INVESTIGATION OF ATTITUDINAL FACTORS TOWARDS THE TRANSITION FROM FACE-TO-FACE TO E-LEARNING IN TANZANIAN HIGHER LEARNING INSTITUTIONS: A MIXED METHODS APPROACH

DALTON H. KISANGA

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ABSTRACT

This study investigated attitudinal factors in the transition from face-to-face to e-learning in Tanzanian higher learning institutions. Five objectives guided the study: first, it examined teachers' understanding of e-learning. Secondly, it examined teachers' attitudes towards e-learning. Further it developed an e-learning attitude scale. It also explored barriers that can hinder the transition from face-to-face to e-learning and finally, it identified strategies that can optimise teachers' and students' involvement in e-learning. The Technology Acceptance Model (Davis 1986) guided this study and a Test of e-Learning Related Attitudes (TeLRA) scale was developed to assess the teachers' attitudes.

The study used a mixed methods approach under the umbrella of pragmatic philosophical assumption. It involved 269 respondents, obtained through stratified simple random sampling and purposive sampling. Questionnaires, semi-structured interviews and documentary review were used in data collection. All quantitative and qualitative data were respectively analysed using statistical package for the social sciences (SPSS) and thematic analysis. Chi-square, logistic regression and multiple regression were performed to examine the association of variables and their predictive power. Principal Component Analysis (PCA) was used to derive empirical constructs from the developed TeLRA scale.

The findings revealed that teaching experience and qualifications had a statistically significant contribution to teachers' understanding of e-learning. Computer exposure and e-learning understanding had a statistically significant contribution to teachers' attitudes toward e-learning. Poor infrastructure, financial constraints, inadequate support, lack of e-learning knowledge and teachers' resistance to change also had a strong influence on the adoption of e-learning. The study also showed that *teacher-to-students* and *students-to-content* interactions as useful strategies to optimise teachers' and students' involvement in e-learning. Findings from this study have contributed to knowledge based on teachers' understanding of, and attitudes towards e-learning in Tanzania and assisted in developing a factorial valid and reliable attitude scale measure.

It is recommended that training in e-learning needs to be provided to teachers to widen their understanding of e-learning. There is also a need to strengthen factors associated with teachers' positive attitudes towards e-learning and to address the barriers identified in this study.

Key Words: Attitude; barriers to e-learning adoption; e-learning; higher learning institutions; teachers; TeLRA scale.

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ABBREVIATIONS

COL	Commonwealth of Learning
DIT	Dar es Salaam Institute of Technology
ICT	Information and Communications Technologies
IT	Information Technology
IVs	Independent Variables
HLI	Higher Learning Institution
LMS	Learning Management System
MoEVT	Ministry of Education and Vocational Training
Moodle	Modular Object-Oriented Dynamic Learning Environment
NACTE	National Council for Technical Education
NTU	Nottingham Trent University
ODL	Open and Distance Learning
OUT	Open University of Tanzania
SIDA	Swedish International Cooperation Agency
SIM	Student Information Management System
SPSS	Statistical Package for the Social Sciences
TAM	Technology Acceptance Model
TANESCO	Tanzania Electric Supply Company
TCU	Tanzania Commission for Universities
TeLRA	Test of e-Learning Related Attitudes
TEN/MET	Tanzania Education Network/Mtandao wa Elimu Tanzania
TERNET	Tanzania Education and Research Network

TOSRA	Test of Science Related Attitudes
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTCL	Tanzania Telecommunication Limited
UCC	University Computing Centre
UDSM	University of Dar es Salaam
URT	United Republic of Tanzania
UTAUT	Unified Theory of Acceptance and Use of Technology
VLE	Virtual Learning Environment
VETA	Vocational Education and Training Authority
VSAT	Very Small Aperture Terminal

DEFINITION OF SOME KEY TERMS

E-learning expert	....	is a person, working in an HLI, who is professionally trained in ICT, with intense practical experience in e-content development and online instructional design through research in the field of e-learning.
Higher Learning Institution (HLI)	....	refers to an academic institution such as a university, university college and higher technical education which award academic Higher Diploma and/or degrees as well as post-graduate degrees recognised by NACTE/TCU.
Principal	....	is a head of HLI which is not a university.
Teacher	....	is an academic professional who facilitates learning or supports/assist learners' education in HLIs.

DEDICATIONS

To my beloved wife Sarah your love, patience, and loving inspiration throughout my study were overwhelming. You have always been there whenever I sought your support. To my sons Brian, Isaac and Adrian who sustained the lack of attention and love during the whole period of my study.

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ABOUT THE AUTHOR

Dalton H. Kisanga, MEng (Comp S/W), BSc (Ed) is currently an Assistant Lecturer in the Department of Computer Studies at the Dar es Salaam Institute of Technology (DIT), Tanzania. He has been working at DIT for 20 years; as a tutor of Mathematics for 5 years and later as a tutor of Computer Programming for 15 years. From time to time (2002-2012), he has been a member to different National Council for Technical Education (NACTE) curriculum development and validation committees that developed as well as evaluated certificate, diploma, higher diploma and degree level curriculums.

He developed research interest on the impact of educators' attitudes towards electronic learning and teaching in higher learning institutions after teachers from three HLIs (including the one he is working with) rejected the use of Student Information Management Systems (SIMS). This prompted an inquiry as to why teachers, particularly long experienced and those from non-science/technology discipline rejected the new technology and how to address such a problem. The interest on the present study was further enhanced after attending African Virtual University (AVU) Capacity Enhancement Program workshops on design, develop, deliver and manage Open Distance and e-Learning programs (ODeL) in Senegal (2008) and Kenya (2009). Mr Kisanga is a member of two professional bodies, the National Council for Technical Education (NACTE) and the Teachers Service Commission (TSC) in Tanzania.

OBJECTIVES AND RESEARCH QUESTIONS AT A GLANCE

Objective		Research Question		Data Analysis	
				Analysis Method	Purpose
A	To examine teachers' understanding of e-learning.	1	What do teachers understand about e-learning?	Thematic Analysis.	To identify emerging themes and assess the level and diversity of teachers' understanding of e-learning.
		2	To what extent can teaching experience, teachers' qualifications, gender, and exposure to computers predict teachers' understanding of e-learning?	Logistic regression.	To examine predictive power of each variable to predict teachers' understanding of e-learning.
B	To examine teachers' attitudes towards e-learning.	3	What are teachers' attitudes towards e-learning?	Comparizon of Total scores against the median.	To examine percentage difference between teachers with positive and negative attitudes towards e-learning.
		4	Is there any association between teaching experience, teachers' qualifications, gender, exposure to computers, teachers' understanding of e-learning and teachers' attitude towards e-learning?	Chi-square test.	To asses the relationship between independent variables and attitude towards e-learning.
				Multiple regression.	To explore how well a set of independent variables is able to predict attitude towards e-learning.
C	To develop an attitude scale for measuring teachers' attitudes towards e-learning.	5	To what extent do themes of the developed attitude scale performed on explaining attitudes towards e-learning?	Principal Component Analysis (PCA).	To obtain a small but conceptually significant number of themes that explain attitudes towards e-learning.
				Computation of frequency and percentage.	To examine degree of agreement/disagreement with each item within themes of the developed scale.
D	To explore barriers that can hinder the transition from face-to-face to e-learning.	6	What are the barriers that can hinder the adoption of e-learning in Tanzanian HLIs?	Thematic Analysis.	To identify emerging themes that can reflect barriers affecting adoption of e-learning in higher learning institutions.
		7	What strategies can be used to address the barriers that can hinder the adoption of e-learning in Tanzanian HLIs?	Thematic Analysis.	To identify emerging themes that can suggest possible measures to address barriers of e-learning adoption.
E	To identify strategies that can optimise teachers' and students' involvement in e-learning.	8	What are the best strategies that can be used to optimise teachers' and students' involvement in e-learning?	Thematic Analysis.	To identify emerging themes that can suggest strategies to optimize teachers' and students' involvement in e-learning.

Research objectives, questions and analysis methods used

STRUCTURE OF THE THESIS

This Thesis is organised in six Chapters. Chapter One presents the *Problem and Its Context*, while Chapter Two provides the *Literature Review*. Chapter Three deal with the *Research Methodology*. Chapter Four presents the *Results* from the study and Chapter Five give the *Discussion* of findings. Chapter Six finally, presents the *Summary, Conclusions* and *Recommendations*.

CHAPTER ONE
THE PROBLEM AND ITS CONTEXT

1.0 Introduction

This chapter provides the Background Information to the study and a Statement of the Problem. The Chapter also presents Objectives of the Study; Significance of the Study; Scope of the Study; Limitations of the Study; and the Conceptual Framework that guided the study.

1.1 Background information

1.1.1 Tanzanian higher education system: An overview

Tanzania is located in East Africa, with a total of 885,800 km^2 of land (World Factbook 2012) and 44.9 million people growing at a rate of 2.7% per annum (URT 2013b). The Tanzanian formal education and training system has a 2–7–4–2–3+ format (URT 2010a). That is, 2 years of pre-primary education; 7 years of primary education; 4 years of secondary ordinary level education; 2 years of secondary advanced level education and 3 or more years of higher education (URT 2010a).

Institutions of higher education in Tanzania include universities, university colleges and higher technical education institutions (URT 2005). Universities and university colleges offers programmes leading to a certificate, diploma, degree, postgraduate diploma, postgraduate degree and honorary degree awards (URT 2005), whereas the higher technical education institutions offers professional programmes leading to a certificate, diploma, higher diploma, degree, postgraduate degree and other related awards (NACTE 2013). Medium of instruction in all HLIs in Tanzania is English with a face-to-face learning and teaching approach as the dominating delivery mode (URT 2009).

Higher education in Tanzania is governed by the two government bodies: Tanzania Commission for Universities (TCU) and National Council for Technical Education (NACTE). While TCU's role is to recognize, approve, register, accredit and coordinates the proper functioning of all universities and university colleges in Tanzania (URT 2005), NACTE oversees and coordinates the provision of technical education and training in all non-university institutions in Tanzania (URT 1997). In addition, both the TCU and NACTE coordinate students' enrolment in HLIs in Tanzania.

In order to cope with institutional changes and development, the government established the Directorate of Higher Education within the Ministry of Education and Vocational Training which aimed at developing policies, guidelines and regulatory frameworks for higher education as well as monitoring and review programmes and/project implementations in HLIs (MoEVT 2014). The unit also oversees and coordinates the three government agencies, which are Tanzania Commission for Universities (TCU), Tanzania Education Authority (TEA), and the Higher Education Students' Loan Board (HESLB). The key function of TEA is to support education institutions (elementary to tertiary level) improve their education quality, equity and access through grants and soft loans from its Education Fund (TEA 2010), whereas the main objective of the HESLB is to issue part/full education financial assistance (as loan) to poor and needy Tanzanian students, with admission in HLIs' programmes leading to higher diploma or degree awards, who cannot afford to pay cost of their education (HESLB 2014).

Despite the government commitment to higher education, HLIs are facing a number of challenges (see Sub-sections 2.2.4, p. 106 and 4.4, p. 241). Several national policies and strategies have been developed to address the situation. Some of them with a direct and immediate implication on higher education are The Tanzania Development Vision 2025; The National ICT Policy (2003); Education Sector Development Programme (2008) and the 2010-2015 Higher Education Development Programme (URT 2010c). Some of the policy documents are outlined in sub-section 1.1.10, p. 45.

1.1.2 ICT and higher education

In the past half a decade, there has been rapid development in technologies in almost every field of knowledge. Information and Communications Technology (ICT) has been used globally to embrace all these fields of technologies, from traditional ones such as broadcasting technologies (radio and television) to current ones such as computers, other mobile devices and the Internet. To date, many studies have been carried out to show how computers, mobile devices and the Internet can best be used to enhance efficiency, effectiveness, support and access to education at all levels of learning (COL 2003; Littlejohn and Pegler 2007; Weller 2007; Anderson 2008a; Garrison 2011, Salmon 2011; Meenakshi 2013).

Throughout this study, ICT will be used to mean all electronic media, which enable users to create, access, store, disseminate, communicate and manage information

(Meenakshi 2013). For the purpose of this study, *electronic media* includes communication media such as radio, television, computers, satellite systems, the Internet, hand held mobile/wireless electronic devices (such as mobile phones, personal digital assistants and smart phones) as well as various services and applications associated with them like all types of text, image, audio and video processing as well as transmission (Anderson 2008b; Wang and Wang 2010).

ICT is daily becoming of increasing importance in higher education. HLIs are experiencing changes, not only in terms of curricula but also the approaches to learning and teaching strategies (Weller 2007; Meenakshi 2013). These changes in learning strategies from traditional to dynamic interactive strategies based on the use of ICT, create a learner-centered learning environment which was not common in the traditional approaches of classroom learning (Ally 2008) and particularly in Tanzanian education system, which its education system is dominated by face-to-face learning at all education levels (URT 2009). However, the potential of using ICT in education varies according to how it is used (Haddad and Draxler 2002; see also Sub-section 1.1.10, p. 45) and to some extent on the available ICT infrastructure (Swarts and Wachira 2010; see also Sub-section 2.2.4, p. 106, Part i).

In general, integration of ICT into the education system has brought about the use of different terms that explain adoption and use of ICT in educational settings. Such terms are distance learning, online learning, electronic learning (e-learning) and many more (Salmon 2003; Abedi and Badragheh 2011; Guri-Rosenblit and Gros 2011). To set the pace for the discussion the terms are presented in the following sub-sections.

1.1.3 Defining distance learning

Mehrotra, *et al.,* (2001) define distance learning as an educational process whereby teaching is conducted by an educator who is separated with the learner in space and/or time. Isman (see Tavukcu, *et al*., 2011) defines distance education as a learning and teaching process through communication technologies and mailing services where both the teacher and students are at different locations. Further, Abedi and Badragheh (2011) define distance learning as a method of education whereby the learner is physically separated from the teacher and the institution that conducts the learning. Abedi and Badragheh went further by emphasizing the existence of a teacher, one or more students and a course or curriculum used to acquire knowledge.

The rapid development of ICT had influenced the definition of distance learning to gain a new dimension. Terms such as open and distance learning (ODL) as well as open and distance e-learning (ODeL) have been a result of such developments (Dahaner and Umar 2010; Ravasco 2012). However, the primary characteristic remains to be associated with distance in terms of place and time. In view of this, the author finds commonalities from these definitions that distance learning consists of educational processes amongst the teachers and students who are physically separated by time and distance by using varying forms of ICT.

1.1.4 Defining open and distance learning

The combination of open learning and distance learning gave rise to Open and Distance Learning (ODL). On defining open learning, Lewis (1986) stresses three key issues: centrality of learners' choice (that is, learner-directed training or independent learning); use of learning materials (resource-based learning) and, flexible methods of delivery where emphasis is on removal of restrictions or barriers inherited in the conventional classroom.

Stressing the flexibility of the learning, Khan (2005) inserted the term *flexible* and came up with open and flexible learning. Khan associated flexibility with learning at ones' own time, pace and place. Similarly, the Commonwealth of Learning, COL (2003) describes flexible learning to be associated with provision of learning opportunities "accessed any place and any time" (p. 9). Commonwealth of Learning relates flexible learning to "scheduling of activities rather to any particular delivery mode" (p. 9). However, Burge (2011) point out that flexibility is not a new term and thus, it cannot be realized by digital technologies alone. Burge describes flexibility to mean changing inflexible institutional structures, changing traditionally minded administrators, changing restrictive policies and open up accessibility as well as choice.

