular information systems application. Behavioral intention to use is a measure of the likelihood a person would employ the application. TAM's dependent variable is actual usage. TAM has been tested in many empirical researches and the tools used with the model have proven to be of quality and to yield statistically reliable results. Davis finds that perceived usefulness is the strongest predictor of an individual's intention to use an information technology. The researcher therefore applied the theory to evaluate if college tutors consider the emerging ICT related practices useful in their professional tasks.

### **b) The Innovation Diffusion Theory**

Rogers studied the process that communities use in incorporating new ideas and developed a “theory of diffusion” describing how new ideas spread through a given population of people. Diffusion of innovation is the process by which an innovation is adopted and gains acceptance by members of a certain community. The process occurs over time and can be facilitated through action to educate, invite and support participants in incorporating new technologies, approaches, or products and services (Rogers, 2003).

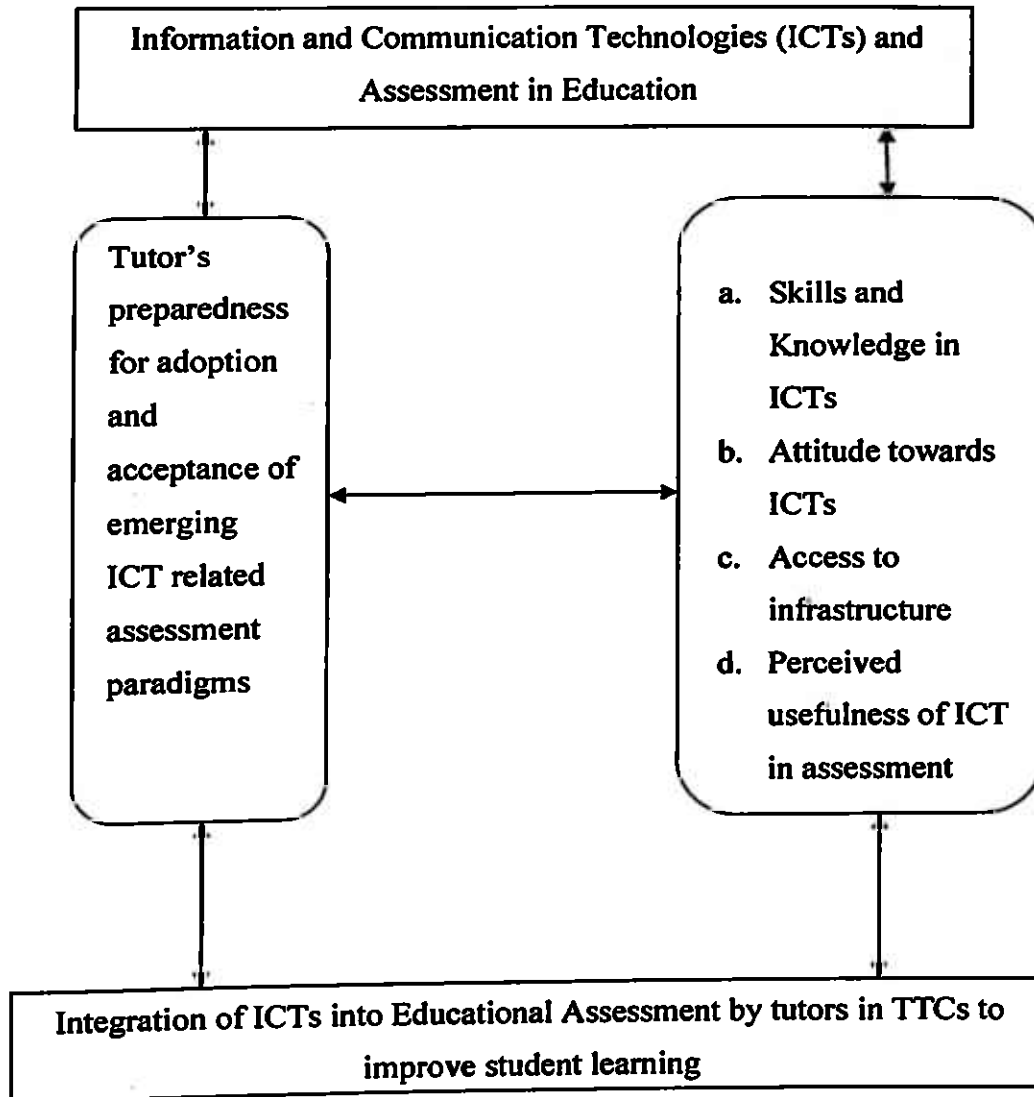
Innovation diffusion research has attempted to explain the variables that influence how and why users adopt a new information medium, such as the Internet. Accordingly, the innovation-decision process is the process through which an individual passes: - first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and finally to confirmation of this decision. (Rogers, 2003)

Why some individuals embrace technological change and adopt innovations more readily than others do may be explained by the application of diffusion of innovations theory (Rogers, 2003). He further concludes that the diffusion of innovation is a type of social change highly dependent upon the individuals who are involved in the adoption of the innovation. Since Rogers uses the terms innovation and technology interchangeably, the diffusion of innovation framework seems particularly suited for the study of the diffusion of ICT into education assessment.

In this study, the researcher employed the Roger’s theory and mainly focused on the first two stages, that is, on knowledge of an innovation and attitudes towards it. Since the teachers’ attitudes are indispensable to the innovation-decision process, the study aims at investigating tutors preparedness in terms of attitude and skills toward ICT integration in assessment in Kenyan teachers’ training colleges.

## 2.4 Conceptual Framework of the Study

Figure 1 Conceptual Framework for the research project



Source: Author, 2012

## **CHAPTER THREE**

### **3.0 METHODOLOGY**

#### **3.1 Introduction**

The purpose of the study was to examine and describe the preparedness of college tutors to integrate ICTs into the assessment processes and practices in education. This chapter discusses the procedure and techniques that were used in this study. It focuses on research design, locale of the study, target population, sample and sampling procedures, research instruments, data collection procedures, data processing and data analytical techniques.

#### **3.2 Research design**

A descriptive case study was designed to investigate tutors' preparedness towards integration of ICTs into educational assessment in teacher training colleges. The research employed both qualitative and quantitative tools as they were best suited to produce data for realization of research objectives. Both methods supplemented each other in that qualitative method was seeking to build a holistic description to inform understanding of the phenomenon while quantitative methods provided the discrete quantifiable data.

The case study examined tutors preparedness to use ICTs in educational assessment in depth. Singleton, Straits, & Straits (1993) recommend case studies when the item under study is a single social phenomena or a single unit of analysis, such as an organization. Data about the present status, past experiences, and environmental forces that contribute to the situation of tutors of Kagumo TTC and how these factors relate to one another were gathered. The Case study was designed to bring out the details from the viewpoint of the participants by using multiple sources of data.

#### **3.3 Study locale**

The locale of the study was Kagumo Teachers' Training College in Nyeri County of Kenya. Kagumo TTC is a public institution with a mandate of Ministry of Education (MoE) to train Diploma teachers for Kenya's secondary schools. It is currently the oldest and largest mid-level college training Diploma teachers in Kenya, offering a diverse curriculum. The tutors are employees of Teachers Service Commission (TSC) with specializations in various disciplines which include Humanities, Sciences, Mathematics and Languages.

Kagumo TTC is one of the public institutions offering three year Diploma in Teacher Education (DTE) curriculum with an average of three hundred students per cohort. Several subjects are offered including but not limited to Agriculture, Biology, Chemistry, English, Kiswahili, Mathematics, History, Geography and Religious Education. Professional and support subjects which include Education, Physical Education, Environmental Studies, etc are also offered to all trainees. The DTE curriculum is developed by Kenya Institute of Education and examined by KNEC.

Kagumo TTC mandate to implement DTE curriculum, and train teachers is very crucial in the country's education development, and hence the quality and competences of the trainers is imperative. Therefore, the ability of the tutors to integrate ICTs for education is an issue of concern. The contribution of the college in teacher training in Kenya is enormous and was therefore selected for the case study in this research.

### **3.4 Population of the study**

The researcher made careful consideration during basic planning of research and selection of the study population. The study population is defined as all the members of a real or hypothetical set of people, events or objects, with which a researcher wishes to generalize the research study (Borg and Gall 1989). The level of a nation's education is dependent on the quality of its teachers; hence teacher education is instrumental. As tutors in Kenyan colleges seek to prepare quality teachers, they are expected to be fairly receptive towards adoption and implementation of ICT in education. The target population for this study consisted of the tutors of Kagumo Teachers' Training College. Tutors were drawn from all teaching subjects and comprised both genders. The target population of this study was one hundred and fourteen (114) tutors of Kagumo TTC which include sixty seven Males and forty seven Females.

### **3.5 Sample size**

A set of respondents was selected from the population of the one hundred and fourteen tutors for the purpose of this case study. To ensure that the sampled tutors accurately represent the target population, quota sampling was used to predetermine the number of participants desired. The researcher determined sample size, along with appropriate proportions of subsamples, when identifying participants of certain characteristics. A sample of forty respondents was selected in equal numbers from four quotas namely Humanities, Sciences,

Mathematics and Languages. A sample of forty respondents was selected in the study after considering the homogeneity of the population in that they are all teachers in the same institution.

### 3.5.1 Sampling procedure

Sampling procedure was conducted to ensure that the results from the study were representative of the entire population. Sampling refers to the process of selecting individuals from a larger group of people and drawing conclusion that are “an accurate representation of how the larger group of people acts or what they believe” (Frankel & Wallen, 2006). To select a representative sample, the researcher prepared a sampling frame which was a list of all tutors in Kagumo TTC. The tutors were categorized according to their disciplines and gender.

The four main disciplines, namely Humanities, Sciences, Mathematics and Languages were purposively selected. A total of ten tutors were selected proportionally from each of the four disciplines by taking into account their gender. This resulted to a sample of forty respondents. For Humanities, tutors of History and CRE were purposefully selected, for Sciences Chemistry and Biology, while in Languages only English, being the language of instruction was considered. Table 3.1 summarizes the sample framework.

