FACTORS CONTRIBUTING TO LOW ICT INTEGRATION IN TEACHING ELECTRICAL ENGINEERING COURSES IN TECHNICAL TRAINING INSTITUTIONS IN NAIROBI COUNTY, KENYA.

BY

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DECLARATION

Declaration by the student

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

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I dedicate this thesis to my wife Nelly Yator and my three children Brenda, David & Ann, for their love and sacrifice that they have accorded me. Devotion also goes to my mum and sister for their love and financial support.

ABSTRACT

Information Communication Technologies have been incorporated in many sectors of the economy globally over time. In education, Governments around the world are investing large amounts of capital to realize the benefits of ICT's, in ensuring a widespread access to networks and their applications. The use of ICT's as an alternative to existing traditional methods of teaching Electrical Engineering is one of the evolutions that is transforming education sector. This study was aimed at investigating factors that contribute to low integration of ICT's in teaching Electrical Engineering courses in TVET Institutes in Nairobi County. The study sought to achieve this by investigating the influence of Classroom internet connectivity, Computer hardware and software use in teaching, training on ICT equipment, Excellent classroom ICT expertise, Frequent staff training on ICT, teaching syllabus content and trainer's workload in teaching and Supportive classroom ICT infrastructure. The study adopted a descriptive survey study design. The study targeted heads of departments and trainers of Electrical Engineering in TVET institutions in Nairobi County. Data was collected using questionnaires; quantitative techniques were employed in data analysis. The study established MATLAB, presentation slides, CAD software; Smart boards, Desktop and Laptop computers among other ICT infrastructure are available in TVET institutions. The study concluded that, computer systems and ICT infrastructure, trainers' ICT compliance, conventional issue and trainers' workload are the major determining factors that contributed to a low ICT integration in teaching Electrical Engineering courses. The findings of this study are essential to the government and stakeholders in the implementation of TVET as well as advancement ICT in teaching Engineering courses.

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LIST OF ACRONYMS

ANOVA	-	Analysis of Variance
CBT	-	Competency Based Training
CDs	-	Compact Disks
DVDs	-	Digital Versatile Disks
GOK	-	Government of Kenya
HFF	-	Housing Finance Foundation
ICT	-	Information Communication Technology
ISTs	-	Institutes of Science and Technology's
IT	-	Information Technology
ITs	-	Institutes of Technology
KICD	-	Kenya Institute of Curriculum Development
KMO	-	Kaiser Meyer Olkins
KTC	-	Konza Technology City
KTTC	-	Kenya Technical Trainers College
LCD	-	Liquid Crystal Display
MATLAB	-	Mathematical Laboratory
NACOSTI	-	National Commission for Science, Technology and Innovation
NGOs	-	Non Governmental Organizations
NP	-	National Polytechnics
OLS	-	Ordinary Least Squares
PDAs	-	Personal Digital Assistances
SPSS	-	Statistical Package for Social Science
STI	-	Science Technology and Innovation

TIVET	-	Technical Industrial, Vocational and Entrepreneurship training
TTIs	-	Technical Training Institutes
TUC	-	Technical University Colleges
TVET	-	Technical, Vocation Education and Training
TVETA	-	Technical Vocational Education and training Authority
UNESCO	-	United Nations Educational, Scientific and Cultural
VTC	-	Vocational Training Centers
YP	-	Youth Polytechnics

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CHAPTER ONE

INTRODUCTION OF THE STUDY

1.1 Introduction

This section discusses the Background of the study, Statement of the problem, Objectives of the study, Research questions, Justification of the study, Scope of the study, Limitation of the study, Conceptual framework and the Operational definition of terms.

1.2 Background of the study

ICT is an acronym for Information and Communication Technology, which is often used as an extended synonym for Information Technology (IT). ICT are all aspects of managing, communication and processing information. ICT integration includes using computer hardware and software, telecommunication, cell-phones, digital video, cabling, microwaves, radio waves towards effective communication management and processing information (Sarkar, 2012).

Integrating ICT in various sectors of the economy has been a global initiative by many governments in an effort to harness benefits that are realized by ICT's. In the education sector, efforts have been to ensure a widespread access to ICT infrastructure and data networks (Taylor & Zhang, 2007). The GOK (2013) report on the vision 2030 second medium term plan recommended the use of laptop computer equipped with the relevant content for every school age child as an indication that there is need to align integration of ICT in teaching and learning. The government has committed itself towards

Upgrading National ICT Infrastructure so that a national ICT integration of the social, economic and political pillars of the vision 2030 may be realized.

Technical Vocational Education and Training (TVET) is central to the realization of the social pillar through reinforcement of Science, Technology and Innovation (STI) for Regional and Global Competitiveness. However, the quest to providing quality Technical Education in Kenya with a well ICT integrated teaching and learning is still a serious challenge. Gakuu & Kidombo (2008) identified that, nine out of ten (90%) learning institutions in most schools have computers and that close to 30% of the computers are connected to the internet in only 60% of those institutions. The ratio of learners to computers is still low. This is an indication that much investment is still required in learning institutions to achieve integrated ICT teaching and learning.

Research on ICT integration has been focused on secondary schools, The Kenya Technical Trainers College (KTTC) is featured in a few reports (Gakuu & Kidombo, 2008). ICT is incorporated in the KTTC teacher-training curriculum, however, little information as to whether ICT's integrated learning is implemented by the tutors who graduated from the college is provided. Studies indicate that 33.62% of educators participate in continuous educational & professional development courses annually; such courses include ICT integration in teaching. This percentage of tutor's professional development is very low for Kenya to achieve integrated Teaching and learning.

Kibata (2012) identified five key factors that prevented TVET Teachers from implementing flexible and blended approaches in their teaching, the factors include; poor internet connectivity, lack of computer literacy amongst students and staff, lack of enough tutors, lack of ICT policy framework and inadequate facilities such as wired lecture rooms and lack of well-equipped computer laboratories. His study like other scholarly work on this topic has been focused on ICT integration with little focus on particular professional training areas. Moreover much of the surveys on ICT integration findings have been focused on public institutions. There is need to expound ICT integration research to particular professional teaching areas such as Electrical Engineering, Mechanical Engineering, Health and Applied sciences among others. The ICT policy framework is a common phenomenon for all TVET institutions when seeking to Integrate ICT in teaching and learning, therefore ICT Integration research should also incorporate private institution in such studies.

1.3 Statement of the problem

Kenya has made remarkable progress by setting up an ICT policy framework, implementation strategy with measurable outcomes (Farrell, 2007). The framework is aimed at streamlining the nature and implementation of ICT infrastructure in the education sector among other government institutions. Despite this investments, TVET Institutions and ICT integration in teaching is relatively low (Kibata, 2012).

Studies on ICT integration in teaching have been conducted by many researchers in the past decade, these studies have given more emphasis on impact of new technology, its adoption in education rather than integration (Veltman, 2003,pp.1). Morever these studies have not emphasized on particular professional development areas. Farrell (2007) beliefs that, the Kenyan culture of continued use of blackboards and chalk in classroom pedagogy is a big indicator that Kenya is reluctant to adopt new technology in classroom teaching. Researchers (Farrell, 2007; Makori & Onderi, 2013; Wanyeki, 2011; Kibata, 2012), have identified Kenya's rigidity in adopting new technology in teaching and learning. This study investigated factors inhibiting integration of ICT in teaching Electrical Engineering in TVET institutions. Factors identified in literature such as teacher's daily pedagogy, inadequate staffing, infrastructural facilities, internet connection, existing Technology and their application in teaching Electrical Engineering are investigated. The study expounds existing knowledge on ICT integration in TVET learning and provides basis for further research in integrated ICT teaching and learning.

1.4 Objectives of the study

1.4.1 Main objective

The main objective of this research was to establish factors that contribute to low ICT integration in teaching Electrical Engineering courses in Technical Institutions in Nairobi County.

1.4.2 Specific objectives

The following specific objectives were adopted for the study:

i. To investigate available ICT in Electrical Engineering departments in Technical Institutions in Nairobi County.
ii. To analyze the level of use of the existing ICT in teaching Electrical Engineering in Technical institutions in Nairobi County.
iii. To establish the key factors that hinder effective integration of ICT in teaching Electrical Engineering in Technical Institutions in Nairobi County.

1.5 Research questions

The study was guided by the following research questions.

i) What are the available ICT for teaching Electrical Engineering in Technical Institutions in Nairobi County?

ii) To what extent are the available ICT used to teach Electrical Engineering in technical institutions in Nairobi County?

iii) What are the key factors that hinder the effective integration of ICT in teaching Electrical Engineering in technical institutions in Nairobi County?

1.6 Justifications of the study

The study is of great significance to research on ICT integration, it extends current knowledge on ICT integration in teaching Electrical Engineering. The result of the study is of great importance to education planners, policy makers and other players concerned with the integration of ICT in teaching Electrical Engineering in TVET Institutions in Nairobi County and the entire TVET in Kenya.

The results also adds value to the TVET training in teaching of Electrical Engineering. The 21^{st} century TVET tutor is a facilitator with enriched ICT skills in classroom teaching. The study address ICT training needs in the TVET Electrical Engineering department for both staff and students, thereby responding to changing human resource demands in Electrical Engineering world of work.

1.7 Scope of the study

This study focused on investigating factors that inhibit ICT integration in teaching of Electrical Engineering in Technical Institutes in Nairobi County. The study only covered the teaching of Electrical Engineering courses offered in technical and vocational institutions in the region. Targeted institutions included National

Polytechnics (NP), Technical Training institutions (TTI) and Institutes of science and technology (IST). However it did not target youth polytechnics offering Electrical Engineering courses. Furthermore, other courses (like mechanical, Business, Institutional Management) offered at the targeted institutions were not considered. Finally, the research limited the area of study to Nairobi County, although it is hoped that it will be possible to replicate the findings of the study to other counties in the Country. Geographically, Nairobi County, is one of the 47 counties with an area 696 km^2 located at 1.2833^0S and 36.8167^0 E coordinates in the Map of Kenya. It is the smallest yet most populous of the counties, it is coterminous with the city of Nairobi, which is also the capital and largest city of Kenya. Nairobi County was founded in 2013 on the same boundaries as Nairobi Province, after Kenya's eight provinces were subdivided into forty-seven counties. The map of Nairobi County is in shown figure1.1

Figure 1.1: Map of Nairobi County (Kamanzi, 2015)

1.8 Limitation of the study

A limitation is some aspect of the study that may negatively affect the results or generalizability of the results where researchers have no control over it (Mugenda & Mugenda, 1999). Ideally this study was bound by time constraints. In real sense it ought to have been conducted in all TVET institutions in Kenya. But the time required for developing the proposal, collecting data, analyzing the findings and compiling a detailed report, dictated the use of a smaller sample from Nairobi County.

The distribution of technical institutions in Nairobi County compared to the distribution in other counties posed a distinct disparity that would compromise the generalize-ability of the findings of the study as far as the sample was concerned. It is for this reason that the researcher chosen to conduct the research in Nairobi County instead of the 47 counties in Kenya with a view of making inferences on the results obtained to the rest of the counties.

1.9 The conceptual framework

This section provides a schematic presentation of interrelationship between variables in the context of the problem being investigated. Figure 1.2 represents the relationship between the independent variables and the dependent variables. The diagram shows the conceptual model which encompasses the major variables and their possible pattern of influences. The framework identifies age of trainers as the intervening variable of the study. ICT integration in teaching of Electrical Engineering is the dependent variable. Factors which inhibit ICT use in teaching of Electrical Engineering on the other hand were adopted to be the independent variables. The study aimed at revealing the effects that occur when computer and Information Technology is used in teaching Electrical

Engineering subjects in a both Public and Private technical Institutions in Kenya; a case of Nairobi County.

