UNIVERSITY OF NAIROBI
SCHOOL OF COMPUTING AND INFORMATICS

FRAMEWORK FOR ICT INTEGRATION IN TEACHING AND LEARNING IN PUBLIC TECHNICAL TRAINING INSTITUTES IN KENYA

BY

CASPER SHIKALI SHIVACHI

P56/71092/2008

Report Submitted in Partial Fulfilment of the Requirements for the Degree of Master in Science in Information Systems of the University of Nairobi

February 2011

DECLARATION

This research report is my original work and has not been presented for award of a degree in any other university

Casper Shikali Shivachi
P56/71092/2008

This research report has been submitted for examination with my approval as the University supervisor.

Evans Miriti
Lecturer
School of Computing and Informatics
University of Nairobi

Signature: .....

Date: 26/07/2011

DEDICATION

This research report is dedicated to my wife, my children; Joel and Vicky and my mother for their encouragement and patience. Their prayers, understanding and support were the force that fuelled my determination to accomplish this task. To my family I say: "Thank you for remaining steadfast and may the almighty God bless".

ACKNOWLEDGEMENT

I am grateful to all the administrators, teachers and students in the public Technical Training Institute that participated in this study. I appreciate the valuable time that they spared to respond to my questionnaires.

I would like to sincerely thank my supervisor Mr. Evans Miriti, and the panelists Dr. Wanjiku Ng'ang'a and Mr. Robert Oboko all of the School of Computing and Informatics (UON) for their advice, support and inspiration. Their guidance has been invaluable in developing this research report to its full potential. I appreciate the assistance and support received from them. Their enthusiasm in my study has been a constant source of inspiration for me. I acknowledge their timely feedback, encouragement and assistance to compile this research report.

I would like to extend my appreciation to all my friends and colleagues who provided me with various forms of support throughout my study. Mr. Shem Mbandi – Lecturer South Eastern University College and the Late Mr. Robert Irungu – Lecturer Kinyanjui Technical Training Institute deserve special thanks for their useful advice, encouragement and humour during this study.

I am also genuinely indebted to my wife Judith Bulimo and my children Joel and Vicky for their support and understanding especially during the times when they had to sacrifice family comforts because I was so preoccupied with the study.

ABSTRACT

This study set out to develop a framework for Information and Communication Technology (ICT) integration in teaching and learning in public Technical Training Institute in Kenya. The sample for the study was drawn strategically from public Technical Training Institutes in Kenya. Technical training institutes are under the Ministry of Higher Education, Science and Technology and were established to provide hands-on skills and award craft and diploma certificates.

This study is quantitative using a cross-sectional survey design. There was an interest in the different interpretations of use of ICT for teaching and learning across a number of technical training institutes and different processes which had been adopted to achieve this. The main data collection method that was deployed is likert type scaling questionnaires.

The study found that most public Technical Training Institutes are yet to embrace ICT in teaching and learning although they have fairly adequate number of ICT tools. It was also found out that the institutions have few or no ICT support, policies and practices that may enhance ICT integration.

The study concludes that public Technical Training Institutes are at the emerging stage of the UNESCO (2005) model as far as ICT integration in teaching and learning is concerned. In addition, it notes that, as much as there are a number of factors that influence ICT integration in teaching and learning, Competence in ICT applications and tools has a higher influence on pedagogy Integration of ICT. The study therefore recommends a comprehensive and continuous plan for training lecturers and students in the use of advanced ICT applications and tools and motivation of lecturers and students in the use of ICT in teaching and learning.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ICT - Information Communication Technology

TIVET - Technical, Industrial, Vocational and Entrepreneurship Training

ECDE – Early Childhood Development Education

KIE – Kenya Institute of Education

MOHEST – Ministry of Higher Education, Science and Technology

NOF - New Opportunities Funded

UNESCO – United Nations Educational, Scientific and Cultural Organization

STD – Standard Deviation

UON – University of Nairobi

CAI – Computer Assisted Instruction

Nepad – New Partnership for Africa's Development

Dfid – Department For International development

CBAM – Concern Based Model

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Higher education in Kenya is offered in public universities that have been established by Acts of Parliament (some of them with constituent colleges), private institutions with a charter (fully accredited), private universities with a letter of Interim Authority, and private institutions without a charter. Apart from the universities, there are a number of post-secondary institutions offering training at diploma and certificate levels. In the field of teacher training, these include diploma colleges for the training of non-graduate secondary school teachers, and teacher training colleges for primary school teachers. For technical education they include national polytechnics, Institutes of technology and technical training institutes. In addition to these, a number of government ministries also offer three years' professional training at diploma level for their middle-level manpower requirements.

Technical training institutes are under the Ministry of Higher Education, Science and Technology. There are about 19 public technical training institutes and 14 institutes of technology in addition to a number of registered Technical, Industrial, Vocational and Entrepreneurship Training (TIVET) private institution. These were developed to offer training at both Craft and Diploma level with the following general objectives:

a) To provide increased training opportunities for the increasing number of school leavers to enable them to be self-supporting.
b) To develop practical skills and attitudes which lead to income generating activities in the urban and rural areas through self-employment?
c) To provide practical education and training skills which are responsive and relevant to Kenya's agriculture, industrial, commercial and economic needs.
d) To provide the technical knowledge and vocational skills necessary to enhance the pace of this nation's development.

e) To encourage self-employment while at the same time producing skilled artisans, technicians and technologists for formal and informal sectors at the ratio of 1 technologist to 5 technicians to 30 craftsmen (1:5:30).

The government, together with development partners, has continued to provide unconditional support to these institutions in order to ensure that the outlined objectives are achieved. This has led to introduction of quality management policies being inculcated in the management of these institutions, revision of the syllabi and provision of some equipment. However, over the years, public expenditure resources have either remained the same or have shrunk in real terms. Although the education budget is high, the expenditures are skewed to personnel emoluments and primary education, leaving limited resources for other education sectors such as secondary education; Early Childhood Development Education (ECDE); middle level tertiary education; Technical, Industrial, Vocational, Entrepreneurship and Training (TIVET) and university education (Ngware et al 2005).

The Kenya Institute of Education (KIE) has been mandated to continuously revise the syllabi to ensure that the training in these institutions is relevant and meet the changing needs. This has resulted in introduction of Information and Communication Technology (ICT) as a unit in most of the courses in order to provide a basis for ICT integration in the teaching and learning and E-learning.

ICT integration has been defined by Mwinyeria (2009) as "the use of all manner of ICTs across curriculum subjects". This implies that ICT tools are to be used efficiently in the delivery of subject content during teaching and learning in the technical institutions. On the other hand, E-learning is "the delivery of a learning, training or education program by electronic means. E-learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material" (Stockley 2003).

The research is to do with the use of ICT to extend and enhance teaching and learning in technical education, and does not focus on ICT as a subject, or 'discrete' ICT. The researcher appreciates the fact that ICT basic skills courses offered in the technical

curriculum are not successful in causing greater use of ICT within subject areas, although they do raise the levels of ICT skills. Studies show quite a high level of technical skill is required to encourage classroom use of ICT, and even teachers who are confident enough to use ICT in their lesson preparation do not use it in their teaching. As Tearle (2005) puts it "*patterns continue to emerge, but are showing observable differences with the passage of time. This may be influenced by a number of factors such as advances in technology making their mark, the increased availability of ICT in both school and home settings, the stabilizing of the profile of ICT within education generally and the visibility of its use which is now never far from the daily routine of any teacher*". ICT integration has been, and continues to be, a journey of 'trial and error' to determine what models are effective in embedding ICT into teaching, learning and administration(Stevenson, 1997).

The researcher recognizes that researches have been carried out to provide guidelines for ICT integration in teaching and learning in the Institution of higher education. One such report is by Gakuu et al (2009) in which researchers sought to establish status of Pedagogical Integration of ICTs in Kenya. The study established that the pedagogical integration of ICTs had a positive impact on teaching and learning. Both students and teachers reported that they used computers to access knowledge. In 60% of the institutions, off line resources such as Microsoft Encarta Encyclopedia was used, there was also restricted access to information from online resources in schools that had connectivity. However most of the recommendations from these researches cannot apply for the public technical institutions because of the following reasons among others:

(a) Type and nature of the training equipment available in these institutions. This is clearly outlined by the *Pricewaterhouse coopers* report of 2009 which shows that *schools are at different levels of maturity in terms of implementing ICT.* For example, the researchers do not provide a tailored guideline for integrating ICT in teaching and learning of the technical subjects such as mechanical, automotive, building and masonry considering the present equipment in Kenyan institutions;

(b) Public technical training Institutes were established with a special mandate of in calculating hands-on skills hence the need for a special structure in the implementation of the curricula (TIVET bill 2009);

(c) Although education budget is high, the expenditures are skewed to personnel emoluments, primary education, secondary education and Universities, leaving limited resources for public technical training institute (Ngware et al – 2005) ;

(d) According to Gakuu et al (2009), while a lot of attention has been directed toward acquisition of ICT equipment, little has been done to integrate them into teaching and learning. They note that teachers showed great awareness of how ICT can be used to enhance the quality of teaching and learning but this is hampered by challenges that revolve around the lack of clear policies and action plans on the use of ICT both at the school level and at a national level.

(e) According to Keiyoro (2010), there have been concerns raised within the Education sector about the ways in which ICT could be integrated in teaching and learning methodology to enhance the acquisition of knowledge and skills in Science. He further notes that no previous research has been carried out on the effective use of computers in teaching and learning the Science curriculum within Kenyan education system; this view is also shared by Gakuu et al (2009). For this reason, Keiyoro recommends (for future research) development of guidelines for ICT integration in teaching and learning; of course the public technical training institutes are no exceptional.

(f) Despite the assumption that the integration of ICT influences the entire school system, research focusing on ICT in schools is generally limited to the study of variables at class level. In contrast to these studies, the present research explores ICT integration from a school improvement approach. More particularly, it examines the local school policy with respect to ICT integration from both the principal's perspective and perceptions of teachers.

The research endeavors to learn from a range of interpretations of good practice and examines all aspects of the contexts and the processes deployed. Through this approach, the aim is to gain a better understanding of the features which prove to be influential, and hence develop a framework that will facilitate ICT integration in Kenyan public Technical Training Institutes.

1.2 PROBLEM STATEMENT

According to Singh (2007), *the knowledge society reflects a shift from the learner as a passive consumer of educational offerings to an active knowledge gathering and productive participant in educational.* In public technical training institutes, learning is still teacher based with learners depending on their lecturers for most of the knowledge. Integration of ICT in teaching and learning will allow students to have more control over their own learning, to think analytically and critically, and to work collaboratively (Kulk, 1994).

Using educational technologies for drill and practice of basic skills can be highly effective according to a large body of data and a long history of use (Kulk, 1994). According to Kulk (1994), students learn more, and learn more rapidly, in courses that use computers assisted instruction (CAI). This is because new technologies allow students to have more control over their own learning, to think analytically and critically, and to work collaboratively. As a result, without ICT integration in teaching and learning, content delivery in mechanical, automotive and electrical subjects is not effective; teachers cannot use computers and information technologies to improve their roles in the educational process. (Kosakowski, 1998).

The integration of the Internet in teaching and learning has not been effectively utilized in technical institutes. From the Pricewaterhouse coopers report of 2009, many students in Kenyans schools cannot easily access the Internet services especially in rural areas during learning. Studies show that there are advantages to students having access to the internet (Nicol, 1998). Students have opportunity to collect research from a variety of sources, which can come from anywhere in the world giving very broad, detailed information about any subject during learning sessions. ICT facilitates collaborative learning and discussion groups with other students. Nicol comments on the web as being an: "enhanced learning environment" providing a rich resource of global information. Collins

(1991) believes that this increased dependence on the web will bring about many changes in the teaching styles used and hence improve content delivery.

Most of concepts in mechanical, electrical and building are abstract in nature. For example the demonstration of the working of pistons cannot be effectively done using the traditional methods of delivery. As a result, traditional methods of delivery are either in decline or being enhanced or supported by alternative multiple media delivery mechanism. Collins (1991) proposes that this affects the students more, and with effective planning, teachers can contribute more actively to the learning taking place by the student.

The lecturer may adopt a management and supervisory role as opposed to the traditional view of the lecturer teaching students particular subject content (Clarke, 1993). According to Clarke, teachers will no longer be content providers. Rather, they will be discussion leaders, advisors, tutors, field trip leaders - always helping their students build interpersonal skills while they pursue their academic subjects. This will be facilitated with the wide range of ICT software such as Camstacia, NetOp, N-computing and zimbra.

Singh (2007) believes that the web makes its possible to put ideas of theorists like Piaget, Vygotsky, and especially Dewey into practice. He observes that the problem of making these ideas a reality is basically problems of human communication; which can be overcome through the power of computer networks. Computer networks can make these kinds of communication not just possible but easy. Singh notes that communications via computer networks has the potential to make progressive approaches to education more practical and scalable in real, non-laboratory settings. The Kenyan public technical training institutions are handicapped in the area of computer networks (Dfid report - 2009).