**Table 2 Sampling Frame**

Teaching Subjects	Population of Tutors			Sample Size		
	Male	Female	Total	Male	Female	Total
Humanities	6	8	14	4	6	10
Sciences	17	5	22	7	3	10
Mathematics	12	5	17	7	3	10
Languages (English)	5	14	19	3	7	10
<b>Total</b>	<b>40</b>	<b>32</b>	<b>72</b>	<b>21</b>	<b>19</b>	<b>40</b>

Source: Author, 2012

### **3.6 Research instruments**

This study used three research instruments to collect data from tutors, which were questionnaires, an interview schedule and an observation checklist. Yin (1994) suggested use of multiple sources of evidence as the way to ensure construct validity. The study adopted the data triangulation technique by using a combination of data sources with the effect that the strengths and weaknesses in each source are compensated. Triangulation increases the reliability of the data and the process of gathering it. In the context of data collection, triangulation serves to corroborate the data gathered from other sources. It is the development of a formal case study protocol that provides the reliability that is required in this research. The questionnaire sought to measure tutors attitude towards ICTs, level of ICT skills, perceived usefulness of ICT assessment practices, as well as ICT infrastructure accessible to them for integration of ICT into educational assessment. The interview schedule and the observation checklist were used to clarify and fill possible gaps in the completed questionnaire.

#### **Questionnaires**

Questionnaires are appropriate in collecting information that is not directly observable as they inquire about feelings, motivation, attitudes, accomplishments as well as experiences of individuals (Gall et al, 1996). The questionnaire was developed after an extensive review of literature and scales in different educational backgrounds guided by theoretical base of the study. Items were constructed in a way that they accurately measured the objectives of the research. The questionnaire comprised closed-ended items, which sought objective responses and open ended items which sought subjective responses.

The questionnaire sought to measure tutors attitude towards ICTs, level of ICT skills, usefulness of ICT assessment practices, as well as ICT infrastructure accessible to them for integration of ICT into educational assessment. The closed-ended items were based on Likert attitude scale consisting of a set of statements to which an individual responds. The questionnaire was distributed to the respondents selected from the college by hand and was self-administered. The items of the questionnaire consisted of two sections. Section A sought to collect personal information of the respondents while section B had questions seeking to measure the preparedness of college tutors for integration of ICT into the educational assessment.

### **Interview Schedule**

One interview was conducted during the study to gather information from the Principal of the institution on preparedness of the institution's tutors to integrate ICT into their assessment processes. The interview provided qualitative answers required for achieving more complete responses which were not be possible with questionnaire. The interview was guided by structured schedule with open ended questions which were asked by the researcher to the college principal. The interview sought to enquire from the college principal on the policy for ICT, policy for assessment and ICT, provision of ICT infrastructure to tutors and administrative strategies to support tutors in their endeavors of integrating ICT into assessment.

### **Observation Checklist**

The observation checklist was used to ascertain the ICT infrastructure in the College that is accessible to tutors for use in their professional tasks. The researcher examined secondary data that show records of ICT infrastructure as documented in the institution. The data collected mainly entailed verification through direct observation by the researcher on the ICT infrastructure accessible to tutors in the college. The observation was guided by a structured checklist which sought to establish the ICT infrastructure accessible to tutors namely hardware, software and network connectivity. Quantitative and qualitative data was obtained on the type of equipment and quantity that is accessible to college tutors for use in their professional tasks. The observation focused on computers systems, internet connectivity, database systems, website, and computer peripherals such as scanners, printers and cameras.

#### **3.6.1 Validity of the instruments**

The process of developing and validating the instruments in large part focused on reducing errors in the measurement process. It was important to validate the degree to which evidence supports the inferences that were made using data obtained in the research (Fraenkel and Wallen, 2000). Triangulation is the strategy that was employed for improving the validity and reliability of research findings in this case study. Triangulation, which is the searching of converging findings from different sources, was to increase construct validity. The study therefore used three different research instruments, namely questionnaire, interview, and observation.

The development of content valid instruments was typically achieved by a rational analysis of the instruments by lecturers who are experts of measurement and evaluation in the school of



education from University of Nairobi. Specifically, lecturers reviewed all of the items for readability, clarity, comprehensiveness and relevance to research objectives and came to some level of agreement as to which items should be included in the final instrument. The responses from the experts were analysed and the instruments reconstructed as per their recommendations. The instruments were resubmitted to the supervisor for a final validation. The final instruments were printed and administered to the tutors.

### **3.6.2 Reliability of the instrument**

A reliable instrument is one that consistently produces the expected results (Mulusa, 1990) and therefore a pilot study was conducted with tutors who were not part of the study sample to establish internal consistency of the questionnaire. The coefficient of internal consistency provided an estimate of the reliability of measurement and was based on the assumption that items measuring the same construct should correlate. The questionnaire was therefore be piloted with fourteen members chosen from the members of the population and who did not constitute the sample of the case study.

Through piloting, inconsistencies were corrected enhancing the reliability of the instruments. The method that was used for estimating internal consistency reliability was Cronbach's alpha. Results indicate that the coefficients were relatively high ranging from 0.835 (Usefulness of ICT in educational assessment) to 0.756 (Attitude of tutors towards ICT). According to Garson (2008) an instrument is acceptable for research purposes when its reliability using Cronbach's alpha is more than 0.70. The reliability of the items in the questionnaire used in this study was high and in acceptable range. After analyzing the data resulting from the pilot study, ambiguous items were improved or discarded.

## **3.7 Data collection procedures**

### **Preliminary Preparation**

The researcher applied for a permit from the Kenyan Ministry of Education. Communication was then be made to the District Education Office and an introduction letter sought from the office. A letter, to the Principal of the college informing him of the proposed visit and its purpose by researcher was sent. The researcher then visited the institution informing the college administration of intended study. During the visit, an arrangement of issuing the questionnaires to the respondents was made. The researcher also informed the principal of the intended interview and requested for an appointment for the conduction of the interview. The

researcher also informed the college administration of the intention to gather data on college's ICT infrastructure accessible to tutors for use in their professional tasks.

#### **Administration of Instruments**

The questionnaires were delivered to the respondents by hand. The researcher visited the college and administered the instruments to the sampled tutors. The questionnaires were administered and collected the same day from the college tutors. This ensured that the respondents do not discuss and modify their responses. All the respondents were assured of confidentiality and security in dealing with their responses. The college principal was interviewed by the researcher in accordance with the prearranged plan between the two parties. The observation checklist was also be filled by the researcher after visits to the various departmental offices in the colleges.

#### **3.8 Data analysis Technique**

In the process of interpretation of the mass of collected data, both qualitative and quantitative data was analysed. The data analysis was initiated by examining the gathered raw data for accuracy, usefulness and completeness. Qualitative data from open-ended questions in the questionnaire and principal interview was described and content analysis was done by reducing the responses to small statements. Interim report from each item was merged to make a final report. Quantitative analysis involved editing, coding and entering into a table.

Descriptive statistics (frequencies, percentages) were used mainly to analyze the data of the respondents and observation checklist. Parametric statistics were conducted to analyze any difference between tutors' personal characteristics and other variables like tutors attitude towards ICTs, level of ICT skills and perceived usefulness of ICT assessment practices. Report was formulated to be merged in the final report. The data obtained through observation corroborated evidence gathered from questionnaires and interview on the ICT infrastructure accessible tutors.

## CHAPTER FOUR

### 4.0 RESULTS PRESENTATION AND INTERPRETATION

#### 4.1 Introduction

The purpose of this research was to examine the preparedness of tutors for the integration of ICT into educational assessment processes. This chapter presents analysis and findings of the study as set out in the research methodology. The data collected has been edited, organized, analyzed and presented using tables and graphs. The specific areas discussed in this section include questionnaire return rate, general information of respondents, tutors' ICT skills, attitude, access to ICT infrastructure and tutors' views on usefulness of ICT integrated assessment practices. The data was gathered from questionnaire, an interview and observation checklist. The research instruments were designed in line with the objectives of the study.

#### 4.2 Background

##### 4.2.1 Questionnaire Return Rate

The study sampled forty respondents from the target population in collecting of data with regard to the preparedness of tutors for the integration of ICT into educational assessment. The questionnaire return rate results are shown in Table 3

**Table 3: Response Rate**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Responded	38	95%
Not responded	2	5%
<b>Total</b>	<b>40</b>	<b>100%</b>

**Source: Author, 2012**

From the study, 38 out of 40 target respondents filled in and returned the questionnaire contributing to 95%. This commendable response rate can be attributed to the data collection procedure, where the researcher personally administered questionnaires and waited for respondents to fill in, kept reminding the respondents to fill in the questionnaires through frequent phone calls and picked the questionnaires once fully filled. This response rate was excellent and representative and conforms to Mugenda and Mugenda (1999) stipulation that a

response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. The questionnaires that were not returned were due to reasons like, the respondents were not available to fill them in at that time and with persistence follow-ups there were no positive responses from them. The response rate demonstrates a willingness of the respondents to participate in the study.

#### **4.2.2 Respondents Information**

The study targeted the teaching staffs in collecting data with regard to preparedness of tutors for the integration of ICT into educational assessment. As such the results on personal profiles of these respondents were investigated in the first section of the questionnaire. They are presented in this section under gender, age, highest level of education, teaching experience and teaching subjects.

The research sought to find out the gender of the respondents. In this study the respondents sampled were expected to comprise both male and female workers. As such, the study required the respondents to indicate their gender by ticking on the spaces provided in the questionnaire. Table 4 shows the distribution of the respondents by gender.

**Table 4: Respondents by Gender**

<b>Gender</b>	<b>Frequency</b>	<b>Percentage</b>
Male	22	57.9%
Female	16	42.1%
Total	38	100%

**Source: Author, 2012**

From the study, 57.9% of the respondents were male staffs, while 42.1% of them were female. It can be concluded that the majority of the employees in the institutions are male staffs. The findings show that the institutions studied had both male and female members.

In order to avoid biasness, this study thus had to investigate the composition of the respondent in terms of age brackets to understand their familiarity with the concept investigated by the study in the education setting. The study posed a question requesting the respondents to indicate their age brackets. Table 5 shows the results of the findings on the age brackets of the respondents.

**Table 5: Age of Respondent**

<b>Age Bracket</b>	<b>Frequency</b>	<b>Percentage</b>
24 yrs and below	0	0.0%
25-32 yrs	0	0.0%
33-45 yrs	19	50.0%
> 45yrs	19	50.0%
<b>Total</b>	<b>38</b>	<b>100.0%</b>

**Source: Author, 2012**

From the study, 50% of the respondents reiterated that they were aged 33-45 years, as well as another 50% of those who were above 45 years of age. The results show that the respondents were well distributed in terms of age and that they are active in technological advancements and productivity and hence can contribute constructively in the issues sought in this study.