Similarly, Dahaner and Umar (2010) argue that openness is about structure and dialogue in learning, accessibility to educational resources and use of different technological strategies to increase access. Consequently, the author believes that the open learning approach removes constraints available in conventional learning and allows learner flexibility to choose content at any time, location and pace, as well as how the learning will be conducted.

Turning to the definition of ODL, COL (2000, p. 2) define it as:

> A learning that separates the teacher and learners in place or time, or in both place and time; learning that is certified by some institution or agency; uses

mixed-media courseware; two-way synchronous or asynchronous communication between learners and teachers; having a possibility of face-to-face interactions and learning with operations that assigns tasks to various staff who work together in course development teams.

In *synchronous* education, the learning process occurs between individuals at the same time (real time interaction), however, not necessarily at the same place, whereas in *asynchronous* education interactions can be limited, individuals can access education material at any time (Ally 2008; Tavukcu, *et al.,* 2011). Likewise, Dahaner and Umar (2010) define ODL as educational methods that use contemporary technologies in both synchronous and asynchronous communication where learners and teachers are physically separated from one another during part or all of the educational process.

By comparing the definitions of distance learning and that of ODL, the difference is hard to see. The relationship between them can be based upon the use of ICT. When distance learning uses emerging electronic media and associated experiences, then learning becomes highly flexible and the said differences fade away. It can also imply that, distance learning can exist without the use of ICT, whereas open learning may not necessarily imply distance learning.

Apart from the dynamic changing of technologies, learning as a process seemed to be the focus of both definitions and the *distance learning*, whether preceded with the term *open* or not, focuses on its limitations associated with distance, that is, separation in place and time between the teacher and learners.

1.1.5 Defining online learning

Carliner (2002) defines online learning as a synchronous or asynchronous educational event that occurs online, where the computer assumes the teacher's role. Ally (2008, p. 17) defines online learning as:

> The use of the Internet to access learning materials; to interact with the content, teacher, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience.

Ally's (2008) definition went further to include support provided to the learner during learning and the expected outcome of the learning process. In brief, his definition focused on the learner and the learning process.

However, both definitions show commonality, which can be summarized as the learning process where the leaner, interacts online with the content, teacher and other learners. The term *online* has been used to mean a state of connectivity in either networked or non-networked environments (Ally 2008). Thus, in online learning, Internet is used as the medium that allows online transfer of skills and knowledge in a manner not limited by time or place (Weller 2007). Therefore, online learning will be used to mean the whole process of learning and teaching online.

1.1.6 Defining e-learning

COL (2003, p. 9) define both online learning and e-learning as "applications of ICT used to enhanced distance education, implement open learning policies, make learning activities more flexible and enable these learning activities to be distributed among many learning venues.” In this definition, both online learning and e-learning are viewed as tools of distance education.

Brown (2003, p. 4) adopts Urdan’s and Weggen’s definition of e-learning as “the delivery of content (and interaction) via all electronic media, including Internet, intranets, extranets, satellite broadcast, audio/video devices and interactive television.” In line with Brown, Tavangarian, *et al.,* (2004, p. 274) define e-learning as:

> All forms of electronic supported learning and teaching, which are procedural in character and aim to effect the construction of knowledge with reference to individual experience, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media to implement the learning process.

Furthermore, Holmes and Gardner (2006, p. 14) define e-learning as “online access to learning resources, anywhere and anytime.”

Guri-Rosenblit (2009) claims that many scholars in higher education have been using the terms distance learning, online learning and e-learning interchangeably when referring to e-learning. Challenging the multiple meanings attached to the term e-learning, Sangra, *et al.,* (2012, p. 148-150) identify four general categories of definition associated to e-learning as:

> *Technology driven:* where learning is conducted by the use of electronic media such as Internet, intranets, hand-held mobile devices, video or audio devices, and computers;
>
> *Delivery system:* e-learning is defined as a method of delivering and accessing knowledge through ICT;
>
> *Communication, interaction and collaboration tool:* that is learning that supports all forms of interaction between and among learners, teacher and content facilitated by the use of ICT;

> *Educational paradigm:* where e-learning is defined as a means to supplement or enhance the traditional educational methods through the use of ICT.

Combining all four categories Sangra, *et al.,* (2012, p. 152) arrived at inclusive definition of e-learning as:

> An approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning.

The pattern of these definitions shows some conflicting views. COL (2003) identify e-learning as a tool of distance education, whereas Tavangarian, *et al.,* (2004) view electronic media whether networked or non-networked as tools of e-learning. Brown (2003) focus on the content and interactivity supported by electronic media.

Although most of these definitions are reflected in Sangra's, *et al.,* (2012) inclusive definition of e-learning, still *electronic media* is viewed to be the most fundamental in the e-learning, while time and location of the learner are secondary. This also implies that e-learning can exist without distance learning and in this perspective, ODL as well as online learning are sub-sets of e-learning, whereas distance learning can also be a sub-set of e-learning if it is facilitated by the use of electronic media.

In spite of these somewhat confusing definitions, most writers agree that, although not necessarily the most important factor, *technology* is still a very important component of modern learning and teaching (Tavangarian, *et al*., 2004; Weller 2007; Dahaner and Umar 2010; Guri-Rosenblint and Gros 2011; Sangra, *et al.,* 2012; Meenakshi 2013). Littlejohn and Pegler (2007, p. 16) argue that the reason for such fluctuating definitions of e-learning is that "…technologies that make e-learning possible continue to change and develop" every day, although it can also be doom to different perceptions of educational technology.

Thus, the usage of electronic media may not imply physical separation of the learner from the teacher at any particular learning process (Guri-Rosenblit 2009). Therefore, throughout this study, the term *e-learning* is adopted to mean all aspects of electronically supported learning (whether in networked/non-networked environments) whereby the learner is interacting with teachers, content and other learners regardless of place and time (Brown 2003; Sangra, *et al.,* 2012). Nevertheless, the author is not suggesting replacement of the traditional education approach that is face-to-face; rather to contribute a significant alternative that can enhance and extend education access to all.

In summary, the use of terminologies distance learning, open and distance learning, online learning and e-learning, and their roles in education may be confusing if the historical perspective that gave rise to them is unknown. In order to discuss the role of e-learning in education, it is helpful to have a historical overview of how it was developed. This is presented in the following sub-section.

1.1.7 Historical perspective of e-Learning

The historical overview of e-learning can be explained better in the context of technologies used in distance learning because the learning approach mediated the separation between learner and teacher through the use of technologies existed at that time (Sumner 2000). Generally, distance learning can be traced in the following four historical phases:

i. correspondence learning;
ii. learning through radio;
iii. multimedia learning; and
iv. Internet learning (Sumner 2000).

i. Correspondence learning

The first major correspondence programme where teacher and learner were at different geographical locations was established in 1800s at the University of Chicago in the United States of America (McIsaac and Gunawardena 1996). The dominant technology in correspondence learning was mainly printed textbooks accompanied by course guides (Garrison and Anderson 2003). This mode of teaching faced many challenges. Society took it to be inferior to formal education practice because it was provided out of the formal environment of schools and that it was for those who could not afford full time residence at an educational institution (McIsaac and Gunawardena 1996). Although communication was mainly bi-directional, correspondence learning built learners' independence in terms of time and place to access the materials (Garrison and Anderson 2003).

In Australia, the history of correspondence learning can be traced through post-secondary distance education with the first print-based distance education programme offered to university students in 1911 (Stuparich 2001). The main objective of the programme was to overcome the large distance that separated students from higher education institutions. From those early stages, correspondence institutions spread in other European countries (Alcala 2001). Today, the old mailing system can be replaced by e-mail and telephone, which can also be integrated into the Web and used in e-learning contexts (Garrison and Anderson 2003).

ii. Learning through radio

An addition to correspondence learning in Australia was the famous *School of the Air* program established in 1951 (BBDC, *et al.,* 2007). In this approach, radio was used as a medium that enabled children located in remote communities to access education (Mehrotra, *et al.,* 2001). Initially, programmes were unidimensional though with advancement of technology, interactive element through question and answer was included in each session (BBDC, *et al.,* 2007). This programme was faced with two main limitations caused by existing technology at that time. It depended on a pedal powered radio and it was expensive for enrolled children to own a radio without support from the government.

However, the *School of the Air* programme spread to many states in Australia and to other countries. To date, the programme has extended to secondary and adult education and uses more sophisticated equipment engaging two-way interactions for both teacher-to-students and students-to-students and is still operating (BBDC, *et al.,* 2007).

iii. Multimedia learning

The interest in using television in education started in the late 1940s when five institutions in the Iowa State in the USA went on air in 1948 (Jeffries [no date]). Such development continued to grow until 1961 when the National Education Television Network (NET) affiliated 53 television stations to share films and coordinated television schedules (Hull, see Jeffries [no date]).

In the early 1960s, the Midwest Programme on Airborne Television Instruction (MPATI) began broadcasting educational programmes to 2000 public schools and universities in six states of the USA (Jeffries [no date]). MPATI project was successful in that it brought together educators from the six states to establish inter-institutional curriculum material as well as organizing various autonomous school districts to work as a team so as to achieve a common educational goal (Jeffries [no date]). Apart from its successes, MPATI experienced some limitation. It was not interactive (uni-dimensional) to allow learners in remote areas engaged in learning, which gave rise to multimedia learning.

Aretio (see Alcala 2001) describes multimedia learning as having started in 1969, when the British *Open University* (OU) was founded. From that time, correspondence learning began to use developing technologies to provide highly effective distance education (McIsaac and Gunawardena 1996). This mode of teaching used printed materials accompanied by audiotapes, videotapes, radio and television broadcasts, and telephone as means of technology used to provide educational support (Alcala

2001). Keegan (see McIsaac and Gunawardena 1996) reports that with a direct result of its success, the British OU model has been widely adopted worldwide.

By the 1990s, the term *multimedia* took on its current meaning. Vaughan (2008) described multimedia as any combination of text, graphic art, sound, animation and video delivered by computer or other electronic or digital means. Multimedia learning aimed at producing and distributing learning and teaching materials to learners (Sumner 2000). With growth of technology, possibilities for communicative action through a two-way communication increased and were made possible through tele-conferencing (Sumner 2000; Aretio 2001).

Rama (see Tinio 2003) described *teleconferencing* as electronic communication interaction among people who are located at two or more different places. Teleconferencing embraces *audio-conferencing* (voice exchange), *audio-graphic conferencing* (exchange of voice and still images), *video-conferencing* (exchange of voice and moving images) and *web-based conferencing* which requires use of computer and Internet to transmit text, graphics, audio as well as visual media (Mehrotra, *et al.,* 2001). The *web-based seminar* (or webinar) is a practical example of a real time online learning that uses audio and visual components through the Internet to conduct lecturers, seminars, workshops and meetings (Amhag 2013).

Although the communication was two-way, the problem with such services was that it involves participants going to the associated centres for communication. Thus, it required users to be at a specific place and at a specific time thereby reducing time and space flexibility (Aretio 2001). Other limitation of teleconferencing is that streaming can be slow and connections may become problematic, resulting in delays in talk-time (Abedi and Badragheh 2011). Nevertheless, the most important factor to this technology was its capability to support two-way communication learning at a distance (Sumner 2000; Garrison and Anderson 2003; Amhag 2013).

iv. Internet learning

Internet learning is a solution to the communication barriers faced by traditional correspondence learning and early use of multimedia technologies (Aretio 2001). The evolution of the Internet and the World Wide Web (WWW) gave insights to training providers to explore their potential and find ways to improve learning (Garrison and Anderson 2003). Through the growth of the Internet and Web-based applications, interaction between and among teachers, students and content is now possible in the formal education process (Mehrotra, *et al.,* 2001; Al-Khashab 2007; Meenakshi 2013). However, the Internet is not the primary medium of learning, but rather it encourages online interactions in a manner not limited by time or place (Weller 2007).

Internet learning has extended its boundaries from wired Internet connections to wireless connections that employed the use of mobile devices. Significant development in the wireless technology was at the beginning of the year 2000 when landline telephones and wired devices were replaced by wireless technologies (Brown 2003). This brought a big impact to education institutions by exploring opportunities these wireless devices can bring in learning and teaching (Kukulska-Hulme 2005). Such exploration brought about a new concept termed as mobile learning or *m-learning* (Brown 2003; Hutchison, *et al.,* 2008; Wu, *et al.,* 2012; Abachi and Muhammad 2014).

In m-learning, leaners interact with teachers, content and other learners through the use of mobile/wireless devices regardless of place and time (Kukulska-Hulme 2005; Hutchison, *et al.,* 2008; Wu, *et al.,* 2012). Mobile devices include mobile phones, smartphones, tablets, iPads, notebooks and laptops. Like other forms of e-learning, m-learning has collaborative features where learners can share knowledge and experiences through short messages and emails (Ozuorcun and Tabak 2012). Moreover, m-learning has portability features that replaced hardcopy versions of books with electronic books or e-books (Abachi and Muhammad 2014). Mobile devices have some limitations including slow Internet connectivity in some places, limited batteries life span, small size screens, content security as well as frequent changes in device models and functionalities (Abachi and Muhammad 2014) although they offer a potential opportunity for learning if the limitations are appropriately addressed.

The most recent developments of e-learning include the Massive Open Online Courses (MOOCs), established in 2008 (Yuan, *et al.,* 2014), where learners can access learning materials using electronic media through the wired/wireless Internet. The arrival of MOOCs has changed the face of education such that leaners, regardless of their academic qualifications can get access to content of various fields of education online and free of charge (Yuan and Powell 2013).

The MOOCs have encouraged some higher education institutions to provide online courses through open learning platforms, such as edX (Yuan and Powell 2013). EdX is an interactive online learning platform initiated jointly by the Massachusetts Institute of Technology and Harvard University aimed to “enhance campus-based education, advance educational research, and increase access to online learning” (Ho, *et al.,* 2014, p. 4). Other higher education MOOCs platform include the *FutureLearn,* which provide online courses from leading UK Universities such as the Open University (OU), Universities of Bath, Birmingham, Bristol, Edinburgh, Glasgow, Nottingham and many more (FutureLearn 2014).

Like any other online learning programmes, MOOCs has technical limitations particularly for learners using mobile devices (as mentioned earlier) as well as pedagogical limitations particularly on whether or not learning offered by MOOCs would lead to quality learning outcomes and experiences for learners (Yuan and Powell 2013). Apart from these limitations, MOOCs is gaining popularity that attracts attention of HLIs to improve flexibility and accessibility of their offered programmes.

In summary, exploration of e-learning in terms of historical phases has been conducted so as to understand and describe technologies used at a particular point and not to label such components at a particular historical phase. Many technologies used in first and second generations such as radio, television, and telephone are still in use today though in more highly developed ways (Garrison and Anderson 2003; BBDC, *et al.,* 2007). Although, a number of criticisms and limitations have been raised against the use of electronic media in education in issues such as quality assurance in assessment and certification (Ndume, *et al.,* 2008), high investment costs (Salmon 2003; Guri-Rosenblit 2009) and controlling leaners' attention to learning (Ally 2008), their potential to supplement traditional face-to-face classroom learning and extending education access to leaners regardless of geographical location have played a significant role in education. The next sub-section present the benefits of e-learning.