1.3 THE OVERALL OBJECTIVE OF THE STUDY

The aim of this study is to ***develop a framework for ICT integration in teaching and learning in the Kenyan public technical training institute.***

1.4 OBJECTIVES

The study will **be guided by** the following objectives:

1. **To** assess the level of ICT integration in teaching and learning in public technical training institute
2. **To** determine the factors that influence ICT integration in public technical training institute
3. **To** establish the nature of training equipment in public technical training institute

1.5 RESEARCH QUESTIONS

1. What are the competency level and practices of lecturers at integrating ICT into teaching and learning at the public Technical Training Institute?
2. What are the ICT support provided at public Technical Training Institute for the integration of ICT into teaching and learning?
3. What are the challenges and constraints of integrating ICT into teaching and learning at the public Technical Training Institute level?

1.6 JUSTIFICATION

The framework developed will provide a Kenyan solution for the government in its efforts to achieve the Vision 2030 through the use technical and vocational training. The guidelines will yield an efficient mechanism for all education stakeholders with the intention of improving content delivery and foster learner-centered learning.

1.7 SCOPE

The research will be conducted among lecturers, administrators, and students of selected public Technical Training Institutes in Kenya. The study will focus on the integration of ICT in the teaching and learning of technical subjects in the various institutions.

CHAPTER 2

2.0 LITERATURE REVIEW

According to Stevenson, (1997), the past two decades during which the phenomenon of information and communications technologies (ICT) had burst onto the educational scene, many commentators have noted the often haphazard and ad hoc nature of ICT assimilation in schools. He continues to point out that the road from 'initial adoption' to embedded use' is littered with war stories of hardware obsolescence, software incompatibility, systemic underinvestment and lack of user competence. The technical institutes in Kenya have not been an exception; some have had to apply for electronic donations from overseas to reduce ratio of student to computer and address accessibility. Most of the donations consist of old computers with very low speeds, small memory capacities hence incompatible with modern operating systems and application software. This is consistence with Stevenson findings on hardware obsolescence. This had led to a lot of electronic waste in terms of computers in the institutions.

According to Tearle (2005), Understanding the issues regarding encouragement, support and infrastructure required to achieve the implementation of ICT has proved to be complex. According to him, there are some schools where almost all staff have adopted ICT use into their working practices, adapting existing approaches to teaching and learning and developing new ones. Yet in other schools – with an apparently similar desire for ICT to be used, and similar with resourcing – only pockets of limited ICT use has been achieved. The public technical institutes in Kenya are run by the Board of governors on behalf of the government and therefore issues regarding to ICT integration are homogenous demanding a common solution. For this reason, the recommendations by Tearle do not provide a basis for ICT integration in the public technical institute.

Many studies have focused directly on ICT use in schools, its uptake, integration, the needs and attitudes of teachers (Tearle, 2005). For example, Marcinkiewicz, (1993), in the Journal of *Research on computing in Education*, focuses on computers and teachers with the aim of determining the factors that influence computer use in the classroom.

Focus on ICT uptake include Persichitte, W et al (1996) in the Journal of *Information Technology for teacher Education* in which they address the diffusion of computer-based technologies. It is important to note that teachers are being asked not only to adopt the use of technology themselves, but they have to teach others how to do this. This adds a layer of complexity to that experienced outside of education; in addition to learning new skills, the teacher has to reconceptualise their own teaching and understanding of learning in order to work with the technology (Tearle, 2005). Consequently, there is a need for the review of teacher education curriculum in order to change the pedagogical skills impacted on the teacher trainees. However this will not address the many graduates waiting to employed as teachers. The government has therefore to be provided with a tailor-made framework for ICT integration in order to realize Vision 2030 as far as technical education is concerned.

According to Tearle (2005) the tangible issues (practical factors) which are considered important in relation to teacher take-up and use of ICT include the following:

- availability of the technology,
- support and training,
- leadership and
- time.

According to him, the first issue continues to receive the most attention and relates to the quantity, type and reliability of computers, access arrangements and location of equipment. The importance of personal computer access is widely recognized both in the workplace and at home (Dawes, 2001; Preston et al., 2000). Computer access for teaching purposes is clearly important (Hoffman, 1996); this relates not just to there being sufficient computers (Pelgrum and Plomp, 2001; Andrews, 1997) but to the location of equipment and access arrangements such as timetabling (Kiili, 2003; Tearle, 2002). In Kenya, this has been compounded with poor infrastructure and high prices for computers and computer accessories (Pricewaterhouse coopers report 2009). As result, there is a big milestone when ICT integration for technical institutes is considered.

Computer reliability is also important, referred to by Butler and Sellbom (2002) as the most commonly cited 'significant problem' in the adoption of technology. According to Singh (2007), technical support is important to encourage teachers to use ICT in teaching and learning. Teachers often become discouraged when the technology wouldn't work. In some cases, teachers' sense of self-efficacy quickly diminished, making it less likely that they would continue using technology. Singh continues to note that the lack of technical support and the resulting technical difficulties significantly impeded teacher's abilities to implement what they had learned. When teachers could not obtain sufficient technical assistance, they frequently altered or abandoned plans to use technology in their classroom. Most public technical institutes lack the technical personnel to provide the necessary technical support. This is because the ministry of higher education, science and technology (MOHEST) has only catered for maintenance of other machines apart from computers (MOHEST web site). For this reason, computer reliability has continued to be a thorny issue in ICT integration hence forcing institutions to employ there own computer technicians.

The need for more training in ICT use has received recent attention, having been neglected as a focus for government intervention for a period between the early 1980s and mid 1990s. This is evidenced by the emphasis on integration of ICT related courses into curricula (ICT policy). There is recognition that training needs to have a carefully planned structure and a focus on 'training outcomes' (Passey and Ridgeway, 1992; Rhodes and Cox, 1990; Owen, 1992; Bennett, 1994), and now, particularly in the light of the New Opportunities Funded (NOF) training (NOF, 1999) and associated initiatives (Intel, 2000) the emphasis is now firmly on the nature of training required and the effectiveness of different training strategies and models (TTA, 2002; Tearle and Dillon, 2002; Myers and Halpin, 2002). As mentioned earlier, most Craft and Diploma graduates from the institutes are unemployed because of the problem of relevance of training outcomes. The training needs for the technical training should be put in consideration to facilitate a successful ICT integration. This will therefore demand a flexible and objective mechanism for formulating policies on the curriculum.

In addition, it is recognized that teachers starting to use ICT in their teaching need various modes of support including technical (Leggett and Persichitte, 1998; Ertmer, 1999; Harrison et al., 2002) and administrative support (Hoffman, 1996). The support of senior staff for practical needs such as time or resources, or recognition of new practices (Fullan, 1992; Kennewell et al., 2000) and that of peers for collaboration (Dawes, 2001) are also important. According to Singh (2007), although teachers are the most important change agents at the educational work floor, what is perhaps even more important in the early stages of integrating ICT is the role played by leadership "gatekeepers" such as school principals. He observes that the school management offers a supportive climate for the use of ICT in the school. The support from administration may not apply for Kenyan institutions. This is because most of the administrators i.e. Board of Governors and Principals are computer illiterate and therefore have no command in ICT matters (Pricewaterhouse coopers report 2009).

Both leadership and management were noted when reviewing the change management literature. Here the emphasis is often more practical, and the need for co-ordination is often referenced (Harrison et al., 2002; Kennewell et al., 2000), with the term leadership most commonly used in a management rather than visionary context.

The adoption and implementation of ICT by organizations in general, and by academic organizations in particular, is a complex process that involves essential changes in the ways of thinking and the professional practice of many users. Many researchers have studied and investigated these adoption processes, and various models have been suggested to characterize and explain these processes in different types of organizations (Bates, 2000; Bonk, Cummings, Hara, Fischler, & Lee, 1999; Harasim, 2000; Owston, 1997; Mioduser, Nachmias et. al. 2000)

Reiber and Welliver (1989) and later Marcinkiewicz (1994) developed the Instructional Transformation model, which has been used by a number of researchers (e.g. Knee, 1996) to help schools design their restructuring plans using technology. Their model developed from a study of adoption behaviour drawing on the *Concern Based Model*

(CBAM) and the work of Rogers (1983). They saw much value to educators in the model, particularly in 'recommending staff development, remediation, or differential staffing' (Marcinkiewicz & Welliver, 1993, p. 5). The Instructional Transformation Model proposes a hierarchy for the successful application of technology to education using a *Level of Use* type of approach. This hierarchy involves the following five steps (a) familiarization, (b) utilization, (c) integration, (d) reorientation, and (e) evolution. (Rieber & Welliver, 1989, p. 21) gives a six level model with the inclusion of the Non Use level prior to the first step. These steps are comparable to the steps developed for the Apple Classrooms of Tomorrow (ACOT, 1995) where there is a period of familiarization (Entry) representing baseline exposure to technology; utilization (Adoption) occurring when teachers try the technology; integration (Adoption) beginning the appropriate use of ICT; reorientation (Appropriation) where ICT becomes a part of the learning context and evolution or revolution (Invention) where there is a change in methods and media to facilitate learning. These stages are confirmed in long-term projects like the Apple Classrooms of Tomorrow (ACOT, 1995) studies which show that teachers must travel through a number of stages to integrate ICT fully into their classrooms and their teaching programs and teachers must progress through all five phases, otherwise, the technology will likely be misused or discarded (Rieber & Welliver, 1989; Marcinkiewicz, 1994).

Rogers (1995) suggested a five-stage model for characterizing the process of change in organizations in general and the integration of new technologies into teaching – in particular. This model emphasizes the way in which the individual relates to the innovation, from the initial stage of awareness to the technological innovation; through the stages of expressing interest, evaluation and experiencing the new technology; to its complete adoption in the fifth stage.

Bonk et al (1999) focus on the integration of innovative technology (the Internet) into teaching, and suggest a model that describes the use of the Internet over a sequence of ten phases that define the extent of use of the Internet based on the type and intensity of the pedagogical use of the World Wide Web.

Sandholz et al (1997) and Mandinach & Cline (1994) propose a four-stage developmental model of professionalization in teaching and of assimilating ICT into teaching processes: survival; attainment of mastery; impact over the teaching process; and innovation.

Other researchers in this field focus on factors that promote and inhibit the adoption process of ICT and its assimilation into teaching and learning practice. These studies identify two main clusters of factors that influence the usage patterns of integrating ICT into teaching and learning: external-environmental factors; and internal-personal factors (Preston, C., Cox, M., & Cox K. 2000). External-environmental factors included promoting elements such as: existing training programs, offered technological and pedagogical support system, proficient technological infrastructure. External-inhibiting factors include: significant time invest, the lack of organizational rewarding, and lack of technological and pedagogical support system. Internal-personal factors include contributing factors such as the users' positive attitudes toward ICT and their beliefs in the potential advantages of integrating ICT into teaching. The inhibiting internal factors are expressed in raising doubts in ICT and its contribution to teaching and learning.

According to Lai et al (2001), the action for the implementation of ICT into schools involves the following:

- Infrastructure and Professional Development
- Integration of ICT
- Strengthening of current practice

This model is too simplistic; it does not sufficiently take into account the complexity of the school environment and the many interacting factors that impact on classroom practice. This includes factors external to the school such as national policy and societal expectations. As a result it does not acknowledge how difficult it is to alter teacher practice or the "substantial discretionary authority [teachers have] in their classrooms" (Cuban, 2001). That is not to deny that without a sufficient level of installation there can be no integration. What appears to be ignored is that the provision of infrastructure and professional development does not guarantee use in classroom practice.

According to Alberton et al (2009), a framework for ICT integration in teaching and learning would include the following components:

1. The motivations that may promote or inhibit the implementation of ICT in teaching:
   - Internal motivations include: attitudes and beliefs toward teaching and the contribution of technology to teaching and learning processes.
   - The external motivations include: system-wide policy and support, provision of pedagogical and technological support systems.
2. The actual implementation of ICT in teaching and course management.
3. Reported impact on pedagogical and administrative aspects of CCs' work- changes that had taken place following the use of ICT.

In a nutshell, a number of researchers have attempted to provide a basis for ICT integration into teaching and learning. However, this study will address the following gaps in order to provide a feasible framework for public technical training institute:

1. Hardware availability verses electronic waste;
2. Institutional managers and ICT;
3. Planning;

CHAPTER 3 METHODOLOGY

3.1 Research Framework

The study has been based on the following UNESCO model of 2005. The model was chosen because it summarizes the stages found in the other previous models of ICT adoption in teaching and learning which have been reviewed in this study.

Component	Details
Emerging	• Awareness of technology and its importance. • Baseline exposure to technology; determine the entry behaviour of teachers and students • User training • Installation • Use of ICT tools for traditional lesson delivery
Applying	• Technology becomes essential for the educational goals of the classroom. • Technology becomes traditional classroom practice with a focus on increased student productivity and engagement.
Infusing	• Rethink the education goals of the class with the use of technology; Focus on cooperative, project-based and interdisciplinary work incorporating the technology. • Focus on learner centered-delivery with technology
Transforming	• Evolving classroom that are completely integrated with technology for all subjects e.g. use digital classroom. • Discover new uses of technology in teaching and learning.