The institution studied has staffs with varied education backgrounds, hence different academic qualifications. This difference might contribute to differences in the responses given by the respondents. As such the study sought to establish the highest academic qualifications attained by the respondents. The responses on this question are depicted in table 6.

**Table 6: Level of Education of respondents**

<b>Level of education</b>	<b>Frequency</b>	<b>Percentage</b>
Diploma	2	5.3%
Degree	13	34.2%
Masters Degree	23	60.5%
<b>Total</b>	<b>38</b>	<b>100.0%</b>

**Source: Author, 2012**

According to the results depicted in table 6, an overwhelming majority (60.5%) of the respondents indicated that they had acquired masters degrees as their highest level of education, 34.2% of them had undergraduate degrees, while 5.3% of the respondents had attained college diplomas as their highest level of education.

**Table 7: Cross-Tabulation of Gender of Respondent against Level of Education**

		Level of Education					
		Diploma		Degree		Masters Degree	
		f	%	F	%	f	%
Gender of respondent	Male	2	9.5%	10	47.6%	9	42.9%
	Female	0	0%	3	18.8%	13	81.3%

From the cross tabulation, 81.3% of female and 42.9% of male respondents have masters degrees, the degree holders are 47.6% of male respondents and 18.8% of female, while all the respondents with diplomas as their highest level of education are male respondents. This results imply that majority of the respondents had at least an undergraduate degree and hence understood the information sought by this study. These findings further imply that all the respondents were academically qualified and also familiar with their duties and could dispense them effectively in terms of professional work ability and performance.

The length of service/working in an organization determines the extent to which one is aware of the issues sought by the study. The study further sought to establish the length of time that the respondents had been working in the institutions. The results on this question are presented in Table 8.

**Table 8: Teaching Experience of Respondents**

Duration in Years	Frequency	Percentage
11-15 yrs	11	28.9%
16-20 yrs	6	15.8%
21-25 yrs	12	31.6%
> 26yrs	9	23.7%
Total	38	100.0%

Source: Author, 2012

From the study, 31.6% of the respondents indicated that they had a teaching experience of 21-25 years, 28.9% of them had worked in the teaching field for a period of 11-15 years, 23.7% of the respondents indicated that they had a teaching experience of more than 26 years, while 15.8% of the respondents indicated that they had an experience of 16-20 years.

**Table 9: Cross-Tabulation of Gender of Respondents against Teaching Experience**

		Teaching experience of respondents							
		11-15 yrs		16-20 yrs		21-25 yrs		> 26yrs	
		f	%	f	%	f	%	f	%
Gender of respondent	Male	7	33.3%	3	14.3%	6	28.6%	5	23.8%
	Female	4	25%	2	12.5%	6	37.5%	4	25%

Source: Author, 2012

The study reveals that that 23% of male and 25% of female respondents have teaching experience of more than 26 years, 33.3% of male and 25% of female respondents have 11-15 years of teaching respondent, while 28.6% of male and 37.5% of female respondents have teaching experience of 21-25 years. This shows that the respondents had adequate work experience in the teaching career to respond effectively.

**Table 10: Categories of Teaching Subjects of respondents**

Subjects	Frequency	Percentage
Science based	16	42.1%
Art based	22	57.9%
Total	38	100.0%

Source: Author, 2012

On the subjects taught, 57.9% of the respondents' subject combinations were categorized art-based subjects as compared to 42.1% of those who classified that they taught science based subjects. The cross tabulation shows that 81.3% of respondents teaching art based subjects are female, while 61.9% were male were teaching science based subjects.

**Table 11: Cross-Tabulation Gender of respondent against teaching Subjects**

		Teaching Subjects			
		Science based		Art based	
		f	%	F	%
Gender of respondent	Male	13	61.9%	8	38.1%
	Female	3	18.8%	13	81.3%

Source: Author, 2012

### 4.3 The Results of the Study

#### 4.3.1 Level of skills of tutors

The respondents were requested to indicate whether there have ICT skills that enable integration of ICT into educational assessment.

**Table 12: ICT Skills to Integration of ICT into Assessment**

Response	Frequency	Percentage
Yes	32	84.2%
No	6	15.8%
Total	38	100.0%

Source: Author, 2012s

From the study 84.2% of the respondents indicated that indeed there have ICT skills that could enable integration of ICT into assessment as opposed to 15.8% of those who indicated contrary.

**Table 13: Teaching subject area of respondents against their view on whether they are equipped with ICT Skills**

		Endowed with ICT Skills that enable integration of ICT into educational assessment			
		Yes		No	
		f	Percentage	f	Percentage
Subject area of respondent	Science based	13	81.3%	3	18.8%
	Art based	19	86.4%	3	13.6%

Source: Author, 2012

The finding revealed that 81.3% of Science based as compared to 86.4% of Art based respondents indicated that they have ICT Skills that would enable them integrate ICT into assessment.



**Table 14: ICT Training Attained by Respondent**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	37	97.4%
No	1	2.6%
<b>Total</b>	<b>38</b>	<b>100.0%</b>

**Source: Author, 2012**

On whether the respondents have ever been trained on ICT, an overwhelming majority of the respondents, comprising 97.4%, indicated that they had been trained on ICT, while only 2.6% of them indicated that they had never been trained on ICT.

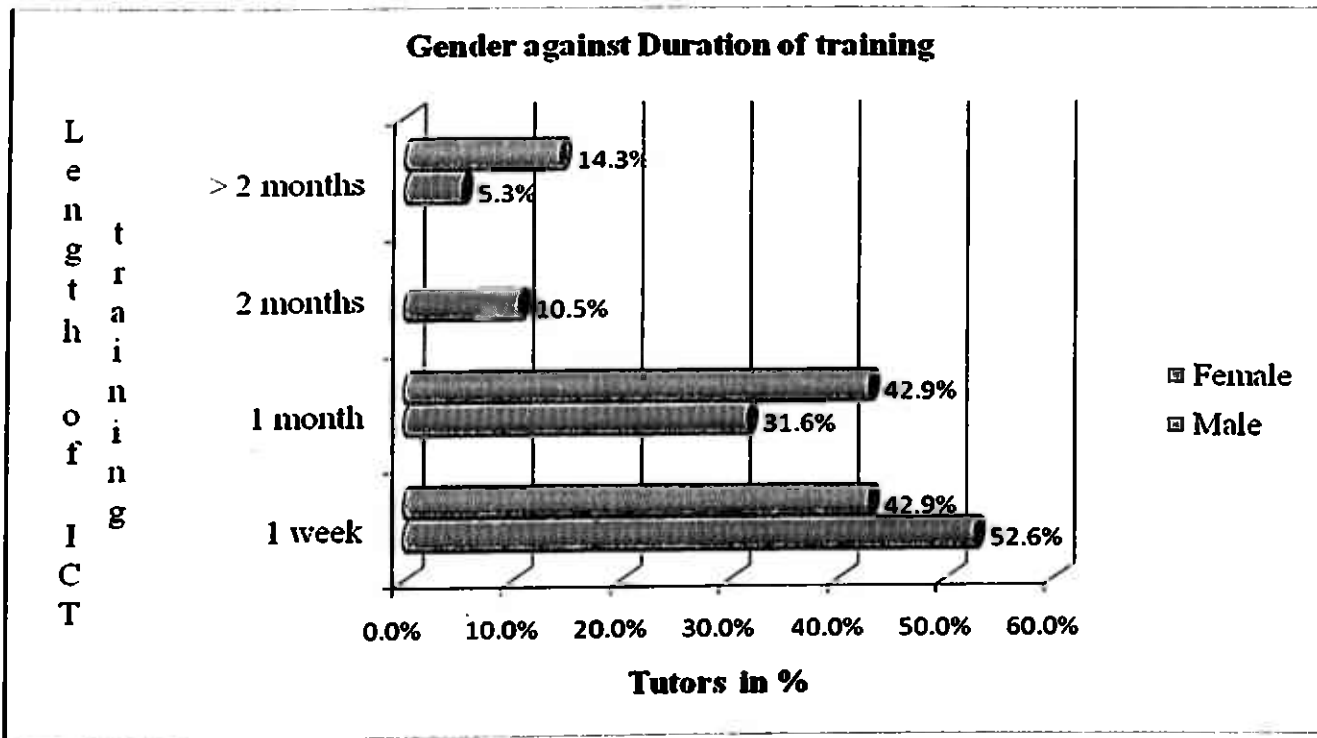
**Table 15: Duration of Training respondent had undergone**

<b>Duration</b>	<b>Frequency</b>	<b>Percentage</b>
1 week	20	52.6%
1 month	13	34.2%
2 months	2	5.3%
More than 2 months	3	7.9%
<b>Total</b>	<b>38</b>	<b>100.0%</b>

**Source: Author, 2012**

The study was interested in finding out the length of time that the ICT training took. From the study, 52.6% of the respondents indicated that the training was taken for 1 week, 34.2% of the respondents indicated that they were trained for a duration of 1 month, 7.9% of the respondents indicated that the training was for more than 2 months, while 5.3% of them indicated that the duration of training was 2 months.

**Graph 1: Cross Tabulation of Gender against Duration of training**



Source: Author, 2012

The finding indicate that 52.6% of males and 42.9% of female respondents had received training for 1 week as compared to 31.6% female respondents and 42.9% male respondents had acquired a 1 month training while only 10.5% male respondents had acquired a training of 2 months against none of the female respondents and 14.3% of female respondents had been trained for more than 2 months against 5.3% of male respondents.