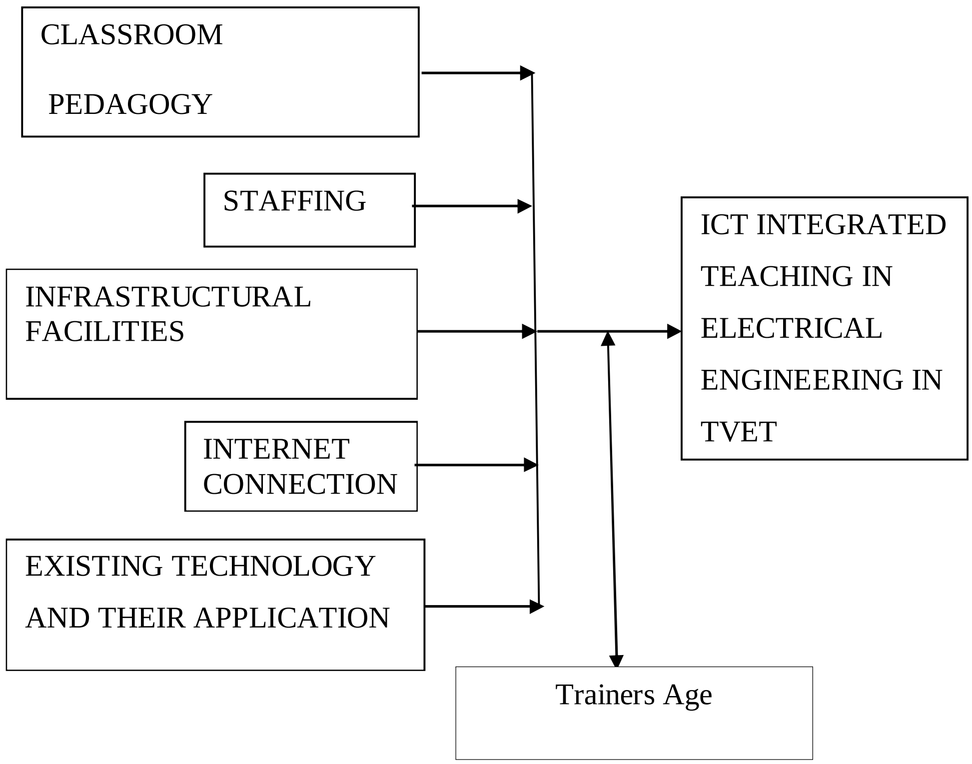

Figure 1.2 Conceptual Framework

1.10 Organization of the Thesis

This thesis is divided into five chapters. These are briefly described in the following paragraphs. The first chapter is the introduction of the thesis. It describes the problem background and statement, research objectives, scope and contributions of the thesis.

The second chapter is literature review. It presents a detailed analysis of existing literature on ICT integration in teaching with specific emphasis on Electrical

Engineering courses in TVET institutions. It presents the ICT's available in TVET institutions, benefits integrated ICT and learning, factors which contribute low ICT integration in teaching Electrical courses highlights the gaps in previous studies on ICT integration in teaching.

The third chapter is research methodology. It explains the research design and research strategy used in this study, the target population and how the sample size was arrived at, research instruments used including their validity and reliability and methods of data analysis.

The fourth chapter presents results of this study, demographic profiles; findings on the various factors that contribute to low ICT integration in TVET institutions. A comparison on ICT integration in public and private TVET institutions is provided.

The fifth chapter presents discussions, conclusion and recommendations. It gives a general conclusion of the research presented in this thesis and also proposes recommendations that can be implemented to enhance ICT integration in teaching Electrical Engineering courses in Kenya.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter draws related literature of the study from Journal articles, research/Government reports, Academic papers, thesis, dissertations, conferences-proceeding reports, newspaper articles and internet websites in order to show the knowledge gap that exist in the field of ICT in teaching of Electrical Engineering courses in technical institutions in Kenya. The literature review provides an important ingredient for establishing foundational elements such as what has already been discovered about the topic on previous research. Literature review provides the context for a research topic, builds on previous research, and includes the researcher‘s critical and analytical judgment (McNeill & Chapman, 1985; Mugenda & Mugenda, 1999; Kothari, 2004).

2.2 Definitions

The term ICT’s has been defined by various scholars. This study adopts the definition of (Abdullahi, 2013; Sarkar, 2012), technologies that provide access to information through telecommunication. It is similar to Information Technology (IT), but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums. It is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer network, computer hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning.

ICT's makes it possible for us to collect, store, analyze and share more information, more quickly and more accurately than we can do on our own. This is what makes them such empowering tools. But they do this by adding to our existing information and communications resources, rather than replacing those which we already have.

ICT integration is aimed at preparing students for the digital era; trainers are seen as the key players in using ICT in providing dynamic and proactive learning environment. The study adopts definition of ICT integration from Sarkar (2012), as the process of determining where and how technology fits in the teaching and learning scenario.

2.3 Global trends of ICT integration in education

Public access to ICT is available to various extents in most of the larger urban centers in Africa especially through cyber cafes. Most of the national ICT policies in Africa identify the need to provide access for the general population as an essential ingredient for development (Abdullahi, 2013). The process of adoption and diffusion of ICT in education in Africa is in transition. In the Caribbean countries of North America, ICT use in education is in its dynamic stage. George (2015) contemplates that new developments and innovations take place on a daily basis in the Caribbean countries. According to the report, most secondary and many primary schools enable teachers and students to access computers and the Internet. Internet connectivity to schools is in many cases adequate to meet current needs. However, hardware quality and maintenance still pose critical challenges in such schools (Ghavifekr, et al., 2013).

There is a growing recognition that the skills gap for ICT professionals is widening. Many organizations have come to realize that certain new technologies can optimize efficiency and make processes more effective (Oyebolu & Olusiji, 2013). Therefore, specific measures are needed to curb the widening skills gap necessitated by the new technologies. It is clear that ICT can bring industry closer to their customer, partners and suppliers through a more integrated business and communication systems (Abdullahi, 2013). ICT can provide enhanced educational opportunities for students in their campuses or those who do distance learning. Optimum work efficiency, enhanced education and distant learning has played key factors in the demand for skilled ICT professionals which has always outstripped its supply to a level that has caused economic slowdown in the high tech industries. Most companies around the world put more emphasis on skilled manpower. This is in accordance with the report published by (Assar, 2012; UNESCO, 2011). ICT integration in TVET must consider ICT use in specific skill areas because technological innovations and developments in industry today are ICT biased and demand graduates who are competent in the use of ICT. Specialized ICT skills are required in the work place for production and communication, and are seen as an essential complement to traditional content knowledge acquired from engineering, science, and accounting courses. It is therefore, crucial to give priority training that is enriched with ICT to graduates pursuing such highly demanding skills in a growing economy.

ICT integrated education is a strategic change agent for transformation of the economy to a knowledge economy. Swarts & Wachira (2010) asserts, the economic development challenges presented by education systems in Tanzania is recognized to be caused by ICT inadequacy by trained personnel graduating from higher institutions. This finding agrees with (Oyebolu & Olusiji, 2013). They both identified the potential of ICT as a key component in addressing the challenge in teaching and training. However, according to Raihan & Han (2013), the most significant limitation of educational framework in the developing countries is the insufficient quantity of educational institutions and qualified trainers for higher studies which is a reflection of the situation in Kenya.

The Internet and its allied Information and Communication Technology (ICT) tools and resources on the other hand, is changing both the process and product of education with new and creative ways of teaching and learning (Otunla, 2013; Oyebolu & Olusiji, 2013; UNESCO, 2017). A thorough investigation to establish whether TVET institution has a reliable internet connection need to be done since there is no clear information of whether the public institutions are putting a similar effort to create new ways of teaching and learning.

Under the right conditions, the Internet offers an opportunity for addressing the learning needs of diverse groups in Africa, including the bulk of learners that are currently out of school, in a cost-effective way. A blended learning environment that leverages the Internet can potentially help connect education to work, improve the skills that allow youth to access employment and empower lifelong learning.

Paul and Uhomoibhi (2014) conclude that most ICT devices use electricity and require constant supply. However, the rural communities in most African countries will continue to live without ICT for several decades due to inadequate infrastructure. This poses a great disadvantage to the TVET public and private institutions located in the rural areas in its quest to integrate ICT in teaching. The Republic of Sudan is planning to have computers available in all education levels by 2015 as agreed at the ICT summit in Geneva.

2.4 ICT integration in Kenya

According to the basic education act of 2013, integration of ICT in education is defined as the incorporation of information communication technologies to support and enhance the attainment of the curriculum objectives. According to the act, enhanced and appropriate competencies of skills, knowledge, attitudes and values require proper management of educational training with respect to the effectiveness and efficiency of the teaching and learning process. However, researchers Kajunju (2015) argue that, most African countries have introduced computer studies in its schools as an optional subject which imposes a slow rate of adopting new technology and integrating it in classroom teaching. This is why Kenya has remained redundant in the use of blackboards and chalk in its classroom teaching (Abdullahi, 2013; Assar, 2012; Sarkar, 2012). “TVET subsector have revealed that in spite of the many efforts that researchers and educators put over the years in preparing teachers in the educational uses of ICTs, teachers still lack the Pedagogical skills and knowledge needed to be able to teach with ICT technology successfully” (Maina, Ogalo, & Mwai, 2015, p. 55) are other examples showing indicators of a slow adoption to new technology in the teaching of TVET courses. While much attention is being given to the development technologies that drive ICT integration in TVET (Maina, Kahando, & Maina, 2017), need analysis in to the competency of TVET trainers on ICT skills is required so as to address the mismatch that may exist between ICT technologies in teaching and the ability of trainers to using them in their teaching. How ICT is used in the TVET classroom towards improving on quality training , a discussion about which types of technologies are available and how they can be best used in teaching and learning necessary (Kafka, 2013; Latchem, 2017) .

Regarding which technologies are available to trainers and instructors, a whole range of high and low technologies of ICTs have been mentioned by a number of researchers (Assar, 2012; Kafka, 2013; UNESCO, 2015), they range from Virtual Learning Environments , podcasts, video - conferencing, tape recorders, mobile phones, radio and computer software's. The researcher had to filter out the various ICT technologies in order to achieve the proposed research objectives of the study. ICT software, computer hardware and supportive infrastructure were key in determining whether trainers use ICT in teaching Electrical Engineering courses in technical institutions in Nairobi County. Regionally, ICT use is still not elaborate. In western Kenya, TVET Institutions still have weak capabilities in ICT use for teaching various subjects an indication their struggle to position themselves in the modern industry-institutional dynamics as pointed out by (Jared, Oloko, & Orwa, 2015).

The use of ICT in the training process is of great importance. However, it is clear that inadequate ICT skills by trainers present the greatest challenge in trying to integrate ICT in training technician and TVET trainees. Human resource capacity and deficiency of trainers in TVET institutions is another major challenge facing the sector prompting Kariuki (2013) to propose training courses that address ICT literacy and awareness amongst trainers within the job and during their professional training.