Table 0-1: Research framework

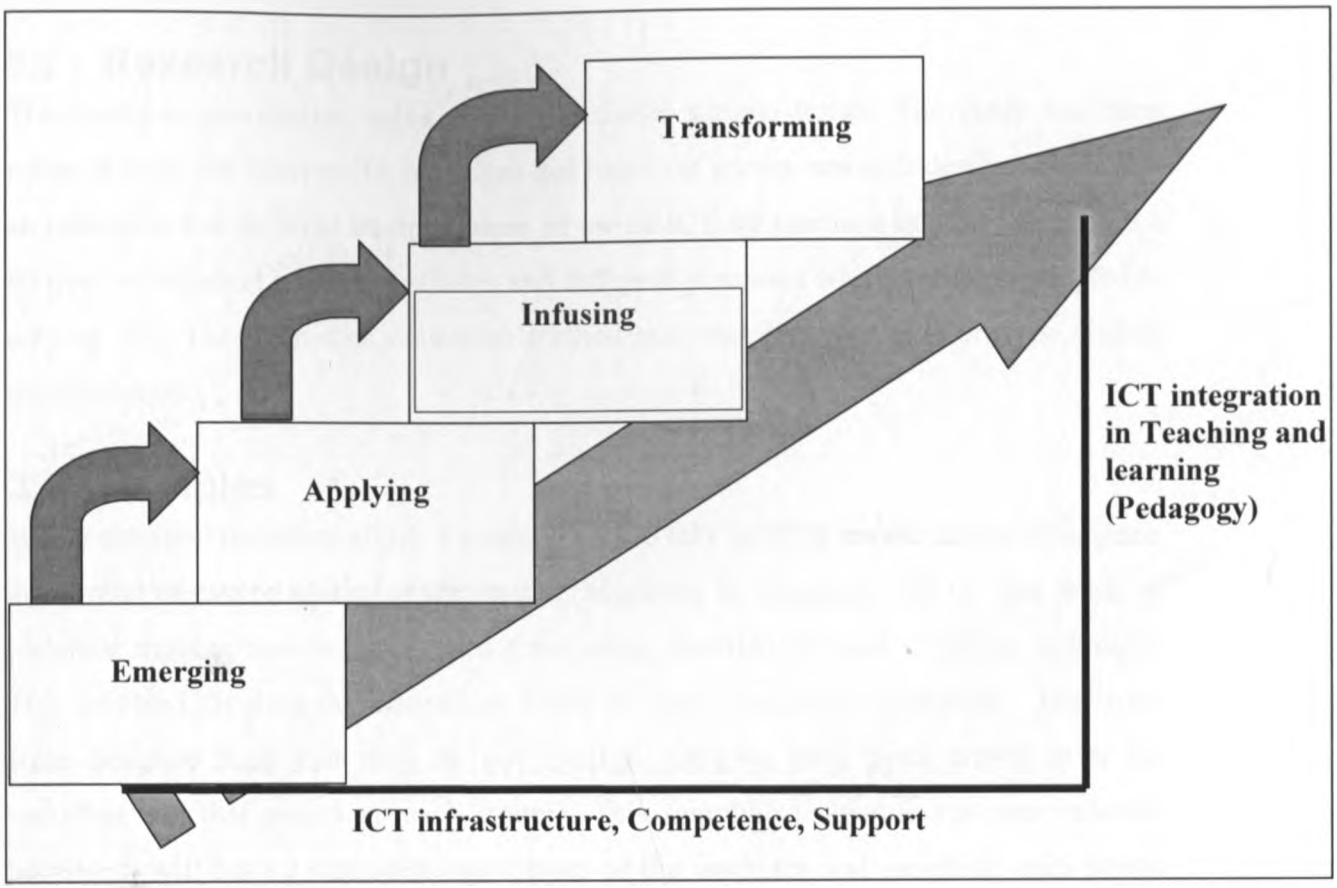

Figure 0-1 Research framework

3.2 Research Design

This study is quantitative using a cross-sectional survey design. The study has been undertaken in the interpretive paradigm but based on survey research design. There was an interest in the different interpretations of use of ICT for teaching and learning across a number of technical training institutes and different processes which had been adopted to achieve this. The main data collection method that was deployed is likert type scaling questionnaires.

3.3 Samples

Where time and resources allow, a research should take as big a sample as possible, since this would ensure reliability of the results (Mugenda & Mugenda, 2003). This study of technical training institutes has been done using stratified random sampling technique. This involved dividing the institutions based on their geographical location. The strata were designed such that they do not overlap. Samples have been drawn from the sampling unit that makes up each stratum. This sampling technique has been selected because it will ensure homogeneous classes of the institutes and sampling units which will involve administrators, Heads of ICT, lecturers, and students.

The following formula was used to determine the minimum sample size for the study.

$$n = \frac{Z\alpha^2 p (1 - p)}{d^2}$$ (Kothari 2006)

Where

$Z\alpha$ the standard normal deviate at the required confidence level.

n is the sample size.

d is the level of significance

P is the proportion in the target population estimated to have characteristics being measured

Using a confidence level of 95%, the $Z\alpha$ was 1.96. Since there is no estimate available of the proportion in the target population, then 40% was used (Mugenda & Mugenda, 2003) i.e. P = 40% and with as significance level of 0.05 i.e. d = 0.05%, then sample size is:

$$n = \frac{1.96^2 \times 0.4 (1 - 0.4)}{0.05^2} = 245$$

From the above formula, the sample size to be used must be at least 245. However, since larger sample sizes give more reliable results, the researcher targeted to have 300 valid responses.

3.4 Instruments

The study has used likert type scaling questionnaires. The questions in our questionnaire were unambiguous and easy for respondents to complete. Davis' (1989) original measurement scales for perceived usefulness and perceived ease of use included seven levels. Our research also adopted a 7 – point likert type questions. Likert type questions are used to assess perceptions and they have the advantage of yielding continuous data that lends itself to many statistical analyses. The instruments were designed to generate descriptive statistics regarding:

- ICT competence;
- ICT infrastructure/facilities;
- ICT support, practices and policy;
- ICT integration in teaching and learning and ;
- challenges and constraints.

The instruments has given rise to data on the attitudes of staff and students to ICT, and the suggestions for the procedure they believe ICT could offer learning benefits for students. The questionnaires had some questions that invited additional free text comment; designed to add some interpretation of 'check box' responses.

Selection of the respondents was based on the person's role within the institute, their use of ICT and their department. It was intended that the respondents should cover a range of different levels of enthusiasm for ICT use, as well as representing a mix of subject specialization, age, gender and length of time in teaching.

3.5 Research Variables

Variable	Sub Variable	Data source
ICT competence	• Types of ICT devices used in: - content development; - delivery; • Level of competency	• Administrator • Head of ICT • Lecturer • Student
ICT infrastructure/facilities	• Description of Infrastructure • Usage of facilities in ICT integration: Pedagogy, content development and delivery of content, assessment and learning	• Administrator • Head of ICT • Lecturer • Student
ICT support, practices and policy	• ICT practices in teaching and learning • Institute ICT Policies • Documented Procedures on ICT integration (pedagogy, content development/delivery, assessment, technical and user support., if any) • Hardware and software plans • National ICT plan and policies in education	• Administrator • Head of ICT • Lecturer
ICT integration in teaching and learning	• Description of strategies • Methods used in teaching and learning • Facilities used in teaching	• Administrator • Head of ICT • Lecturer • student
Challenges and constraints	Description of challenges and constraints: −lack of awareness −lack of funds −human resource −pedagogy approach −infrastructure/facilities −lack of time	• Administrator • Head of ICT • Lecturer

Table 0-2: Research variables

Dependent variable:

- ICT integration in teaching and learning

Independent variables:

- ICT competence
- ICT infrastructure/facilities
- ICT support, practices and policy
- Challenges and constraints

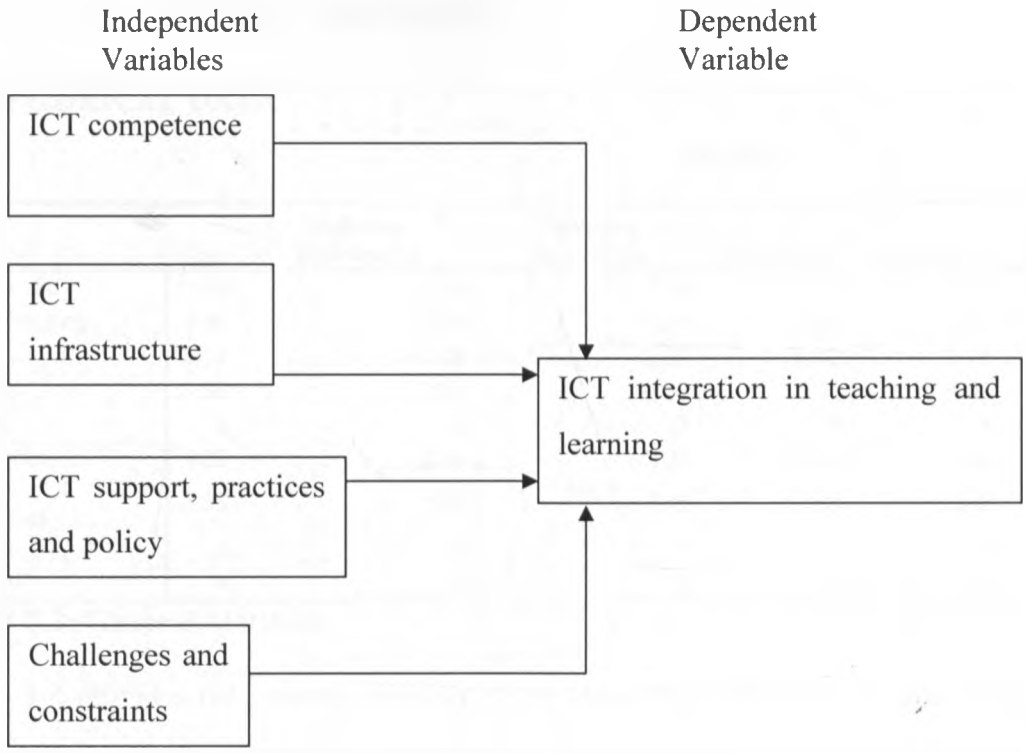

Figure 0-2 Independent and dependent variables

3.6 Procedure

Permission to conduct the research was obtained from the relevant authorities. Questionnaires was administered to the respondents and scored. Participants were assured of confidentially.

The questionnaires were pre-tested to assess and enhance the semantic content validity of the items by assessing the correspondence between candidate items and the definitions of

the constructs they were intended to measure. This was done using three students and two lecturers from the Kabete Technical Training Institute in Nairobi. The assessment resulted in re-organization of the test items into different domain constructs. Some test items were re-framed for clarity.

3.7 Data Cleaning

The data collected was first coded, keyed in a data file and then cleaned in preparation for analysis. This was done to check the data set for errors. The following table provides a summary of the preliminary data cleaning.

CATEGORICAL DATA

Statistics

		Age	Education qualification	Teaching experience	Designation	Department	Course
N	Valid	176	176	176	176	278	106
	Missing	124	124	124	124	22	194
Mean		2.61	2.83	2.62	5.02	3.72	5.16
Median		3.00	3.00	3.00	5.00	4.00	4.00
Mode		3	3	3	5	4	3
Skewness		.122	.235	-.195	-3.843	.102	1.756
Std. Error of Skewness		.183	.183	.183	.183	.146	.235
Minimum		1	2	1	1	1	1
Maximum		5	4	5	6	8	18

Table 0-3: General Statistics

Table 3-3 provides the general statistics of the categorical variables i.e. age, Education qualification, teaching experience, designation department and course undertaken. All the respondents were expected to give s response about their department; 278 out of 300. However, some variables were optional for some respondents e.g. education qualification, designation, teaching experience, age were optional for students while course was optional for Lecturers. This resulted to different number of valid and missing values of the variables.

The table further provides the minimum and maximum values entered for each variable e.g. age is 1(under 30) and 5 (over 50) respectively.

ORDINAL DATA

	N	Minimum	Maximum	Mode
Competence in ICT applications and tools	282	1	6	3
Number of ICT tools	282	1	12	3
Practices	176	1	7	5
ICT tool oftenly used to support teaching	282	1	6	4
Teaching method is used with ICT during teaching	175	1	6	5
Challenges and constraints	176	1	6	2
Valid N (listwise)	175			

Table 0-4: Descriptive statistics for ordinal data

From table 3-4, a total of 282 questionnaires have been considered for the analysis i.e. 18 questionnaires were invalid. The variables under study have been indicated with their corresponding valid, minimum, maximum values and their corresponding mode.

3.8 Validity

Validity is concerned with whether the findings are really about what they appear to be about (Saunders et. al., 2006). Validity is defined as the extent to which the data collection method or methods accurately measures what they were intended to measure (Saunders et al, 2006). Cooper and Schindler (2003) believe that validity refers to the extent to which a test measures what we actually wish to measure. There are two forms: external and internal. The external validity of research findings refers to the data's ability to be generalized across persons, settings, and times. Internal validity is the ability of a research instrument to measure what is purposed to measure. The following are measures that was taken to ensure validity:

- Data was collected from reliable sources i.e. Public technical training institutes
- Survey questions were made based on literature review to ensure the validity of the results.
- The questionnaire was pre-tested for meanings and semantics against the definitions of the constructs by experts.

3.9 Reliability

Reliability is an assessment of the degree of consistency between multiple measurements of a variable. It demonstrates to which extent the operations of a study, such as data collection procedures can be repeated with similar results. A measure is said to be reliable if a person's score on the same test given twice is similar.