1.1.8 Benefits of e-learning

E-learning is viewed as an essential component for any modern education institution in learning as well as teaching, and it has also challenged HLIs to redefine their teaching and research practices (Guri-Rosenblit 2009; Castillo-Merino and Serradell-Lopez 2014). A significant advantage of e-learning is that it improves access to quality educational materials through the availability of e-learning resources created over many years. Zehry, *et al.,* (2011) point out that e-learning not only develops online and Information Technology (IT) skills for users, but also makes revising and updating of electronic educational materials simpler as well as quicker than for printed materials. If education institutions are moving toward the use of the Internet for delivery, both on campus and at a distance, then there can be a perception that e-learning provides major benefits.

i. Benefits for learners

E-learning is not bounded by time zones, location and distance. Learners can have access to electronic contents at any time, around the clock and at disperse physical locations (Holmes and Gardner 2006). A key advantage of e-learning is when learners have control over the content, learning sequence, pace of learning, time and, often, media offering choices to suit different learning styles (Hill 2003; Zehry , *et al*., 2011).

Ally (2008) pointed out that certain types of ICT such as teleconferencing technologies enable instructions to be received simultaneously by multiple, geographically dispersed learners (for example, one-to-many videoconference). Also e-learning allows learners to access electronic materials without an interaction with the teacher (Ally 2008). Learners can use the Internet to access up-to-date and relevant learning materials because with e-learning teachers can easily and quickly change as well as modify their learning contents and be available to the learning audience across the world (Ally 2008).

ii. Benefits for teachers

E-learning allows certain activities that were previously done by teachers to be carried out by electronic devices. Hill (2003) pointed out that in e-learning, many routine teaching activities such as delivering information and organizing learners' activities are carried out by the computer, leaving the teacher to concentrate on learners and learning.

The view that teaching can take place at any time and location implies that teachers can cut down travelling time, costs (Salmon 2011) and environmental pollution allowing them to be more involved in learning and teaching activities. Concurrently, e-learning provides an opportunity for teachers to evaluate and up-date their materials through contributions received from other experts in the same field, for quality assurance (Hill 2003).

Ally (2008) adds that teachers can deliver electronic materials on any machine over the Internet or company's intranet (cross-platform) without having to develop a different course for each unique platform. With e-learning, access of materials can be controlled. For example, in online learning, teachers can direct and scrutinize who receives online training, when, how many times, and in what sequence (Ally 2008). If designed properly, e-learning can be used to determine learners' needs and their current level of expertise, and assign appropriate materials for learners to select so as to achieve their expected outcome (Ally 2008), that is, personalized learning.

iii. Benefits for education institutions

The potential of e-learning technologies has enabled institutions to reach new learners at a distance, increase convenience of and expanding education opportunities (Weller 2007; Salmon 2011). Teachers and learners no longer have to rely exclusively on printed books and other materials in physical media available in libraries and in limited quantities for their educational needs (Holmes and Gardner 2006). With the Internet, the World Wide Web and e-books, a wealth of learning materials in a wide range of subjects and in a variety of media can be accessed from any location and time of the day by an unlimited number of people (Mehrotra, *et al.,* 2001; Ally 2008). That is particularly significant for many education institutions in developing countries that have limited and outdated library resources (Jhurree 2005).

Moreover, e-learning being mostly or entirely conducted off-site helps institutions reduce the demand on institutional infrastructure such as buildings and therefore, alleviates capacity constraints and consequently increasing student enrollment (Weller 2007; Castillo-Merino and Serradell-Lopez 2014).

iv. Benefits for governments

Naluyaga (2010) comments that e-learning can help to solve the problem of shortage of teachers due to the fact that one teacher is able to teach many learners at the same time. For this reason, the government, in most developing countries, e-learning can be the best alternative to cope up with a high number of student enrolments in the constrained physical campus (Weller 2007). Weller argues that governments can build virtual institutional infrastructures rather than physical buildings at a reasonable low cost.

Benefits from e-learning can be practical when institutions can substitute some online provision for on-campus face-to-face teaching, instead of duplicating it, thereby facilitating peer learning and use of standard or pre-existing software as well as learning objects (Guri-Roseblint 2009). When used, these strategies are more likely to reduce the operational and maintenance costs of e-learning and thus, become more economical, especially for a developing country like Tanzania. Despite the benefits e-learning can offer it is not free of challenges. This is explored in the next section.

1.1.9 Challenges of e-learning

The main challenge of e-learning is how to offer pedagogical experience equivalent to that of face-to-face learning with a knowledgeable, sympathetic and well-equipped teacher to a large number of learners in geographically dispersed and socially diverse settings (Mayes 2001). Garrison and Anderson (2003) argue that quality learning in a knowledge-based future will depend on the ability to access and understand information, that is, ability to order and construct knowledge. This is another challenge, since there appear to be no simple rules for designing and delivering an effective e-learning experience, although many suggested how can be made (for example, Mehrotra, *et al.,* 2001; Salmon 2003; Holmes and Gardner 2006; Bradshaw and Vanhegan 2009; Pitman 2013).

Al-Khashab (2007) describes other possible challenges in preparation and operation of e-learning. Firstly, is the Internet connections speed and access capability to ICT for both educators and students, which depend on technological infrastructures that exist in place and time. This also includes similar accessibility challenges caused by the use of mobile devices as outlined earlier. Secondly, is the cost implication to its development and implementation. Many e-learning platforms require expensive technical support, adequate infrastructure and the high cost of electronic media (Salmon 2003; Holmes and Gardner 2006; Weller 2007; Guri-Roseblint 2009).

The third challenge is learners' motivation and initiative (Al-Khashab 2007). Al-Khashab argues that many students have relatively high confidence and experience in using ICTs rather than the e-learning platform. Al-Khashab suggests that contents should be developed so as to increase learners' interest level to e-learning platform. This was also observed by Guri-Roseblint (2009) who adds that students can be inactive in e-learning settings if the content in the self-study package does not engage them in stimulating activities (see also Castillo-Merino and Serradell-Lopez 2014).

Thus, addressing challenges of e-learning is a collaborative task in all aspects between educators, technologists, and researchers to create a combination of learning activities that are appropriate to students’ needs, teachers’ skills and style, learning objectives of the programme, institutional technical capacity and available software resources (Ally 2008). Challenges of e-learning adoption in HLIs are further explored in Sub-section 2.2.4, p. 106.

1.1.10 E-learning in Tanzania

i. Background

Like other countries in Africa, Tanzania is experiencing a rapid increase in use of ICTs. For instance, the number of mobile cellular subscriptions has increased to 27 million by September 2013 compared to 8.5 million in June 2007 (World Factbook 2012; URT 2013c) ranking the country as 39th in the world mobile cellular subscribers’ table (World Factbook 2012).

Similarly, the number of Internet users had rapidly increased to 4.8 million by June 2010 from 680,000 in 2009 (URT 2010b; World Factbook 2012). This figure accounts for only 11% of the Tanzanian population, out of whom, 2.6 million where from different organisations/institutions, 1.9 million from household or individual and 0.3 million from Internet cafes (URT 2010b).

Furthermore, the number of Internet users per access type in the country shows a growing trend for mobile wireless technology. By June 2010, Tanzania had 2.2 million Internet users from mobile wireless devices which is about double the figure recorded in 2008 (URT 2010b). Compared with other Internet access type such as cable modems, fixed wireless, VSAT and other broadband (3Gs, WiFi and WiMax), mobile wireless users are growing at an average rate of 42% per year (URT 2010b). With the increasing usage of mobile handsets for Internet services, the number of Internet users is expected to rise at a relatively higher rate than those in cybercafes and organisations/institutions (URT 2010b).

In 2009, Tanzania received the first of the three competing sub-marine fibre optic cables as an alternative technology to satellite (Kasper 2009). With such cable, Tanzania expects to increase capacity of peer-to-peer networks, Internet services, high definition television broadcast and substantially reduce costs for data transfer (Smit 2011). Swarts and Wachira (2010) claim that the National fibre optic cable network, also named as the National ICT Broadband Backbone (NICTBB, see www.nictbb.co.tz, accessed 16/11/2014), is expected to lower telecommunication costs by 95%. To date, the system is connected to several countries including South Africa, Mozambique, Kenya, Rwanda, Uganda, Djibouti, Ethiopia, Botswana, Lesotho, Namibia, Swaziland and Zimbabwe (Smit 2011).

ii. Towards e-learning: Policies and strategies

Investment in education and human resource development are among the main focus of successive governments. Tanzanian government's support to e-learning is demonstrated in policy papers and initiatives. For example, in 1996 Tanzania launched a National Science and Technology Policy, which among other things advocates the integration of science and technology in education and provide a provision for adequate science and technology learning and teaching facilities in education (URT 1996). In 2003, the National ICT policy was launched, which, among other things, emphasizes support for the creation and development of ICT materials by encouraging local content development for electronic activities/services and promoting inclusion of schools in local multi-media development (URT 2003a).

To harmonize ICT and education initiatives the government, through the Ministry of Education and Vocational Training, developed an *Information and Communications Technology (ICT) Policy for Basic Education* in 2007 that would, among other things, structure the adoption of ICT within the education sector (URT 2007). The policy suggests the use of a number of technologies, such as radio, computers, mobile phones and the Internet (Swarts and Wachira 2010). The area prioritised were Teachers' Training Colleges (TTCs) followed by secondary schools and finally, primary schools (URT 2007). In this study, public TTCs are governed by the Ministry of Education and Vocational Training and therefore, they are not under TCU or NACTE.

To date, each of the 34 government TTCs has 30 thin client computers and a networking infrastructure that allows participating teachers to exchange information with their peers in other colleges (Hooker, *et al.*, 2011). For the primary and secondary education, there have been disjointed initiatives through different stakeholders and the Ministry. For instance, in 2005 the electronic school (e-School) forum was formed (Swarts and Wachira 2010), which aimed at installing ICT in secondary schools, starting with 200 schools in phase one to 2000 schools in phase 2 over a period of five years with a target of all schools in 2015 (Swarts and Wachira 2010). A more up to date data at present is unknown.

Furthermore, the Ministry of Education and Vocational Training is currently supplementing classroom learning with radio and television broadcast programmes and in addition, an ICT curriculum for both pre-primary and primary schools is now in operation (Mwalongo 2011). The other most recent initiative is the e-reader project, which is supported by the United Nations High Commissioner for Refugees (UNHCR) and a non-profit enterprise *Worldreader*, which aimed at providing electronic learning to 2,300 students in four secondary schools in Western Tanzania (Williams 2014).

Finally, HLIs in Tanzania have made a significant investment in ICTs. Hooker, *et al* (2011) report that all universities have computer centres connected through satellite, available for both teachers and students. Moreover, education and research networking activities are mushrooming with e-learning as a strategy to increase access becoming the key development point for many HLIs (Swarts and Wachira 2010; Hooker, *et al*., 2011).

iii. Education and research networking

Education and research networking activities in Tanzania began to take shape in 2007 when the National Research Education Network (TENET), which was later renamed Tanzania Education and Research Network (TERNET), was established (Bakari, *et al.,* 2007). As a representative of HLIs and research organizations in Tanzania, TERNET aims at providing platforms to enable the sharing of education and research resources, particularly in aspects related to Education Management Information Systems (EMIS), e-libraries, research databases as well as e-learning capacity development and enhancement (Swarts and Wachira 2010). Most of TERNET initiatives are in the infant stage and are operated based on volunteered contributions from member institutions.

To date TERNET is part of UbuntuNet Alliance, a regional association of National Research and Education Networks (NRENs) in Africa, which aims to develop and connect all research and education networks in Africa to research and education networks worldwide (UbuntuNet Alliance [no date]). TERNET's long term plan is to utilize the national ICT backbone network to connect institutions in all regions of Tanzania consequently, contributing to the country's economic and educational developments (Bakari, *et al.,* 2007).

Although one of the TERNET aims is improving e-learning capacity development and enhancement, earlier studies indicate that use of digital e-learning environments has formally been adopted by the Open University of Tanzania (OUT 2014) and the University of Dar es Salaam (Ngugi, *et al.,* 2007; Nkwera 2011; Hooker, *et al*., 2011). Similar initiatives for adopting e-learning are also emerging in other institutions such as Sokoine University of Agriculture (Sanga, *et al.,* 2013).

iv. E-learning experience at the Open University of Tanzania

The Open University of Tanzania (OUT) is an accredited government institution that offers degree and non-degree courses through open and distance learning mode (Mnyanyi, *et al*., 2010; OUT 2014). The content delivery mode at OUT is through "broadcasting, telecasting, ICT, correspondence, enhanced face-to-face, seminars, contact programmes or the combination of any two or more of such means" (OUT 2014, p. 4).

In facilitating learning, OUT has developed an e-learning platform called OUT Learning Management System, OUTLeMS (see http://elms.out.ac.tz/login/index.php accessed on 21/04/2014) where most of the education resources are placed for students to use (Sanga, *et al.,* 2013). To date, OUT offers two Master degree programmes through blended learning (that is e-learning used in conjunction with face-to-face teaching), one in International Cooperation and Development, and the other in Humanitarian Action, Cooperation and Development (OUT 2014).

Apart from these initiatives, implementing e-learning at OUT has not been smooth. As an ODL institution in Tanzania, OUT is facing several challenges pertaining to e-learning development among course lecturers and students (Mnyanyi, *et al*., 2010). They include low digital bandwidth, lack of expertise in e-learning, inadequate ICT infrastructures, inadequate human resources, high costs of e-learning equipment and attitudinal factors (Mnyanyi, *et al*., 2010). The main attitudinal factor that affected the promotion of e-learning was teachers' negative attitude towards e-learning as an effective means for learning and teaching (Nihuka and Voogt 2011). However, with the submarine fibre in place, HLIs are expected to greatly benefit by using high speed Internet connections for research and education (Hooker, *et al*., 2011).

v. E-learning experience at the University of Dar es Salaam

The University of Dar es Salaam (UDSM), like other public universities in Tanzania, is facing the problem of high congestion in its campuses due to an increase in student enrolment (Nkwera 2011). In order to circumvent the problem of congestion and sustain the academic programme, UDSM has launched three Open Distance e-Learning Centres (ODeL) in three regions, namely Arusha, Mwanza and Mbeya, so as to enable off-campus students to take part in the university programmes online (Nkwera 2011).

The e-learning programmes have a few face-to-face sessions that are conducted at the University of Dar es Salaam main campus and at ODeL centres (Kigombola 2013a). Students access learning materials and conduct online discussions with their lecturers through a UDSM Moodle Learning Management System (Munaku 2013) available at http://lms.udsm.ac.tz (accessed on 21/04/2014). Currently, the centres have started to offer Bachelor of Business Administration, Master of Engineering Management, Post-Graduate Diploma in Education and a Post-Graduate Diploma in Engineering Management (Kigombola 2013b).

1.1.11 A need for e-learning in Tanzanian HLIs

E-learning has, over recent years, become ever more popular and it is gaining wide acceptance as a "non-traditional" mode of accessing higher education (Altbach, *et al.,* 2009).

Several factors have hastened the need for e-learning in Tanzania. These include global technological change (URT 2007; Altbach, *et al.,* 2009), scarcity of resources and buildings in terms of teachers, education materials and congestion in classrooms (URT 2009; URT 2010c) as well as an increase in student enrolment in HLIs against the number of teachers graduated from the universities resulting in high teacher-to-student ratio (URT 2010a). These are explored in the next sub-sections.

i. Global technological change

Globalization and technological change processes that are rapidly developing have created a new global economy "powered by technology, fuelled by information and driven by knowledge" (Tinio 2003, p. 3). Emergence of a new global economy has serious implications for the nature and purposes of education institutions. As access to information continues to grow exponentially, academic institutions cannot remain as mere venues for transmission of prescribed sets of information from teacher to students over a fixed period of time (Jhuree 2005). Rather, schools must promote "learning to learn," that is, acquisition of knowledge and skills that make possible continuous learning over their lifetime (Ally 2008).