The study sought to establish how the ICT training was sponsored. The results are as shown in table 16

**Table 16: Sponsorship on ICT Training**

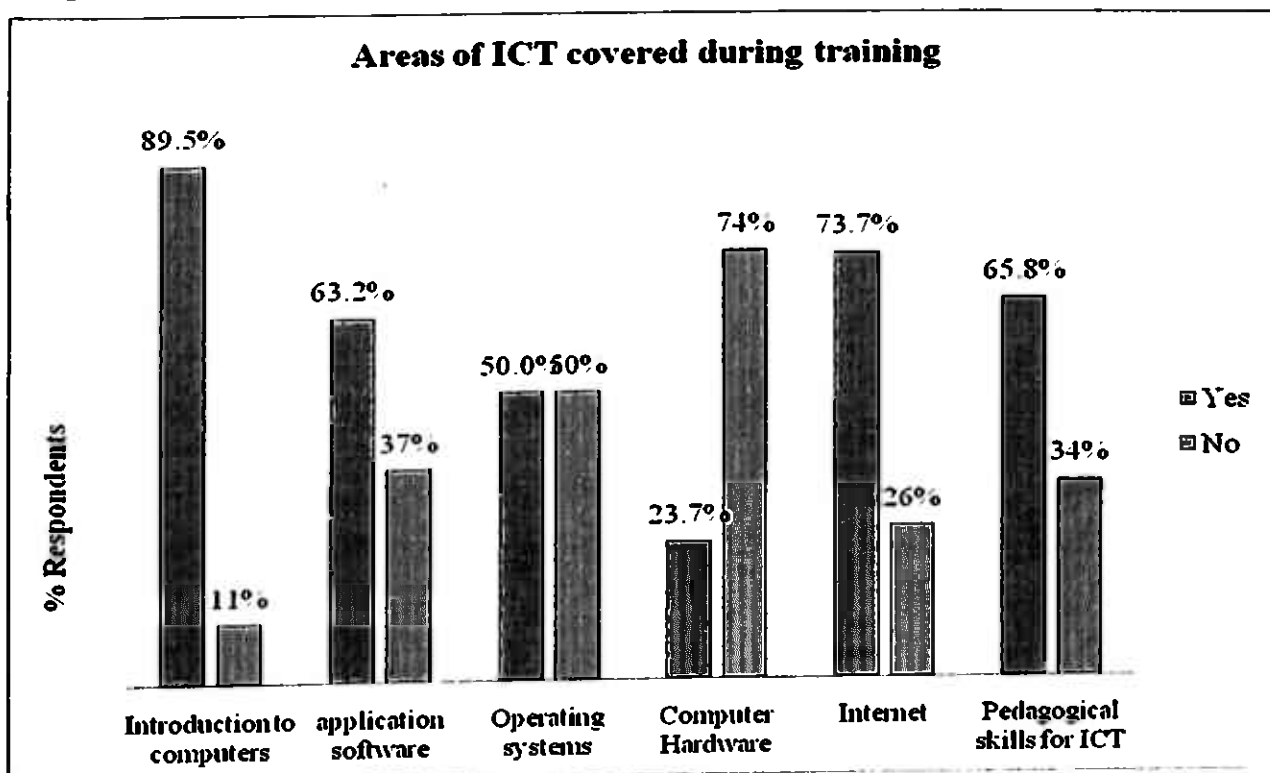
Training	Yes		No	
	f	%	f	%
College sponsorship of the ICT training	23	60.5%	15	39.2%
Self sponsorship of the ICT training	17	44.7%	21	55.3%
Ministry of Education/ USAID sponsorship of the ICT training	3	7.9%	35	92.1%

Source: Author, 2012

According to the results, 60.5% of the respondents indicated that they had received College sponsorship of the ICT training, 44.7% were self sponsored on the ICT training, 7.9% if the respondents had been sponsored by the Ministry of education in collaboration with USAID for the ICT training.

The respondents were required to indicate the various areas that were covered in ICT training that they had received. The results are as shown in the graph 2

**Graph 2: Areas Trained During the ICT Training**

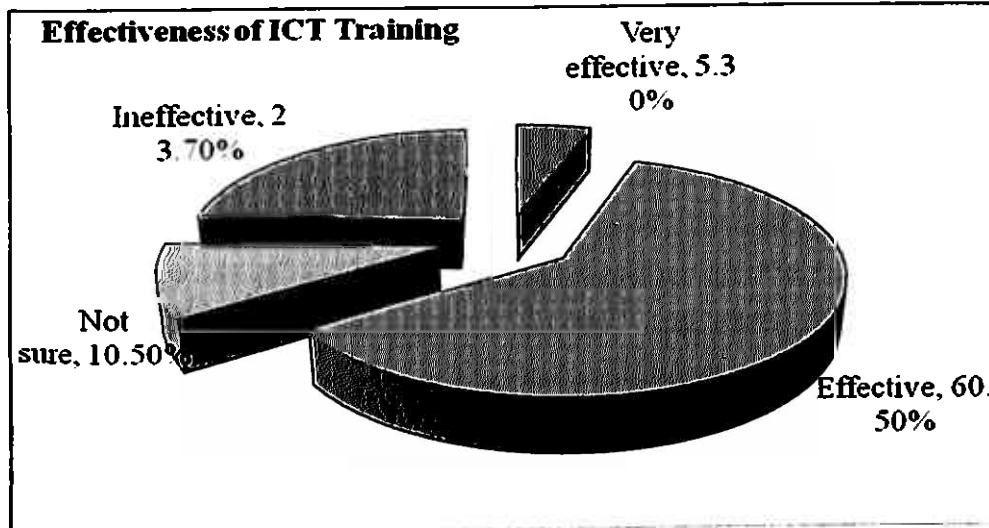


**Source: Author, 2012**

Majority of the respondents (89.5%) indicated that the ICT training was mainly on introduction to computers, 73.7% of them indicated that they got training on Internet, 65.8% of the respondents reiterated that they got training on Pedagogical skills for using ICT, 63.2% of them indicated ICT training on application software, 50% had ICT training on Operating systems, while only 23.7% of them got training on Computer Hardware.

The study further required the respondents to rate the ICT training in terms of equipping skills for use of assessment tasks.

**Figure 2: Rating of ICT training in terms of equipping with skills for use in assessment tasks**



Source: Author, 2012

From the study, 60.5% of the respondents rated the ICT training in terms of equipping skills for use of assessment tasks as being effective, 23.7% if they rated it as being ineffective, while only 5.3% of the respondents rated that training as being very effective.

**Table 17: Tutors rating of ICT Skills in Application Software**

ICT Skills	None		Low		Moderate		High	
	f	%	f	%	f	%	f	%
File handling (Creating/opening files)	0	0.0%	5	13.2%	20	52.6%	12	31.6%
Word Processing	0	0.0%	6	15.8%	14	36.8%	18	47.4%
Spreadsheets e.g. Excel	2	5.3%	12	31.6%	18	47.4%	6	15.8%
Presentation tools e.g. PowerPoint	1	2.6%	9	23.7%	18	47.4%	10	26.3%
Database Management Systems	6	15.8%	20	52.6%	8	21.1%	1	2.6%
Email, Chat	3	7.9%	11	28.9%	12	31.6%	12	31.6%
Web Search Engines	4	10.5%	12	31.6%	13	34.2%	8	21.1%

Source: Author, 2012

The results of table 17 have further been summarized in table 27 of appendix I. According to the results, 47.4% of respondents rated their word processing skills to be high, 52.6% rated

file handling skills to be moderate, and 47.4% rated presentation tools and spreadsheets skills as moderate. The study also revealed that 31.6% of respondents had low skills in Web search engines and 28.9% of respondent had low skills in email and chat. The study also depicted that respondents has least skill in database management system with 52.6% with low skill and 15.8% indicating they had no skills.

The findings from the interview revealed that in the performance contract document, the college has made a commitment to train a portion of its tutors every term. Also the college has also been conducting ICT training to its tutors in partnership with the Ministry of Education and in collaboration with private organizations or donors like Intel, Cisco, USAID, AED and FH1360. However the principal suggested that the Ministry of Education ought to develop a course tailored to meet the specific needs of the teacher trainers in collaboration with other government agencies like Kenya Education Management Institute rather than relying on well wishers. The principal's interview also revealed that in most cases, the college managers have been left out in ICT trainings. The need to equip all the teacher trainers including the college administrators was expressed during the interview.

#### **4.3.1.1 Summary on ICT Skills**

The study revealed that 97% of respondents had received training on ICT with 52% having training for only one week. Majority of respondents (60%) had been trained through the initiative of the college and 55% of tutors had not made personal effort to acquire ICT skills. The research findings revealed that 89.5% of respondents had received training on introduction to computer and only 22.7% of the respondents have received training on computer hardware. The respondents indicated trainings were helpful with 60% say it was effective. The study revealed that no area of software application in ICT did respondents indicate to have high skills but perceived their skills to range from moderate to low. The respondents rated word processing skills as the highest with database skills rated lowest. An independent sample t-test was conducted to compare difference in ICT skills across different age groups of respondents. There was difference in the mean scores of ICT skills for respondents aged 33-45 years ( $M=22.00$ ,  $SD=3.64$ ) and  $>45$  years ( $M=18.13$ ,  $SD=3.75$ );  $t(31)=3.01$ ,  $p=0.005$ . (Table 31, appendix I)

### 4.3.2 Attitude of tutors towards ICT

The respondents were required to indicate their levels of agreement on various aspects of ICT and assessment. The results are shown in table 18 and summarized in table 28 in appendix I.

**Table 18: Levels of Agreement with various Aspects of ICT of tutors**

	Strongly Agree		Agree		Not Sure		Disagree		Strongly Disagree	
	f	%	f	%	f	%	f	%	f	%
	a) ICT integration into educational assessment is essential in testing learning objectives	23	60.5%	13	34.2%	1	2.6%	1	2.6%	0
b) I am willing to embrace ICT related practices when assessing learners.	21	55.3%	15	39.5%	2	5.3%	0	0%	0	0%
c) Use of ICT in assessment practices makes examination management more efficient	21	55.3%	11	28.9%	5	13.2%	0	0%	0	0%
d) Use of ICT makes analysis of assessment data much easier	24	63.2%	14	36.8%	0	0%	0	0%	0	0%
e) Immediate feedback through use of ICT in assessment processes enhances learning	17	44.7%	18	47.4%	1	2.6%	1	2.6%	0	0%
f) Security of assessment tools like tests is enhanced by use of ICT	11	28.9%	14	36.8%	6	15.8%	5	13.2%	0	0%
g) I trust use of ICT in educational assessment processes	15	39.5%	16	42.1%	5	13.2%	0	0%	0	0%

Majority of the respondents strongly agreed that use of ICT making analysis of student's assessment data easier as shown by 63.2% and ICT integration into educational assessment

essentiality in testing learning objective as shown by 60.5%. The respondents further agreed that willingness to embrace ICT related practices when assessing learners as shown by 55.3%, use of ICT in assessment practices making examination management more efficient as shown by 55.3%, immediate feedback through use of ICT in assessment processes enhances learning as shown by 44.7%, trust while using ICT in educational assessment processes as shown by 42.1% as well as security of assessment tools like tests is enhanced by use of ICT as shown by 36.8% of respondents.