One way to test the reliability of a test is known as test-retest method. In this method, a questionnaire is given out to the intended participants and data is collected. The same questionnaire is administered again after sometime to the same participants or the same kind of participants. If the questionnaire is reliable, the data collected for the first the second instances should correlate perfectly. This method is expensive since the questionnaire has to be administered twice. It also takes long since, there has to be a time lapse between to two data collection times. Another way to do this is to use split half reliability. This method randomly splits the data set into two. A score for each participant is then calculated based on each half of the scale. If a scale is very reliable a person's score on one half of the scale should be the same to their score on the other half, therefore, across several participants' scores from the two halves of the questionnaire should correlate perfectly. The correlation between the two halves is the statistic computed in the split half method, with large correlations being a sign of reliability. The problem with this method is that there are several ways in which a set of data can be split into two and so the results could be a product of the way in which the data were split. To overcome this problem, Cronbach (1951) came up with a measure that is loosely equivalent to splitting data in two in every possible way and computing the correlation coefficient for each split. The average of these values is equivalent to the Cronbach's alpha, which is the most common measure of the scale of reliability. This is the reliability measure that was employed in this research. Apart from the reason given above for the superiority of Cronbach's alpha over split half method, we have used it because it is the most common reliability measure used in related work (Colesca & Dobrica, 2008; Davis, 1989). The generally agreed upon lower limit for Cronbach's alpha is 0.7 (Pallant, 2003; Colesca & Dobrica, 2008; Davis, 1989). The results of the Cronbach's alpha of the reliability analysis are presented in Table 4. As the table shows, the reliability analysis

gave an alpha coefficient exceeding 0.70, which is regarded as acceptable reliability coefficients.

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	ICT_APP1	2.6095	1.2683	169.0
2.	ICT_APP2	2.7574	1.3342	169.0
3.	ICT_APP3	2.8462	1.3496	169.0
4.	ICT_APP4	2.7574	1.3026	169.0
5.	ICT_APP5	3.0296	1.5253	169.0
6.	ICT_APP6	4.0592	1.6062	169.0
7.	ICT_APP7	4.4793	1.4272	169.0
8.	ICT_APP8	4.6213	1.4137	169.0
9.	ICT_APP9	4.5740	1.4254	169.0
10.	V19_A	4.5207	1.4188	169.0
11.	V20_A	4.6391	1.3070	169.0
12.	V21_A	4.7692	1.2199	169.0
13.	ICT_IMP1	1.7041	.8424	169.0
14.	ICT_IMP2	1.8343	.8976	169.0
15.	ICT_IMP3	1.7811	.9093	169.0
16.	ICT_IMP4	1.7633	.8747	169.0
17.	ICT_IMP5	1.8462	.9194	169.0
18.	ICT_IMP6	2.0178	1.1311	169.0
19.	ICT_IMP7	1.8462	.9940	169.0
20.	ICT_IMP8	1.8757	1.0976	169.0
21.	ICT_IMP9	1.9112	1.0399	169.0
22.	V31_A	2.0000	1.1701	169.0
23.	V32_A	1.9349	1.0973	169.0
24.	V33_A	1.8225	1.0428	169.0
25.	TOOL1	3.1006	1.3168	169.0
26.	TOOL2	3.5976	1.0983	169.0
27.	TOOL3	3.3669	1.2565	169.0
28.	TOOL4	4.3254	1.0886	169.0
29.	TOOL5	4.3077	1.0746	169.0
30.	TOOL6	4.5917	1.0201	169.0
31.	TOOL7	4.3018	1.3793	169.0
32.	TOOL8	4.6036	1.0248	169.0
33.	TOOL9	4.4793	1.2105	169.0
34.	TOOL10	5.0769	.9636	169.0
35.	TOOL11	4.8698	1.0441	169.0
36.	TOOL12	4.4379	1.2335	169.0
37.	TOOL13	4.4142	1.3562	169.0
38.	TOOL14	4.8402	1.1092	169.0
39.	TOOL15	4.7811	1.0990	169.0
40.	TOOL16	4.4911	1.2350	169.0
41.	TOOL17	4.2663	1.2512	169.0
42.	TOOL18	4.3491	1.3680	169.0
43.	TOOL19	4.3254	1.3996	169.0
44.	TOOL20	4.2604	1.4069	169.0
45.	TOOL21	4.7101	1.2315	169.0
46.	TOOL22	4.8757	.9586	169.0
47.	TOOL23	3.5976	1.3466	169.0

48.	PRA_GEN	4.4320	1.4173	169.0

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
49.	PRA_GEN2	4.4083	1.5446	169.0
50.	PRA_GEN3	4.6568	1.3673	169.0
51.	PRA_GEN4	4.4320	1.4464	169.0
52.	PRA_GEN5	4.5562	1.3446	169.0
53.	PRA_GEN6	4.3728	1.5421	169.0
54.	PRA_GEN7	4.9349	1.1188	169.0
55.	USE_TL1	4.0414	1.5444	169.0
56.	USE_TL2	4.4083	1.3733	169.0
57.	USE_TL3	4.5266	1.2491	169.0
58.	USE_TL4	4.9527	1.1276	169.0
59.	USE_TL5	5.3195	4.3471	169.0
60.	USE_TL6	5.0000	1.0351	169.0
61.	USE_TL7	5.1657	.9173	169.0
62.	USE_TL8	5.1006	.8497	169.0
63.	USE_TL9	5.1716	.7639	169.0
64.	USE_TL10	5.1834	.8427	169.0
65.	USE_TL11	5.2189	.8051	169.0
66.	USE_TL12	5.1124	.9785	169.0
67.	USE_TL13	5.2189	.8342	169.0
68.	METHOD1	4.4675	1.4922	169.0
69.	METHOD2	4.6805	1.2266	169.0
70.	METHOD3	4.7929	1.2290	169.0
71.	METHOD4	4.8876	1.1043	169.0
72.	METHOD5	4.5562	1.4387	169.0
73.	METHOD6	4.5799	1.3998	169.0
74.	METHOD7	5.0059	.9480	169.0
75.	METHOD8	5.1893	.8163	169.0
76.	METHOD9	5.1479	.9364	169.0
77.	METHOD10	5.1834	1.0331	169.0
78.	METHOD11	5.0888	1.0399	169.0
79.	CHAL1	1.9290	.7836	169.0
80.	CHAL2	2.1065	.9514	169.0
81.	CHAL3	2.2426	1.1155	169.0
82.	CHAL4	2.6095	1.3633	169.0
83.	CHAL5	1.9882	.8728	169.0
84.	CHAL6	2.7396	1.3375	169.0
85.	CHAL7	2.2130	.9708	169.0
86.	CHAL8	2.2426	1.0090	169.0
87.	CHAL9	2.4438	1.0958	169.0
88.	CHAL10	2.2426	.8276	169.0
89.	CHAL11	2.4675	1.2152	169.0
90.	CHAL12	2.0828	.8268	169.0
91.	CHAL13	2.1716	.8592	169.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	347.2426	2246.5777	47.3981	91

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
ICT_APP1	344.6331	2170.7694	.6279	.9451
ICT_APP2	344.4852	2166.2632	.6323	.9451
ICT_APP3	344.3964	2172.2288	.5765	.9453
ICT_APP4	344.4852	2186.0132	.4833	.9456
ICT_APP5	344.2130	2163.9663	.5658	.9452
ICT_APP6	343.1834	2169.7340	.4963	.9455
ICT_APP7	342.7633	2169.7175	.5628	.9453
ICT_APP8	342.6213	2173.0343	.5428	.9454
ICT_APP9	342.6686	2170.4372	.5580	.9453
V19_A	342.7219	2173.4877	.5373	.9454
V20_A	342.6036	2182.0859	.5142	.9455
V21_A	342.4734	2199.7984	.3958	.9459
ICT_IMP1	345.5385	2222.8214	.2902	.9462
ICT_IMP2	345.4083	2220.2906	.3012	.9462
ICT_IMP3	345.4615	2215.5000	.3534	.9461
ICT_IMP4	345.4793	2212.2272	.4082	.9460
ICT_IMP5	345.3964	2218.4669	.3148	.9462
ICT_IMP6	345.2249	2229.9849	.1433	.9467
ICT_IMP7	345.3964	2215.8955	.3173	.9462
ICT_IMP8	345.3669	2219.8051	.2472	.9464
ICT_IMP9	345.3314	2218.4134	.2765	.9463
V31_A	345.2426	2224.3634	.1889	.9466
V32_A	345.3077	2218.7024	.2580	.9464
V33_A	345.4201	2211.3165	.3485	.9461
TOOL1	344.1420	2223.9440	.1683	.9467
TOOL2	343.6450	2212.7899	.3153	.9462
TOOL3	343.8757	2181.7999	.5384	.9454
TOOL4	342.9172	2228.7431	.1620	.9466
TOOL5	342.9349	2190.5969	.5450	.9455
TOOL6	342.6509	2205.3595	.4193	.9459
TOOL7	342.9408	2186.8536	.4482	.9457
TOOL8	342.6391	2205.2201	.4188	.9459
TOOL9	342.7633	2176.5746	.6068	.9452
TOOL10	342.1657	2209.3771	.4004	.9460
TOOL11	342.3728	2196.0090	.5056	.9456
TOOL12	342.8047	2179.5747	.5686	.9453
TOOL13	342.8284	2174.7978	.5529	.9453
TOOL14	342.4024	2204.7062	.3902	.9460
TOOL15	342.4615	2200.9524	.4308	.9458
TOOL16	342.7515	2192.8783	.4511	.9457
TOOL17	342.9763	2182.5352	.5344	.9454

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
TOOL18	342.8935	2182.2386	.4887	.9456
TOOL19	342.9172	2173.0764	.5483	.9453
TOOL20	342.9822	2166.3033	.5978	.9451
TOOL21	342.5325	2191.3338	.4660	.9457
TOOL22	342.3669	2222.8051	.2528	.9463
TOOL23	343.6450	2193.7423	.4045	.9459
PRA_GEN	342.8107	2168.8925	.5733	.9452
PRA_GEN2	342.8343	2158.7462	.5953	.9451
PRA_GEN3	342.5858	2174.3036	.5521	.9453
PRA_GEN4	342.8107	2159.4520	.6326	.9450
PRA_GEN5	342.6864	2173.1927	.5710	.9453
PRA_GEN6	342.8698	2159.1139	.5937	.9451
PRA_GEN7	342.3077	2190.2619	.5258	.9455
USE_TL1	343.2012	2144.4950	.6970	.9447
USE_TL2	342.8343	2147.6271	.7626	.9445
USE_TL3	342.7160	2162.6569	.7089	.9448
USE_TL4	342.2899	2187.1833	.5511	.9454
USE_TL5	341.9231	2240.0833	-.0301	.9550
USE_TL6	342.2426	2198.4825	.4844	.9457
USE_TL7	342.0769	2198.3333	.5511	.9456
USE_TL8	342.1420	2198.6702	.5922	.9455
USE_TL9	342.0710	2202.7925	.6025	.9456
USE_TL10	342.0592	2213.0917	.4134	.9460
USE_TL11	342.0237	2206.1899	.5254	.9457
USE_TL12	342.1302	2195.0187	.5519	.9455
USE_TL13	342.0237	2206.4161	.5036	.9458
METHOD1	342.7751	2153.0563	.6593	.9449
METHOD2	342.5621	2167.8071	.6765	.9450
METHOD3	342.4497	2168.0823	.6726	.9450
METHOD4	342.3550	2187.4684	.5604	.9454
METHOD5	342.6864	2166.7284	.5807	.9452
METHOD6	342.6627	2164.4272	.6157	.9451
METHOD7	342.2367	2199.8484	.5154	.9457
METHOD8	342.0533	2200.3245	.5953	.9456
METHOD9	342.0947	2208.7886	.4194	.9459
METHOD10	342.0592	2203.1989	.4363	.9458
METHOD11	342.1538	2191.3690	.5560	.9455
CHAL1	345.3136	2241.5261	.0598	.9467
CHAL2	345.1361	2239.6302	.0671	.9468
CHAL3	345.0000	2226.9524	.1746	.9466
CHAL4	344.6331	2237.5789	.0554	.9472

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CHAL5	345.2544	2228.2146	.2136	.9464
CHAL6	344.5030	2244.8348	-.0004	.9474
CHAL7	345.0296	2230.5170	.1649	.9466
CHAL8	345.0000	2242.4881	.0321	.9470
CHAL9	344.7988	2270.2450	-.2382	.9478
CHAL10	345.0000	2261.2857	-.1956	.9473
CHAL11	344.7751	2262.1753	-.1477	.9477
CHAL12	345.1598	2248.3731	-.0316	.9470
CHAL13	345.0710	2251.5187	-.0697	.9471

Reliability Coefficients

N of Cases = 169.0 N of Items = 91 Alpha = .9465

Intepretation

The output from the reliability test provides a number of pieces of information concerning the scales used in study:

- The number of items for each scale; this is given in terms of the number of cases e.g. ICT_APP1 has 166 responses with a mean of 2.6095 which is skewed towards agree (3).
- In terms of reliability, the most important value is the alpha value. This is the Cronbach's alpha coefficient which is, in this case, 0.9465. This value is more than 0.7 which implies that scale can be considered to be reliable with the sample.
- The column marked corrected item total correlation give an indication of the degree to which each item correlates with the total score. Low values (less than 0.3) indicate that the item is measuring something different to the scale as whole.