Tanzania, like other developing countries, cannot afford to stay passive in the face of e-learning if they are to compete in the global market, which is increasingly being driven by knowledge and information instead of manufacturing industries (URT 2007). Jhurree (2005, p. 468) commented that:

> For countries to compete with each other in the global information-based and knowledge-based economy, they need a workforce that is skilled in the use of technology to gain the necessary competitive edge over one another. Hence, it is no longer a question of if technology should be integrated in the school setting, but a question of when and how to integrate technology so that it benefits all the parties concerned – students, teachers, administrators, parents and the community.

The health of any country's economy, poor or rich, developed or developing, depends substantially, on the level and quality of education of its people (Meenakshi 2013). Education reform is occurring throughout the world and among the tenets of the reform it provides is the introduction and adoption of e-learning in the education system (Jhurree 2005; Weller 2007; Garrison 2011; Meenakshi 2013).

ii. Scarcity of resources and high student enrolment pressure

The Tanzanian education system is dominated by face-to-face learning at all education levels (URT 2009). The system has witnessed an increasing number of students, which overwhelms available resources and infrastructures, from elementary to tertiary levels (URT 2010c). For example, in secondary education, which include both government and non-government secondary schools from year one (Form 1), to year six (Form 6), student enrolment increased from 675,672 in 2006 to 1,638,699 in 2010 (URT 2010a). The rapid increase of enrolment has been a result of the Government initiative of constructing at least one secondary school for each Ward all over the country (URT 2010a). However, such an increase was not related to the supply of teachers. For example, from 2005 to 2009, over 300 public secondary schools were built by communities so as to supplement government efforts; this led to a shortfall of over 25,000 secondary school teachers (Naluyaga 2010).

Similar situation exists in primary education. For instance, in 2008, Tanzania was facing a shortage of 110,000 teachers (TEN/MET 2010) rendering the teacher-to-students ratio very unsatisfactory. Teacher-to-student ratio in some primary schools in both urban and rural area are as high as 1:90 (URT 2009; TEN/MET 2013) instead of the targeted national classroom-pupil ratio of 1:40 (URT 2012). In such a situation, interactive learning and individual attention from teachers is impossible due to big class sizes (URT 2009).

The increase of student enrolment has a large impact on HLIs, and this creates a challenge to the quality of education provided. In 2010/2011, Tanzania had 135,367 students admitted in public and private universities, which was about triple the figure recorded in 2006/2007 (TCU 2012). Besides, other students, despite their good passes, are denied access to HLIs due to insufficient physical and human resources, and other associated problems. For example, in 2007/2008 the University of Dar es Salaam enrolled only 6,329 (30%) out of 21,156 qualifying applicants (TCU 2012). Recent statistics shows a similar trend, whereas only 7,104 students out of 16,610 applicants were admitted in the 2010/2011 academic year at the same university (TCU 2012). Consequently, e-learning can be an appropriate and desirable solution (Sanga, *et al.,* 2013).

1.2 Statement of the problem

The Tanzanian education system is in transition from face-to-face classroom learning to e-learning (URT 1996; URT 1998; URT 2003; URT 2007; URT 2008; URT 2010c). Therefore, e-learning is a new learning approach in Tanzanian HLIs, which demand knowledge from education stakeholders prior its acceptance and implementation. Teachers are the key stakeholders of all formal education, their knowledge of e-learning has a significant impact on their decision of whether to accept or reject e-learning (Rogers 2003). Acceptance or rejection of e-learning is a social phenomenon where attitude has an important role to play. Literature shows that teachers' attitudes on adoption of new technology have significant impacts on successful implementation and the formation of students' attitudes towards technology (Sun, *et al.,* 2008; Gibson, *et al.,* 2014). Therefore, investigating their knowledge of, and attitudes towards e-learning was very essential.

In addition, other factors may also have an impact towards education transformations. These can include but not limited to adequate infrastructure and support that can address constraints caused by high student enrollment rate in HLIs every year (URT 2010c; TCU 2012). Student enrolment in Tanzanian HLIs appears to be increasing at a greater rate than teacher recruitment rate (see Sub-section 1.1.11, p. 51) causing pressure not only in the buildings and teaching resources, but also to the face-to-face learning and teaching method exist. Despite government efforts to combat such challenges through different initiatives (see Sub-section 1.1.10, p. 45, Part ii), more effort is needed to interpret these initiatives in the education system as well as addressing constraints in resources and infrastructure if learners are truly to benefit from the education provided by HLIs in Tanzania. Therefore, a need to investigate potentials of e-learning as a supplement approach to the present face-to-face education system was also essential.

Many researchers have investigated the role of e-learning in the education systems (for example, Stuparich 2001; Garrison and Anderson 2003; Littlejohn and Pegler 2007; Weller 2007; Clarke 2008; Garrison 2011). These scholars suggest that e-learning is the best alternative to cope with constraints of access to education. Literature demonstrated successful results from using e-learning approach in terms of improving efficiency, effectiveness, time and access of education at all learning levels (see Sub-section 1.1.8, p. 40).

One main feature of success from using e-learning depends, to a considerable extent, on the teachers' attitudes towards e-learning systems (see Sub-section 2.2.2, p. 89). Teachers play a key role in the integration of new technology in the learning and teaching process. Many studies conducted on teachers' attitude toward e-learning (for example, Teo, *et al* 2009; Zhou, *et al.,* 2010; Hong, *et al* 2011; Nair and Das 2012; Bourgonjon, *et al.,* 2013; Gibson, *et al.,* 2014; Ndibalema 2014) have provided significant contributions to education stakeholders on how e-learning can be accepted, planned and implemented for future as well as continuous successful learning. However, most studies that focus on teachers' attitudes towards e-learning originate in parts of the world, that is not Tanzania (for example, Teo, *et al.,* 2009; Hong, *et al.,* 2011; Teo, *et al.,* 2011; Gibson, *et al.,* 2014).

Studies conducted in Tanzania have mainly tended to focus on challenges for integrating ICT into the education system (for example, Kessy, *et al.,* 2006; Sife, *et al.,* 2007; Hare 2007; Komba 2009; Tedre, *et al.,* 2010; Hooker, *et al.,* 2011) and others on implementation of e-learning (Ndume, *et al.,* 2008; Mnyanyi, *et al.,* 2010; Nihuka and Voogt 2011; Nagunwa and Lwoga 2012; Sanga, *et al.,* 2013). Apart from Ndibalema's (2014) study which investigated teachers' attitudes towards e-learning in Tanzania, studies by Mtebe and Raisamo (2011), Nihuka and Voogt (2011) as well as Ndume, *et* *al.,* (2008) presented attitudinal factors focused on aspects not related solely to teachers' attitudes towards e-learning.

Ndibalema (2014) investigated teachers' attitudes towards the use of ICT as a pedagogical tool in Tanzanian secondary schools. The results showed that teachers had positive attitude towards using ICT as a pedagogical tool, however, he used descriptive statistics to arrive at his findings. His findings would have been more useful if he had investigated factors that influenced teachers' attitudes and examined if they had any statistical significant association with teachers' attitudes. Moreover, his study involved only 90 teachers from secondary schools in one district in a single region.

Mtebe and Raisamo (2011) used Unified Theory of Acceptance and Use of Technology (UTAUT) to investigate teachers' intention to adopt and use open educational resources (OER) in teaching in Tanzanian HLIs. The results showed that out of the four key constructs of UTAUT that are direct determinants of usage intention, only *effort expectancy* had statically significant positive effect on instructors' intention to use OER. However, their study did not investigate the role of teachers' attitudes as well as demographic characteristics such as gender, age, teaching experience and qualifications in explaining teachers' intention to adopt and use OER in teaching. Moreover, data were collected among 104 teachers through emails which could bias the findings as only those who have ICT skills and experience could participate in the study (Unwin, *et al.,* 2010).

Nihuka and Voogt (2011) measured teachers and students' perception as well as perceived benefit of e-learning, whereas Ndume, *et al.,* (2008) examined personal acceptance of e-learning and certification obtained through an online programme. Although both studies revealed supportive findings to e-learning, the former study involved teachers and students from only one university whereas the later involved teachers and students from two HLIs. Tanzania has 47 public and private registered universities and university colleges (TCU 2014) and 166 public and private registered HLIs, which are not universities (NACTE 2012). Moreover, both studies did not provide factors that could influence their participants' perceptions towards e-learning and no statistical significant tests were conducted to supplement their findings.

Although Ndibalema (2014), Mtebe and Raisamo (2011), Nihuka and Voogt (2011) and Ndume, *et al.,* (2008) have contributed knowledge to the body of literature, they place less emphasis on investigating teachers' demographic characteristics, which could considerably influence teachers' attitudes towards e-learning. The assumption that teachers would always accept a technology out of its usability and usefulness can be misleading. Holden and Rada (2011) remark that many technologies have been rejected by targeted users regardless of their perceived usability and usefulness because they "were developed without an adequate understanding of the target user population" (p. 344).

Literature also shows that most of studies in teachers' attitudes towards e-learning (for example, Teo, *et al.,* 2009; Hong, *et al.,* 2011; Teo, *et al.,* 2011; Pynoo, *et al.,* 2012) were quantitative describing teachers' attitudes towards e-learning but did not incorporate participants' perceptions that describe their opinions and understanding on the phenomenon under investigation. Thus, a need to gain full understanding of the phenomenon arose whereby both quantitative and qualitative data were to be used in a single research. *Quantitative* research approach is a research strategy in which its data collection and analysis are based on quantity, whilst *qualitative* research approach is a strategy that focuses on words (non-quantifiable data) during data collection and analysis (Bryman 2012).

This study responds to this knowledge gap and investigated attitudinal factors that influence the transition from face-to-face to e-learning in Tanzanian HLIs. The study of attitudinal factors in Tanzania and the development of the Test of e-Learning Related Attitudes (TeLRA) scale (see Sub-section 3.6.1, p. 149) are contributions to knowledge that have been brought by this study.

1.3 Objectives of the study

1.3.1 Main objective

The main objective of the study was to investigate attitudinal factors affecting the transition from face-to-face to e-learning in Tanzanian HLIs.

1.3.2 Specific objectives

The study had the following specific objectives:

i. To examine teachers' understanding of e-learning;

ii. To examine teachers' attitudes towards e-learning;

iii. To develop an attitude scale for measuring teachers' attitudes towards e-learning;

iv. To explore barriers that can hinder the transition from face-to-face to e-learning; and

v. To identify strategies that can optimise teachers' and students' involvement in e-learning.

1.3.3 Research questions

The following research questions guided the study:

	Objectives		Research Questions
A	To examine teachers' understanding of e-learning.	1	What do teachers understand about e-learning?
		2	To what extent can teaching experience, teachers' qualifications, gender, and exposure to computers predict teachers' understanding of e-learning?
B	To examine teachers' attitudes towards e-learning.	3	What are teachers' attitudes towards e-learning?
		4	Is there any association between teaching experience, teachers' qualifications, gender, exposure to computers, teachers' understanding of e-learning and teachers' attitude towards e-learning?
C	To develop an attitude scale for measuring teachers' attitudes towards e-learning.	5	To what extent do themes of the developed attitude scale performed on explaining attitudes towards e-learning?
D	To explore barriers that can hinder the transition from face-to-face to e-learning.	6	What are the barriers that can hinder the adoption of e-learning in Tanzanian HLIs?
		7	What strategies can be used to address the barriers that can hinder the adoption of e-learning in Tanzanian HLIs?
E	To identify strategies that can optimise teachers' and students' involvement in e-learning.	8	What are the best strategies that can be used to optimise teachers' and students' involvement in e-learning?

Table 1.3.1: Objectives and research questions**.**

1.4 Significance of the study

The study would be of great importance to different educational stakeholders in Tanzania. In particular, to teachers and e-learning professionals, results from the study have created knowledge about e-learning including practical implementation strategies for quality e-learning. Results can also guide them to prepare e-learning instructions which can encourage effective communication as well as interaction at all levels. Moreover, results unveiled teachers' new roles and responsibilities in e-learning environments and ways to adapt to this change.

To principals of HLIs and the Ministry of Education and Vocational Training, the study increased awareness of e-learning and factors for teachers' attitudes towards e-learning. It also pointed out the barriers that can hinder the adoption of e-learning in HLIs. Identification of barriers and attitudinal factors will assist in planning as well as increase effectiveness in adoption of e-learning by dealing with the barriers and factors leading to negative attitudes while strengthening factors leading to positive attitudes. Lastly, this study developed a new e-learning related attitudes test scale that can be used by researchers in a similar field of study in any country.

1.5 Scope of the study

The study focused to teachers and principals from four HLIs that were not practicing formal e-learning programmes. The term *formal* is used to emphasise registered and operating e-learning programmes leading to academic higher diploma or degree awards. The study was also focused to e-learning experts from two other HLIs that were engaged in formal e-learning programmes.

Furthermore, the study focused on selected variables as determining factors for teachers' attitudes towards e-learning as explained in the theoretical framework (see Sub-section 2.1.4, p. 82). In particular, teachers' understanding of e-learning, teachers' attitudes towards e-learning and the effects of gender, teaching experience, qualification as well as computer exposure to teachers' understanding of, and attitudes towards e-learning were explored. Similarly, factors affecting the adoption of e-learning in HLIs including strategies to address them were also explored. Given the delimitation, findings from this study may be limited to the six HLIs involved in the study. Therefore, they might not be generalized to all HLIs in all regions across the country, though they will be of interest.

1.6 Limitations of the study

This study used questionnaires as the main data collection tool. One of the disadvantages of this research instrument is that respondents may provide false responses different from their actual beliefs and feelings towards e-learning (Denscombe 2010; Robson 2011). However, the limitation was minimized by using both close-ended and open-ended questions, semi-structured interviews and documentary review, which helped in cross-checking responses (Becker and Bryman 2004; Denscombe 2010).

In addition, responses expressed by interviewees may be partly subjective, that is, they could be influenced by personal and social experiences and background within their working environment (Bryman 2012). Therefore they cannot be over generalized beyond such context. However, again, the limitation was minimized by using close-ended questions, open-ended questions, and documentary review for *data triangulation* (see Sub-section 3.7.2, p. 157), which improve the reliability of the interview approach.

1.7 Definitions of concepts

The following are definitions of key concepts that have been used throughout the study. They are defined to help the reader understand how they were used in the context of this study.

Attitude: Attitudes are positive or negative evaluative judgements of an entity based on affective, cognitive or behavioural experience (Schwarz 2007).

E-learning: E-learning connotes for all kinds of electronically supported learning (whether in networked/non-networked environments) where the learner interacts with teachers, content and other learners regardless of place and time (Brown 2003; Sangra, *et al.,* 2012).

Information and Communications Technology (ICT): Information and Communications Technology mean, all electronic media, which enable users to create, access, store, disseminate, communicate and manage information (Meenakshi 2013).