2.5 TVET Training in Kenya

The sessional paper number 14 of 2012 on reforming education and training towards reviewing the policy framework on the system of education in Kenya defines Technical, Vocational Education and Training (TVET) to mean range of learning experiences which are relevant to the world of work and may occur in a variety of learning contexts including education and training institutions or the workplaces.

TVET in Kenya, in the technical education subsector, offers TVET training at various institutions which include; technical university colleges (TUC), national polytechnics (NP), technical teachers trainers college (TTTC), technical training institutes (TTIs) institutes of technology (ITs) and vocational training centers (VTC).

Registered TVET institutions in Kenya has been on the increase in the last decade, GOK (2013,pp.72) report on vision 2030 second medium term plan 2013 – 2017 revealed that "registered TVET institutions increased to 813 of which 493 were fully registered by 2012. As at 2013, there were seven national polytechnics, 24 technical training institutes, 14 institutes of technology, 817 youth polytechnics, 1 technical teacher's trainers' college and 706 private TVET institutions".

Apart from technical university colleges (TUC) and vocational training centers (VTC), TVETA (2018), has listed 979 accredited TVET institutions nationally out of which 520 offers at least an artisan, certificate, diploma or higher national diploma in Electrical Engineering courses. Nairobi County has a total of 208 accredited TVET institutions where only 26 (16 private and 10 public) TVET institutions offer Electrical Engineering courses. Graduates from TVET institutions are awarded Certificates and Diplomas in various disciplines. The findings of this research were based on the 26 accredited TVET Institutions in Nairobi County whose results were generalizable to other TVET institutions in Kenya.

2.6 Benefits of ICT Integration in Teaching of Electrical Engineering

Technology increases student learning and student motivation to learn. It also supports critical thinking, problem solving skills and collaborative learning (UNESCO, 2015). ICT can contribute in several ways to the development of various skills and attitudes in Technical, vocational Education and Training (TVET). The use of such technologies in the learning process can actually teach students how to access and productively use information which is presented in a new and very attractive way (Oyebolu & Olusiji, 2013).

Information and communication technology (ICT) has been much heralded as holding great potential value for the improvement of teaching and learning in Technical vocational education and Training (TVET). Oyebolu & Olusiji (2013), cautions that, TVET institutions should be mindful of challenges caused by integrating ICT into education delivery system as it may post some pedagogical problems that usually arise due to innovation and change. Computer-mediated professional development provide conducive and neutral environment for demystifying technology with comfort. It is therefore imperative that, lecturers without key information processing skills (such as ICT skills) for professional development may find it difficult to cope with the pace of new and emerging technologies in their teaching career (Otunla, 2013).

According to the report of Kafka (2013), Technology is of increasing importance in people’s everyday lives and that it will most certainly increase in the coming years. There is no doubt therefore that, Information Communication Technology (ICT) is an important tool in curriculum implementation for a developing society like Kenya through TVET training institution. ICT when appropriately used can assist in addressing the key educational challenges, e.g. e-learning and m-learning (internet, multimedia and mobile learning) technologies and alternative delivery systems for access. Rich integration of ICT in education improves quality of teaching, contribute to equity of learning and increase relevance in training (Swarts & Wachira, 2010).

With new technology, students can spend less time doing calculations and more time creating strategies for solving complex problems and developing a deep understanding of the subject matter. Word processors have greatly simplified some aspects of writing, editing, and rewriting (Kafka, 2013). They further argue that, Technology has also been shown to increase student motivation and engagement, prepare students for jobs, and enhance students' ability to work collaboratively, however there is hardly, if any, tools and methods to measure the impacts in these domains.

Apart from the capability of ICT to provide a dynamic and proactive teaching and learning environment, Electrical Engineering graduates from TVET institutions could rather fit in to the world of work suitably if they acquire skills through a technologically infused rigorous training. ICT could as well enhance hands-on innovative ways of solving real life problems that exist in the sector by introducing simulative technics in finding solutions to engineering problems.

2.7 Challenges in Implementing ICT in TVET

Oribabo (2014) argues that, some parents in Nigeria if not many do not value education. They want the government to do everything for them. They equally believe that everything in education is free, which is not. In Kenya and other developing countries, social - technical infrastructure and digital-literacy is affecting the integration of ICT in teaching and learning (Muhammad, Albejaidi, & Akhtar, 2017). It therefore implies that, a positive trainer's perception on ICT integration in an environment that has sufficient supportive ICT infrastructure will ultimately spearhead the objective of using new technology in teaching. Besides the dissemination of ICT across all sectors, deep organizational changes are required and new skills are needed to fully exploit the new technologies.

What matters most in a knowledge based society, are the people, ideas and the ability to make commercial use of them. One of the main challenges is therefore to identify, measure, forecast, and finally to provide the necessary ICT skills to ensure economic and social sustainability. Kanyoro, Nancy, & Sophia (2016), believes that, Re-training of instructors and Trainers on the use of pure practical approaches in teaching through an integrated approach with modern ICT technologies is necessary during their training. However, not much of the strategies have been adopted Kenya.

Lack of equipment also limits the practical experience for students and many well-trained ICT students leave the teaching field behind for business and industry jobs (Muhammad, Albejaidi, & Akhtar, 2017).

The use of unqualified teachers in schools is not widespread in both developed and developing countries as identified within the literature reviewed by (Makori & Onderi, 2013). Lack of appropriate tools, finance, and computer knowledge by learners, makes adoption of new technology very slow and is made even worse if such learners fear to use trial and error techniques (Wanyeki, 2011).

Related studies geared towards addressing the various challenges facing the implementation of ICT integrated teaching of technical skills is paramount. The challenges outlined by various researchers require further filtering so as to establish the most essential factors that seem to inhibit the use of ICT in the teaching of Electrical Engineering courses as the study sought to investigate.

2.8 ICT for Teaching Electrical Engineering

The UNESCO (2008) cited in (Otunla, 2013) argue that Teacher's inadequate competency Standards in ICT skills is a major attempt to set standards on pedagogic benchmarks for ICT integration in teaching. The systematic use of ICT for teaching purposes is still low. Students are mainly learning basic computer skills and some principles of computer operation only.

A wide range of engineering software’s have been adopted across the globe to teach engineering phenomenon in an analytical perspective as a methodology for solving real engineering problems. MATLAB, CAD and Electronic workbench are just a few of the engineering software’s that have been used in the education and engineering sectors over time.

MATLAB has proved itself to be a very effective tool in the educational process by providing a simple and powerful tools for analyzing and visualizing results of numerical simulations and measurements (Davidovich & Ribakov, 2010; Rhudy & Nathan, 2016). Its universality allows easy understanding of complicated processes in different fields of engineering such as Electrical Engineering, forming a basis for greater success in education and training.

The MATLAB program has caused a paradigm shift in the way programming languages have learned by students all over the world.

It has seen electrical and computer engineering fields allow all students to learn the basic programming concepts using MATLAB so that students could then effectively use MATLAB in their upper-level courses and beyond (Attaway, 2010; McMahon, 2007).

There is need to launch re-training programme for Electrical Engineering trainers on the integration of ICT in their areas of specialization particularly on the application of available instructional software like MATLAB and CAD. Ng'eno, Githua and Changeiywo (2013) recommended a quasi-experimental study to be carried out where trainers are trained on the use of ICT in their classes and establish their effectiveness in teaching compared to those who apply conventional approach to teaching.

Curriculum implementation transforms the curriculum objectives and designs into skills needed to boost the industry through the transfer of skills and competencies from the trainers to the trainees (Ngure, 2013). This involves the competent use of training methods based on sound learning principles, with the aim of furnishing the trainees with three types of skill necessary for an all-round worker: basic literacy, technical and interpersonal skills.

Computer aided design (CAD) being the other commonly used engineering software, has made classical methods of Descriptive Geometry entirely obsolete (Bokan, Ljucovi´c, & Vukmirovi, 2009). However, this discipline is still very important for strengthening one’s spatial intuition. In order to integrate the classical and modern approaches, AutoCAD and ArchiCAD have developed with several electronic accessories that can be used to design abstract systems in various levels of engineering teaching process.

Distance education is not the absolute solution for the difficulties and barriers encountered in traditional educational settings, but it does provide the potential for greater service to more individuals seeking learning opportunities (Wambugu & Kyalo, 2013).

Given that, the Technical Vocational Education and Training (TVET) sub-sector is critical to the development of industry requiring skilled human capacities. High quality training services must be delivered by the sector to enhance the productivity and competitiveness (Hooker, et al., 2011). This therefore requires trainers and trainees to have the necessary skills to support the use of ICT for teaching and learning.

Higher education in Kenya has experienced a shift from conventional classroom teaching to distance education, from the margins to the mainstream of higher education policy and practice in many countries (Wambugu & Kyalo, 2013; Nyabisi, 2012). However, many institutions of higher learning still do the conventional teaching methods that require a quick technological revolution or a paradigm shift in curriculum delivery so as to allow universities across the globe train graduates who are ICT compliant and technology oriented.

2.9 Summary

Based on the reviewed literature, the need to finding out the key contributing factors towards low ICT used for teaching Electrical Engineering courses was identified. The research intensively explain the common factors that have led to low integration of ICT in teaching Electrical Engineering in TVET institutions in Kenya as well providing remedies required to improve its integration in teaching the subjects.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter discusses the methodological approach for the study. The presentation of the research methodology includes a discussion of the research design, target population, sampling procedure, research instruments developed, validity and reliability of the research instruments and the validation methodology utilized by the study.

3.2 Research design

A research design is the specification of methods and procedures for acquiring the information needed. It is the overall operational pattern or framework of the project that stipulates what information is to be collected from which sources and by what procedures. This research used a survey design as a guide to the inquiry of factors contributing to low ICT use in teaching Electrical Engineering courses in technical institutions in Nairobi County by adopting a set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem.
This was adopted since it provides a method of obtaining large amounts of data, usually in a statistical form, from a large number of people in a relatively short time (McNeill & Chapman, 1985; Rahi, 2017). "A survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (Creswell, 2009, p. 145).

This approach is most suited for gathering descriptive information in a quantitative perspective. Quantitative method is a scientific method whose grounds can be identified in positivist paradigm. It focuses on fresh data collection in accordance to the research problem from a relatively large population and the analysis of the data. However this method ignores qualitative methods that collects information on individual’s emotions and feelings or environmental contexts (Rahi, 2017).

It usually takes the form of closed and open ended questions in a self-completion pre-design questionnaire where Respondents fill in their responses or an interviewer reads the questions to the respondent and fill in the response in the questionnaire on behalf of the respondent (McNeill & Chapman, 1985; Kothari, 2004). The study was about factors contributing to low ICT integration in teaching Electrical Engineering courses in technical training institutions in Nairobi County. “This research design guides the steps involved in the research process, outlining the essential building blocks or steps of collecting and analyzing data” (Myers, 2009, p. 22). The design also relates the research problem to an appropriate methodology and provides the most effective methods for data collection and analysis (Rahi, 2017).

3.3 Research methodology

A discussion of methodology (questionnaire, interviews and focus group) reflects the philosophical standpoint chosen for the overall research process. This study used survey research methodology where questionnaire was used to give shape to what was studied and how it was studied as well as indicating the relationship between the investigator and research participants as outlined by (Cheruiyot & Maru, 2013).

Questionnaires are designed to collect data from a group of people coming under the purview of the study. The questionnaire is designed to collect data from large, diverse and widely scattered groups of people or population. It is therefore device for securing answers to questions by using a form which the respondent fills in the responses.