CHAPTER 4 DATA ANALYSIS

4.0 Introduction

Descriptive statistics has been used to show the level of competence, ICT integration, practices and challenges that exists in the public technical training institutes. This was done after carrying out reliability tests on the scales.

Correlation and multiple regression analysis were done on the independent variables and dependent variable in order to establish the factors that influence ICT integration in public technical training institute.

4.1 Reliability test

The dependent and independent variables used in the study used different scales. For this reason, there was need to check that each scale is reliable with the particular sample used. The cronbach's alpha coefficient was determined to indicate the internal consistence of the scales.

Variable	Cronbach's alpha	No of items
ICT competence	0.949	12
ICT infrastructure/facilities	0.932	24
ICT support	0.927	7
ICT integration	0.944	11
Challenges and constraints	0.757	13

Table 0-1: Reliability test

Interpretation

In terms of reliability the most important value is the alpha value. The results indicate that cronbach's alpha coefficients are more that 0.7 implying that the sample is reliable.

4.2 Descriptive statistics

Descriptive statistics for categorical/Nominal data

GENDER

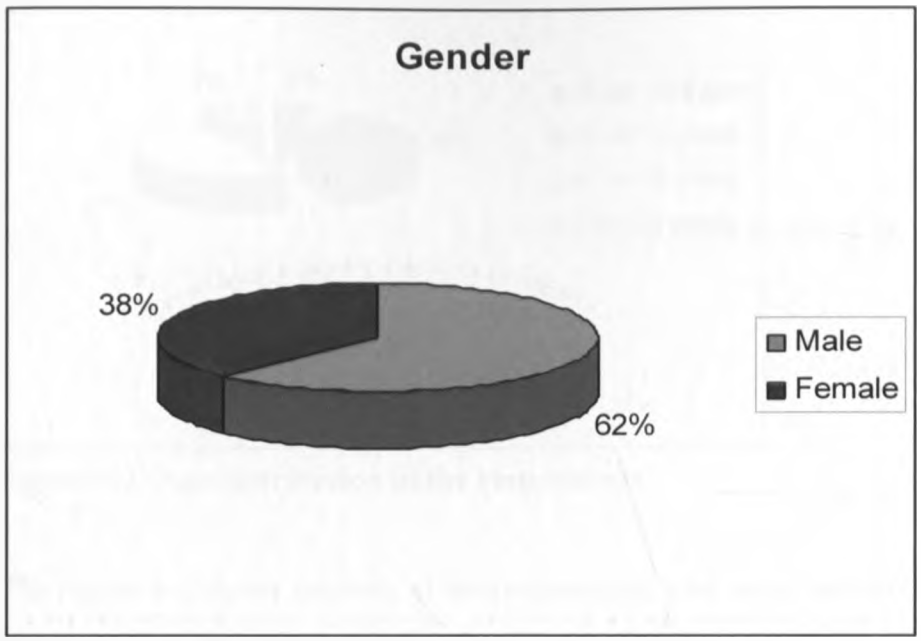

Figure 0-1: Gender distribution of the respondents

Interpretation

The Figure 4-1 shows that the overall percentage for males was almost twice that of females.

AGE

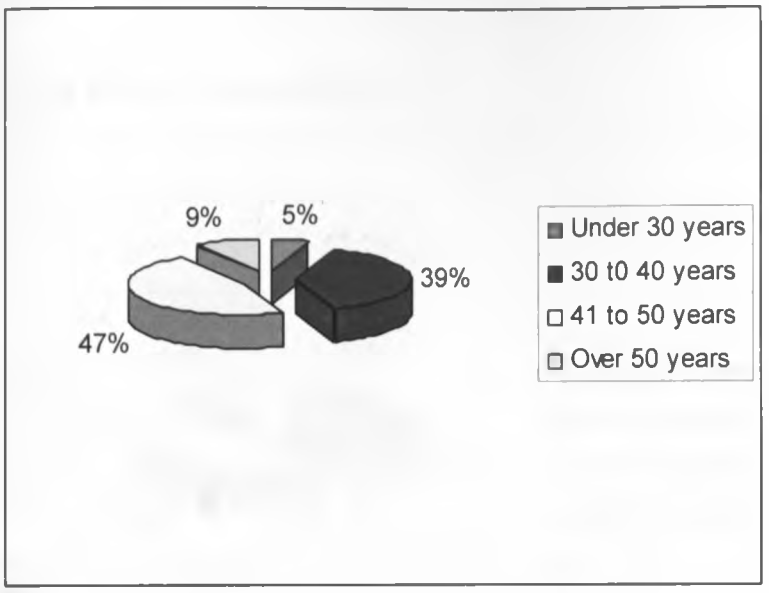

Figure 0-2: Age distribution of the respondents

The Figure 4-2 shows majority of the respondents, who were lecturers, are between 41 to 50 years. This age group accounts for 47% of the respondents. Lecturers who are below 30 years of age make up only 5%.

LEVEL OF EDUCATION

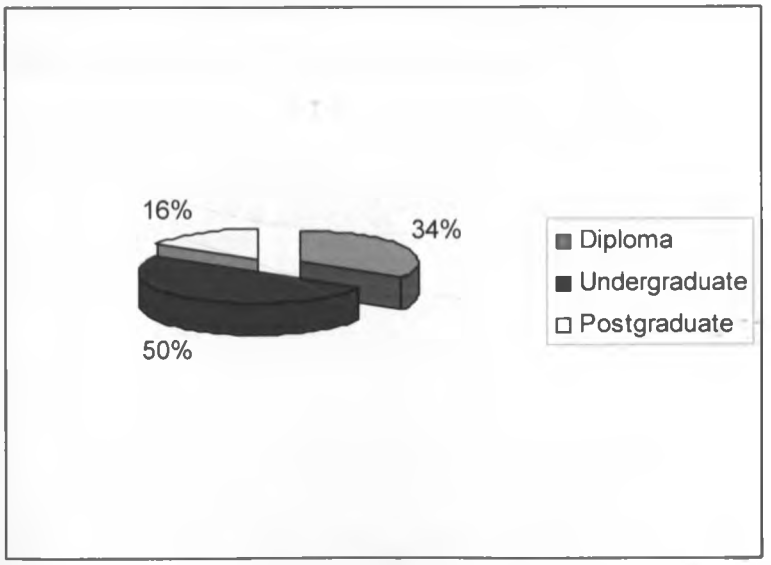

Figure 0-3: Distribution of the level of Education

The Figure 4-3 shows majority of the respondents, who were lecturers, are undergraduates This group accounts for 50% of the respondents. Lecturers who are below 30 years of age make up only 5%.

TEACHING EXPERIENCE

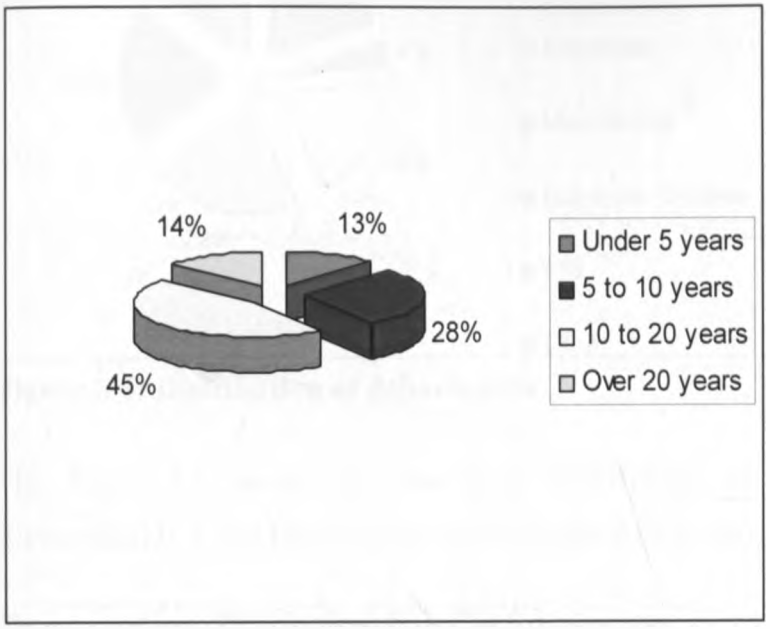

Figure 0-4: Distribution of teaching experience

The Figure 4-4 shows majority of the respondents, who were lecturers, have taught between10 to 20 years. This group accounts for 45% of the respondents. Lecturers who have worked under 5 years make up only 13%.

DEPARTMENTS

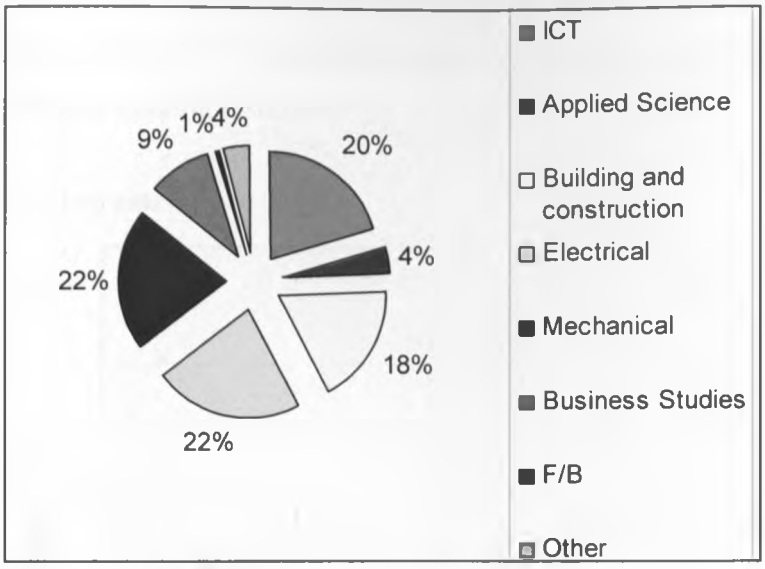

Figure 0-5: Distribution of departments

The figure 4-5 shows that the main departments under study were mechanical, Electronics, ICT and Building and construction which constitute 82% of the responses.

Descriptive Statistics for Ordinal data

Competence in ICT applications and tools

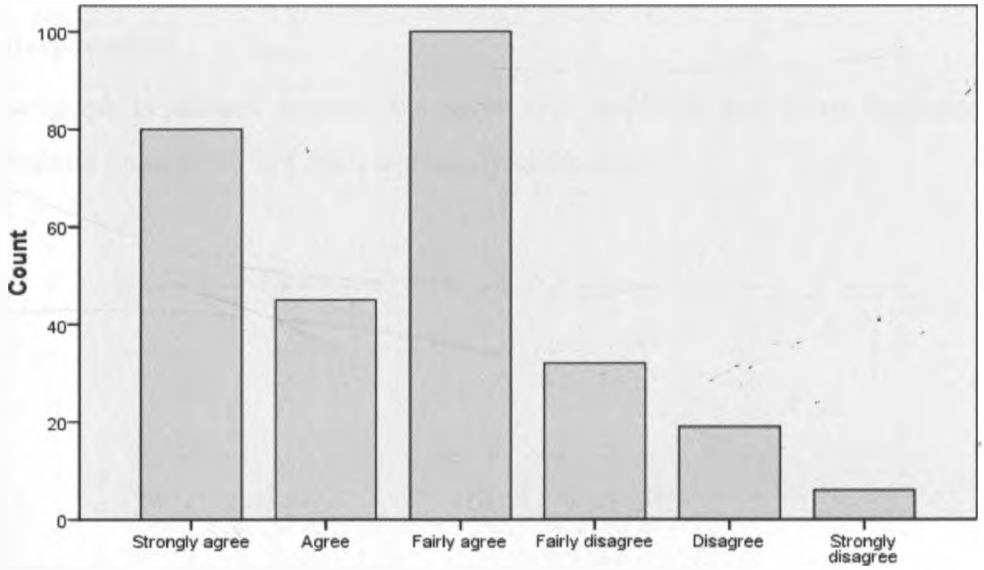

Figure 0-6: Competent in ICT applications

Interpretation

The graph is skewed towards the agree side which imply that there is a considerable level of competence in ICT application and tools among the lecturers and students in public technical training institutes.