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents the Literature Review related to the study. It is composed of the following sections:

i. the concept of attitude;
ii. theories of attitude formation;
iii. theoretical approaches to attitude toward technology;
iv. teachers' understanding of concepts ;
v. teachers' attitude toward e-learning ;
vi. attitude scales on e-learning;
vii. barriers facing e-learning adoption in HLIs;
viii. strategies that can optimise involvement of teachers and students in e-learning; and
ix. synthesis and research gap.

The literature of these areas was examined so as to highlight and provide understanding on issues concerning the transition from face-to-face learning to e-learning. Managing the transition, include how teachers understood and perceived the concept *e-learning*; theories underpinning their attitude formation and factors that could influence their attitudes. It also includes barriers that could hinder the adoption of e-learning in HLIs as well as exploration of strategies that can be used to optimise involvement of teachers and students in e-learning.

The provided review of literature helped to establish guidelines for evaluating e-learning adoption in Tanzanian HLIs.

2.1 Theoretical grounding

2.1.1 Concept of attitude

The concept of attitude has been one of the most influential phenomena of all social and psychological constructs (Ajzen 1991; Eagly and Chaiken 2007; Schwarz 2007; Dempsey and Mitchell 2010). Thus, it is necessary to understand the meaning of this concept so as to grasp interpersonal and intergroup relations. Throughout the history of social psychology, social scientists have used attitude to explain human actions, since they regarded attitudes as behavioural dispositions (Ajzen and Fishbein 1980). Attitude theorists have defined attitude based on different emphasis. For example, Azjen and Fishbein (1980) define attitude enacting a particular behaviour to mean a person's judgment that performing the behaviour is good or bad, such that a person is in favour of or against performing such behaviour.

In their critical examination of human behaviour Ajzen and Fishbein (1980) developed a Theory of Reasoned Action (TRA). The theory argues that people consider the implication of their actions before deciding whether or not to get involved in a particular behaviour (Ajzen and Fishbein 1980). The theory views a person's attitude and subjective norms towards performing the behaviour as direct determinants of a person's intention toward performing the said behaviour. *Attitude toward behaviour* refers to "persons' belief that the behaviour leads to certain outcomes and their evaluation of these outcomes" (Ajzen and Fishbein 1980, p. 8), whereas *subjective* *norm* refers to individuals' perception that other people who are important to them think they should or should not act on the aspect in question (ibid.). The theory further views intention (of whether or not to perform behaviour) as the immediate determinant of behaviour (or action).

However, in the broad context of factors affecting behaviours, the theory has been criticized for treating attitude toward the behaviour and subjective norm as two distinct influences of behavioural intention (Hale, *et al.,* [no date]; Greene 2009). Researchers have found attitude toward the behaviour and subjective norm to have a stronger relationship between them such that an individual with positive subjective norm will more likely possess positive attitude towards performing the behaviour and the vice versa (Hale, *et al.,* [no date]). This implies that subjective norm would directly influence attitude and less directly influence person's intention. Another argument against TRA is that attitude toward the behaviour and subjective norm are not sufficient predictors of behavioural intention or indirectly of behaviour (Hale, *et al.,* [no date]; Greene 2009). It implies that other factors such as persons' demographic characteristics (for example, gender, age, academic achievements and experiences) may also influence the behaviour. Ajzen and Fishbein (1980) define such factors as *external variables*, which can influence behaviour indirectly through attitude and subjective norm. The development of the Theory of Planned Behaviour (Ajzen 1991), which extends TRA by including the individual's perception of the ease with which the behaviour can be performed, termed as the behavioural control, suggested that the TRA may not solely adequate in predicting and explaining behaviour. Nevertheless, TRA has remained to be a powerful foundation for researching individuals' behaviour across many fields (Greene 2009).

In a study that reviewed historical developments of the concept *attitude*, Fazio (2007) defines attitude as evaluative knowledge that exists in memory. Contrary to other researchers, he emphasises the existence of attitudes and argues that attitude is not a hypothetical construct but rather evaluative knowledge that exists in memory. Fazio (2007) argues that viewing attitude as hypothetical constructs is neglecting the "acquisition and use of evaluative knowledge" (p. 607). He implies that a person's previous experiences reside in memory and that they can be activated and used to make evaluative judgements in other situations.

On exploring an inclusive definition of attitude, Eagly and Chaiken (2007, p. 598) define it as "…a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour." The word *tendency* has been used instead of *disposition* (permanence) or *state* (temporariness) to emphasise an aspect that attitude can either be short-term or long-term (ibid.). They claim that "…many attitudes are enduring, others are not" (p. 585). Contrary to Fazio (2007), Eagly and Chaiken (2007, p. 584) argue that "attitudes do not exist at all until a person perceives an attitude object, and responds to it on an explicit or implicit basis". In explicit attitudes, individuals are consciously aware of their own evaluative tendencies and which, in turn, influence their beliefs and behaviours, whereas for implicit attitudes, individuals are unaware/unconscious of their own evaluative tendency, but have an impact on their beliefs and behaviours (Dempsey and Mitchell 2010).

Eagly and Chaiken (2007) argue that individuals who have no exposure to an entity could not be said to *have* negative or positive attitudes toward it. Instead, they are likely to *acquire* negative or positive attitudes through a "…mental association that joins the attitude object to relevant prior cognitive, affective or behavioural experience" (p. 595). They claim that an attitude is inside the person, not directly observable. However, it can be made observable by interacting with them through special research instruments. For example, in their study, which examined influence of consumers' implicit attitudes on making a choice of a product, Dempsey and Mitchell (2010) report that when an individual had not formed an explicit evaluation about a product, they alternatively use implicit attitude to decide, rather than depending on product attribute information. This implies that if attributes characterizing the attitudinal object are missing, individuals can evaluate an entity positively or negatively from their implicit attitude after evaluating the value associated with it. The same concept can also be true when presenting teachers to e-learning. In his study to identify critical factors that affect teachers' acceptance and use of e-learning, Newton (2003) suggests that apart from poor institutional support and other institutional barriers, teachers' willingness to participate in e-learning activities was based on the implicit value teachers put on learning and teaching.

In spite of these multitudes of concepts about attitude, an underlying pattern from most of these definitions recognizes *evaluation* as the most essential component of attitude. Attitude shapes our perception and judgements about other people, events, situation, idea or physical object (Ajzen and Fishbein 2005). Schwarz (2007, p. 649) argues that, "people do not *have* attitudes…they merely evaluate…they form judgements" about an entity featured in terms of their action. Consequently, this study defines attitude to be positive or negative evaluative judgements of an entity based on affective, cognitive or behavioural experience (Schwarz 2007).

2.1.2 Theories of attitude formation and attitude change

Attitude formation relates to how individuals form evaluative judgments about an entity (Ajzen and Fishbein 2005). Attitudes can be developed from three general classes of information: affective information, cognitive information and information concerning past behaviors or behavioral intentions (Barki and Hartwick 1994; Ajzen and Fishbein 2005). People's evaluative judgment of an object depends on how they feel about it (affective evaluation), knowledge they have about the object (cognitive evaluation) and how they have acted towards it in the past, termed as behavioural evaluation (Barki and Hartwick 1994; Eagly and Chaiken 2007; Fazio 2007; Dempsey and Mitchell 2010). All these elements are respectively used to describe how people feel, understand and behave.

i. Affective information and attitude formation

The assumption that evaluative judgments happen as a result of cognitive processes where an individual associates the attitudinal object and valued attributes has been challenged by attitude theorists. Studies conducted on attitudes have proposed that the evaluation process of an attitudinal object may also be controlled by affective components (Bodur, *et al.,* 2000; van den Berg*, et al.,* 2006; Dempsey and Mitchell 2010). The affective component is a set of feelings and emotions an individual uses to associate with an attitudinal object, whereas cognitive components are beliefs held by the individual about the attitudinal object (van den Berg*, et al.,* 2006). Objects may make people feel good or bad for a reason unrelated to beliefs and, thus, influence attitude (ibid.). Attitudes that develop due to affective information reflect general moralistic value judgments and the process involved in this situation is known as *mere exposure effect* (Zajonc, see Burgess and Sales 1971).

Mere exposure effect is a psychological phenomenon whereby people rate familiar stimuli more positively than unfamiliar stimuli (Burgess and Sales 1971). Literature on mere exposure effect indicates that the higher the number of exposure to the stimuli, the higher the positive affective evaluation judgement (Burgess and Sales 1971; Jakesch and Carbon 2012; Huang and Hsieh 2013). Research has established that individuals' repeated exposure to an object enhance liking of it even if they do not develop any specific belief about the stimulus (Dempsey and Mitchell 2010; Dimofte and Yalch 2011). This is contrary to a common phrase *familiarity breeds contempt*, which implies that the more people get to know something very well, they tend to notice bad qualities while taking for granted the good qualities. However, the present study criticize this phrase because it depends on the people, event, situation, idea or physical object you get familiar with and how you would feel about it. This is also supported by results from Norton's, *et al.,* (2007) study, which revealed that it is not to every case when familiarity is enriched with more knowledge about the stimuli may necessarily lead to greater dislike. Mere exposure effect has been demonstrated in different domains including visual-based (Burgess and Sales 1971; Young and Claypool 2010) and haptic or touch-based (Jakesch and Carbon 2012).

Research into attitudes shows that emotion works together with cognitive process, that is, emotional feelings and the way an individual thinks or believes about an entity or situation (Ajzen 2001). However, Fazio (2007) argues that cognitive rationale toward an entity can be outweighed by emotional feelings an individual has about an entity. It implies that when emotion is activated, then its effect would be expected to influence an attitude, which, in turn has an impact on peoples' actions (Ajzen and Fishbein 2005).

ii. Cognitive information and attitudes formation

Ajzen and Fishbein (1980) developed the Theory of Reasoned Actions, which suggests that a person's behavioural intention depends on the person's attitude about behaviour and subjective norms. On one hand, the theory explains how beliefs determine attitudes. Beliefs are cognitive links between an entity and its associated attributes or characteristics (Fazio 2007). Fazio (2007, p. 608) claims that individuals' evaluative judgment about an entity can be constructed out of "attributes that characterize the entity and their favourability." It implies that individuals can construct positive or negative attitudes toward an attitudinal object on the basis of its salient attributes existing at that time (ibid.).

In relation to technology, Rogers (2003) describes five perceived attributes that can influence a positive or negative attitude about the technology. They include the following:

i. "Relative advantage, that is, the degree to which technology is perceived to be better than the idea it supersedes;

ii. Compatibility, that is, the degree to which technology is perceived as being consistent with the existing values, past experiences and needs of potential adopters;
iii. Complexity, that is, the degree to which technology is perceived to be difficult to understand and use;
iv. Trialability, that is, the degree to which technology may be experimented on a limited basis; and
v. Observability, that is, the degree to which the results of the technology are visible to others" (Rogers 2003, p. 15).

In terms of teachers' attitude towards e-learning, it can imply that teachers, in relation to their ICT experiences, can construct different attitudes about e-learning based on whatever attributes that were significant at that time. Such attitudes may come from association (or resemblance) with similar technology previously evaluated (Eagly and Chaiken 2007). If the attributes were previously positively valued, then teachers would most likely associate them with e-learning and value it positively. Evidence from other studies shows that cognitive construct can stimulate affective construct (or attitudes) if features or attributes that stimulate cognitive processes are more salient than those stimulating emotional feelings (Ajzen 2001). Ajzen and Fishbein (2005, p. 193) claim that "once a set of beliefs is formed, it provides the cognitive foundation from which attitudes…is assumed to follow in a reasonable and consistent fashion."

On the other hand, the TRA explains the role of social pressure thrust on an individual to perform or decline from performing the behaviour in question (Ajzen and Fishbein 1980). This is also supported by Friedkin (2010, p. 196) that "…the effect of significant others' behaviours may be based on individuals' perceptions of the attitudes of significant others about the behaviour that the significant others have or have not adopted." It can imply that teachers' attitudes towards e-learning can also be influenced by their perceptions on how other people who are important to them evaluate e-learning. Such individuals who are important enough to influence teachers' attitudes can be the principal, head of department, co-workers and students. Venkatesh and Davis (2000) argue that when a co-worker perceives that e-learning is useful, an individual close to the co-worker will most likely tend to have positive attitudes towards it. Although such assertion might be true of the concept of e-learning but care should be taken that ensure the quality and strategic reasons of adopting e-learning technology in question. Literature also shows that teachers can decide when to use e-learning technologies after they have evaluated capabilities and relative advantages that technology can offer (Rogers 2003; Ferdousi 2009).

iii. Behavioural information and attitude formation

Social psychologists found that attitudes and actual behaviour are not always perfectly aligned (Ajzen and Fishbein 2005). The Theory of Reasoned Action proposed that behavioural intention (rather than attitude) has a direct impact on actual occurrence of behaviour, whereas attitude has the ability to predict behavioural intention. It implies that if we want to predict teachers' behavioural intention towards e-learning, then we have to assess their attitudes towards e-learning.

However, in the present study, teachers were not explicitly required to indicate whether or not they intend to engage in the e-learning. Instead, the researcher was interested in their attitude towards e-learning, which were assessed through questionnaires.

2.1.3. Theoretical approaches on attitude toward technology

To date, there are a number of studies that have investigated the role of attitudes and factors that influence attitudes towards technology acceptance and implementation in institutions. For example Zhang, *et al.,* (2008) provided a systematic examination of two concepts on attitude, namely, attitude towards object (ATO) and attitude toward behaviour (ATB) in relation to behavioural intention in technology acceptance as well as use. Al-Busaidi and Al-Shihi (2010) developed a theoretical framework to examine factors that influence teachers' attitudes towards LMS and their actual use.

In addition, Teo and Schaik (2012) investigated the effect of each variable in four theoretical models (Theory of Reasoned Action, Theory of Planed Behaviour, Technology Acceptance Model and integrated model) on teachers' intention to use technology. Recently, Bourgonjon, *et al.,* (2013) examined teachers' acceptance of video game-based learning and factors that influence teachers' acceptance of this technology in education. Most recently, Chien, *et al.,* (2014) explored teachers' beliefs towards technology-based assessments and their actual use in classrooms. These studies and many more have come up with variety of models.

In the next Sub-section, three theoretical models of attitude toward technology are explored. They include Rogers' (2003) Innovation Diffusion Theory (IDT), Venkatesh's, *et al.,* (2003) Unified Theory of Acceptance and Use of Technology (UTAUT) and Davis' (1986) Technology Acceptance Model (TAM). These models provide an underlying rationale, which finally, led the researcher to establish the theoretical foundation for the research model (see Sub-section 2.2.4, p. 82) and explains the reasons for adapting it as the theoretical framework that guided the study**.**

i. Innovation Diffusion Theory (IDT)

Rogers (2003) claims that adopting a new innovation or technology can be described in the following two perspectives: with an individual and with an organization. Individuals are involved because technology explains social change as one of the most fundamental of all human processes, whereas organisations are involved because in many cases, technologies are adopted by organisations before individuals can adopt them (ibid.). Technology presents an individual or an organization with a new alternative or alternatives as well as new means for solving problems (Rogers 2003).

Spreading an innovation requires a special type of communication termed as *diffusion* (Rogers 2003). Rogers (2003, p. 5) defines diffusion as “a process in which an innovation is communicated through certain channels over time among the members of a social system.” Rogers further added that social changes occur when new ideas are invented, diffused and finally, adopted or rejected.