The interview of the principal pointed out that although people prefer doing things the traditional ways and do not want to be exposed as people who do not know, he believes that tutors have positive attitude towards technology and only require to continual training and facilitation through provision of required ICT equipment.

#### **4.3.2.1 Summary on attitudes of tutors toward ICT**

The research findings reveal that tutors' attitudes are extremely positive, with the four most positive statements attracting strong agreement from fifty percent. The finding illustrate that majority of tutors belief that analyzing of student's assessment data is much easier when using ICT and received the strongest agreement from the tutors with a mean of 4.63. It also evident from the study findings that respondents believe that ICT integration into assessment is essential in testing learning objectives received strong agreement from 60.5% of tutor. However significant number of respondents skeptical on security of assessment tools when employing ICT practices when assessing their learners and received only 28.9% strong agreement of respondent and mean of 3.89.

#### **4.3.3 ICT infrastructure: Nature and Form**

The respondents were required to indicate whether they have access to access to computers at home.

**Table 19: Access to Computer at Home by tutors**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	36	94.7%
No	2	5.3%
Total	38	100.0%

**Source: Author, 2012**

From the study, 94.7% of the respondents unanimously indicated that they have access to access to computers at home, while only 5.3% of the respondents do not have access to access to computers at home.

**Table 20: Cross Tabulation of Gender against Access to Computer at Home**

		Access to computer at home			
		Yes		No	
		f	%	f	%
Gender of respondent	Male	19	90.5%	2	9.5%
	Female	16	100%	0	0.0%

Source: Author, 2012

From the table, 90% of male against 100% of female respondents have access to computer at home.

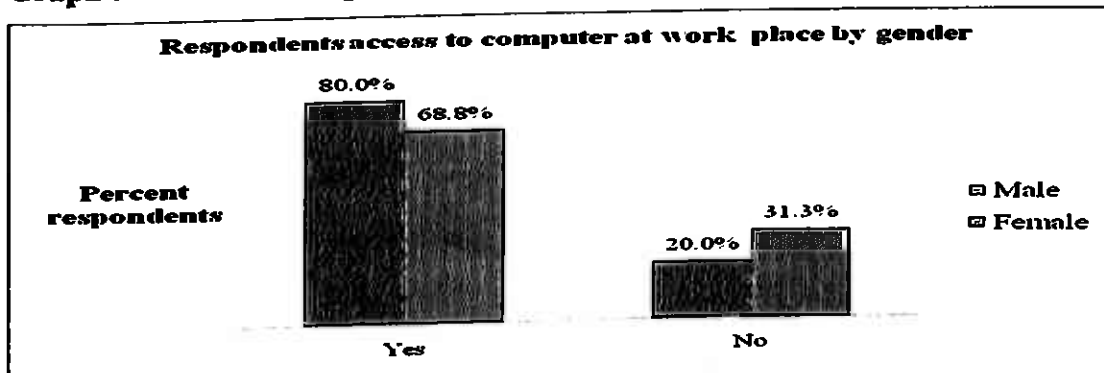
**Table 21: Access to Computer at Work place by tutors**

Response	Frequency	Percent
Yes	28	73.7%
No	10	26.3%
Total	38	100.0%

Source: Author, 2012

On whether the respondents had access to computers at work, 73.7% of them indicated that they access computer at work, while 26.3% of the respondents indicated that they don't access computer at work.

**Graph 3: Gender of respondents against access to computer at their work place**



Source: Author, 2012



The research findings indicate that 80.0% of males and 68.8% of female respondents have access to computer at work.

**Table 22: Access to Internet Services at Work Station**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	36	94.7%
No	2	5.2%
Total	38	100.0%

**Source: Author, 2012**

On whether the access to internet services at work station, 94.7% of the indicated agreement while only 5.2% of them indicated they don't access to internet services at work station.

**Table 23: Mode of Internet Connection accessible to tutors**

<b>Sources of Internet Connection</b>	<b>Frequency</b>	<b>Percent</b>
Wireless	28	73.7%
Cable	9	23.7%
Both Wireless and Cable	1	2.7%
Total	38	100.0%

**Source: Author, 2012**

From the study, 52.6% of the respondents had access internet connection from wireless sources, 23.7% of them access internet from a cable connection and also 23.7% had access of internet from both Cable and Wireless.

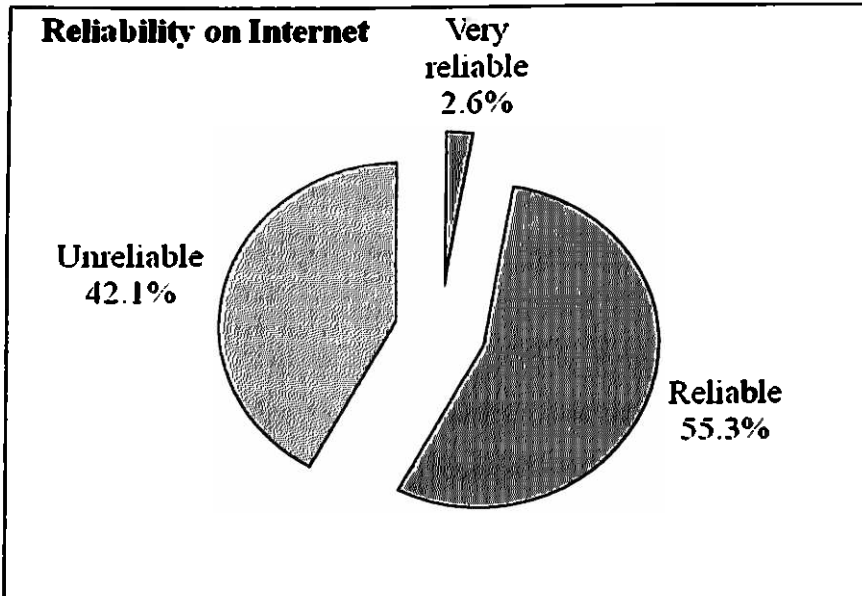
**Table 24: The rating of speed of Logging in to Internet by tutors**

<b>Speed</b>	<b>Frequency</b>	<b>Percentage</b>
Fast enough	8	21.0%
Not fast enough	17	44.7%
Slowly	13	34.2%
Total	38	100.0%

**Source: Author, 2012**

Majority of the respondents (shown by 44.7%) indicated that speed of logging in to internet is not fast enough, 34.2% of them indicated it's slow, while 21.0% of them indicated that the speed of connection is fast enough.

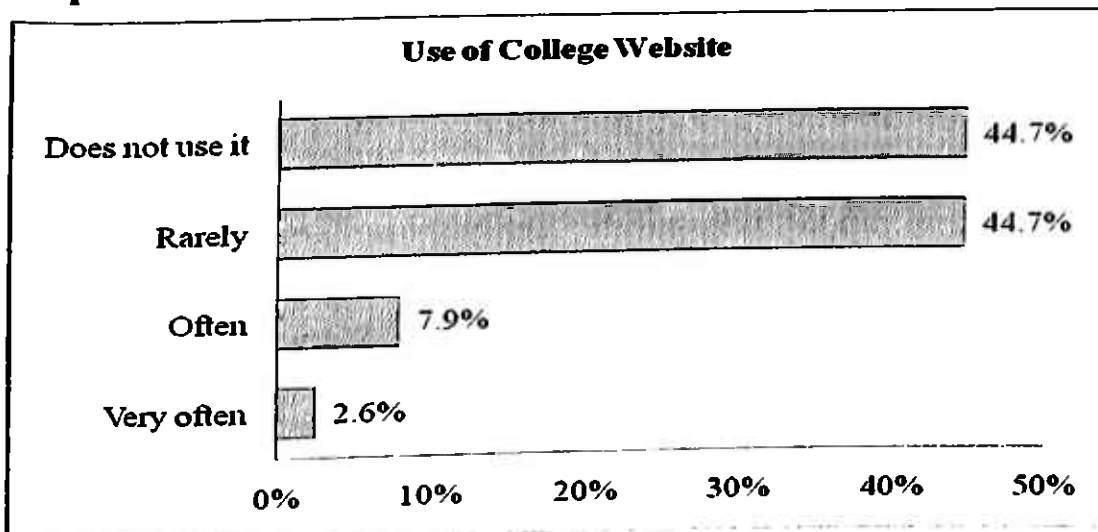
**Figure 3: Respondents rating of Internet reliability**



**Source: Author, 2012**

From the study, 55.3% of the respondents indicated that the internet is reliable, 42.1% of them indicated that the internet is unreliable, while 2.6% of the respondents rated the internet being very reliable.

**Graph 4: Use of the institution Website by the respondents**

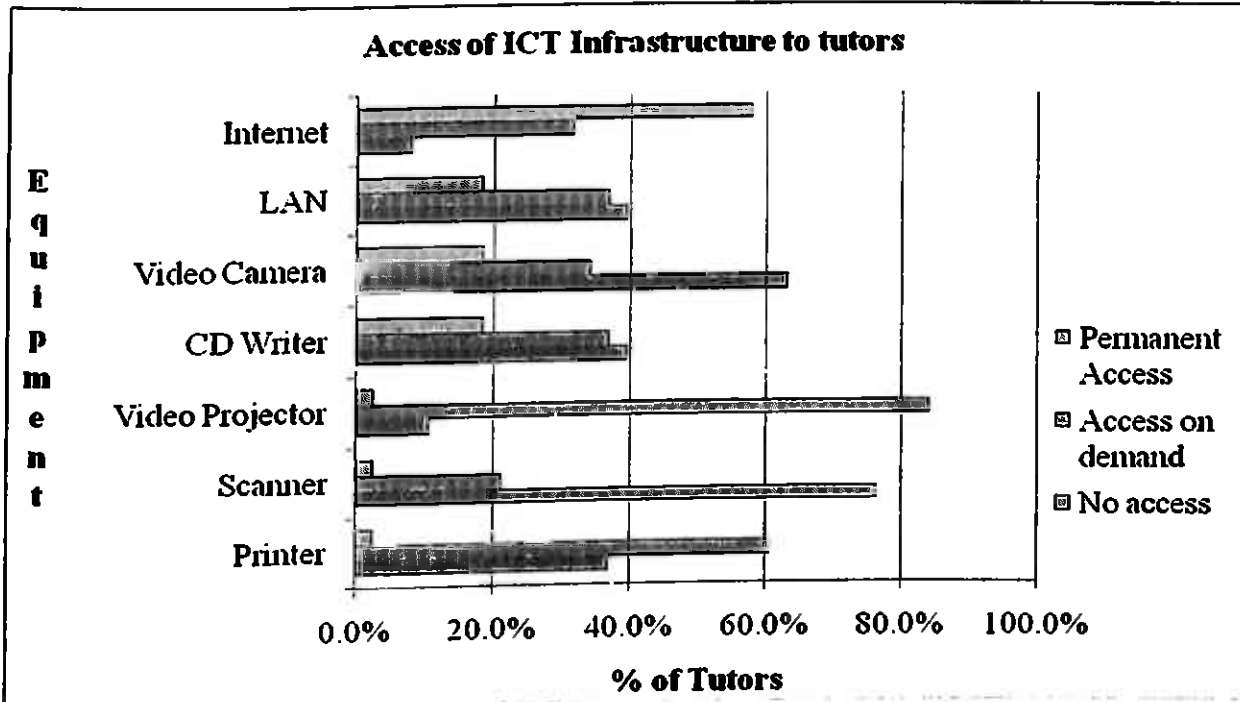


**Source: Author, 2012**

From the study, on the use of college website 2.6% of the respondents indicated that they use it very often, 7.9% use it often, 44.7% rarely use it and 44.7% does not use it at all.