ICT infrastructure

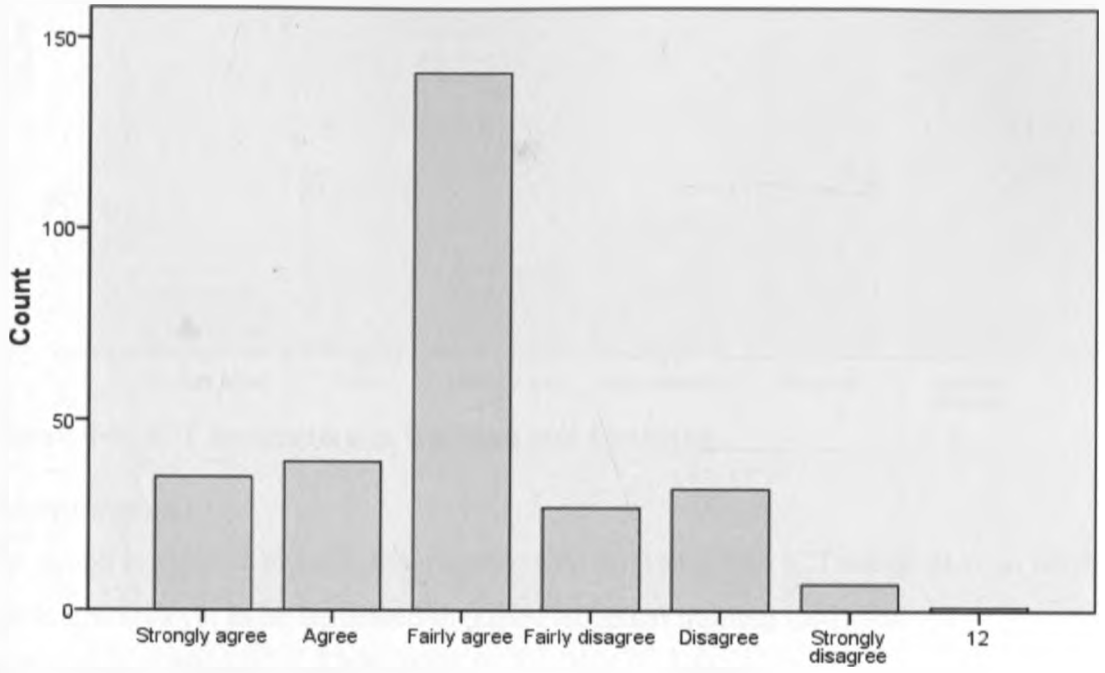

Figure 0-7: Adequate number ICT infrastructure/facilities

Interpretation

The graph is skewed towards the agree side implying that most Institutes fairly have adequate number of ICT tools especially computers.

ICT integration in teaching and learning

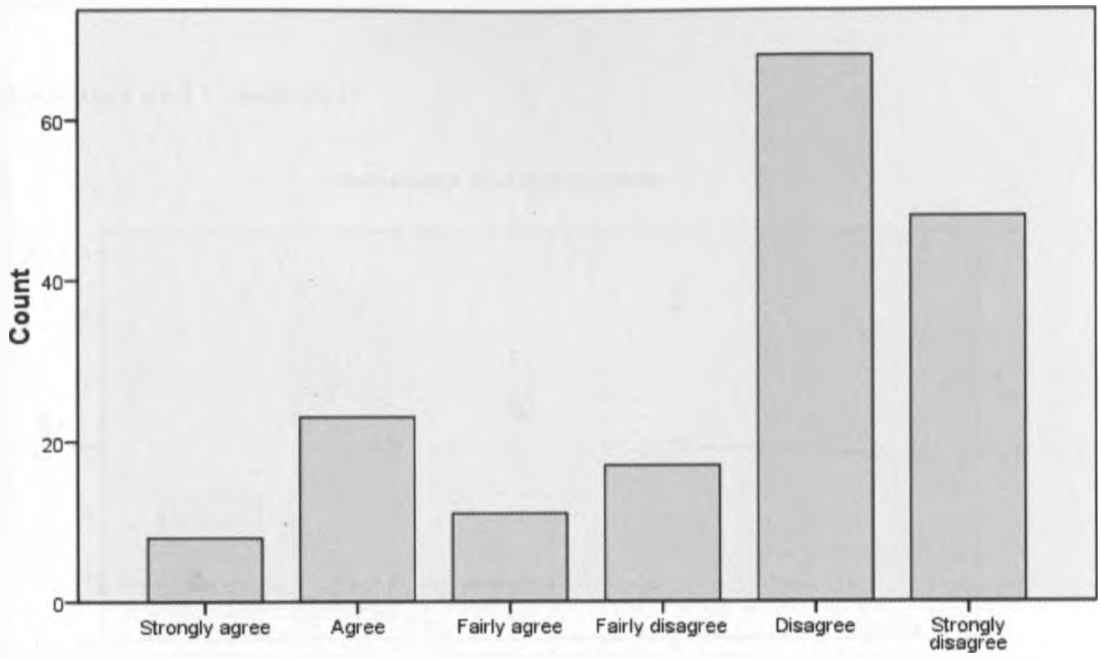

Figure 0-8: ICT integration in teaching and Learning

Interpretation

The graph is skewed towards the disagree side implying that ICT integration in teaching and learning is yet to be embraced in public technical training institutes.

ICT support, Practices and Policy

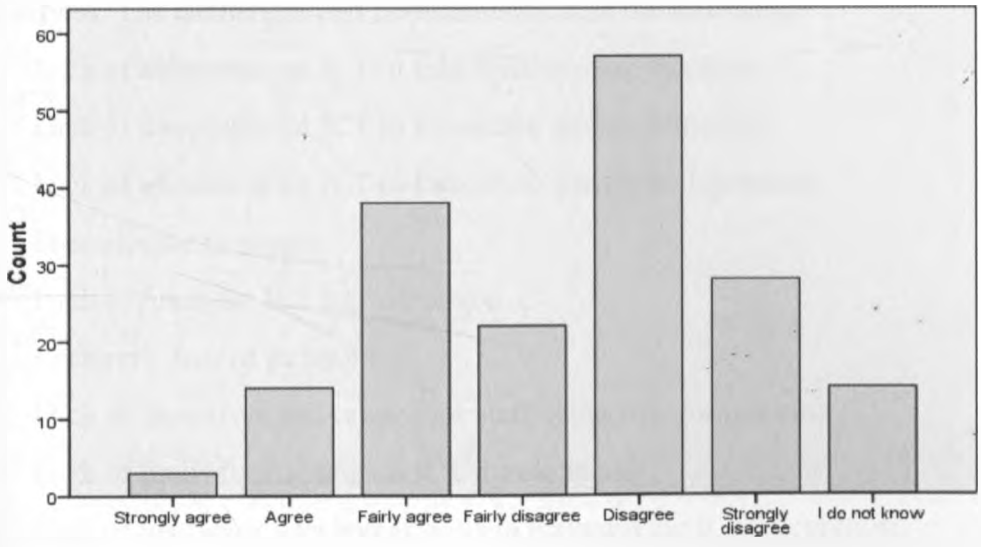

Figure 0-9: Adequate ICT support, Practices and Policy
Interpretation

The graph is skewed towards the disagree side indicating low ICT support and practices in public technical training institute.

Challenges and Constraints

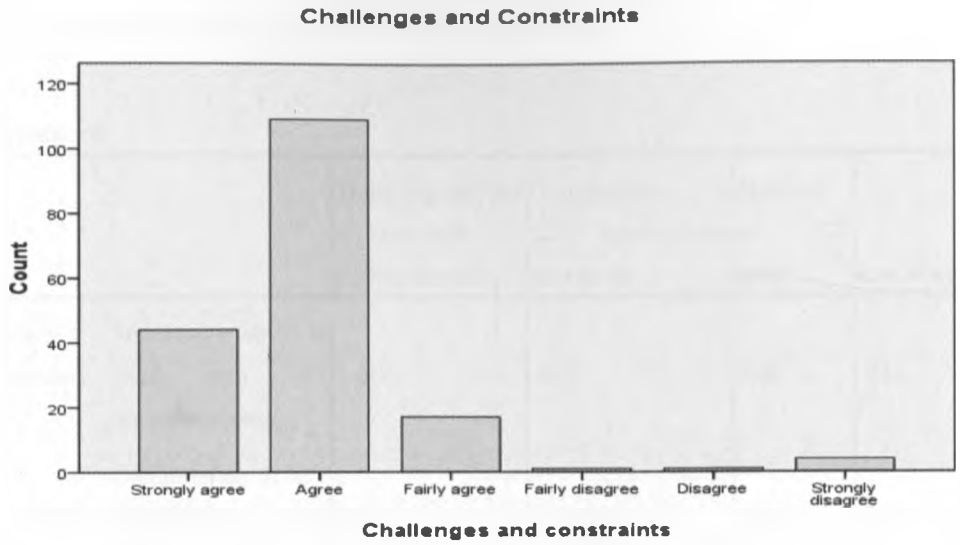

Figure 0-10: Challenges and Constraints in ICT integration

Interpretation

The graph is skewed towards the agree side showing that there are challenges and constraints. This variable has negatively influenced ICT integration in public training institutes. The challenges and constraints include the following:

- Lack of awareness on ICT in Education among lecturers.
- Lack of awareness on ICT in Education among principals.
- Lack of awareness on ICT in Education among policymakers.
- Poor electricity supply.
- Lack of funds for ICT infrastructure.
- Lecturers' fear of technology.
- Lack of incentives and reward for staff using ICT for teaching.
- Lack of funds for training on ICT in education.
- Lack of instructor's technical skills to maintain the ICT integration.
- Lack of monitoring system for ICT integration in the classroom.

4.3 Relationship between the dependent and independent variables

Correlation analysis was used to describe the strength and direction of the linear relationship between variables. The Pearson correlation coefficients were determined to show the strength and direction of the relationship.

Correlations

		Teaching method is used with ICT during teaching	Competence in ICT applications and tools	Number of ICT tools	Practices	Challenges and constraints
Pearson Correlation	Teaching method is used with ICT during teaching	1.000	.552	.052	.244	.009
	Competence in ICT applications and tools	.552	1.000	.264	.299	.089
	Number of ICT tools	.052	.264	1.000	.036	.043
	Practices	.244	.299	.036	1.000	.081
	Challenges and constraints	.009	.089	.043	.081	1.000

Table 0-2: Relationship between dependent and independent variables

Interpretation

All the variables have a positive Pearson correlation coefficients implying that an increase in the independent variable results to an increase in the dependent variable. However, competence in ICT application and tools has the highest coefficient of 0.552. This indicates that ICT integration is greatly influenced by competence in ICT applications and tools. All the independent variables have a correlation coefficient of less than 0.3. This is reasonable and therefore the variables are acceptable.

When a regression analysis is run, two values of importance are the Beta Coefficient (β) and the Sig. Value (S). When a variance exhibits a high Beta value, then it implies that there is a strong unique contribution to explaining the dependent variable, when the variance explained by all other variables is explained for. The Sig. Value tells whether

the variable is making a statistical significant unique contribution to the equation. If the Sig. Value is less than 0.05, then the variable is making a significant unique contribution to the prediction of the dependent variable. If the value is greater than 0.05, then you can conclude the variable is not making a significant contribution to the prediction of your dependent variable.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.641(a)	.411	.401	.60017

Table 0-3: Regression analysis showing the co-efficiency of determination (r square)

a Predictors: (Constant), OVERALL ICT CHALLENGES, OVERALL ICT INFRASTRUCTURE, mean for ICT COMPETENCE

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.017	.339		5.943	.000
	mean for ICT COMPETENCE	.274	.062	.271	4.423	.000
	OVERALL ICT INFRASTRUCTURE	.513	.062	.509	8.318	.000
	OVERALL ICT CHALLENGES	-.050	.081	-.037	-.623	.534

Table 0-4: Regression analysis beta and significant values

a Dependent Variable: OVERALL ICT INTEGRATION

CHAPTER 5 DISCUSSION

5.1 PROPOSED FRAMEWORK FOR ICT INTEGRATION

Using findings from the first stage of the research, the researcher proposed a conceptual framework for ICT integration in teaching and learning in Public Training Institutes The framework is table 9.

Variable	Emerging	Applying	Infusing	Transforming
Competence in ICT Applications and tools	• Focus on developing ICT literacy • Learning to apply ICT	• Focus on using ICT to improve lesson delivery • Using ICT to support training and professional development	• Involve in embedding ICT across the curriculum • Using ICT to collaborate in solving a problem	• Focus of curriculum is now learner centered • Integrate subject area in real world application
ICT infrastructure	• Few stand-alone workstations for administration • Word processing, Spreadsheet, database and presentation software. • Classrooms	• Computer lab • Computers, printers and limited peripherals • Word processing, Spreadsheet, database and presentation software. • Software according to subject needs • Internet access	• Computer lab and/or classroom computers networked • Resource-rich learning centers • Range of devices e.g. digital cameras, scanners, video and audio recorders • Video conferencing • Range of subject oriented content • Range of subject	• Whole Institute using ICT with access to a wide range of current devices • Conferencing and collaboration • Distance learning • Web courseware • Student self-management software • Digital rooms • Shareable digital resources

			specific software (simulation software) • Digital resources accessible via a central repository • Hardware and software plans	
ICT support, Practices and policy	• ICT department servicing the rest of Institute needs	• ICT planning isolated • Centralized policies on hardware and software development • Limited ICT development led by a specialist • Establishment of ICT maintenance unit	• ICT planning is part of strategic plan of institution • Repair and maintenance procedures • Plans for professional development	• ICT is integral to Institute development plan • Inclusive policies • Integral professional development
ICT integration in teaching and learning	• Awareness of technology and its importance. • Baseline exposure to technology; determine the entry behaviour of teachers and students • User training • Installation • Use of ICT tools for traditional lesson delivery	• Technology becomes essential for the educational goals of the classroom. • Technology becomes traditional classroom practice with a focus on increased student productivity and engagement.	• Focus on cooperative, project-based and interdisciplinary work incorporating the technology. • Focus on learner centered-delivery with technology	• Evolving classroom that are completely integrated with technology for all subjects e.g. use digital classroom. • Discover new uses of technology in teaching and learning.