The perception of individuals toward a technology being new will determine their reaction towards it, that is, either to adopt or reject it (Dillon and Morris 1996). Studies reveal that decisions of whether to accept or reject a new technology depends, among other factors, the attitude towards that technology (Teo and Schaik 2012; Pynoo, *et al.,* 2012). Fazio (2007) views attitudes in two perspectives: First, as one's past behaviours and experiences with the object, that is, the individual’s prior evaluative knowledge association to the object. Second, he views attitude to be based on “appraisals of the attributes that characterize the object” (p. 608).

Attributes that characterize the technology help to explain their different rates of adoption. Rogers (2003) describes six perceived attributes of technology as observed by individuals that help to explain their different rates of adoption. They include relative advantage, compatibility, complexity, trialability, observability as well as ability of the technology to be modified (re-invented) by a user (Rogers 2003). Other variables include type of innovation-decision being either optional, collective or from authority; communication channel such as mass media or interpersonal communication; nature of the social system (for example, its norms) and the extent of change agents’ promotion efforts in diffusing the innovation (Rogers 2003).

Generally, the primary intention of this theory is to provide an explanation on how an innovation moves from the stage of invention to the final stage of either being adopted or rejected. Diffusion is a process that requires a lengthy period of time from when the technology is made available to the time when it is fully adopted (Rogers 2003). Thus, the theory is useful when data are gathered from users at different time during the adoption process rather than through a cross-sectional data gathered at one point in time (Rogers 2003). Though not concerned with IT exclusively, the diffusion theory offers a convenient model for both predicting and analysing adoption of any innovation at a global level (Dillon and Morris 1996; Weller 2007).

ii. Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh, *et al.,* (2003) define Unified Theory of Acceptance and Use of Technology (UTAUT) as a technology acceptance model aimed at explaining users' intentions to use an information system and subsequent usage behaviour. UTAUT was developed through a review and consolidation of constructs of eight models that were employed to explain information system usage behaviour (Venkatesh, *et al.,* 2003). The eight models include the:

i. Innovation Diffusion Theory (IDT);
ii. Theory of Reasoned Action (TRA);
iii. Theory of Planned Behaviour (TPB);
iv. Technology Acceptance Model (TAM);
v. Motivational model;
vi. Model combining the TAM and the TPB;
vii. Model of PC Utilization; and
viii. Social Cognitive Theory (Venkatesh, *et al.,* 2003).

The UTAUT model contains four key constructs that are direct determinants of *usage intention* and *behavior*. They include *performance expectancy, effort expectancy, social influence,* and *facilitating conditions* (Venkatesh, *et al.,* 2003). They define *performance expectancy* as a degree to which individuals believes that using the technology will enhance their job performance, and *effort expectancy* as a degree to which individuals associate easiness on using the technology (ibid.). Furthermore, *social influence* is defined as the degree to which individuals perceives that people who are important to them believes that they should use the technology and *facilitating conditions* are defined as the degree to which individuals believes that the physical and technical infrastructure exist to support the use of technology (Venkatesh, *et al.,* 2003).

In UTAUT the constructs performance expectancy, effort expectancy and social influence are direct determinants of behavior intention, whereas facilitating conditions determines use behavior. The variables gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behavior (Venkatesh, *et al.,* 2003). Although the UTAUT has been derived from eight different models, its core constructs could not properly represent some items taken from the eight models, thus calling for the model revalidation or extension (Venkatesh, *et al.,* 2003).

A range of studies, for example, Chiu and Wang (2008) as well as Wang and Wang (2010), attempted to extend the UTAUT model. Wang and Wang (2010) extended the UTAUT in their study to determine determinants of mobile Internet (m-Internet) acceptance in relation to gender differences. Reasons for their extension were based on suggestion provided by Pedersen and Ling (see Wang and Wang 2010) who argue that the traditional adoption models in IT research may be modified and extended when they are applied to adoption of new technology such as m-Internet.

For this reason, Wang and Wang (2010) added three constructs (perceived playfulness, perceived value and palm-sized computer self-efficacy) and chose *behavioural intention* as a dependent variable. They omitted *use behaviour*, *facilitating conditions* and *experience* from the original UTAUT because the rate of regular usage of mobile services through m-Internet was low in Taiwan. Similarly, they omitted *voluntariness of use* and *age* from the UTAUT because most m-Internet adopters were aged 20 to 35 years old. Out of the three added constructs, perceived playfulness did not have a strong influence on behavioural intention, whereas perceived value had a significant influence on adoption intention (Wang and Wang 2010). Palm-sized computer self-efficacy played a critical role in predicting the m-Internet acceptance (Wang and Wang 2010).

Chiu and Wang (2008) claim that the existing variables of UTAUT cannot reflect learners' motives. To address the limitation, they extended UTAUT by introducing components of a *subjective task value* and *computer self-efficacy* for studying learners' continuance intentions in Web-based learning. Chiu and Wang (2008) viewed *value,* which is not in the UTAUT, as a key role that provides the basis for understanding human behaviour in and across cultures. They used four motivational components of subjective task value, which are "attainment value (importance), intrinsic value (interest), utility value (usefulness), and cost" (Chiu and Wang 2008, p. 194). Results from their study indicated that the original UTAUT constructs, namely, performance expectancy, effort expectancy and the extended constructs computer self-efficacy, attainment value, intrinsic value as well as utility value were significant predictors of individuals' intentions to continue using Web-based learning, whereas cost had a significant negative effect.

Descriptions presented here suggest identifying other potential constructs that could add to prediction of intention and behaviour over and above what is already known and understood (Venkatesh, *et al.,* 2003). In the study to examine major drivers that have an impact on a framework's acceptance and success, Polancic, *et al.,* (2010, p. 575) report that, "…only one study has confirmed UTAUT's validity and robustness." Although the original model of UTAUT has mapped together eight established models, the researcher found it unsuitable for this study as it did not include an attitude construct. Moreover, Williams, *et al.,* (2011) claim that, UTAUT may not suit all situations demanding for an effective alternative model.

iii. Technology Acceptance Model (TAM)

Davis (1986) developed the Technology Acceptance Model (TAM) as an extension of the Theory of Reasoned Action. The TAM is an information systems theory that represents how the user accepts and uses technology (Davis 1986). The theory suggests that when users are presented with a new technology, their decision on how and when to use will depend on two belief constructs. One, the degree to which a person believes that using a particular system would enhance his or her job performance, termed as *perceived usefulness* (U) and second, the degree to which a person believes that using a particular system would be free from effort, termed as *perceived ease-of-use,* E (Davis 1986).

The main purpose of TAM is to provide the basis for tracing the impact of external variables on internal beliefs E and U; attitudes; and behavioural intentions, BI (Davis, *et al.,* 1989). External variables may include facilitating conditions in terms of infrastructure, support on system use and many more (Teo 2009; Chien, *et al.,* 2014). The presence of external variables may facilitate positively or negatively acceptance and use of technology (Teo 2009). In the critical review of the TAM model, Legris, *et al.,* (2003, p. 197) claim that "…external variables provide a better understanding of what influences E and U and their presence guides the actions required to influence a greater use."

Furthermore, behavioural intentions (BI) to use the technology are modelled as a function of attitude toward using and perceived usefulness (Davis 1986). However, the model also suggests the possibility where individuals may come to actual use of a technology independent of their positive attitudes toward it as long as that technology is perceived to be useful and/or easy to use in ways that enhance their productivity (Davis, *et al.,* 1989; Venkatesh, *et al.,* 2003). Nevertheless, research has consistently shown that BI is the strongest predictor of actual use (Davis, *et al.,* 1989; Dillon and Morris 1996; Legris, *et al.,* 2003; Teo 2009; Turner, *et al.,* 2010; Pynoo, *et al.,* 2012).

The TAM also suggests that both E and U have a significant impact on a user's attitude (A) toward using the technology (Dillon and Morris 1996; Legris, *et al.,* 2003; Teo 2009, Lee, *et al.,* 2011). It further suggests that U will be influenced by E, since users are more likely to use technology when they perceive it to be easy to use (Venkatesh, *et al*., 2003; Teo 2009). The relationship between U and A suggests that the more an individual perceives the technology to be useful, the more favourable that individual's attitude toward use will be (Davis 1989; Venkatesh, *et al.,* 2003). Similarly, the relationship between E and A suggests that the more that an individual perceives technology as easy to use; the more favourable that individual's attitude toward use will be (Davis 1989; Venkatesh, *et al.,* 2003).

In summary, the TAM model remains to be among the most cited, validated and often used theoretical model when it comes to examining the acceptance and use of technology not only in business and commercial environments but also in the educational context (Legris, *et al.,* 2003; Teo 2009; Turner, *et al.,* 2010; Polancic, *et al.,* 2010; Nair and Das 2012; Teo and Schaick 2012; Persico, *et al.,* 2014). Therefore, it was found to be favourable to this study than the preceding models (see the following sub-section).

2.1.4. Conceptual framework

This study was guided by the Technology Acceptance Model (TAM) adapted from Davis (1986). The model adapted in this study (see Figure 2.1.4), consists of four constructs: external variables (EV), teachers' perceived usefulness (U), teachers' perceived ease of use (EoU) and the teachers' attitude (A) toward e-learning. Two constructs from TAM namely, *behaviour intention* and *actual system use* were not included in the conceptual framework because usage of e-learning in Tanzanian HLIs is still in its infancy (Hooker, *et al.,* 2011; Sanga, *et al.,* 2013). Therefore, attitude (A) was selected to be a dependent variable. In this model, EV and independent variables (IVs) were suggested to mediate the impact of the two constructs U and EoU on A. These variables are illustrated in Figure 2.1.4 with single directional arrows representing one way impact.

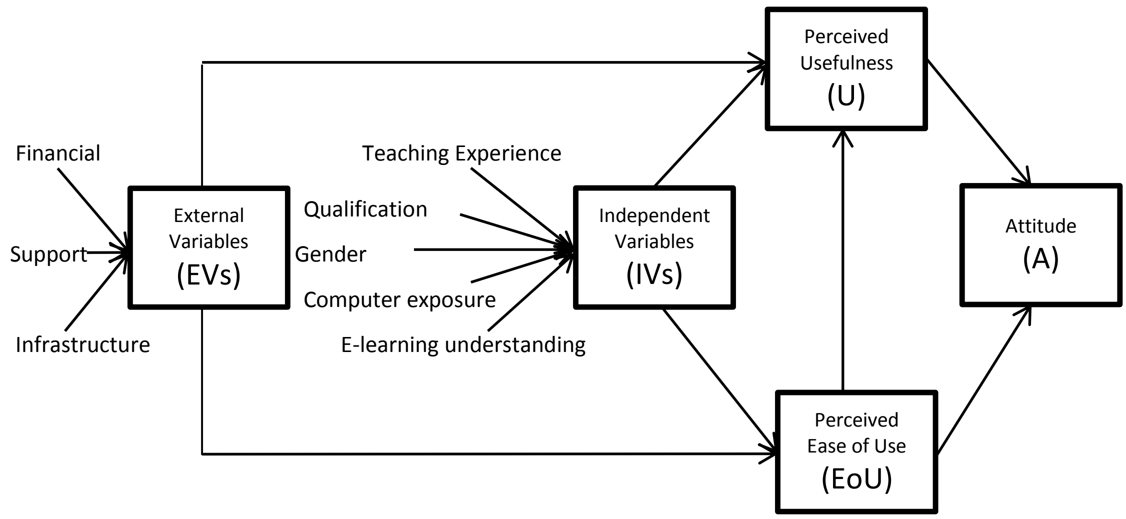


Figure 2.1.4: A conceptual framework of the study**.**
Source: Adapted from Davis, et al., (1989).

Figure 2.1.4 shows the conceptual framework where U means the degree to which a person believes that using a particular system would enhance his or her job performance and EoU means the degree to which a person believes that using a particular system would be free from effort (Davis 1986). Both U and EoU have direct influence to A, that is, the more an individual believes a technology to be useful and/or the more an individual believes technology to be easy to use, the more positive that individual's attitude will be (Davis 1986; Venkatesh, *et al.,* 2003; Rogers 2003; Teo 2011). In other words, teachers may have a positive attitude towards e-learning if they believe it to be useful and/or easy to use (Rogers 2003; Teo 2011).

Similarly, EV can determine U, that is, if e-learning is well facilitated in terms of funds, support and infrastructure, and produce the intended outcome, it will likely be perceived as more useful regardless of its EoU outcome (Davis, *et al.,* 1989). Likewise, EV has direct impact on EoU in such that the more an individual gets support in using e-learning platforms and/or the more adequate and reliable infrastructure is available the more that individual's ease of use the system perception will be enhanced (Davis, *et al.,* 1989). This can imply that the presence of EVs in this model is very useful because the assumption that teachers would always accept e-learning out of its usability and usefulness can be misleading. Teachers may reject e-learning regardless of its usefulness for the reasons related to EVs. External variables are factors operating in real-life situation and in this study they included aspects related to infrastructural challenges; financial constraints; technical support and managerial support (Figure 2.1.4).

Moreover, EoU has a direct influence on U, that is, the more an individual perceives e-learning technology to be easy to use, the more that individual will perceive it to be useful (Davis 1989; Teo, *et al.,* 2009; Hong, *et al.,* 2011). In this model, the IVs teaching experience, academic qualification, gender, computer exposure and e-learning understanding are suggested to mediate the impact of the U and EoU on A. In this study, U was measured by how teachers perceived aspects related to benefits from e-learning, whereas EoU was measured by how teachers perceived use of e-learning tools such as computers. Rogers (2003, p. 418) claims that "the adoption of an innovation related to communication technology can be measured by computer records of each individual's degree of use of personal computers and so forth."

Other research also associates teachers' attitudes by their personal characteristics (or mediated factors) such as gender (Venkatesh, *et al.,* 2000; Venkatesh, *et al.,* 2003; Dong and Zhang 2011), years of teaching experience (Nasser and Abouchedid 2000;

Cavas, *et al.,* 2009; Onasanya, *et al.,* 2010), exposure/experience to computers (Onasanya, *et al*., 2010; Krishnakumar and Kumar 2011; Buabeng-Andoh 2012) and academic qualification (Males 2011; Rahimi and Yadollahi 2011).

Throughout the study, the abbreviation, IVs is used (unless stated otherwise) to represent independent variables, which included exposure to computer, teaching experience, academic qualification, gender, and teachers' understanding about e-learning (Figure 2.1.4). The IVs were used to identify if there were any significant associations with A. In other words, teachers' attitude toward e-learning was expected to depend on teachers' personal beliefs and influence of other relevant external variables in order to appear.

Four reasons for adapting the TAM model in this study were identified: first, TAM is helpful for both prediction and explanation in the sense that through user's internal beliefs and other variables, the researcher can identify reasons that lead to adoption or rejection of e-learning and find appropriate corrective measures or explanations for that decision (Davis, *et al.,* 1989; Turner, *et al.,* 2010; Hong, *et al.,* 2011). Second, the TAM constructs are more capable of being tested, tried and analysed and arrive at a conclusion than, say, broad concepts of Innovation Diffusion Theory (Porter and Donthu 2006). Third, it is easy to extend and validate it so as to suit the required measure whilst results from applying the extended TAM are often accepted as being accurate predictors of adoption as well as usage (Davis 1989; Legris, *et al.,* 2003; Turner, *et al.,* 2010).