The study also sought to establish condition under which respondent accesses ICT infrastructure in the college. The results are presented in graph 5 and table 29 in appendix I.

**Graph 5: Access to Various Computer Accessories**



**Source: Author, 2012**

According to the results depicted in the graph, majority of the respondents (57.9%) indicated that they have a permanent access to Internet connectivity for use in professional tasks. However 84.2% of the respondent indicated that they have access on demand to video projector for use in professional tasks in college and 36.8% can access to College local area network for use in professional tasks in college. Also 60.5% of respondents indicated that they access Printer on demand, while 63.2% indicated that they do not have access to video digital camera in professional tasks in college. On CD Writer, 68.4% of respondents indicated they have no access and 76.3% stated that they have no access to scanner for use.

The Principal of the college was interviewed and research findings revealed that college administration has purchased one desktop computer for every department and have placed them in the college digital center. The interview also revealed that the college has other ICT equipment which are shared among the teaching staff. These include five laptops, video

projectors, printers and scanners. It emerged that tutors can access them once they sign out for the required equipment. The Principal also indicated that the college has an application software for tutors use to post digital notes to the library for students use. The college also has Management Information System (MIS) software which is accessible to the tutors through the college Local Area Network (LAN). The MIS is used for keeping students' records and marks, generating students' progress reports and analyzing of scores.

It was that established from the interview that the college has internet connectivity with internet 'hot spots' around the tuition area. This makes it possible for tutors to access internet through wireless connection. However the principal indicated that sometimes the internet connection is slow and may not be adequate to all users in the college. The principal revealed that the cost of internet is rather high due to payment of annual subscriptions. It also emerged from the interview that the college has been considering connection to fiber optic cable but the cost is inhibitive and may not be economically viable.

It was corroborated from interviewing the Principal that the college website is already in place. The website is mostly used for communication general information about the college such as location, facilitates, co-curricular activities, contacts etc. currently, the website is not used for any educational tasks including assessment. The interview also revealed that the college has a technician in charge of routine maintenance of ICT equipment and offering technical support to the tutors. It was however expressed that in order to automate all college sections and departments, more technical persons like system administrator are required.

However the Principal expressed that the existing ICT infrastructure is not adequate due to the low computer/tutors ratio. The principal indicated that college although the college does not have a specific policy addressing use of ICT in assessment, lack of sufficient prerequisite ICT software and hardware for use by students and tutors is the major barrier. The principal suggested that all tutors be encouraged and facilitated to acquire their own laptops.

The researcher confirmed through guidance of an observation checklist that the colleges has twenty five computers set aside for use by tutors, printers, scanner, video projector and digital camera. Management Information System, Local Area Network and a website are place. The college has internet connection which is accessible to tutors while using personal or college computers via LAN or through wireless mode.

#### 4.3.3.1 Summary on nature and form of ICT infrastructure

The findings revealed that majority of tutors have access to working computers at home (94.7%) and in the work place (73.7%). It further indicated that most tutors have access to internet in college with majority of them getting it through wireless connection (73.7%). However findings indicate that the internet is not strong enough with only few respondents rating its access as fast enough (21.0%). A significant percent of respondents also felt that the internet is unreliable (42.1%). The study also revealed that the college has a websites which it broadly uses to communicate general information and most respondents and not evidence of its use in assessment was established. The findings indicated insignificant use of the website by the tutors with only 7.9% of them indicating they often use it and 44.7% indicating they rarely uses it and 44.7% having not accessed it. According to the research findings, majority of the respondents (57.9%) indicated that they have a permanent access to Internet connectivity for use in professional tasks. However 84.2% of the respondent indicated that they have access on demand to video projector and 39.5% indicated to have no access to College local area network. Also 63.2% indicated that they do not have access to video digital camera and on CD Writer, 68.4% of respondents indicated they have no access and 76.3% stated that they have no access to Scanner.

#### 4.3.4 Integrated ICT assessment practices in place

The study sought views of respondents on college's readiness for ICT integration into assessment practices and views obtained are listed table 25.

**Table 25: Views of tutors on College readiness of ICT integration for assessment**

	Frequency	Percentage
Yes	25	65.8%
No	11	28.9%
Total	36	94.7%

**Source: Author, 2012**

On college readiness for integration of ICT into assessment processes 65.8% indicated that the college was ready and only 28.9% indicated that the college was not. The respondents give various explanations on their views on the college's readiness for integration of ICT into assessment processes. Those of the view that the college is not ready were the minority and indicated that most students and tutors have limited skills in ICT including those in

leadership; ICT infrastructure is inadequate, with appropriate software lacking and facilitation is poor with limited resources allocated to support ICT implementation. The majority of respondents who indicated the college is ready for integration of ICT into assessment stated that college has shown effort in providing ICT infrastructure and quoted the twenty five computers that have been bought for the department, tutors have undergone ICT training and the college have secure a management information system. The study sought views of respondents on usefulness of various assessment practices in education that are integrated with ICT. The results obtained are presented in table 26 below and a summary showing the means and SD for each statement is shown in table 30 of appendix I.

**Table 26: Views of tutors on usefulness of ICT integrated assessment practices**

	No knowledge of		Not needed		Of limited Value		Valuable		Very Valuable	
	f	%	f	%	f	%	f	%	f	%
Creation of own digital assessment questions for the learners	8	21.1%	0	0%	4	10.5%	20	52.6%	6	15.8%
Administration of assignments to students through the internet e.g. e-mail	6	15.8%	2	5%	4	10.5%	17	44.7%	8	21.1%
Analysis of learners assessment scores by use of computer applications	6	15.8%	0	0%	1	2.6%	12	31.6%	18	47.4%
Establishment of electronic data management system for students academic records	5	13.2%	0	0%	1	2.6%	10	26.3%	21	55.3%
Dissemination of students results by use of ICT infrastructure e.g. website	4	10.5%	0	0%	1	2.6%	16	42.1%	16	42.1%
Creation of electronic items banks for assessment questions	5	13.2%	0	0%	2	5.3%	16	42.1%	14	36.8%
Online registration of candidates for public examinations	4	10.5%	0	0%	1	2.6%	14	36.8%	17	44.7%

**Source: Author, 2012**

From the study, 55.3% of respondents rated the usefulness in establishment of electronic data management system for students' academic records as being very valuable, 47.4% of respondents rated usefulness of analysis of learners' assessment scores by use of computer applications very valuable and 44.7% of respondents rated usefulness in online registration of candidates for public examinations as very valuable. Also 42.1% of the respondents viewed dissemination of student results by use of ICT infrastructure and creation of electronic items banks for assessment questions as valuable. However 10.5% of them indicated that creation of own digital assessment questions and administration of assignments to students through the internet to be of limited value. The study also revealed that 21.1% of respondent had no knowledge on creation of own digital assessment questions for learners. The study also depicted that 15.8% lack knowledge on administration of assignments to students through the internet and analysis of learners' assessment scores by use of computer applications.

The respondents were asked to suggest conditions that are required for sustained use of ICT in assessment and they suggested that there is need for continuous staff training on ICT, provision of enough modern ICT infrastructures including faster internet connection, improved networks coverage and proper maintenance and repair of ICT equipment. The respondents also pointed out that adequate fund should be set aside for ICT programmes in the college, appropriate software for the college to be developed, offer mechanisms for data protection and system security. Good will from the institutions management and prioritization of ICT tools in education were also suggested. The interview of the Principal revealed that the registration of students for public examination with KNEC is presently being done online. The paradigm shift requires the tutors to get acquainted and probably adopt the technology.

#### **4.3.4.1 Summary on integrated practices in place**

The findings indicate that the tutors consider establishment of electronic database management system for the students' academic records as the most beneficial with 55.3% indicating it's very valuable. The other ICT integrated assessment practices namely online registration of candidates, online dissemination of results and use of computer application to analyze scores were also favoured by the tutors with over forty percent viewing them as very valuable. Creation of electronic items banks and administration of online assignment were also considerably found beneficial with majority of respondents indicating there are valuable. Findings also indicate that tutors consider creation of assessment questions least valuable and some tutors lack knowledge for ICT integration into assessment practices enquired.

## **CHAPTER FIVE**

### **5.0: DISCUSSION, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Introduction**

This section of report provides a discussion on the findings for each research question, the conclusion of the study and recommendations for policy and further research for the sustained integration of ICT into assessment practices in education.

#### **5.2 Discussion of the Findings**

##### **5.2.1 Level of ICT Skills of tutors**

The study findings revealed that most tutors (84.2%) are confident that they have the basic ICT skills that would enable them integrate ICT into assessment practices. Finding illustrated that majority of tutors had an opportunity to attend in-service course related to use of ICT with varied durations of training. Tutors were asked to indicate the length of duration of training and the study revealed that majority (53%) had received ICT training for only week, with the minority (13%) of respondents having received ICT training for duration longer than for one month or more. This could mean that tutor may therefore not be adequately equipped with prerequisite ICT knowledge and skills. This could be attributed to the short training periods they have been exposed to.