Table 0-1: Proposed framework for ICT integration in public Technical Institutes

Based on the finding competence in ICT applications and tools (r = 0.552) has a high influence on the level on ICT integration in teaching and learning. The management these Institutions should endevour to provide training in order to enhance competencies in ICT applications and tools. This will enhance ICT in pedagogy at these Institutions.

From the results, these institutions have no or low degree of ICT support, policies, and practices; the mode of the responses to adequate ICT support, policies and Practices, was disagree. Institutes may have to resort to the following suggested solutions (Lundall and Howell 2000), to keep their ICT programmes functioning:- outsourcing some of the work regarding computer networks; sharing ICT technical staff with other schools in the neighbourhood and combining certain roles such as ICT technical support staff.

CHAPTER 6 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Based on the data analysis, most public technical training institutes are at the following stages of the UNESCO model of 2005:

Research variable	**Stage**
Competence in ICT applications and tools	Applying
ICT infrastructure	Applying evolving to the infusing stage
ICT support, practices and policy	Applying
ICT integration	Emerging

The acquisition of ICT skills alone by teachers without the appropriate pedagogy is inadequate for effective utilization of ICT in teaching and learning (Hakkarainen et al, 2001). According to Sabieh (2001), although it may be relatively simple to teach technological skills, this is not the case when it comes to learning how to use technology as a pedagogical tool. Indeed, teachers need ICT skills, but they also need knowledge and skills that enable them to use ICT in pedagogy (Kieyoro, 2010). More often than not, ICT skills professional development focuses on teaching ICT skills without showing teachers how to integrate these skills into their specific subject areas (Mathew et al., 2002: Sabieh, 2001). However, it is necessary to teach teachers how to incorporate what they learn in their teaching strategies and science activities (Sabieh, 2001).

Necessary resources and capabilities required for use of ICT in teaching and learning technical subjects in technical training institutes should include effective well trained teachers and learners in ICT usage. It also needs to include availability of ICT infrastructure for example well equipped computer laboratories, networked computers, reliable power supply, affordable Internet connectivity and security. ICT maintenance and technical support is also necessary.

6.2 Limitation of the study

The sample size was restricted as well as the response rates. This was because of inadequate funds and time; a larger sample would have been preferred. Normally, larger samples give better results and hence are more reliable. However, given the homogeneity of the population (only public technical training institutes) from which the sample was drawn, the sample size limitation was compensated for by the inclusion of a comprehensive Literature Review that helped conceptualize this study.

6.3 Recommendations

It has become apparent throughout this study that lessons have been learnt and useful insights gained to guide present and future roll out plan of ICT integration in teaching and learning for public technical training institute.

- There should be a comprehensive and continuous plan to train the lecturers and students in the use of advanced ICT applications and tools.
- Every classroom and computer laboratories should be installed with LCD projectors and/or interactive whiteboard.
- Develop a resource center.
- A wireless Internet access throughout the Institute.
- Monitor and motivate lecturers and students in the use of ICT in teaching and learning.

6.4 Suggestion for further research

Future research should establish the influence of minor factors e.g. procurement of ICT facilities, selections of ICT equipment, maintenance of the equipment to effective ICT integration in teaching and learning. In addition, future research should establish the effect of technological changes and the practicability of the proposed framework.

REFERENCES

1. Andrews, P (1997) Secondary teachers' perceptions of computer availability: a qualification study. *Journal of Information Technology for teacher Education*, 6(3), pp. 321-337
2. Becta (2003a) *What the research says about barriers to the use of ICT in teaching.* Coventry: Becta.
3. Bennett, C.K (1994) Reconceptualizing staff development for technology diffusion. *Journal of Information Technology for Teacher Education*, 3(2), pp. 147-160
4. Brown, A. (1994), "*Processes to support the use of information technology to enhance learning*", Computers in Education, 22 (1/2): pp.145-53.
5. Butler, DL and Sellbom, M (2002) Barriers to adopting technology for teaching and learning. *Educause Quarterly*, 25 (2) pp. 22 -28
6. Clarke, C (1999), *Learning and teaching in a new century* Interactions 3 (3) htpp://www.warwick.ac.uk/ETS/interactions/vol3no.3/clark.htm.
7. Colesca, S. E. & Dobrica, L. (2008). Adoption Use of E-Government Services: The Case of Romania. *Journal of Applied Research and Technology,* 6 (3), 204-217.
8. Collins,A (1991), *The role of the computer technology in restructuring schools*, Phil Delta Kappan, 73 (1), pp.28-36.
9. Cuban, L (2001) Oversold and Underused: *Computers in the classroom.* Cambridge, Mass: Harvard University press.
10. Dawes, L (2001) *What stops teachers using new technology*? In M Leask (ed) Issues in teaching using ICT. London: RoutledgeFlamer
11. DFID report (2009),*Country report for Kenya*
12. Ertmer, P (1999) Addressing first and second order barriers to change: *Strategies for technology implementation, Educational Technology Research and Development*, 47 (4), pp. 47-61
13. Esther Mwinyeria (2009) Gesci in Africa – contributing to development of knowledge societies
14. Fabry, D and Higgs, J (1997) Barriers to effective use of technology in education. *Journal of Educational Computing Research*, 17 (4), pp. 385-395

15. Gakuu M. C. (2007) Analysis of the factors and attitudes that influence lecturers' readiness to adopt distance education and the use of ICT in teaching: The Case of The University of Nairobi. Unpublished, PhD Thesis
16. Gakuu M. C. (2009) A Path Analysis Model of the Relationship Between Lecturers' Issues of Concern and Readiness to Adopt eLearning, University of Nairobi, Kenya.
17. Gilbert, S.W (1995), "*Technology and the Changing Academy*", Change, September/October.
18. Harrison, C, Comber C, Fisher, T, Haw, K, Lewin, C, Lunzer, E, McFarlane, A, Mavers, D, Scrimshaw, P, Somekh, B and Watling, R (2002) Impact2*: the impact of information and communication technologies on pupil learning and attainment*: report to DfEs. London :DfES
19. Hoffmann, B (1996) What drives Successful technology planning. *Journal of Information Technology for Teacher Education*, 5 (1/2), pp. 43-55
20. Intel (2000) *Intel Teach to the Future*. Swindol: Intel.
21. Keiyoro P.M (2010) Factors influencing the effective use of ICT in teaching and learning science curriculum in Kenyan secondary schools: The Case Of Cyber and Nepad e – Schools. Unpublished, PhD Thesis
22. Kennewell, S, Parkinson, J and Tanner, H (2000) *Developing The ICT capable school.* London: RoutledgeFalmer.
23. Kidombo and Gakuu (2009) Status of Pedagogical Integration of ICTs in Kenya. PanAfrican Research Agenda. www.ernwaca.org/panaf/spip.php article946.
24. Kiili, K (2003) Technology access: resources wasted in computer laboratories. In C Dowlig and KW Lai (eds.) *Information and Communication Technology and the Teacher of the Future; Working Conference on ICT and the Teacher of the Future*, January 27 – 31, 2003, Melbourne, Australia. London: Kluver.
25. Kosakowski, John, (1998) *The Benefits of Information Technology*, ERIC Digest
26. Kothari, C. R. (2006). Quantitative Techniques. 3rd Ed, New Delhi: Vikas Publishing House PVT LTD
27. Leggett, W and Persichitte, K (1998) Blood, sweat and TEARS: 50 years of technology implementation obstacles. *Tech Trends*, 43 (3), pp. 33-36

28. Longstaff, A. (1999), *Effects of learning technology*. Interactions 1 (3) at http:// www.warwick.ac.uk/ETS?intercations/vol1no.3/longstaf.htm.
29. Marcinkiewicz, HR (1993) Computers andteachers: factors influencing computer use in the classroom. *Journal of Research on Computing in Education*. 26 (2), pp. 220-237
30. Myers, J and Halpin, R (2002) Teachers' attitudes and use of multimedia technology in the classroom: Constructivist-based professional development training for school districts. *Journal of Computing in Teacher Education*, 18 (4) pp. 133-139
31. National ICT Policy (2006) Ministry of Information and Communications http://www.information.go.ke/docs/ICT%20Policy.pdf
32. New Opportunities Fund (1999) *ICT training for teachers and school librarians*. London: New Opportunities Fund
33. Ngware M W, Onsomu E N and Marla D K Private sector Investment in Education and Training: A case of Tertiary Education in Kenya. Report 7
34. Nicol, J (1998), *New opportunities for computer aided lear*ning? Interactions 1 (2) at http://www.warwick.ac.uk/ETS/interactions/vpl1no.2/nicol.htm
35. Owen, M (1992) A teacher-centered model of development in the educational use of computers. *Journal of In formation Technology for Teacher Education*, 1(1), pp. 127-137
36. Passey, D and Ridgway, J (1992) *Effective In-service education for teachers in information technology: a resource for inset providers*, London: HMSO.
37. Pelgrum, W and Plomp, T (2001) Obstacles to the integration of ICT in Education: results from a worldwide educational assessment. *Computers and Education*, 37 (2), pp. 163-178
38. Persichitte, KA and Bauer, JW (1996) Diffusion of computer-based technologies: getting the best start. *Journal of In formation Technology for Teacher Education*, 5(1-2), pp. 35-41
39. Preston, C, Cox, M and Cox, K (2000) *Teachers as innovators: an evaluation of teachers' motivation in the use of ICT. A report funded by the Teacher Training Agency, Oracle and Compaq*. MirandaNet.

40. Pricewaterhouse coppers report (2009) *Using ICT in Schools: Addressing teacher workload.*
41. Rhodes, V and Cox, M (1990) *Time for training. London*: king College London.
42. Ridgeway, J and Passey, D (1995) Using evidence about teacher development plan systemic revolution, in DM Watson and D Tinsley (eds) *Integrating information technology into education* London; Chapman and Hall.
43. Singh K. (2007) *Critical Success Factors For Effective Use Of Information And Communication Technology (ICT) In Teaching And Learning And Its Impact On Student Achievement* Universiti Teknologi MARA Kota Samarahan, Sarawak
44. Stevenson, D (1997) *Information and communications technology in UK schools*: an independent inquiry, London: The Independent ICT in Schools Commission.
45. Strauss, A and Corbin, J (1998) *Basics of qualitative research: techniques and procedures for developing grounded theory*. London: Sage.
46. Teacher Training Agency (2002) *The New Opportunities Fund training for teachers and school librarians in the use of ICT: progress review and lessons learned through the central quality assurance process in England.* London; HMSO.
47. Tearle, P (2005) *The implementation of information and communications technology for teaching and learning in secondary education in the United Kingdom* Unpublished thesis, University of Exeter.
48. Tearle, P and Dillon, P (2002) *Evaluation of the Intel Teach to the Future programme; final report. A report for Intel UK and the Teacher Training Agency.* Exeter. Telematics Centre.
49. Tearle, P(2005) Factors that facilitate implementation and integration of ICT in classroom practice
50. Watson D M and Tinsley D (1995*) Integrating Information Technology into Education* Chapman and Hall, London.
51. Wilkins, M.L and Nantz, K.S (1995), "*Faculty use of Electronics Communication Before and After a LAN Installation: A Three Year Analysis*", Journal of End-User Computing, 7(1), pp.4-11.

APPENDIX A: ADMINISTRATORS' QUESTIONNAIRE

S/NO:_____

SURVEY INSTRUMENT FOR ADMINISTRATORS

I am conducting a survey in order to develop a framework for ICT integration in public Technical Training Institute. The purpose of the survey is to provide data and information required for the construction of the framework. You are therefore invited to provide data and information in the following main parts:

- General information;
- ICT competence;
- ICT infrastructure/facilities;
- ICT support, practices and policy;
- content and pedagogy approach;
- ICT funding;
- challenges and constraints.

Confidentiality and anonymity is highly assured in the final report; you are kindly requested not to indicate your name on this questionnaire.

Please take time to think over the questions and to answer them as fully and carefully as possible.

PART 1: General information

Name of Institution: _____

Designation: _____

Gender: Male ☐ Female ☐

Age in years:

- Under 30 ☐
- 30 to 40 ☐
- 41 to 50 ☐
- Over 50 ☐

Highest level of educational qualification:

- Artisan ☐
- Diploma ☐
- Undergraduate ☐
- Post graduate ☐

Number of years in the teaching professional:

- Under 5 ☐
- 5 to 10 ☐
- 10 to 20 ☐
- Over 20 ☐

PART 2: ICT Competency

1. I am competent in the use of the following ICT applications and tools.

Application/tool	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Word Processor							
Spreadsheet							
Presentation tools e.g. powerpoint							
Internet Surfing							
e-mail							
On-line chat, Forum and conferencing							
Web page creation							
Multimedia editing							
Educational games creations							
E-content							
Simulation software							
Collaboration tools e.g. Zimbra, Camstacia, NetOp							

2. The following ICT competency domains are important in content development and lesson delivery.

ICT Competence domain	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Awareness of ICT policy							
Applying ICT policy in classroom							
Using ICT tools for course design and lesson planning							
Using ICT tools in design of teaching and learning activities							
Using ICT tools in assessment and provide feedback on progress							
Using an authoring environment or tools to design offline and /or web resources							

Using ICT tools to manage, monitor and assess progress of student projects and progress							
Using search engines, social media website and email to find people and resources for collaborative projects							
Development of procedures and policies for ethical and responsible use of ICT in teaching							
Using open-ended software appropriate to subject matter areas							
Using virtual learning environments							
Professional development using e-learning courses							

PART 3: ICT infrastructure/facilities

1. The Institution has adequate number of the following ICT tools.

ICT tool	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Desktop Computers							
Labtops							
Application software							
Interactive whiteboards							
LCD projectors							
Multimedia projectors							
Institute website							
Multimedia facilities e.g. digital camera, videocam, Speakers, DVD							

Digital rooms							
Simulating software							
Color printers							
Black and white printers							
PDAs							
Radio							
Television							
Internet access							
Networked computers							
Antivirus software							
Computer laboratories							
Resource centre							
Fax machine							
UPS							
Reliable electricity							

2. Students have adequate access to the institution's computers.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

3. All lecturers have access to the institution's computers.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

4. Students have access to the institution's internet facilities.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

5. All lecturers have access to the institution's internet facilities.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

6. Lecturers adequately use the available ICT tools for teaching.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

PART 4: ICT support, practices and policy

Indicate your level of agreement with the following statements.