The fourth reason is that the TAM remains to be one of the most cited, validated and often used theoretical model when one examines acceptance and use of technology (Legris, *et al.,* 2003; Flett, *et al.,* 2004; Porter and Donthu 2006; Teo 2009; Polancic, *et al.,* 2010; Sumak, *et al.,* 2011; Nair and Das 2012; Chien, *et al.,* 2014; Persico, *et al.,* 2014). Several studies that have adopted TAM model have found it to be efficient and effective in various domains, for example, in adoption and use of dairy farming technologies (Flett, *et al.,* 2004); accepting and using the Internet (Porter and Donthu 2006); using healthcare information systems (Pai and Huang 2011), testing user's online behaviour in the e-commerce context (Wu, *et al* 2011) and for teachers' intention and/or acceptance of technology (Teo, *et al* 2009; Hong, *et al.,* 2011; Nair and Das 2012; Chien, *et al.,* 2014). Taylor and Todd (1995) suggest that if the goal is to predict IT usage then, TAM is the appropriate model. This is also supported by Lee, *et al.,* (2011) in their study that found TAM to be effective in examining factors that influence employees' adoption and use of e-learning systems. In line with that, Teo (2012, p. 282) claims that, "TAM is effective in predicting pre-service teachers' intention to use technology."

Despite its wide usage, TAM is unable to measure benefit of using technology (Turner, *et al.,* 2010). However, the focus of this study was not to measure the benefit of using e-learning rather it focused on measuring teachers' attitudes towards e-learning (that is, why teachers accept or reject e-learning), through an attitude scale test. Through the presence of EVs, IVs, U and EoU the researcher could establish reasons lead to teachers' differences in attitudes towards e-learning.

Generally, the transition from traditional learning and teaching systems, like face-to-face, to a fast growing e-learning environment in Tanzanian HLIs, sets students and teachers in an environment with different expectations. Not only expectations towards learning might change, but also towards ICT competencies and all other relevant factors associated with technology use as a whole. Since ICTs have not penetrated into remote areas of most African countries and, Tanzania in particular; it remains a pursuant force in the expected development for change in society (Nasser and Abouchedid 2000).

2.2 Empirical studies

2.2.1 Teachers' understanding of concepts

The term *understanding* can have many meaning depending on how it is applied in a variety of educational context (White and Gunstone 1992; Foster [no date]). White and Gunstone (1992) define six ranges of contexts to describe understanding. They include: "understanding of concepts, whole disciplines, single elements of knowledge, extensive communications, situations, and people" (p. 3). However, the Bloom's taxonomy of educational objectives (Bloom 1984; Mayer 2002) defines *understanding* to mean grasping meaning of informational materials and it can be measured by ability to describe the phenomenon under investigation. White and Gunstone (1992) argue that judging an individual's understanding is often subjective depending on the person who judges and the status of that individual who is being judged. Literature shows that *understanding* of concept is developed when new knowledge is associated with previous knowledge through cognitive processes (Foster [no date]; Mayer 2002).

Mayer (2002) categorizes cognitive processes into two perspectives. Firstly, those focused on *retention* and secondly, those focused on *transfer*. The former deal with ability to associate new knowledge with previous knowledge, that is, *remembering* whilst the latter goes further when an individual can construct meaning out of these associations, termed as *understanding* (Mayer 2002). Literature shows that construction of meaning (or *understanding*) can be demonstrated by an individual's ability to describe or explain the phenomenon in question either orally or in written format (Mayer 2002). For example, Probert (2009) used open-ended questions and semi-structured interviews to investigate teachers' understanding of information literacy and their associated classroom practices. Teachers were asked to describe a person who is information literate. Results found that some teachers had a reasonably good understanding of the concept, information literacy. Teachers associated information literacy with literacy or reading or ICT although Probert argues that it is associated with both literacy and ICT.

Literature shows that *understanding* can trigger evaluative judgments or attitudes about the phenomenon in question (Rogers 2003; Ajzen 2005). This is in consistent with Rogers' (2003) model of five stages in the innovation-decision process, which shows knowledge to be the first stage before an individual's decision-making towards technology adoption. Rogers claims that "knowledge occurs when an individual is exposed to an innovation's existence and gains an understanding of how it functions" (p. 169). Understanding of a technology can construct an attitude towards it, which can also determine individuals' reaction to whether accept it or reject it (Rogers 2003). To date, however, there is limited empirical investigation about teachers' understanding of e-learning and factors that predict their understanding. Thus, investigating teachers' understanding of e-learning was very essential.

2.2.2 Teachers' attitudes towards e-learning

Successful implementation of e-learning in education system relies much on support (Garrison and Anderson 2003; Weller 2007; Garrison 2011) and teachers' attitudes (Salmon 2011; Teo 2011; Avidov-Ungar and Eshet-Alkakay 2011; Teo and Ursavas 2012; Pynoo, *et al.,* 2012) towards it. Early literature on teachers' attitude towards technology development, adoption and implementation define attitude toward technology as an affective (experience of feeling or emotion) or evaluative judgement about technology in question (Davis, *et al.,* 1989; Barki and Hartwick 1994). Thus, it is a degree to which an individual perceives technology with the intention to use it (Barki and Hartwick 1994). Technology which is believed to be both important and personally relevant is more likely to create people's positive attitude towards it (Barki and Hartwick 1994; Rogers 2003; Teo 2011). For example, Ferdousi (2009, p. 5) argues that teachers' attitudes have a significant impact on their decisions "…about if, when, and how they will use e-learning systems." On some occasions, teachers can decide when to use e-learning technologies after they have evaluated capabilities that the technology can offer (Ferdousi 2009). Capabilities can include the ability to collect, process, display and store a large amount of data in a variety of interactive formats that motivate interest in learning as well as teaching (Wellington and Ireson 2012).

Generally, attitudes have been found to be a good predictor of teachers' future intentions towards using e-learning (Yuen and Ma 2008; Pynoo, *et al.,* 2012). For example a study of teachers' acceptance and use of an educational portal in Belgium by Pynoo, *et al.,* (2012) reveal that attitude is the main driver for new users to intend to use the technology. Teachers perceived e-learning to be a useful technology to be integrated into their classrooms. Similar results were observed in Hong Kong by Yuen and Ma (2008) who examined teachers' future intention to use e-learning technology among 152 teachers. Responses revealed that teachers' intention to use e-learning was highly determined by their attitudes that e-learning technology will be easy to use (Yuen and Ma 2008). Although the present study investigated teachers' attitudes towards e-learning, the analysis from these results revealed that the two constructs of attitudes, perceived usefulness and perceived ease-of-use [see in Pynoo's, *et al.,* (2012) and Yuen and Ma's (2008) studies respectively], were significant determinants to the prediction of intention to use e-learning.

Nevertheless, successful acceptance and later implementation of e-learning in education is not solely described by attitudes alone, it can include other factors, which may also influence attitude. Deubel (2003) argues that teachers' attitude, motivation and true commitment have a great impact on quality of e-learning. Teachers with a positive attitude and true commitments towards e-learning are ready and willing to discover students' learning preferences, integrate and apply electronic technology tools as well as create the most appropriate method for learners (Yang and Cornelious 2005). Other factors include teachers' involvement in the whole process of e-learning planning, adoption, implementation and evaluation. For instance, in a study that explored teachers' knowledge and attitudes towards the implementation of e-learning, Avidov-Ungar and Eshet-Alkakay (2011) recognize teachers' involvement in decision-making, development, integration and implementation as a significant factor that contributed to teachers' positive attitudes towards e-learning. Such results were influenced by participants being actively involved in all stages of technology-integration project.

Results of Avidov-Ungar and Eshet-Alkakay (2011) are in line with Roger's (2003) theory of diffusion of innovation, which rejects tendency by the higher authority in an organization to enforce adoption of a new technology in the organization without involving the stakeholders. In such cases, users have little or no influence on the decision, but are rather forced to accept the new technology. The key point here is that if users' involvement, willingness as well as attitudes towards a new technology is neglected and replaced by command from higher authority, then implementation might not be as smooth as it is expected (Rogers 2003; Teo 2011). Evidence from Avidov-Ungar and Eshet-Alkakay (2011) illustrates how teachers' involvement in the decision-making process and change can strengthen their positive attitudes towards the technology.

Moreover, the extent to which teachers are involved in the decision-making and motivation they get from significant others about the technology in question play a key role in increasing their level of confidence and perceptions towards it (Rogers 2003; Friedkin 2010). McConell (2011) argues that the higher their self-confidence, the more positively they will perceive e-learning and hence, would be willing to adopt it into their teaching activities. Van der Klink and Jochems (2004, p. 160) argue that "a successful innovation requires ownership, vision and enthusiasm of all educational stakeholders" particularly teachers. In other words, teachers need to be part of such change. They need to have a sense of ownership or belongingness in the whole transition process. If they are not part of change and/or if their attitudes are ignored either in a mandatory or a voluntary environment can trigger a negative attitude, leading to rejection of the technology in question (Rogers 2003). Avidov-Ungar and Eshet-Alkakay (2011) report that teachers' resistance to adopt new technology is considered to be one of the main reasons for failure of processes that involve change in the education systems. Similarly, Johnson and Howell (see Ferdousi 2009, p. 5) report that teachers' negative attitude "…may be hard to change even in the cases in which institutional support is high." Therefore, it is essential that education stakeholders should understand causes of teachers' resistance to adopt new technology in order to account for large financial investment and time spent in implementing e-learning in education particularly HLIs (Salleh 2005). Other specific factors that may also influence attitudes towards e-learning are presented in the next sub-section.

i. Factors influencing teachers' attitude towards e-learning

Factors found to be influencing teachers' attitudes towards e-learning have been explored in several studies (Venkatesh, *et al.,* 2003; Inan and Lowther 2010; Teo, *et al.,* 2011; Dong and Zhang 2011; Chen and Tseng 2012; Karaca, *et al.,* 2013). Literature classified factors affecting teachers' attitudes towards a technology into two categories: internal and external factors (Venkatesh, *et al.,* 2003; Teo 2009). Internal factors include teachers' internal belief about the technology formed by the degree to which teachers will perceive favourably or unfavourably toward the technology, whereas external factors include subjective norms (Ajzen and Fishbein 1980; Venkatesh, *et al.,* 2003), organizational structure (Rogers 2003), technical factors such as complexity of a technology (Rogers 2003; Weller 2007) and environmental factors (or facilitating conditions) such as ICT infrastructure, ICT features and support and many more (Teo 2009; Chien, *et al.,* 2014). Literature also associates teachers' attitudes by their personal characteristics (mediated factors) such as gender (Venkatesh, *et al.,* 2000; Venkatesh, *et al.,* 2003; Dong and Zhang 2011), years of teaching experience (Nasser and Abouchedid 2000; Cavas, *et al.,* 2009; Onasanya, *et al.,* 2010; Karaca, *et al.,* 2013), exposure to computers, (Cavas, *et al.,* 2009; Krishnakumar and Kumar 2011; Karaca, *et al.,* 2013) and academic qualification (Males 2011; Rahimi and Yadollahi 2011).

A literature review seeks to find how significantly these internal, external and mediated factors can influence teachers' attitudes towards e-learning. The next Sub-section presents a critical assessment of their roles in teachers' attitudes towards e-learning.

Exposure to computers

Exposure to computers (or computer experience) has been the most commonly cited factor associated with teachers' positive attitudes to e-learning (Wiesenberg and Stacey 2008; Cavas, *et al.,* 2009; Teo, *et al.,* 2009; Krishnakumar and Kumar 2011; Karaca, *et al.,* 2013). It can imply that teachers' experience and/or knowledge in computers are very crucial for the effective application of e-learning in education.

In technology decision process, Rogers (2003) identifies knowledge as the first stage towards technology decision-making (see Sub-section 2.2.1, p. 87). This is also supported by Karaca, *et al.,* (2013, p. 361) who suggest that "teachers are likely to develop positive attitudes about technology integration when they have sufficient knowledge about its use." It implies that familiarity can lead to positive feelings. Previous research has indicated that teachers with prior computer experience are likely to portray positive attitudes towards e-learning. For example, the study by Cavas, *et al.,* (2009) among 1071 teachers revealed that teachers who use computers in their courses and those who have high level of computer access especially in their schools and at homes portrayed more positive attitude on ICT integration in education than those who did not use computers. Similarly, Krishnakumar and Kumar (2011) conducted a survey that investigated attitude towards e-learning among 255 teachers from HLIs and found that teachers with computer knowledge had positive attitudes towards e-learning.

Other studies (for example, Rolfe, *et al.,* 2008; Onasanya, *et al.,* 2010) have shown association between teachers from certain subject disciplines and attitudes towards e-learning. For instance, Onasanya, *et al*., (2010) conducted a survey to examine teachers' attitude towards integration of e-learning in HLIs. One hundred and fifty teachers from three HLIs participated in the survey. Results revealed that science teachers had more positive attitudes towards e-learning than teachers from other subject disciplines. In line with Onasanya's, *et al.,* (2010) results, Rolfe, *et al.,* (2008) conducted a qualitative study to explore teachers' attitudes towards e-learning from Arts (that is, teachers from the Schools of Politics and American Studies), and Science disciplines. Thirty six teachers from one university were involved in face-to-face semi-structure interviews. Results showed that science teachers had more positive attitudes towards e-learning than Arts teachers. The two studies revealed a pattern, which demonstrated a close relationship between science, engineering and technology disciplines with the higher rate of computer use. It can be claimed that due to the nature of these disciplines, it was relatively easy for teachers to use computers in their learning and teaching activities compared to teachers from other disciplines (Rolfe, *et al.,* 2008).

Association of subject disciplines with computer use can also build teachers' experience and self-efficacy in computers. Rolfe, *et al.,* (2008) claim that attitudes amongst Arts teachers appeared to be "…more polarised" (p. 4). They claim that Art teachers seemed to be unaware of tools that can be offered by e-learning and their pedagogical benefits from those tools. In other words, teachers believe that their subject discipline had no room in e-learning. Contrary to Rolfe, *et al.,* (2008), Tuparova, *et al.,* (2006) investigated teachers' attitudes towards e-learning among 119 teachers from natural sciences, mathematics, informatics, technical sciences and humanities and found no statistically significant difference related to teachers' subject discipline with their attitudes towards e-learning. It can be suggested that exposure to computers can play a greater role in teachers' attitude regardless of the subject discipline.

Teaching experience

Literature on attitude formation towards e-learning has also associated teaching experience with teachers' attitude towards e-learning (Nasser and Abouchedid 2000; Cavas, *et al.,* 2009; Onasanya, *et al.,* 2010; Karaca, *et al.,* 2013). In this study, teaching experience was used to mean years of teaching, in relation with experience in digital technology.

With the global dynamic change of digital technology particularly in education, it could be argued that the most recent graduate and less experienced teachers are more conversant with the recent technology and therefore, are more likely to expose positive attitudes towards e-learning than their counterparts, old graduate teachers (Onasanya, *et al.,* 2010; Karaca, *et al.,* 2013). Prensky (2001) has positioned old graduated teachers who were educated in less or non-digital environment trying to cope up with new emerging technologies as *digital immigrants,* whereas young teachers and students of today who can speak the digital language of the current technologies as *digital natives* (Prensky 2001; Jones and Shao 2011).