Survey questionnaire presented to selected sample from the population was used as the tool for data collection with the intention to make generalization to the population. Generally, research seeks to understand a phenomenon or to find answers to the research inquiry through a planned course of action. The choice of the research methodology and data collection tools are influenced by research questions that seek to gain insight and construct explanations on the phenomenon under study (Ngure, 2013). This help to describe the existing relationships between the public and private TVET institutions in trying to integrate ICT in teaching Electrical Engineering.

3.4 Population and sample selection

Target population is the entire set of units for which the study data are to be used to make inferences. The target population defines those units for which the findings of the study are meant to generalize about the population. The target population was technical training institutes in Nairobi County with a total of 208 accredited TVET institutions out of the total 979 nationally (TVETA, 2018). Since the purpose of this research was to establish the factors contributing to low ICT integration in teaching Electrical Engineering courses in Kenya, the study population comprised Lecturers in the Electrical Engineering departments. In order to generalize from a random sample and avoid sampling errors or biases, a random sample needs to be of adequate size (Taherdoost, 2017). It thus implies that, larger sample sizes reduce sampling margin of error. The margin of error is a statistic expressing the amount of random sampling error in a survey result (Mugenda & Mugenda, 1999; Taherdoost, 2017). Several statistical formulas are available for determining sample size. A complex process is normally involved in determining the sample size for a survey. If a sample size is small, the results may not properly represent the entire population. If the sample size is large, the survey may not be able to be carried out due to cost and time restraints. The crucial considerations needed while calculating or determining the sample size (N) of a population include but not limited to; the confidence level of the results (Z), level of precision (margin of error) (E) and the estimation of the variation of the population (P) to give the formula below

$N = \frac{P(1-P)Z^2}{E^2}$ Where

$E = \sqrt{\frac{p(1-p)}{N}}$

N is sample size

P estimation of the variation of the population

Z confidence level of the results

E margin of error

“In management research the typical levels of confidence used are 95 percent (0.05: a Z value equal to 1.96) or 99 percent (0.01: Z=2.57)” (Taherdoost, 2017, p. 237).

Random sampling method was employed to determine the sample size. Among most researchers, an estimate of variation P =< 0.05 is scientifically acceptable (Ajay & Micah, 2014) while a type one error should be E =< 0.05 while type two should be E => 0.08 according to (Creswell, 2009; Taherdoost, 2017). This research adopted P = 0.05 estimate of variation of the population to give a sample size of 100 trainers with an approximate E = 0.02 margin of error out of an approximate number of 390 trainers in the 26 TVET institutions offering Electrical Engineering in Nairobi County.

$$N = \frac{0.05(1-0.05)1.96^2}{0.02^2} \approx 100 \text{ Trainers}$$

$$E = \sqrt{\frac{0.05(1-0.05)}{100}} \approx 0.02 \text{ Margin of error}$$

Simple random sampling technique was employed to select 10 lecturers including the Head of Electrical Engineering department from each of the 10 technical training institutions randomly selected from both public and private technical institutions giving a total of 100 Respondents. Simple random sampling technique was used because it reduces the chance of variation between a sample and the population it represents (Mugenda & Mugenda, 1999) and (Grinnell, 1993) cited in (Murithi, Gitonga, & Kimanthi, 2013). Equality of sample size in both public and private technical training institutions was to provide a relative trend in the use of ICT in teaching Electrical Engineering.

3.5 Data collection procedure

Accurate and systematic data collection is critical to conducting scientific research. However data collection allows researchers to collect information that they require to collect about particular study objectives depending on research method, methods of data collections or both (Abawi, 2013).

The researcher designed the data collecting questionnaire based on the objectives of the Study. The target Respondents were then defined inclusive of the methods to reach them which then followed the following six steps:

1. Define the objectives of the study
2. Define the target Respondents
3. Questionnaire Design

4. Pilot Testing
5. Questionnaire Administration
6. Results Interpretation

3.6 Data collection tools

The research used survey questionnaires for data collection. A questionnaire is a paper and a pencil data collection instrument filled in by Respondents for the purpose of the research study. This study used a structured questionnaire as the mode of data collection; according to (Dempsey, et al., 2004) a questionnaire is preferred because it allow Respondents to give much of their opinions pertaining to the researched problem. Kothari (2004) notes that the information obtained from a questionnaire is free from bias and researchers influence and thus accurate and valid data is gathered.

3.7 Pilot study

The questionnaire was pre-tested at Nairobi Technical Training Institute, Electrical Engineering department. A sample of 10 trainers were interviewed for the pre-testing of the questionnaire. Pre-testing is done before the actual study to ensure that the items tested what they were intended to (validity) and that they consistently measure the variables under study (reliability) (Kimberlin & Winterstein, 2008). Focused Group discussion method of pre-testing was done using a group of 10 trainers at the department. The choice of Nairobi Technical Training Institute as the center to pilot the instrument because of the fact that it is located within the study location. Any important corrections, clarifications, suggestions and omissions highlighted during the pre-testing exercise were then adopted and used to improve the study instruments.

3.8 Validity of the research instruments

Validity is the degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of tests (Wadsworth, 2006). The researcher used a discussion group of ten experts before commencement of the research to review items in the tools that were used. The items that were invalid were removed before the research was conducted.

3.9 Reliability of the research instruments

Reliability refers to the degree to which the same instrument will give the same results for the same individuals at different times (Wadsworth, 2006). It is known that if reliability coefficient is 0 the observed score consist of errors, but if reliability coefficient is 1.0, the observed score would contain no error. Cronbach's alpha provides a measure of the internal consistency of a test or scale (Tavakol & Dennick, 2011). It is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or construct which reveals how items are inter- related within the test. Internal consistency should be determined before a test can be employed for research or examination purposes to ensure validity.

Reliability coefficient takes value from 0 to 1.0. The reliability coefficient is considered good if it equals or exceeds 0.70 (Litwin, 1995). To establish the reliability of the instrument in this study, the researcher used Cronbach's alpha index. Cronbach's alpha is the most commonly used measure of reliability. It measures the internal consistency among a set of items.

According to (Hajjar, 2018; Tavakol & Dennick, 2011), 0.7 and above Cronbach's coefficient alpha is acceptable. Statistical Package for Social Sciences (SPSS) was used to analyze the 36 items selected to measure reliability coefficient. The findings showed a reliability index of (α = 0.7659) shown in table 3.1 illustrating the instrument as reliable since its reliability Cronbach's alpha exceeded the prescribed threshold of 0.7.

Table 3.1: Reliability coefficients

Scale Cronbach's Alpha		
N of Cases =	97.0	N of Items = 36
Alpha =	.7659	

3.10 Data processing & analysis

The Statistical Package for Social Sciences (SPSS) Version 18 software package was used for analysis of data. This is because it contains set of statistical techniques that allow relationships between one or more independent variable either continuous or discrete and one or more dependent variables (Tabachnick, B.G & Fidell, L.S, 2001). Data analysis was divided into quantitative and qualitative. The quantitative data collected was analyzed using descriptive statistics which include frequency, mean and standard deviation as well as inferential statistics like correlation and regression. Descriptive statistics were used in the analysis of survey data. Ordinary Least Squares (OLS) linear regression was used together with factor analysis to reduce the factors of the study into small sets of variables for easier interpretation. Qualitative data was analyzed based on context analysis of the emerging themes and later displayed using the frequency tables.

3.11 Results interpretation Guide

Mean as a measure of central tendency, standard deviation, correlation analysis, ANOVA, regression and factor analysis were parameters analyzed using SPSS to achieve the specific objectives of the study.

3.11.1 Mean interpretation

In the preceding results, the analysis was done using mean values in the range of 0 to 5 inclusive. A mean of 0 to 1.499 was interpreted as very valid extent while a mean of 4.5 to 5 was interpreted as very invalid extent.

3.11.2 Standard deviation interpretation

The standard deviation was analyzed as either low or high depending on whether the deviation value was less or more than 1. If the standard deviation is less than 1, it showed a low standard deviation which is an indication that the Respondents did not differ much in their opinion, an indication that Respondents almost said the same thing. If the standard deviation was a value greater than one, this was high standard deviation, an indicated that Respondents differed much in their opinion.

3.11.3 Correlation interpretation

The Pearson Correlation Coefficient is used to measure the strength and direction of association that exists between two variables measured on at least an ordinal scale.

3.11.4 Regression Interpretation

Regression is used to rank factors involved in a study, in this case coefficient of regression is used to rank the factors.

3.11.5 Factor Analysis Interpretation

Together with correlation analysis, factor analysis was done to establish the relationships among the study variables.

3.12 Ethical and logistical consideration

Consideration of research ethics and logistical issues enhances the purpose of undertaking the enquiry (Akaranga & Makau, 2016). "These are issues that the researcher must be aware of before starting the research" (Mugenda & Mugenda, 1999, p. 181), that will not only ensure a quality research but save the researcher time, energy and money. A research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) that approved the researcher to proceed to collect data in Nairobi County. A researcher must select the appropriate methodology to employ, relevant ways of collecting data, present the research findings and interpret them accordingly leading to presentation of information in a logical sequence (Akaranga & Makau, 2016). Sampling of Respondents was also done randomly and pre-testing of the questionnaire was done at Nairobi technical training institute before the actual data collection was done in other technical institutions.

The researcher assured the Respondents of their anonymity by asking them not to indicate their names in the questionnaire. The research also cited all the sources used in the development of the research literature to shun cases of research plagiarism and fraud. The data was then analyzed and reported in form of this thesis. The researcher, observed all the appropriate values in all the stages while conducting the research.

3.13 Summary

This chapter addressed the research design, population, and sampling, research instruments used to study the research questions, data collection procedure and ethical issues. Simple random sampling method was employed to determine the sample size. The population sample consisted of Electrical Engineering trainers within technical institutions in Nairobi County. The data collection instrument was the use of a questionnaire. Validity and reliability of the research instrument was conducted using internal consistency (Cronbach's alpha index). An acceptable reliability index of α = 0.7659 was obtained from 36 items of the questionnaire. Data collected was then analyzed using descriptive and inferential statistics.

CHAPTER FOUR

DATA PRESENTATION, INTERPRETATION AND ANALYSIS

4.1 Introduction

The chapter gives an elaborate results interpretation guide and analyzes observations made during the study. The observations are organized and presented in charts, frequency tables from descriptive statistics, and their interpretations following the objectives of the study. The comments and opinions received were incorporated in the discussion to draw the required recommendations.

4.2 Data presentation

The study sought findings as to the factors contributing to low integration of information communication technology in teaching Electrical Engineering in technical institutions in Kenya. The Respondents were drawn from 10 technical institutions in Nairobi County comprising of 5 private and 5 public technical institutions where 10 Electrical Engineering trainers were selected randomly from each institution to give a total of 100 Respondents. The objective of the study was to find out the extent of how Electrical Engineering lecturers used new technology in the teaching of their subjects and try to explain why the trend for such low integration in teaching Electrical Engineering. The contributors to low ICT integration in teaching Electrical Engineering were other aspects sought in the study as well as obtain individual opinions from the Respondents about the appropriate way forward towards improving on the use of new technology in the teaching of Electrical Engineering.

The chapter outlines the results of the methodology used in the study. The findings were analyzed and presented using frequency tables from descriptive statistics. The comments and opinions received were incorporated in the discussion to solicit the required recommendations.