The study enquired areas of ICT covered during the training and majority of respondents indicated they had received training on introduction to computers (89.5%), use of internet (74%), pedagogical skills for using ICT (66%), and applications software (64%). However, only minority of the tutors had not received any training on computer hardware (23%) and in operating systems (50%). The ICT trainings were generally viewed as effective by tutors (60%) in equipping them with prerequisite skills to integrate ICT into assessment. The tutors were also asked to rate their skills with regard to ICT and use of ICT in their pedagogical practices. Respondents indicated they had moderate skills in word processing (M=3.32), file handling (M=3.19) and presentation tools (M=2.97). In the areas of e-mail, web search engines and spreadsheets, tutors' ratings of their ICT skills were low. However respondents felt that they have very low skills in the area database management (52.6%).



It is most likely then tutors may adopt ICT for assessment practices considering that they have moderate ICT skills. This is in agreement with findings of Clyde (1997), who notes that, to be able to use a computer, one requires “the knowledge and skills which are related to the hardware, the system, the software, the information source and the information itself.” The findings reveal that older tutors have lower ICT skills than younger one. This is in agreement with a study carried out by Chio (1992) that indicated that older teachers in the study had less computer literacy than the younger teachers.

Tutors are in general able to work with the most common computer software to help them with their professional tasks. However, tutors who participated in the research have moderate ICT skills and may not be properly equipped with ICT skills to enable the effectively integrate ICT into assessment. It most likely that lack of adequate training opportunities is a major barrier to progress in building the capacity of teacher trainers to increase their competences in the use of ICT for educational assessment. The researcher attributes tutors lack of sufficient skills to the short durations of training noting that majority have trained for only one week. This may also be attributed to lack of personal initiative on the side of tutors to seek ICT training.

### **5.2.2 Attitude of tutors towards integration of ICT into assessment**

The study enquired the extent to which tutors agreed with seven attitudinal statements relating to use of ICT in assessment practices. Regardless of the quantity and quality of technology placed in classrooms, the key to how those tools are used is the teacher; therefore teachers must have the competence and the right attitude towards technology. Among the factors that affect the successful use of computers in the classroom are teachers' attitudes towards computers. The research findings reveal that tutors' attitudes are positive, with the four most positive statements attracting over fifty percent strong agreement and negligible levels of strong disagreement.

The finding illustrate that tutors belief that analyzing of student's assessment data is much easier when using ICT and received the strongest agreement from the tutors. It also evident from the study findings that respondents believe that ICT integration into assessment is essential in testing learning objectives and makes management of examination more efficient. Majority of respondents also expressed the willingness to embrace ICT practices when assessing their learners.

Teachers need to believe that new approaches to assessment are effective and will make a difference for their students in order for them to continue using new approaches. Although majority agreed that immediate feedback through the use of ICT in assessment, few respondents disagreed with it. The research finding also revealed a diverse outlook towards security of tests and examination when ICT tools are used. This could mean that some respondents do not believe ICT would enhance security of the tests and another minority of tutors does not trust the use of ICT in educational assessment.

Within the scope of the study, it was found out that tutors have positive attitude toward ICT integration into their assessment tasks. A major reason for studying teachers' attitude towards computer use is that it is a major predictor for future computer use in the classroom. Hence with the research finding showing that tutors have positive attitude towards integration of ICT into assessment, then their adoption and acceptance of ICT in assessment anticipated. The results of this study are in agreement with the results of Korte (2006), which assessed the educators' (teachers and principals) attitudes towards ICT integration and found that Cyprus educators held very positive attitudes towards ICT integration.

### **5.2.3 ICT Infrastructure accessibility: Nature and form**

The findings revealed that majority of tutors have access to working computers at home (95%) and also in the work place (74%). However, in the work place, it was observed that departmental computers for tutors are placed in the digital center. There is likelihood that they may not be maximally put into use as compared to when placed in tutors' offices. The research further indicated that most tutors have access to internet in college with majority of them getting it through wireless connection. However findings indicate that the college internet is not strong enough with only few respondents (21%) rating its access as fast enough. A significant percent of respondents (42%) also felt that the internet is unreliable. The study also revealed that the college has a websites which it broadly used to communicate general information and there was no evidence of its use in assessment was established. However, findings indicated marginal use of the website by the tutors with majority of tutors (90%) indicating that they have rarely or never accessed it.

According to Medlin (2001) and Surendra (2001), the accessibility and availability of computers is an important factor affecting the use of computers for instructional purposes. In the college, it was observed that at least ten percent of tutors are in departments where one computer is available for every two tutors. Nevertheless in several departments, especially

those with many members of staff, disparities exist in computer availability. In some departments, gap is even greater as there are more than ten tutors sharing one computer. The findings also reveal that most computers do not have CD writers.

The tutors do not have permanent access to most ICT infrastructure at the college, with the internet having best access (M=2.5). Other ICT equipment like printer, video projector, digital camera, and local area network connections are not adequately available to the tutors. The equipment that are least accessible to the tutors are scanner (M=1.26) and CD writer (M=1.37). It is therefore mostly likely that tutors may not embrace ICT for assessment in education due to limited ICT infrastructure. This is in agreement with a study by Hennesy et.al. (2010), to explore factors that influence classroom use of ICT in Sub-Saharan Africa, which noted that introducing technology into schools is largely dependent upon the availability and accessibility of ICT resources. The findings reveal that majority of respondents are able to access required ICT equipment when need arises. The research findings reveal that ICT infrastructure is available in college though they may not be adequate hence adoption of ICT may be hindered.

#### **5.2.4 Views of tutors on Usefulness of ICT integrated assessment practices**

The findings revealed that tutors considered ICT integrated assessment practices valuable in their professional tasks. The results were obtained after evaluating the respondent's views towards seven applications of ICT in educational assessment. Globalization and innovations in technology have led to an increased used of ICTs in education sector - and assessment and testing is no exception. Uses of ICTs in assessment processes are widespread and are continually growing worldwide. In this research, the author examined views of tutors on several important aspects related to use of ICT tools for students' testing and assessment.

The findings revealed that tutors perceived the ICT integrated assessment practices to be valuable with five statements attracting over seventy five percent for both valuable and very valuable views. Findings also indicate that the tutors consider establishment of electronic database management system for the students' academic records as the most beneficial. The other ICT integrated assessment practices namely online registration of candidates, online dissemination of results and use of computer application to analyze scores were also favoured by the tutors. Creation of electronic items banks and administration of online assignment were also considerably found beneficial. However, finding indicate that tutors consider creation of own assessment questions least valuable. The researcher notes that a significant

percent of tutors lack the prerequisite knowledge for ICT integration into assessment practices enquired in this study.

Actually, the user's acceptance is considered an important element in the successful implementation of technology in the educational setting, and which is greatly influenced by the users' attitudes towards technology. Following Hung-Pin Shih (2004), several studies showed that 'perceived usefulness' has the greatest impact on the individual intention to use. Perceived usefulness explains the user's perception to the extent that the technology will improve the user's workplace performance (Davis et al. 1989). This means the user has a perception of how useful the technology is in performing his job tasks. This study therefore infers that the tutors view ICT integrated assessment practices as useful and it's most likely that if provided with required hardware, software and training, they may be prepared for their adoption and acceptance.

### **5.3 Conclusion**

The purpose of the study was to examine the preparedness of tutors for the integration of Information and Communication Technologies into the educational assessment processes. It is vital that the teacher education colleges has well-trained tutors, able to incorporate ICT into education in a way that leads to change from the old to the new paradigms of testing and assessment. Teachers' use of ICT in the assessment depends on several factors such as college and national policies, availability and access to resources, support in school, ICT training, or teachers' own beliefs about teaching and learning.

Mainstreaming ICT in education and training has to take place on all fronts and requires large scale planning, decision making and actions, increasing access through infrastructure, use through content development and professional development, and quality of use through teacher guidance. In addition to the teacher-quality challenge, the college technology infrastructures are still insufficient for advanced, large-scale, standalone computer-based and Internet-based testing. Inadequate computer hardware, bandwidth constraints, and limited capacity to maintain, update, and administer schools' technological infrastructure are serious impediments to deploying online testing, especially for more secure, high-stakes public testing.

Although ICT use is commonly promoted for use by students and teachers, research evidence suggests that successful implementation of ICT in assessment is not necessarily as widespread. The researcher has found, based on this study, that teachers recognize the value of ICT in educational assessment and have positive attitudes. However, they experience problems with accessibility of modern ICT hardware, appropriate software for use in preparation and administration of assessment tools. The process of adopting these technologies is likely to be hampered by inadequate training of tutors and therefore the researcher infers that majority of tutors in teacher education colleges are not so far adequately facilitated and thus prepared in terms of knowledge and skills to integrate ICT into educational assessment processes.

#### **5.4 Recommendations**

On the basis of analysis of tutors' preparedness for the integration of ICT into educational assessment and conclusions arrived at in this study, the researcher has produced the following recommendations. These recommendations are targeted at the respective levels involved in Teacher Education.

##### **5.4.1 Recommendations Policy Makers**

The National assessment body to formulate and coordinate a national assessment policy outlining strategies and action plans specifically aimed at promoting adaptation and use of computer-based and Internet based testing.

Policymakers should create a fund to support the research and development of the next generation of assessment technology and practice by focusing on applications that involve partnerships among researchers, psychometricians, testing bodies, state officials, and educators.

Support and/or incentives for Teacher educational institutions to purchase ICT facilities (e.g. dedicated government funding, including a budget for maintenance services; tax rebates on ICT hardware and software for educational institutions; investment in or sponsoring of research in developing low-cost ICT hardware and software, etc).

Regulations concerning the curriculum specifying the principal ICT skills that should be acquired by tutors in teacher education related to the pedagogical aspects of integrating ICT into teaching and learning, as well as use of the Internet, and the application of ICT to assessment.

#### **5.4.2 Recommendations the Institutions**

It is proposed that colleges to improve the availability of ICT infrastructure like appropriate local networks, equipment, software, and Internet connectivity. This infrastructure must be efficient and effective, and available for use by all students and teachers

There should also be continuous and systematic training of teachers on ICT skills acquisition and the training programmes should be adapted to the particular needs of teachers and fit to personal and subject specific needs. An extensive network of skilled technicians must be developed to support Teachers Education colleges' administrators, teachers, and students.

It is proposed that on tutors' attitudes, Teacher Education colleges to support the use of ICT by offering a supportive culture, incentives, resources, and fostering self-efficacy. This could be achieved by providing easy to use ICT based materials, peer learning and peer sharing of experiences, securing reliable infrastructure, triggering teacher's knowledge in their subject, and easy access to research findings.

The Teacher Education colleges should digitize past assessment tools - tests, examinations, practical and assignments for use by learners through ICT infrastructure like CD, college platforms and websites.