Statement	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
The Institution has ICT policy that is relevant and applicable							
The Institution has hardware and software plans that are relevant and applicable							
The Institution has documented procedures on provision of User support that are applicable							
The institution is adhering to the policy requirements as expected of education and training institutions							
The Institution has a mechanism auditing the implementation of the policy and documented procedures							
The institution organizes training for lecturers on ICT use in Teaching and learning							
The Institution assesses lecturers based on their ICT usage in teaching							

PART 5: Content and Pedagogy approach

1. The following teaching methods with ICT are applied in classrooms during teaching

Teaching method	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Use of ICT to develop course materials							
Use of ICT for Learner-centered approach e.g. project-based, problem-based, games							
Provide CD/DVD and soft files as learning resource							
Provide on-line learning resources							
Require students to use ICT to seek knowledge							
Require students to use ICT to apply knowledge							
Require students to do assignment on-line							
Require students to do exams and quizzes on-line							
Use ICT for online discussion such as chats, sms, blogs							
Use e-learning management system for teaching e.g. webcity, moodle, wizlearn							
Use of Internet during teaching							

2. The use of ICT in teaching has helped students to improve in the following areas.

Area	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Creativity							
Curiosity							
Ask questions that demonstrate understanding							
Analyze and solve							

problems							
Ability to find relevant and useful information							
Written communication skills							
Verbal communication skills							
Attitude and motivation toward learning							
Independent learning							
Teamwork/collaboration							
Class attendance							
Examination scores							
Opportunities for employment after graduation							

PART 6: ICT funding

1. Is there an annual budget for purchase of ICT tools for teaching and learning?
   Yes ☐ No ☐

   If yes, what is the approximate percentage of ICTs in your annual overall budget?

   _____

2. How are the ICT activities, equipment and software funded? Select all that apply and indicate its approximate amount per year.

Source of funding	Approximate amount/year
Government	
Board of governors	
Non-governmental organizations	
Student fees	
Individual donors	
IT industry	
Production Units in the Institution	
Other, please specify	

3. Are there any ICT and ICT for education affiliation or collaboration between the institution and other institution, organizations or the industry?

   Yes ☐ No ☐

If yes, please specify

_____

_____

_____

PART 7: Challenges and constraints

The following are major challenges and constraints in integrating ICT into teaching and learning in the institution.

Challenge and constraint	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Lack of awareness on ICT in Education among lecturers							
Lack of awareness on ICT in Education among principals							
Lack of awareness on ICT in Education among policymakers							
Poor electricity supply							
Lack of funds for ICT infrastructure/facilities							
Lecturers' fear of the technology							
Lack of incentives and rewards for staff using ICT for teaching							
Lack of funds for training on ICT in education							
Lack of time for training on ICT in education							
Lack of instructor's technical skills to maintain the ICT integration							
Lack of knowledge on ICT-pedagogy integration							
Lack of ICT facilities to be used during classroom interactions							
Lack of monitoring system for ICT integration in the classroom							

Thank for taking time to respond to all the questions

APPENDIX B: HEAD OF ICT AND LECTURERS' QUESTIONNAIRE

S/NO:_____

SURVEY INSTRUMENT FOR HEAD OF ICT AND LECTURERS

I am conducting a survey in order to develop a framework for ICT integration in public Technical Training Institute. The purpose of the survey is to provide data and information required for the construction of the framework. You are therefore invited to provide data and information in the following main parts:

- General information;
- ICT competence;
- ICT infrastructure/facilities;
- ICT support, practices and policy;
- content and pedagogy approach;
- challenges and constraints.

Confidentiality and anonymity is highly assured in the final report; you are kindly requested not to indicate your name on this questionnaire.

Please take time to think over the questions and to answer them as fully and carefully as possible.

PART 1: General information

Name of Institution: _____

Department: _____ Designation: _____

Gender: Male ☐ Female ☐

Age in years:

- Under 30 ☐
- 30 to 40 ☐
- 41 to 50 ☐
- Over 50 ☐

Highest level of educational qualification:

- Artisan ☐
- Diploma ☐
- Undergraduate ☐
- Post graduate ☐

Number of years in the teaching professional:

- Under 5 ☐
- 5 to 10 ☐
- 10 to 20 ☐
- Over 20 ☐

PART 2: ICT Competency

1. I am competent in the use of the following ICT applications and tools.

Application/tool	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Word Processor							
Spreadsheet							
Presentation tools e.g. powerpoint							
Internet Surfing							
e-mail							
On-line chat, Forum and conferencing							
Web page creation							
Multimedia editing							
Educational games creations							
E-content							
Simulation software							
Collaboration tools e.g. Zimbra, Camstacia, NetOp							

2. The following ICT competency domains are important in content development and lesson delivery.

ICT Competence domain	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Awareness of ICT policy							
Applying ICT policy in classroom							
Using ICT tools for course design and lesson planning							
Using ICT tools in design of teaching and learning activities							
Using ICT tools in assessment and provide feedback on progress							
Using an authoring environment or tools to design offline and /or web resources							

Using ICT tools to manage, monitor and assess progress of student projects and progress							
Using search engines, social media website and email to find people and resources for collaborative projects							
Development of procedures and policies for ethical and responsible use of ICT in teaching							
Using open-ended software appropriate to subject matter areas							
Using virtual learning environments							
Professional development using e-learning courses							

PART 3: ICT infrastructure/facilities

1. My Institution has adequate number of the following ICT tools.

ICT tool	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Desktop Computers							
Labtops							
Application software							
Interactive whiteboards							
LCD projectors							
Multimedia projectors							
Institute website							
Multimedia facilities e.g. digital camera, videocam,							

Speakers, DVD							
Digital rooms							
Simulating software							
Color printers							
Black and white printers							
PDAs							
Radio							
Television							
Internet access							
Networked computers							
Antivirus software							
Computer laboratories							
Resource centre							
Fax machine							
UPS							
Reliable electricity							

6. Students have adequate access to the institution's computers.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

7. All lecturers have access to the institution's computers.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

8. Students have access to the institution's internet facilities.

   Strongly agree ☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

9. All lecturers have access to the institution's internet facilities.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐

   Strongly disagree ☐ I do not know ☐

6. Lecturers adequately use the available ICT tools for teaching.

   Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ -Disagree ☐

   Strongly disagree ☐ I do not know ☐

PART 4: ICT support, practices and policy

1. Indicate your level of agreement with the following statements.

Statement	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do no know
The Institution has ICT policy that is relevant and applicable							
The Institution has hardware and software plans that are relevant and applicable							
The Institution has documented procedures on provision of User support that are applicable							
The institution is adhering to the policy requirements as expected of education and training institutions							
The Institution has a mechanism auditing the implementation of the policy and documented procedures							
The institution organizes training for lecturers on ICT use in Teaching and learning							
The Institution assesses lecturers based on their ICT usage in teaching							

2. The following ICT tools are oftenly used to support teaching in the institution.

ICT tools	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Computers							
Laptops							
LCD projectors							
Interactive whiteboards							
Internet							
Websites							
Web collaboration tools e.g. blogs, mail list, youtube, Netop							
Digital cameras							
Simulation software							
Video camera							
Multimedia editing facilities							
DVD							
Digital rooms							

PART 5: Content and Pedagogy approach

1. I apply the following teaching methods with ICT in my classroom during teaching.

Teaching method	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Use of ICT to develop course materials							
Use of ICT for Learner-centered approach e.g. project-based, problem-based, games							
Provide CD/DVD and soft files as learning resource							
Provide on-line learning resources							
Require students to use ICT to seek knowledge							
Require students to use ICT to apply knowledge							
Require students to do assignment on-line							
Require students to do exams and quizzes on-line							

Use ICT for online discussion such as chats, sms, blogs							
Use e-learning management system for teaching e.g. webcity, moodle, wizlearn							
Use of Internet during teaching							

2. The use of ICT in teaching has helped students to improve in the following areas.

Area	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I k
Creativity							
Curiosity							
Ask questions that demonstrate understanding							
Analyze and solve problems							
Ability to find relevant and useful information							
Written communication skills							
Verbal communication skills							
Attitude and motivation toward learning							
Independent learning							
Teamwork/collaboration							
Class attendance							
Examination scores							
Opportunities for employment after graduation							

PART 6: Challenges and constraints

The following are major challenges and constraints in integrating ICT into teaching and learning in the institution.

Challenge and constraint	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Lack of awareness on ICT in Education among lecturers							
Lack of awareness on ICT in Education among principals							
Lack of awareness on ICT in Education among policymakers							
Poor electricity supply							
Lack of funds for ICT infrastructure/facilities							
Lecturers' fear of the technology							
Lack of incentives and rewards for staff using ICT for teaching							
Lack of funds for training on ICT in education							
Lack of time for training on ICT in education							
Lack of instructor's technical skills to maintain the ICT integration							
Lack of knowledge on ICT-pedagogy integration							
Lack of ICT facilities to be used during classroom interactions							
Lack of monitoring system for ICT integration in the classroom							

Thank for taking time to respond to all the questions

APPENDIX C: STUDENTS' QUESTIONNAIRE

S/NO:_____

SURVEY INSTRUMENT FOR STUDENTS

I am conducting a survey in order to develop a framework for ICT integration in public Technical Training Institute. The purpose of the survey is to provide data and information required for the construction of the framework. You are therefore invited to provide data and information in the following main parts:

- General information;
- ICT competence;
- ICT infrastructure/facilities;
- ICT practice;
- content and pedagogy approach;

Confidentiality and anonymity is highly assured in the final report; you are kindly requested not to indicate your name on this questionnaire.

Please take time to think over the questions and to answer them as fully and carefully as possible.

PART 1: General information

Name of Institution: _____

Department: _____

Course: _____

Gender: Male ☐ Female ☐

Year of Study: First ☐ Second ☐ Third ☐

PART 2: ICT Competency

I am competent in the use of the following ICT applications and tools.

Application/tool	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Word Processor							
Spreadsheet							
Presentation tools e.g. powerpoint							
Internet Surfing							
e-mail							
On-line chat, Forum and conferencing							
Web page creation							
Multimedia editing							
Educational games creations							
E-content							
Simulation software							
Collaboration tools e.g. Zimbra, Camstacia, NetOp							

PART 3: ICT infrastructure/facilities

1. The Institution has adequate number of the following ICT tools.

ICT tool	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Desktop Computers							
Labtops							
Application software							
Interactive whiteboards							
LCD projectors							
Multimedia projectors							
Institute website							
Multimedia facilities e.g. digital camera, videocam, Speakers, DVD							
Digital rooms							
Simulating software							
Color printers							
Black and white printers							
PDAs							
Radio							
Television							
Internet access							
Networked computers							
Antivirus software							
Computer laboratories							
Resource centre							
Fax machine							
UPS							
Reliable electricity							

10. Students have adequate access to the institution's computers.

Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐
Strongly disagree ☐ I do not know ☐

11. All lecturers have access to the institution's computers.

Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐
Strongly disagree ☐ I do not know ☐

12. Students have access to the institution's internet facilities.

Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐
Strongly disagree ☐ I do not know ☐

13. All lecturers have access to the institution's internet facilities.

Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐
Strongly disagree ☐ I do not know ☐

6. Lecturers adequately use the available ICT tools for teaching.

Strongly agree☐ Agree☐ Fairly agree☐ Fairly disagree☐ Disagree ☐
Strongly disagree ☐ I do not know ☐

PART 4: ICT practices

I oftenly use the following ICT tools to support my studies.

ICT tools	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Computers							
Laptops							
LCD projectors							
Interactive whiteboards							
Internet							
Websites							
Web collaboration tools e.g. blogs, mail list, youtube, Netop							
Digital cameras							
Simulation software							
Video camera							
Multimedia editing facilities							
DVD							
Digital rooms							

PART 5: Content and Pedagogy approach

The use of ICT has helped me improve in the following areas.

Area	Strongly agree	Agree	Fairly agree	Fairly disagree	Disagree	Strongly disagree	I do not know
Creativity							
Curiosity							
Ask questions that demonstrate understanding							
Analyze and solve problems							
Ability to find relevant and useful information							
Written communication skills							
Verbal communication skills							
Attitude and motivation toward learning							
Independent learning							
Teamwork/collaboration							
Class attendance							
Examination scores							
Opportunities for employment after graduation							

Thank for taking time to respond to all the questions