4.3 Response rate

This study involved a sample size of 100 Electrical Engineering lecturers drawn from both public and private technical institutions in Nairobi County. Ninety seven (97%) response rate representing 51% Respondents from the public technical institutions and 49% from the private technical institutions in Nairobi County participated in the survey.

4.4 Respondents demographics

Data collected on individual respondent included gender, age, level of education, teaching experience, student population in classes and subject specialization of the lecturer. This section provides a discussion of the demographic characteristics of these profiles.

4.4.1 Gender of Respondents

Table 4.1 shows the gender statistics of the Respondents. It was observed that there were more male (82.5%) than female (17.5%) teaching Electrical Engineering.

Table 4.1: Gender of Respondents

Variable	Frequency	Percent (%)
Female	17	17.5
Male	80	82.5

4.4.2 Age of Respondents

The Respondents' ages were grouped as below 30 years, 30-39 years, 40-50 years, and above 50 years of age. The results indicate most of the Respondents were of the age bracket 30-39 years representing 51.5% of the Respondents while the least was the Respondents above 50 years of age representing 3.1% of the study population. The results indicate most of the teaching staffs are in the middle age Table 4.2 shows the results.

Table 4.2: Age of Respondents

Variable	Frequency	Percent (%)
Below 30 Years	37	38.1
31-39 Years	50	51.5
40-50 Years	7	7.2
Above 50 Years	3	3.1

4.4.3 Level of education of Respondents

There is a significant correlations between the level of education of trainers and ICT integration in classroom teaching according to (Alazam, Bakar, Hamzah, & Asmiran, 2012). The higher the level of education of a trainer implies to better tendency of him or her to integrate ICT in his or her teaching. While trainers who have lower level of education face challenges while trying to use new technology in teaching.

Responses were received about levels of education; the study established certificate/Diploma accounted 11.3%, Higher Diploma 12.4%, Degree holder 69.1% and Master degree 7.2%. The result indicates majority of the trainers have sufficient education qualification in the technical skills hence integrating ICT in teaching was not a problem for most of them. This information is shown in Table 4.3 below.

Table 4.3: Level of education of Respondents

Variable	Frequency	Percent (%)
Certificate/Diploma	11	11.3
Higher Diploma	12	12.4
Degree	67	69.1
Masters	7	7.2

4.4.4 Teaching Electrical Engineering experience in years

The study also examined the teaching experience of Respondents and established that majority have taught less than 5 years (48.5%), followed by those who have taught between 5 – 10 years (36.1%), those who have taught more than 15 years accounted for (11.3%) while 4.1% of the Respondents have taught between 11- 15 years. The results are indicated in Figure 4.1. This could be an inhibitor to ICT integration since majority of the trainers have no sufficient teaching experience.

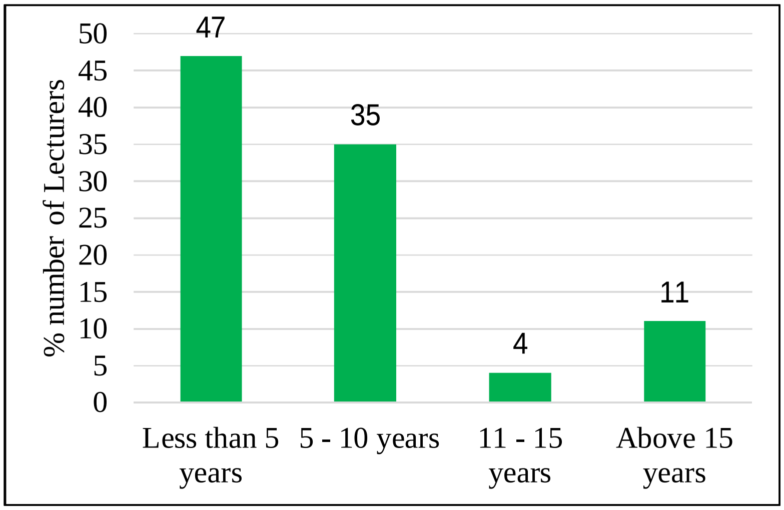

Figure 4.1: Respondents teaching experience (Author, 2018)

4.5 Electrical Engineering class population

Most class population had 31 - 45 students making 52.6% of the total sample. 26.8% of the class had 16 - 30 students. Only 15% of the class population in Electrical Engineering department had above 45 students while 5% represented class population with less than 15 students. The student body has considerably expanded and diversified, both socially and geographically over time. The average acceptable student- teacher in a classroom is 30:1 globally (Waita, Mulei, Mueni, Mutune, & Kalai, 2015) . Figure 4.2 reveals that, most of the classrooms had more number of students than the acceptable ratio, which is an indicator that more classrooms and trainers are needed in technical institutions in Nairobi County to allow ICT incorporation in teaching Electrical Engineering courses.

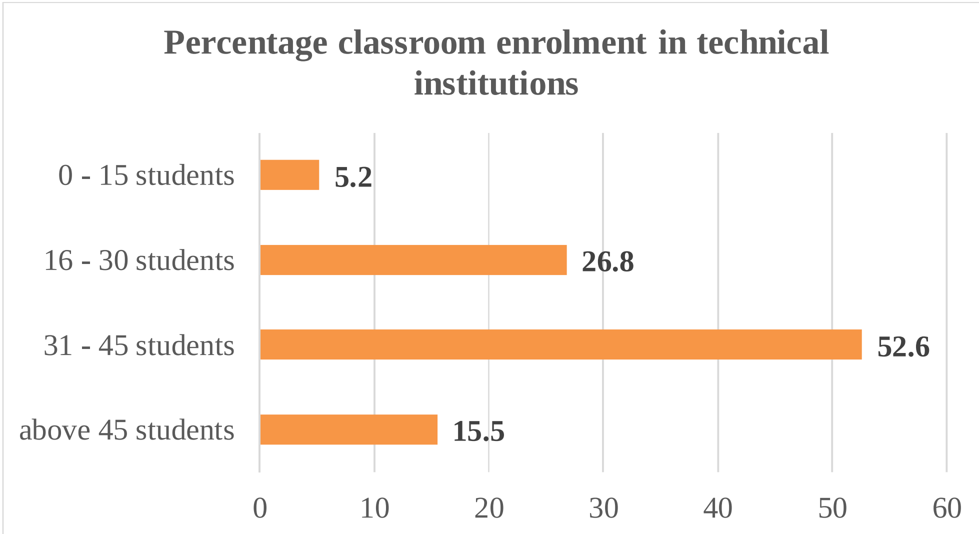

Figure 4.2: Classroom enrollment (Author, 2018)

4.6 Trainers area of specialization

About 70.1% of the Electrical Engineering trainers are Electrical power option (Machines and Power systems) bias whereas only 29.9% taught electronics related subjects (Telecommunication, control and instrumentation systems). The results are shown in figure 4.3

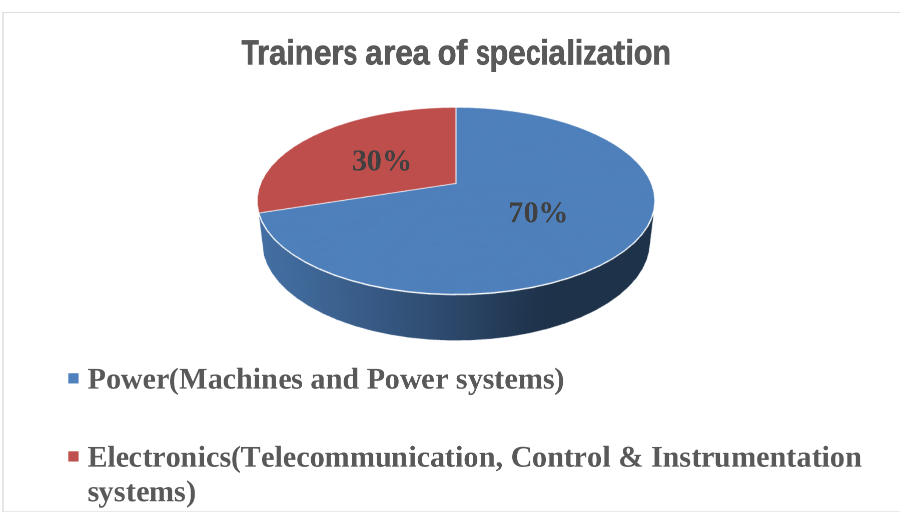

Figure 4.3: Trainers area of Specialization (Author, 2018)

A good number (43.3%) of trainers in Electrical Engineering taught across all levels of learners, mostly diplomas, craft and artisans. Only 3.1% taught higher national diploma. In fact none of the private institutions sampled taught more than two levels as indicated in table 4.4.

Table 4.4: Levels of learners taught by trainers in Electrical Engineering

level	**Private**		**Public**		**Cumulative (%)**
	Frequency	**Percent (%)**	**Frequency**	**Percent (%)**	
Artisan	1	2.1	1	2.0	2.1
Craft	7	14.6	5	10.2	12.4
Diploma	21	43.8	17	34.7	39.2
Higher diploma	19	39.6	3	6.1	3.1
At least two levels			23	46.9	43.3

4.7 Trainers teaching workload per week

The study established 50.5% of trainers in Electrical Engineering teach between 16 - 20 hours a week, 14% have a work load of above 20 hours. 14.4% teach below 10 hours a week while 20.6% teach between 11 - 15 hours respectively. A comparison on private and public institutions showed trainer with a workload of more than 20 hours per week are in private institutions (20.8%) as opposed to public institutions (8.2%). However the findings of this study indicates work load is slightly above the recommended 15 hours per week, this would be having negative impact on integrating ICT in teaching. Table 4.5 represents these findings.

Table 4.5: Trainers teaching load per week

Range	Public		Private		Total (%)
	Frequency	Percent (%)	Frequency	Percent (%)	
Below 10 hours	3	6.1	11	22.9	14.4
11-15 hours	7	14.3	13	27.1	20.6
16 – 20 hours	35	71.4	14	29.2	50.5
Above 20 hours	4	8.2	10	20.8	14.4

4.8 Trainers ICT literacy in Electrical Engineering

The survey sought from the Respondents about the Trainers ICT Literacy and the available ICT's in their department that could enhance integration in teaching. Using a Likert scale of 1 = Not at all, 2 = in some lessons, 3 = in all lessons, 4 = upon request response on the usage of equipment and software in teaching Electrical Engineering was obtained. This section provides a discussion on these findings.

4.8.1 Computers in teaching Electrical Engineering

The study sort to establish usage of desktop computers, laptops and mobile phones in teaching Electrical Engineering in Technical Training Institutions, Figure 4.4 outlines the results of these findings.

The goal of using computer and related technology is to stimulate learning, elaborate inadequate computer technology support for teaching, improve learning outcomes and improve teacher's pedagogical practices (Gilakjani, 2013). The adequacy of such technology will automatically improve ICT integration in a classroom teaching.

The Respondents were asked whether they use computers in upon requests, in all lessons, in some lessons or not at all. The survey indicated that, computers were only used in teaching some lessons with Laptop computers being highly used (60.8%) compared to desktop (57.7%) and mobile phones (36.1%). Mobile phones were used mostly to access online resources via internet connection. The results also indicated some trainers did not use computers at all in their teaching with mobile phones rarely used (48.8%) followed by desktop computers (26.8%) then laptop computers (9.2%). These results therefore indicated a low ICT integration in teaching of Electrical Engineering courses.