#### **5.4.3 Recommendations for Further Research and development**

Adaptation of curricula to ICT integration and development or acquisition of standardized quality-assured digital educational contents and assessment questions, and software should be encouraged.

There should be online platforms, forums, blogs or similar social networking sites that facilitate collaboration, the sharing of experience and the exchange of material between teachers.

Initiate the process of developing a digital testing system and facilitate the use of ICT in students' assessment as an information source for use in traditional tests, on-screen testing and interactive testing.

This study focused on one teacher Education College and the researcher recommend that the study be replicated to the other teacher education colleges to determine their tutors' preparedness for ICT integration.

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## APPENDIX I: ADDITIONAL TABLES ON ANALYSIS OF FINDINGS

**Table 27: Rating of ICT Skills in Application Software**

ICT Skills	Mean	SD
File handling	3.19	.660
Word processing	3.32	.739
Spreadsheets	2.74	.795
Presentation tools	2.97	.788
Database management systems	2.11	.708
E-mail, chat	2.87	.963
Web Search Engines	2.63	.970

**Table 28: Attitude with various Aspects of ICT**

Agreement	Mean	SD
ICT integration into educational assessment essentiality in testing learning objectives	4.37	1.025
Willingness to embrace ICT related practices when assessing learners	4.50	.604
Use of ICT in assessment practices making examination management more efficient	4.47	.687
Use of ICT making analysis of student's assessment data easier	4.63	.541
Immediate feedback through use of ICT in assessment processes enhances learning	4.43	.647
Security of assessment tools like tests is enhanced by use of ICT	3.89	1.036
Trust while using ICT in educational assessment processes.	4.29	.710

**Table 29: Access to Various Computer Accessories**

Accessories	Mean	SD
Access to Printer in professional tasks in college	1.66	.534
Access to Scanner in professional tasks in college	1.26	.503
Access to Video projector in professional tasks in college	1.92	.363
Access to CD Writer in professional tasks in college	1.37	.589
Access to Video digital camera in professional tasks in college	1.39	.547
Access to College local area network in professional tasks in college	1.81	.776
Access to Internet connectivity in professional tasks in college	2.50	.647

**Table 30: Usefulness of ICT integrated assessment practices**

Usefulness of ICT integrated assessment practices	Mean	SD
Usefulness in creation of own digital assessment questions for learners	3.42	1.368
Usefulness in administration of assignments to students through the internet	3.51	1.346
Usefulness in analysis of learners assessment scores by use of computer applications	4.00	1.414
Usefulness in establishment of electronic data management system for students academic records	4.13	1.339
Usefulness in dissemination of student results by use of ICT infrastructure	4.08	1.194
Usefulness in creation of electronic items banks for assessment questions	3.95	1.293
Usefulness in online registration of candidates for public examinations	4.11	1.203

**TABLE 31: INDEPENDENT-SAMPLE T-TEST BETWEEN ICT SKILLS AND AGE OF RESPONDENTS**

**Group Statistics**

	Age of respondent	N	Mean	Std. Deviation	Std. Error Mean
Total score for Views on usefulness of ICT practices	33-45 yrs	19	28.63	8.057	1.848
	> 45yrs	16	26.81	7.305	1.826
Total score for Attitude of tutors toward ICT	33-45 yrs	18	10.33	3.646	.859
	> 45yrs	17	12.65	3.200	.776
Total score for Computer skills	33-45 yrs	17	22.00	3.640	.883
	> 45yrs	16	18.13	3.757	.939

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Total score for Views on usefulness of ICT practices	Equal variances assumed	.001	.981	.694	33	.492	1.82	2.621	-3.513	7.151
	Equal variances not assumed			.700	32.794	.489	1.82	2.588	-3.469	7.107
Total score for Attitude of tutors toward ICT	Equal variances assumed	.042	.840	-1.990	33	.055	-2.31	1.162	-4.679	.051
	Equal variances not assumed			-1.998	32.834	.054	-2.31	1.158	-4.670	.043
Total score for Computer skills	Equal variances assumed	.004	.948	3.009	31	.005	3.68	1.288	1.249	6.501
	Equal variances not assumed			3.006	30.727	.005	3.68	1.289	1.245	6.505

**APPENDIX II: LETTER OF ADMINISTRATION**

**WAITHAKA, JOSPHAT MWATHA  
P. O. BOX 1763 -10101,  
KARATINA**

**August, 2012**

**Dear Madam/Sir,**

**RE: REQUEST TO FILL THE QUESTIONNAIRE FOR RESEARCH PURPOSE**

**The purpose of this questionnaire is to collect data for use in determining the preparedness of tutors for the integration of Information and Communication Technology (ICT) into the educational assessment processes.**

**The researcher is a student of Master in Education in Measurement and Evaluation, in the school of Education of the University of Nairobi.**

**You are kindly requested to provide answers to the questions as honestly as possible. You are assured that the information you give will be treated with utmost confidentiality and will be used only for the purpose of research.**

**Thank you very much for your co-operation**

**Yours sincerely**

.....  
**J. M. Waithaka**

## APPENDIX III: RESEARCH INSTRUMENTS

### A. Questionnaire for Tutors in Teacher Training Colleges

I wish to request that you kindly respond to all the questions provided below as honestly as possible. Please put a tick [ ✓ ] on the objective questions and write on the spaces provided for the structured items.

#### Section A: PROFILE OF THE RESPONDENT

- 1) What is your gender      Male [  ]      Female [  ]
- 2) What is your age?
  - 24 years and below      [  ]
  - 25 - 32 years      [  ]
  - 33 -45 years      [  ]
  - 45 years and above      [  ]
- 3)      What is your highest level of education?
  - Diploma      [  ]
  - Degree      [  ]
  - Master Degree      [  ]
  - Other (specify)      \_\_\_\_\_
- 4) How long is your teaching experience?
  - 10 years and below      [  ]
  - 11 - 15 years      [  ]
  - 16 - 20 years      [  ]
  - 21 – 25 years      [  ]
  - Over 26 years      [  ]
- 5) What are your two Teaching Subjects? \_\_\_\_\_ and \_\_\_\_\_

#### Section B

##### I. ICT Skills

- 6) Do you have the ICT skills that would enable you integrate ICT into your assessment practices in your subject area?  
Yes [  ]      No [  ]
- 7) (a) Have you ever received any ICT training?  
Yes [  ]      No [  ]

(b) If yes, i) how long was the duration of the training? \_\_\_\_\_

ii) Who sponsored you for the ICT training?

College  Self- sponsor

Ministry of Education  Other (specify) \_\_\_\_\_

(iii) Which of the following areas of ICT did the training cover?

(Please tick as many as may be applicable)

a) Introduction to computers	
b) Application Software	
c) Operating Systems	
d) Computer Hardware	
e) Internet	
f) Pedagogical skills for using ICT	
Other: Please specify	

8) How would you rate the ICT training in terms of equipping you with skills for use during your assessment tasks?

Very effective

Effective

Not sure

Ineffective

Very ineffective

9) Please indicate your skill level in the following application software:

	None	Low	Moderate	High
a) File handling (Creating/opening files)				
b) Word Processing				
c) Spreadsheets e.g. Excel				
d) Presentation tools e.g. PowerPoint				
e) Database Management Systems				
f) Email, Chat				
g) Web Search Engines				
Other: Please specify				



## II. Attitude toward ICT integration into assessment

10) Please indicate your level of agreement with the following statement.

SA – Strongly Agree, A – Agree, NS - Not Sure, D – Disagree, SD – Strongly Disagree

	SA	A	NS	D	SD
h) ICT integration into educational assessment is essential in testing learning objectives					
i) I am willing to embrace ICT related practices when assessing learners.					
j) Use of ICT in assessment practices makes examination management more efficient					
k) Use of ICT makes analysis of students' assessment data much easier					
l) Immediate feedback through use of ICT in assessment processes enhances learning					
m) Security of assessment tools like tests is enhanced by use of ICT					
n) I trust use of ICT in educational assessment processes					

## III. Accessibility of ICT infrastructure

11) Do you have a computer at home?

Yes

No

12) Do you have a computer in your place of work assigned for your use in teaching activities?

Yes

No

13) Do you have access to the internet in your work station?

Yes

No

If yes,

i. Through which mode?

Wireless

Cable

Other (please specify) \_\_\_\_\_

ii. How fast are you able to log in so as to access information?

Fast enough

Not fast enough

Slowly

Not able

iii. What is your view on reliability of the internet?

Very reliable

Reliable

Unreliable



17) Please indicate your view on the **usefulness** of the following ICT integrated educational assessment practices.

	No knowledge of	Not needed	Of limited Value	Valuable	Very Valuable
a) Creation of own digital assessment questions for the learners					
b) Administration of assignments to students through the internet e.g. e-mail					
c) Analysis of learners assessment scores by use of computer applications					
d) Establishment of electronic data management system for students academic records					
e) Dissemination of students results by use of ICT infrastructure e.g. website					
f) Creation of electronic items banks for assessment questions					
g) Online registration of candidates for public examinations					

18) Suggest conditions required for sustained use of ICT in assessment.

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## **B. Interview Schedule for Principal of Institution**

1. What ICT facilities does the college have?
2. Are they accessible to the tutors for use in their teaching activities?
3. Does the college have an ICT policy?
4. Does the college ICT policy conform to that of Ministry of Education?
5. Do the elements in the college ICT policy include assessment?
6. Have you arranged for ICT trainings for your tutors?
7. How often are the ICT trainings planned and implemented?
8. What measures has the administration put in place in to ensure tutors get required technical support?
9. What is your view on use of ICT in assessment practices in your college?
10. Are the computers in the college connected to one another/networked?
11. Do you have internet connection in the institution?
12. Is the Internet connection by wireless or cable?
13. Do you log in fast enough to get information from the internet?
14. Can you download a large document from the college internet?
15. Does the institution have a management information system (MIS) to manage students' assessment records?
16. Does the college have a website in place?
17. Is the website used for any assessment process?
18. What concerns do you have pertaining to the use of ICT in assessment?

### C. Observation Checklist

<b>ICT Infrastructure</b>	<b>Description</b>
Type of computers being used	
Number of Computers available to tutors	
Operating system(s) in use	
Internet connection being used	
Number of computers connected to the Internet	
How is internet primarily used in the college	
Availability of Management Information System (MIS)	
Reliability of power	
Computer Peripherals available	
Website	
Other	