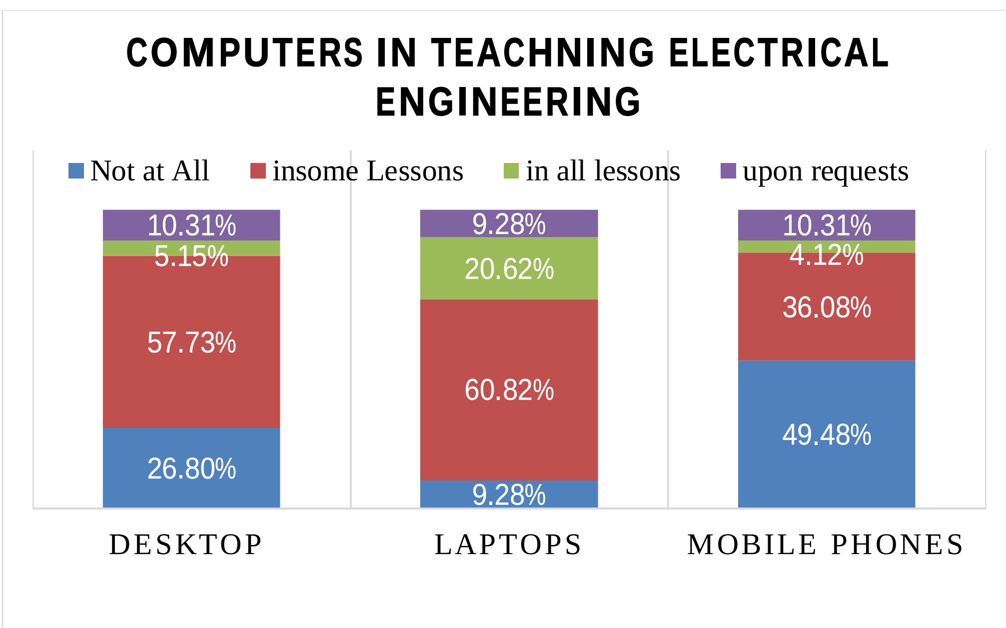

Figure 4.4 : Computers integration in Electrical Engineering (Author, 2018)

4.8.2 Computer software in teaching Electrical Engineering

The use of computer-based software in teaching engineering courses enable students integrate knowledge gained from various courses and help them to understand the connections between different engineering fields (Ibrahim, et al., 2010). The students are involved in problem-based learning during hands-on activities such as AUTOCAD designs and simulations wiring systems

The survey obtained responses on the usage of presentation slides, CAD software, MATLAB software and Electronic workbench software in teaching of Electrical Engineering. High number of Respondents indicated that they knew how to use computer software in teaching Electrical Engineering with presentation slides (69.1%), CAD software (57.6%), Electronic workbench (51.5%), however, simple minority had previously used MATLAB software at (36.1%). Evidence showed that trainers who used computer software in the teaching of Electrical Engineering subjects were as shown in figure 4.5 ; power point presentation (45.5%) followed by CAD software (41.2%), Electronic Workbench (38.1%) and MATLAB software (26.8%) in that order. A small number of lecturers used presentation slides in teaching all lessons while MATLAB software was not used in all lessons.

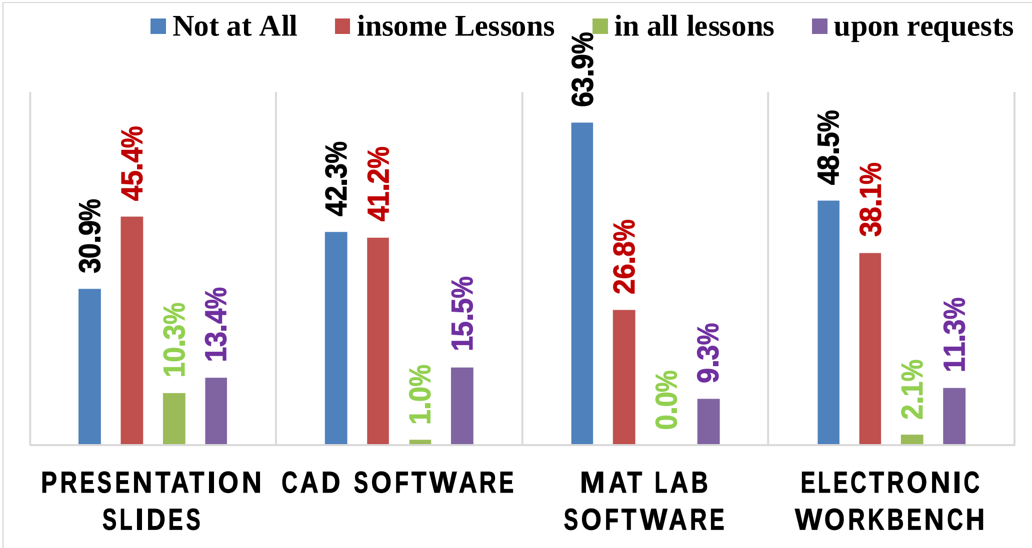

Figure 4.5: Software in teaching Electrical Engineering (Author, 2018)

A comparison on the use of the software in technical institutions indicated MATLAB software as highly used in private at (82.8%) than public (39.8%). Comparatively, other software's presentation slides, CAD software, Electronic workbench are comparatively used in the two types of institutions. Figure 4.6 presents these findings.

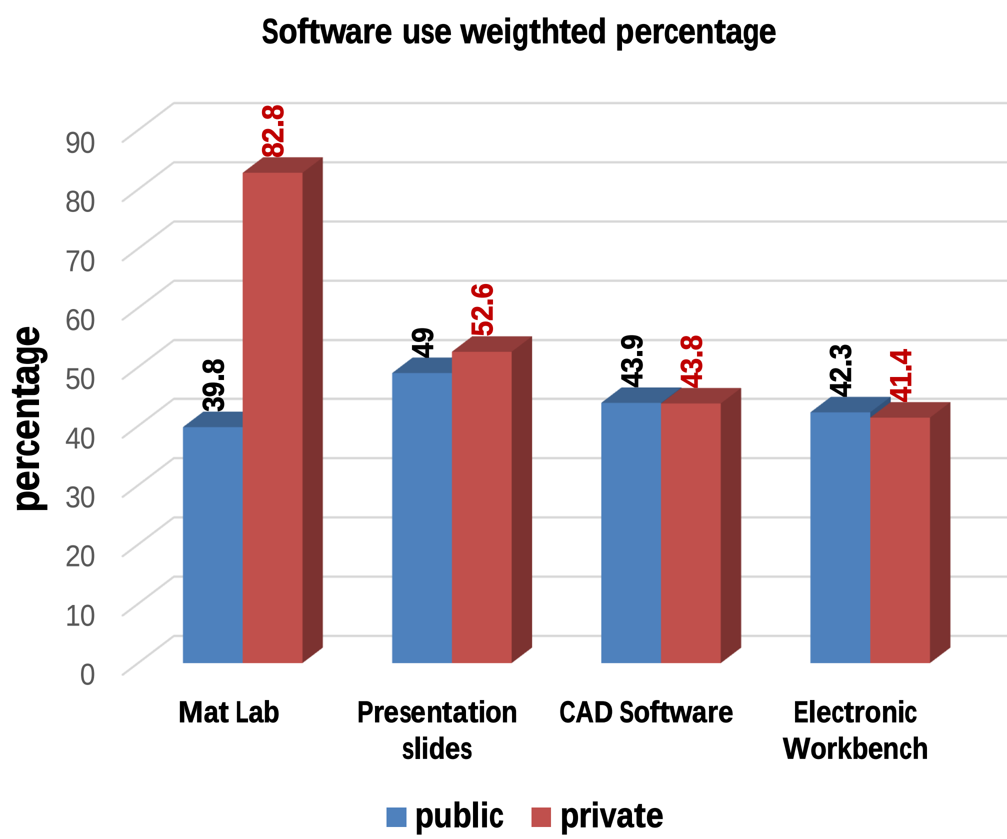

Figure 4.6: Software use in private and public institutions (Author, 2018)

4.8.3 ICT support infrastructure in teaching Electrical Engineering

The study sort to establish the availability of other ICT supporting infrastructure such as smart boards, interactive whiteboards, LCD Projectors, tele-conferencing facilities and Audio/Video equipment in the teaching of Electrical Engineering as shown in figure 4.7.

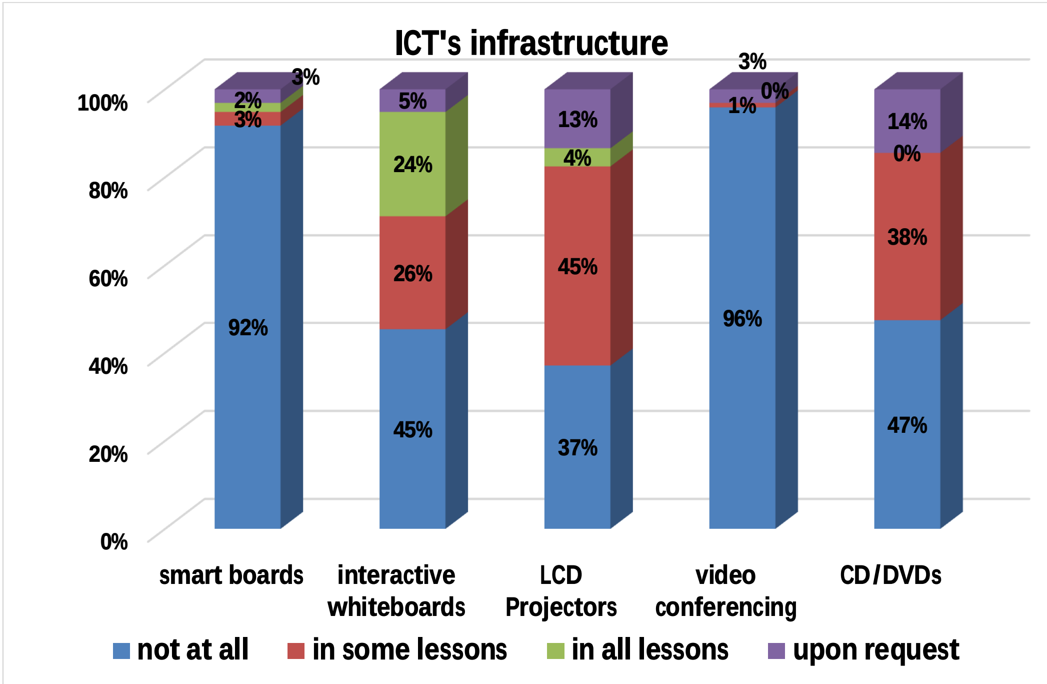

Figure 4.7: ICT infrastructure in Electrical Engineering (Author, 2018)

The findings indicate LCD projectors (45%), CD/DVDs (38%), interactive whiteboards (26%), smart boards (3%) and video conferencing (1%) were used by trainers in teaching of Electrical Engineering in some lessons. However, Whiteboards (24%), LCD projectors (4%), & Smart boards (2%) were used in all lessons by trainers in teaching Electrical Engineering.

4.8.4 Ranking of factors facilitating ICT integration

In order to rank the various factors that facilitated integration of ICT in teaching Electrical Engineering, the study utilized regression to rank the factors in the order of their ability to facilitate integration. R was defined as the measure of the correlation between the observed value and the predicted value of the criterion variable. R Square (R^2) was the square of this measure of correlation and indicated the proportion of the variance in the criterion variable which was accounted for by the model. In essence, this was a measure of how good a prediction of the criterion variable can be made by knowing the predictor variables. However, R^2 tends to somewhat over-estimate the success of the model when applied to the real world, so an adjusted R^2 value was calculated which took into account the number of variables in the model and the number of observations the model was based on. The adjusted R^2 value gave a measure of the success of the model. The study obtained an adjusted R^2 value of 0.473; we can say that the model accounted for 47.3% of the variance in the criterion variable. The findings are shown in Table 4.6 for model fittings, Table 4.7 for model ANOVA and Table 4.8 for the coefficients.

Table 4.6: Regression model summary

Model	**R**	**R^2**	**Adjusted R^2**	**Std. Error**
1	0.719	0.517	0.473	0.777

Predictors: (Constants), Supportive classroom ICT infrastructure, Simulation of Electronic circuits, Require training on ICT equipment, Excellent classroom ICT expertise, Conventional teaching by blackboards, Frequent staff training on ICT, Too wide syllabus used in ICT in teaching and Classroom have internet connectivity were identified.

4.8.5 Model significance with ANOVA

Table 4.7 reports on ANOVA, which assesses the overall significance of the model. With ANOVA analysis, for a $P < 0.05$, the model is said to be significant (Sow, 2014). The model was found to be significant as the P value = 0.000 which was less than the prescribed value to test the hypothesis that the result of the model could be used.

Table 4.7: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	56.739	8	7.092	11.755	.000
	Residual	53.096	88	.603		
	Total	109.835	96			

4.8.6 Model coefficients to interpret relative ranking of the factors

Regression coefficient was used to rank the factors inhibiting ICT integration. A regression rank of factors with positive beta values is termed significant and insignificant when the beta value is negative (Mensah, 2015). The biggest inhibitors in the implementation of ICT integration was found to include frequent ICT training of lecturers with Beta = 0.492, lecturers having excellent ICT expertise with beta = 0.173, use of conventional teaching methods beta = 0.181. However, classroom having internet connectivity beta = -0.003 and too wide syllabus to use ICT in teaching beta = -0.116 did not inhibit ICT integration in teaching since the beta values were negative. Table 4.8 presents the findings.

Table 4.8: Model coefficients

Mode	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	.291	.458		.634	.528
Classroom have internet	-.003	.087	-.003	-.033	.973
Conventional teaching	.135	.063	.181	2.159	.034
Require training on ICT equipment	.049	.067	.059	.727	.469
Excellent classroom ICT expertise	.174	.080	.173	2.180	.032
Frequent staff training on ICT	.484	.086	.492	5.660	.000
Too wide syllabus to use ICT in teaching	-.112	.082	-.116	-1.374	.173
Supportive classroom ICT infrastructure	.038	.084	.043	.450	.654

4.8.7 Key challenges that contribute to low ICT integration

The survey utilized factor analysis in order to summarize the factors that influence ICT integration into most important factors in order to reduce them to only key factors.

Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables (Williams, Onsman, & Brown, 2010). It is an important tool that can be used in the development, refinement, and evaluation of tests, scales, and measures that can be used in education and clinical contexts by paramedics. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variances observed in a much larger number of manifest variables (Yong & Pearce, 2013). Factor analysis can also be used to generate hypotheses regarding causal mechanisms or to screen variables for subsequent analysis (for example, to identify co-linearity prior to performing a linear regression analysis).

Initial communalities are estimates of the variance in each variable accounted for by all components or factors. Extraction communalities are estimates of the variance in each variable accounted for by the factors (or components) in the factor solution (Williams, Onsman, & Brown, 2010). Each number represents the correlation between the item and the un-rotated factor. This technique was applied to summarize the latent variables or sub-variables representing dominant success factors that can explain ICT integration. To make interpretation easier, a linear transformation on the factor solution, variable maximum rotation was done, which gave fewer components (factors) that are uncorrelated with one another. The findings are shown in Table 4.9 for model fittings, Table 4.10 for communality of factors and Table 4.11 for extracted factors.

Kaiser Mayer- Olkin (KMO) and Bartlett's Tests indicate the suitability of the data for structure detection. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy is a statistic that indicates the proportion of variance in your variables that might be caused by underlying factors (Yong & Pearce, 2013). The KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory analysis to proceed. From the analysis, the KMO measure was 0.714, an indication that the Bartlett's Test of sphericity is significant. In order to determine the number of factors to retain, the factors with eigenvalue greater or equal to one were retained.

Table 4.9: KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling Adequacy.		**.714**
Bartlett's Test of Sphericity	Approx. Chi-Square	476.881
	Df	91
	Sig.	.000

4.8.8 Communality extraction

Communalities indicate the amount of variance in each variable that is accounted for. Principal component extraction is always between 0 and 1.0 for correlation analysis (Sibanda & Pretorius, 2014). The communalities in this table are all high, which indicates that the extracted components represent the variables well. If any communalities are very low in a principal components extraction, one needs to extract another component (Danesh, 2017). For correlation analysis, the proportion of variance is accounted for in each variable by the rest of the variables. Extraction communalities are estimates of the variance in each variable accounted for by the factors in the factor solution. Small values indicate variables that do not fit well with the factor solution (Danesh, 2017), and should possibly be dropped from the analysis. According to Table 4.10, the extraction communalities for this solution were all acceptable.

Table 4.10: Communalities extraction

Factors	Initial	Extraction
Classroom have internet connectivity	1.000	.611
Conventional teaching by blackboards	1.000	.610
Institutional ICT goodwill in teaching	1.000	.641
Require training on ICT equipment	1.000	.544
Simulation of Electronic circuits	1.000	.619
Excellent classroom ICT expertise	1.000	.544
Frequent staff training on ICT	1.000	.616
Too wide syllabus to use ICT in teaching	1.000	.697
Supportive classroom ICT infrastructure	1.000	.637
Quality departmental ICT support	1.000	.705
Presence of Enough ICT hardware	1.000	.560
Workload reduces ICT use	1.000	.760
Comprehensive internet connectivity	1.000	.706
Personal initiative propels my ICT use in teaching	1.000	.569

4.8.9 Component extractions

Table 4.11 presents the component matrix, where four components were extracted. This suggests that the factors that influence ICT integration were classified into four factors. The factor transformation matrix describes the specific rotation applied to the factor solution. This matrix is used to examine the factors and explain their classification.

Table 4.11: Component matrix

Factors	**Component**			
	1	2	3	4
Classroom have internet	.756	-.107	.123	-.113
Conventional teaching	.047	-.521	.579	-.024
Institutional ICT goodwill	.716	-.353	-.014	-.067
Training on ICT equipment	-.058	-.279	.669	-.122
Simulation of Electronic circuits	.593	-.337	-.025	.391
Excellent classroom ICT expertise	.311	.506	.029	-.437
Frequent staff training on ICT	.714	-.173	-.168	-.222
Too wide syllabus to use ICT	.120	.549	.616	-.030
Supportive ICT infrastructure	.576	.548	-.066	-.008
Quality departmental ICT support	.688	.410	.251	-.017
Presence of Enough ICT hardware	.738	.074	-.013	-.099
Workload reduces ICT use	-.054	.443	.400	.633
Comprehensive internet	.693	-.407	.101	.225
Personal initiative ICT use	.439	.215	-.442	.367

An item is considered to belong to a factor component if its factor loading corresponds to that particular component and is relatively higher factor loadings > 0.5 in the factor components (Danesh, 2017; Sibanda & Pretorius, 2014). The factors could be summarized in to the following four categories: Computer system and ICT infrastructure, trainers ICT compliance, conventional issues and trainers' workload depending on factor loadings as shown in table 4.12, 4.13, 4.14 and 4.15 respectively.

Table 4.12: Factor category 1- Computer systems and ICT infrastructure

Factors	Factor Loading
Classroom have internet connectivity	0.756
Institutional ICT goodwill in teaching	0.716
Simulation of Electronic circuits	0.593
Frequent staff training on ICT	0.714
Supportive classroom ICT infrastructure	0.576
Quality departmental ICT support	0.688
Presence of Enough ICT hardware	0.738
Comprehensive internet connectivity	0.693

Table 4.12 represent factors making up computer system and ICT infrastructure category with factor loadings > 0.50. Internet connectivity (0.756), ICT hardware (0.738), ICT infrastructure (0.576) and ICT support (0.688) are just a few of the factors that were extracted to describe computer system and ICT infrastructure.

Table 4.13: Factor category 2- Trainers ICT compliance

Factors	Factor Loading
Excellent classroom ICT expertise	0.506
Too wide syllabus to use ICT in teaching	0.549
Supportive classroom ICT infrastructure	0.548

Excellent classroom ICT expertise, too wide syllabuses and supportive classroom ICT infrastructure in table 4.13 formed the second category of trainers ICT compliance since the factor loadings were 0.506, 0.549 and 0.548 respectively.

Table 4.14: Factor category 3- Conventional issue

Factors	**Factor Loading**
Conventional teaching by blackboards	0.579
Require training on ICT equipment	0.669
Too wide syllabus to use ICT in teaching	0.616

The third category table 4.14 represent conventional issues comprising conventional teaching by blackboards, required training on ICT equipment and too wide syllabuses to use ICT in teaching.

Table 4.15: Factor category 4 - Trainers workload

Factors	**Factor Loading**
Workload reduces ICT use	0.633

Trainers workload become the fourth category of key factors that inhibited ICT use in teaching of Electrical Engineering with a factor loading of 0.633 table 4.15.

4.9 Summary

The chapter gives an elaborate results interpretation guide and analyzes observations made during the study. The observations were organized following the objectives of the study.

From the analysis, the study established MATLAB, presentation slides, CAD software; Smart boards, Desktop and Laptop computers among other ICT infrastructure were available in TVET institutions. Private institutions recorded relatively higher level of ICT usage than public institutions. Finally, the results established computer systems and ICT infrastructure, Trainers ICT compliance, Conventional issue and Trainers workload to be the key determinants for successful ICT integration in teaching Electrical Engineering courses.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Results and discussions

The study established a relatively low ICT integration in teaching Electrical Engineering in Nairobi County. This is an indication that despite of the fact that TVET stakeholders have put more effort towards achieving classroom digitization, reducing trainer's ICT illiteracy and improving ICT infrastructure, much is still yet to be achieved. The trainers need to be using modern technology to prepare the trainees for the job market which is dynamically changing (Ibrahim, et al., 2010). The study indicated that Private institutions recorded high integration of technologies in teaching of Electrical Engineering courses in technical institutions such as the use of Laptops (52.6%), use of lecture slides (52.6%), use of PLC & e-mail (68.0%) among other technologies as opposed to public institutions.

The study sought to establish factors that contribute to low integration of ICT in teaching Electrical Engineering, factors such as availability of computers, classroom infrastructure, ICT support, teaching workload, internet connectivity identified in literature were tested. Respondents were asked to rate these factors using a Likert scale from 1 – 5 where; 1 = strongly disagree, 2 = Disagree, 3 = neither agree nor disagree, 4 = agree and 5 = strongly agree. The study established personal trainer's initiative drive as key while using ICT in teaching Electrical Engineering at a mean of 3.75 in order achieved ICT integration. Trainer's excellent ICT expertise (mean = 3.49), trainer's workload reducing ICT use (mean = 3.10), require training on ICT (mean = 3.11) were among the factors cited as critical in ICT integration.

5.2 Conclusion

This study was designed to respond to the following general objective: To establish factors that contribute to low ICT integration in teaching Electrical Engineering courses in technical training institutions in Nairobi County. Factor analysis was used to reduce the variable under study to four independent factors, it was realized that all the factors contribute to the overall research objective. The regression model of these factors was found to be 71.9% applicable in the area of study.

The first Specific objective was to establish the available ICT's in Electrical Engineering departments in technical training institutions in Nairobi County. The study established MATLAB software, CAD software, lecturer slides, CD's and DVD', Laptop computers, LCD projectors, Mobile phones, smart boards, interactive white boards, workbench software and video conferencing in few institution where ICT's available in technical training institutions. Mobile phones were used to access online training materials with the help of internet access by both trainers and trainees.

The second specific objective was to analyze the usage of the existing ICT's in teaching Electrical Engineering in technical training institutions in Nairobi County. From the literature review the ICT's were classified into Computer systems, Computer software and ICT supporting infrastructure. The computer systems identified in this study comprised of desktop computer, laptop computers and mobile phones. The laptop computers were found to be most used by many trainers followed by desktop computers while mobile phones are hardly used unless while accessing online training materials via the internet for teaching Electrical Engineering. The computer software identified in the study includes presentation slides, CAD software, MATLAB software and Electronic workbench.

Specific objective number three was to establish factors that hinder effective integration of ICT's in teaching Electrical Engineering in Technical Training Institutes in Kenya. The study used factor analysis to reduce factors identified in literature into four factors. The factors identified in literature include internet connectivity, institute ICT goodwill, trainers training and syllabus to be covered. Factor analysis grouped these variables into four categories that hinder integration of ICT in teaching of Electrical Engineering courses that were summarized as computer systems and ICT infrastructure, Trainers ICT compliance, Conventional issue and Trainers workload.

The research objectives guided the research and data analysis. The study aimed at analyzing factors that inhibit ICT integration in teaching Electrical Engineering in Nairobi. There has been incredible uptake of ICT in many sectors in the recent past (Ibrahim, et al., 2010). Education practitioner's view ICT as a tool that will transform the education sector ranging from content availability, teaching methods to transmission of content. Regardless of the advancements in ICT's, there remain many technical and non-technical obstacles that must be addressed in order to enhance efficient integration of ICT in teaching (George, 2015).

5.3 Recommendations

The study has achieved what it set to accomplish, identify factors that contribute to low integration of ICT in teaching Electrical Engineering courses in technical training institutions in Nairobi County. The findings obtained in this study and information obtained from literature, is evident that ICT integration in the teaching of Electrical and Electronic engineering has not been widely accepted. There are a number of challenges that are hindering the adoption of ICT's in teaching in TVET institutions. This study presents the following recommendation to enhance integrated ICT teaching and learning of Electrical Engineering courses in Kenya.

1. The government and other stakeholders in TVET should provide adequate ICT infrastructure
2. Trainers Professional development courses should put emphasis on trainers ICT literacy, competence and modern pedagogy
3. ICT incorporated Training curricula tailor made to specific courses should be designed to curb the issues of too wide load for the trainers and trainees.
4. TVET institutions to provide relevant Engineering software's geared towards linking what is trained and what industry require from trainees

5.4 Suggestions for further research

1. Research to be undertaken on other Engineering fields such as Mechanical, Automotive, Building among others to establish if ICT is used in teaching.
2. Research on ICT integration in teaching trade test courses in Youth Polytechnics (YP) need to be undertaken.
3. An enquiry in to whether the trainer's colleges offer sufficient training on ICT skills to trainees before being allowed to train in TVET Engineering courses.

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APPENDICES

Appendix 1: Questionnaire for Electrical Engineering Lecturer

FACTORS CONTRIBUTING TO LOW ICT INTEGRATION IN TEACHING ELECTRICAL ENGINEERING COURSES IN TECHNICAL TRAINING INSTITUTIONS IN NAIROBI COUNTY

My name is Solomon. I am carrying out a study on "Integrating information communication technology in teaching of Electrical Engineering in technical institutions in Kenya: a case of Nairobi County"; in partial fulfillment of the requirements for the ward of masters of education degree in technology education (Electrical & Electronics option) in the University of Eldoret. Your input in terms of providing information as required in this questionnaire will be highly appreciated and very valuable to my study. What you response will be treated with utmost confidentiality. Do not write your Name or any identification on this questionnaire.

***SECTION (I)*: Respondents personal information** *(Tick appropriately)*

1. What category is your institution? Public [ ] Private [ ]
2. Please tell us your age? (*years)* Below 30 [ ] 30- 39 [ ] 40-50 [ ]above 50 [ ]
3. Your gender? Male [ ] Female [ ]
4. Your highest level of education & Training attained? Certificate/Diploma [ ] Higher Diploma [ ] Degree [ ] Masters [ ] PHD [ ]
5. What is your teaching experience in Electrical Engineering in years?

Less than 5 [ ] 5-10 [ ] 11-15 [ ] Above 15 [ ]

6. The highest number of students you teach per subject class?

Less than 15 [ ]   16-30 [ ]   31-45 [ ]   above 45 [ ]

7. Classify your area of specialization?

Electrical Power (Machines & Power systems) [ ]

Electronics (Telecommunication, Control & Instrumentation) [ ]

8. What levels of students to you teach? Artisan [ ] Craft [ ] Diploma [ ]

Higher Diploma [ ]

9. What is your teaching load?*(hours)* less than 10 [ ] 11-15[ ] 16-20[ ]

above 20[ ]

SECTION (II)*: Respondents level of ICT literacy and presence of new technology in Electrical Engineering.** ***Please tick (√) your rating **(*1 = Not at all, 2 = in some classes, 3 = upon request and 4 = in all classes)***

1. How often do you use the following equipment or software in your teaching?	**Not at all**	**In some lessons**	**Upon request**	**In all lessons**
a) Desktop computers	[ ]	[ ]	[ ]	[ ]
b) Personal (laptops)	[ ]	[ ]	[ ]	[ ]
c) Mobile phones	[ ]	[ ]	[ ]	[ ]
d) Presentation lecture slides	[ ]	[ ]	[ ]	[ ]
e) CAD software	[ ]	[ ]	[ ]	[ ]
f) MATLAB software	[ ]	[ ]	[ ]	[ ]
g) Electronic Workbench software	[ ]	[ ]	[ ]	[ ]

h) Smart boards	[ ]	[ ]	[ ]	[ ]
i) Interactive whiteboards	[ ]	[ ]	[ ]	[ ]
j) LCD projector system	[ ]	[ ]	[ ]	[ ]
k) Video conferencing systems	[ ]	[ ]	[ ]	[ ]
l) Audio/Video equipment (CD/DVDs)	[ ]	[ ]	[ ]	[ ]
Other (*please specify below*) -- -- -- ---------------------------				

2. Please rate the following statements from a scale of 1 to 5 where

1 = strongly disagree

2 = Disagree

3 = neither agree nor disagree

4 = agree

5 = strongly agree

(i) The department have enough computers for teaching Electrical Engineering

[1] [2] [3] [4] [5]

(ii) The nature of classroom infrastructure supports ICT use in teaching Electrical Engineering

[1] [2] [3] [4] [5]

(iii) I receive quality ICT support in teaching Electrical Engineering in my department

1 2 3 4 5

(iv) My teaching workload reduces my ability to use ICT in teaching Electrical Engineering

1 2 3 4 5

(v) There is a comprehensive internet connectivity in my department

1 2 3 4 5

(vi) The classrooms where I teach from are connected to the internet

1 2 3 4 5

(vii) I need training in the use of some ICT equipment in my department

1 2 3 4 5

(viii) The institute is in the forefront towards the use of ICT in classroom teaching

1 2 3 4 5

(ix) ICT courses are provided to the staff frequently

1 2 3 4 5

(x) I feel my ICT expertise in classroom teaching is excellent

1 2 3 4 5

(xi) Personal initiative propels the use of ICT in teaching Electrical Engineering in my department. 1 2 3 4 5

(xii) Electrical Engineering syllabus is too wide for me to use ICT in teaching

1 2 3 4 5

(xiii) I usually simulate electronic circuits in my classroom to ascertain their functionality

1 2 3 4 5

(xiv) Give your general comments about what should be done to improve integrating ICT in the teaching of Electrical Engineering

…………………………………………………………………………………………

Thank you for participating in the study

Appendix II: Operational definition of terms

The following terms and definitions were used in this study:

ICT Integration - use of computer and Technology in teaching and learning Electrical Engineering subjects

Teaching – Delivery of knowledge and skills from Electrical Engineering subjects

Learning - acquisition of knowledge and skills from Electrical Engineering subjects

Electrical Engineering – TVET institution Engineering department offering diploma, Craft & Artisan curricula courses in Telecommunication, Instrumentation and Electrical power engineering

Technical institutions – Vocational technical colleges offering Technical and vocational training at the level of artisan, craft certificate, diploma and national polytechnics

Public technical Institutions- Vocational technical colleges offering Technical training at the level of artisan, craft certificate, diploma and national polytechnics

Financially supported by the Government

Private technical Institutions- Colleges offering Technical training at the level of artisan, craft certificate, diploma and national polytechnics owned or financed by private individuals/organizations

Technology - use of computers, laptops, mobile phones, software, smart phones, PDAs, iPads, projectors, smart boards, CAD software, application software, electronic workbench software etc.

Power option – Area of subjects that involved heavy current devises (Electrical power systems & Electrical machines)

Electronics option – Area of subjects that involved light current devises (Telecommunication systems, control systems & instrumentations systems)

Appendix III: Budget

This section outlines the estimates of the expected cost of the research study during the research process. Table 5.1 shows the budget used by the researcher during the research.

Table 0.1: Research Budget

ITEM	**QUALITY**	**UNIT COST(KSH)**	**AMOUNT (KSH)**
Research Assistant	4	10,000	50,000
Stationary	1	5,500	5,500
Research Instrument	1	5,000	5,000
Contingencies	1	30,000	30,000
TOTAL			**90,500**

Appendix IV: Research work plan

Table 5.2 shows the work plan used by the researcher

Table 0.2: Researcher's work plan

ACTIVITY	TIME FRAME	RESPONSIBLE PERSON	PROGRESS REPORT
Course work	August, 2012- August, 2013	Researcher	done
Identify problem	September,2013- December,2013	Researcher	done
Develop the proposal	January,2014– March, 2014	Researcher	done
Critic the Proposal	April, 2014- November, 2014	Supervisors	done
Present the proposal	December,2014	Researcher	done
Collect data	January, 2015- July ,2015	Researcher & Research assistant	Done
Analyze Data	July ,2015 September ,2015	researcher	Done
Compile a research report	September , 2015 - December , 2015	Researcher	Done
Submit the thesis	January ,2016	Researcher	Done

Appendix V: Research permit

CONDITIONS

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

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 5555

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MR. SOLOMON KEMBOI KIPLIMO
of UNIVERSITY OF ELDORET, 0-60100 EMBU,has been permitted to conduct research in *Nairobi County*

on the topic: *INTEGRATING INFORMATION COMMUNICATION TECHNOLOGY IN TEACHING ELECTRICAL ENGINEERING IN TECHNICAL INSTITUTIONS IN KENYA:A CASE OF NAIROBI COUNTY*

for the period ending:
4th December,2015

Permit No : NACOSTI/P/15/6250/6178
Date Of Issue : 30th June,2015
Fee Recieved :Ksh 1,000

Applicant's Signature

Director General
National Commission for Science, Technology & Innovation

Figure 5.1: Research permit