Previous research that investigated association between teaching experience and attitudes towards e-learning have yield inconsistent results. On one hand, results from Tuparova's, *et al.,* (2006), Buabeng-Andoh's (2012) and Karaca's, *et al.,* (2013) studies had consistently supported the above argument. Tuparova's, *et al.,* (2006) claim that teachers with more than ten years of teaching experience are less inclined to develop and apply e-learning materials. Although no reasons were suggested, it can be argued that such teachers either could not cope up with the pace of current technology where

Rogers (2003) referred to them as *laggards,* that is, late technology adopters or they were reluctant to accept changes. Similarly, a study by Buabeng-Andoh (2012) that investigated teachers' skills, perceptions and practices about e-learning among 231 teachers reveals a negative correlation between years of teaching experience and use of e-learning technologies. He found that teachers with fewer years of teaching experience integrated e-learning into their teaching activities more than long experienced teachers. A similar result was obtained by Karaca, *et al.,* (2013) who found that teaching experience had negative direct effects on teachers' attitudes towards e-learning.

On the other hand, Shin (2010) conducted a study that investigated teacher-related factors that influenced teachers' use of e-learning among 661 teachers. Results revealed that long experienced teachers had higher levels of technology integration in their teaching than less experienced teachers. Shin associate results with policy on education technology, which mandates teachers to use ICT in at least 10% of their teaching activities. That was highly responded to by long experienced teachers than inexperienced teachers because of fear of acting against the policy and its implication to their jobs (Shin 2010).

A slight similar result was found by Wiesenberg and Stacey (2008) who conducted a study to determine the type of teaching approach that would result when transfer from face-to-face to online learning would be instituted. Twelve participants from a Canadian university and ten from an Australian university who had experience on teaching in both face-to-face and online environments were involved in the survey.

Participants were required to portray their attitudes toward use of advanced communication technologies (ibid.). Results showed that Canadian teachers were more in favour of online teaching than the Australian teachers (Wiesenberg and Stacey 2008). Reasons for such a pattern were associated with long teaching experience for Canadian teachers in both face-to-face and online methods than their counterparts.

In summary, the argument that the most recent graduate and less experienced teachers are more likely to expose positive attitudes towards e-learning than their counterparts, should be treated with care because we cannot rule out the other argument that the recently graduated teachers could also be taught by long experienced teachers. Nevertheless, examination of these studies implies that years of teaching experience can also play a significant role in determining teachers' attitudes towards e-learning, though; the number of years in service may not necessarily have a direct impact.

Gender

Previous studies have found gender to have a significant impact on individual attitudes towards technology (Venkatesh, *et al.,* 2000; Venkatesh, *et al.,* 2003; Sim, *et al.,* 2011; Wong, *et al.,* 2012). In a longitudinal field investigation of gender differences in individuals' adoption decision with respect to technology, Venkatesh, *et al.,* (2000) claim that managing institutional adoption of technology process requires a clear understanding of the gender differences in relation to an individual's technology adoption and usage decisions. Dong and Zhang (2011) argue that it is essential to understand the impact of individual gender differences "… when studying technology adoption across countries" (p. 385). It can imply that, when teachers are introduced with new technology, their decision whether to accept or reject can also be determined by their gender differences.

Former studies on gender differences and attitude on technology adoption revealed that men tended to be highly task-oriented (Minton and Schneider, see Dong and Zhang 2011) and, therefore, they were likely to adopt the technology when they perceived it to be a tool to accomplish tasks. This was also supported by Venkatesh, *et al.,* (2003) who found out that men were highly task-oriented and were found to be influenced by their perception that technology is useful. However, recent studies (for example, Onasanya, *et al.,* 2010; Demuth 2010; Shin 2010; Rahimi and Yadollahi 2011) have indicated no correlation between gender and teacher's attitude towards e-learning.

Other scholars link gender with other factors. For example, Ong and Lai (2006), found that men's perception in future intention to use e-learning was highly influenced by their perceived usefulness on e-learning, their self-efficacy and easiness of use, while women's perceptions were dominated only by self-efficacy and ease of use. In China, Dong and Zhang (2011) investigated the role of gender in adoption of technology and found that Chinese women's adoption decision was strongly influenced by their attitudes, whereas there were subjective norms for Chinese men.

Results from these studies invite further investigation from what is already known to examine whether or not gender has a significant association with an individual's attitude towards e-learning. This would not only enhance understanding but also it would suggest consideration of other factors such as cultural differences along with gender when examining teachers' attitude towards e-learning.

Academic qualification

Only a few studies found a significant effect of qualification or education level on teachers' attitudes towards e-learning (Males 2011; Sim, *et al.,* 2011; Rahimi and Yadollahi 2011). Males (2011) investigated teachers' uses of, and attitudes towards technology in urban schools in New Jersey, USA. Results revealed that teachers holding a doctorate degree were significantly fewer in number in using e-learning technologies than bachelor and master degree teachers.

In a similar study in Iran, Rahimi and Yadollahi (2011) argue that e-learning use is positively and significantly related to teachers' academic qualifications. Their results revealed that teachers with master degrees used e-learning tools more than teachers with a Bachelor degree. However, a study by Demuth (2010) who investigated the adoption of technology among college teachers and students in the USA indicated no statistically significant association between academic qualification and teacher's attitude.

Inconsistent findings from these studies could be due to type of study and sample used (see Sub-section 5.2.1, 285, Part iii), however they call for further investigation to examine whether or not there is association between teachers' academic qualifications and their attitude towards e-learning. Ideally, further investigation carried out from different cultural and education settings would enrich the existing knowledge to what is already known from the previous studies.

E-learning understanding

To date, little is known about the influence of teachers' e-learning understanding on their attitudes towards e-learning. However, there is a related study by Probert (2009) who investigated teachers' understanding of information literacy in relation to their subject disciplines in New Zealand. Teachers' descriptions were related to chosen definitions and terms, and frequency counts for each use of terms were generated through the SPSS software. Results showed that teachers from languages and other social studies had good understanding of information literacy rather than teachers of mathematics, science, technology, health and physical education (Probert 2009). Nevertheless, results from semi-structured interviews with heads of departments and team leaders showed that their descriptions generally, portrayed a better understanding than those from close-ended questions from teachers, regardless of their subject disciplines (ibid.).

More recently, Smith (2013) conducted a qualitative research that explored teachers' understanding and perception of information literacy and factors that influence their understanding of information literacy in education in Canada. Results from this study revealed inconsistent understanding of the concept information literacy. Inconsistent understanding of concepts among teachers has its repercussions particularly to learners in their future work, personal or academic careers consequently causing the society constructing a negative attitude on the quality of knowledge school graduates acquired about information literacy.

Results from the above studies suggest a need to examine teachers' understanding of e-learning prior examining their attitudes towards it because literature shows that understanding can influence attitude and consequently their actions toward it (Rogers 2003; Ajzen and Fishbein 2005). Inconsistent definitions of information literacy revealed by Probert (2009) and Smith's (2013) studies suggest to education stakeholders that knowledge is essential for a successful planning, accepting and later implementation of the intended concept. Although, empirical investigation on association of e-learning understanding and attitudes is scarce, this study examined whether or not there were any associations.

2.2.3 Attitude scales on e-learning

Examination of approaches used to measure attitude reveals that attitude scales are the most commonly used with summated rating Likert scales (Albaum 1997; Johns 2010). A Likert, or Likert-like, scale employs self-reporting methods with a series of questions focused on assessing attitudes. Respondents would rate the attitudinal object by choosing the best option that reflects their level of agreement or disagreement (Likert 1932). Trends over the past two decades on attitude scales on e-learning show the development of attitude measures towards computers (Nickell and Pinto 1986; Francis 1993; Richter, *et al.,* 2000) and towards e-learning (Bernard, *et al.,* 2004; Wilkinson, *et al.,* 2010; Teo 2010a; Morse, *et al.,* 2011; Hernandez-Ramos, *et al.,* 2014).

Although use of attitude scales in e-learning has provided rich data for analysis and interpretation, the literature has identified weaknesses with many existing scales (Garland and Noyes 2008; Teo 2010a; Hernandez-Ramos, *et al.,* 2014). For example, in their analysis of previous computer attitude scales developed in 1980s and 1990s, Garland and Noyes (2008) discovered that the stability of most of these scales has declined since they were first developed. Although the examined scales were all reliable, Garland and Noyes (2008, p. 563) argue that, “the traditional style of computer attitude scale is no longer as relevant as when first developed.” Wilkinson, *et al.,* (2010, p. 1369) refer to such scales as “dated with technological developments”. It implies that, with individuals’ cultural and ICT experiences as well as new technological developments, educators need scales that demonstrate predictive validity (Garland and Noyes 2008) as well as reflecting current developments.

A further weakness of attitude scales is their inability to be used in diverse populations. Literature reveals validated attitude scales towards e-learning with different constructs each applicable in a particular context. For example, Bernard, *et al.,* (2004), utilize factor analysis to test their development and validation of a 38-item attitude scale to predict achievements in online learning. This analysis revealed four themes that included “general beliefs about distance education, confidence in prerequisite skills, self-direction and initiative, and desire for interaction” (p. 31). However, this scale could not meet the present study’s requirements that aimed at investigating teachers’ attitudes towards e-learning. The scale aimed at measuring achievements in online learning.

The attitude scale presented by Wilkinson, *et al.,* (2010) measures students' attitudes towards e-learning across five themes: IT skills, IT experience, IT use, IT access, Attitude to computers and Attitude to computers in education. Further analysis of this scale revealed that its items concentrated mainly on measuring of skills and experience with computers and the Internet, thus in the researcher's opinion it lacked the diversity of attitudinal aspects geared to the concept *attitude towards e-learning*. Although the scale demonstrated both external and internal reliability, it demanded more improvement to produce a useful scale to other domains (Wilkinson, *et al.,* 2010).

Moreover, Teo (2010a) developed a 21-item E-learning Accepted Measure (ElAM) scale with three themes: Tutor Quality, Perceived Usefulness and Facilitating Conditions. Similarly, ElAM did not meet the current study requirements in that it was aimed at measuring users' acceptance of e-learning in relation to their use of e-learning systems, contrary to the present study that aimed at examine attitudes to non-users of e-learning systems. Although the scale was developed and validated in two different studies, its validity remained limited to the sample used (Teo 2010a).

Morse, *et al.,* (2011) developed a 17-item Attitudes Towards the Internet Scale (ATIS) with three themes: General Internet Usage, Negative Internet Attitudes and Task Facilitation. Unlike the aim of the present study, ATIS focused only on one aspect, which was attitude towards the Internet. In line with Teo (2010a), it was suggested that ATIS needs to be validated in other domains to enhance its reliability (Morse, *et al.,* 2011). A more recent study by Hernandez-Ramos, *et al.,* (2014) developed a 15-

item single construct attitude scale to examine teachers' attitudes towards ICT. The scale demonstrated acceptable internal consistency but focused only on measuring attitudes towards use and was validated among teachers of a single university (Ibid.). Findings from analysis of above studies show that all scales demonstrated psychometric properties but, they could lack efficacy in different cultural domain and/or items lack diversity of aspects or themes geared to measuring attitudes towards e-learning.

Therefore, Fraser's (1981) Test of Science Related Attitudes (TOSRA) scale was adapted in this study to develop a Test of e-Learning Related Attitudes (TeLRA) scale (see Sub-section 3.6.1, p. 149). TOSRA was developed to measure attitude towards science among secondary school students and it had seven, ten-item themes, which include Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science and Career Interest in Science (Fraser 1981). TOSRA uses a five-point Likert style response format with response categories ranging from *Strongly Agree* to *Strongly Disagree* (Ibid.). TOSRA has accepted internal reliability, discriminating validity and has undergone test-retest to 238 students administered in two-week period between the two studies (Fraser 1981).

TOSRA was adapted in this study because of its cross-cultural validity. It has been tested in Australia and the United States (Fraser 1981), Indonesia (Fraser, *et al.,* 2010), Turkey (Telli, *et al.,* 2010), as well as Pakistan (Anwer, *et al.,* 2012). Most recently, one sub-scale, named, *Enjoyment of Science Lessons* has been validated in Albania, Kosovo, Romania, Poland and Austria (Emilov 2013). Moreover, each theme has conceptually-similar items and through factor analysis all themes revealed unidimensionality property (Fraser, *et al.,* 2010). Furthermore, TOSRA has been modified and applied to measure attitudes towards Mathematics through a Test of Mathematics Related Attitudes, TOMRA (Taylor 2004; Hoang 2008; Chow 2011).

Although TOSRA was originally designed for measuring secondary school students' attitudes towards science, literature shows that with a careful review and modification of themes, TOSRA can also be used among teachers. For example, Chin (2005) adopted TOSRA in measuring teachers' attitudes towards science in Taiwan. Similarly, Santiboon (2013) adopted TOSRA and developed Test of Administrator-Related Attitudes (TOARA) to measure teachers' attitudes towards school's administration in Thailand. The adaptation of TOSRA in the development of TeLRA is presented in sub-section 3.6.1, p. 149.

2.2.4 Barriers that hinder adoption of e-learning

Rogers (2003) describes adoption of technology or innovation through two perspectives: with organizations and individuals (see Sub-section 2.1.3, p. 74, Part i). Thus, it is unlikely to separate the two perspectives when discussing challenges of adoption as well as implementing e-learning in HLIs.

However, institutions can face different challenges within their unique circumstances. Van der Klink and Jochems (2004) categorize the challenges into two: institutional and individual challenges related to teachers. Several studies have associated institutional and individual factors with barriers for e-learning adoption in HLIs (for example Sife, *et al.,* 2007; Mnyanyi, *et al.,* 2010; Unwin, *et al.,* 2010; Saekow and Samson 2011; Nagunwa and Lwoga 2012).

Sub-sections that follow expand on significance of these challenges by providing explanation of their impacts on adoption of e-learning in HLIs.

i. Institutional factors

ICT infrastructure

The most commonly cited institutional factor in earlier studies (Newton 2003; Sife, *et al.,* 2007) was poor ICT infrastructure in terms of communication, sources of power supply, computer laboratories as well as ICT technical support units. These factors are still apparent in recent studies (Unwin, *et al.,* 2010; Saekow and Samson 2011; Nagunwa and Lwoga 2012; Sanga, *et al.,* 2013; Chien, *et al.,* 2014).

In their study to evaluate e-learning readiness of Thailand universities, Saekow and Samson (2011) found no e-learning adoption readiness to most public and private universities. Most universities were facing problems associated with Internet connectivity and technical skills for supporting e-learning (Saekow and Samson 2011). Unwin, *et al.,* (2010) investigated usage of e-learning systems among 358 respondents across 25 African countries. The study revealed considerable ICT infrastructural constraints (particularly connectivity, Internet bandwidth, high cost for access to Internet and technical support) that need to be addressed before e-learning systems can be extended to open and distance learning.

Challenges associated with ICT infrastructures are just part of the problems. Literature claims that if proper planning prior to adoption is done and appropriate implementation strategies are developed, then these problems can be minimized if not eliminated (Nichols 2008; Mnyanyi, *et al.,* 2010).

Institutional ICT policy

Issues related to systematic strategic plan for adopting e-learning and the institutional ICT policy, which set milestones in place are closely associated with barriers that can hinder adoption of e-learning in HLIs (Newton 2003; Sife, *et al.,* 2007; Nichols 2008; Glenn 2008; Unwin, *et al.,* 2010; Saekow and Samson 2011). Garrison (2011) highlighted several issues that need to be included in a policy document and strategic plan. They include the following, to mention few institutional vision and mission; need and risk assessment; description of educational principles and outcomes; implementation initiatives and strategy as well as ICT infrastructure and support services (Garrison 2011). These are guidelines that can assist an institution in transforming its traditional learning and teaching practice into e-learning. Having a strategic plan in place reduces risks of finding an institution into an ad hoc situation of adopting e-learning. Lack of a systematic strategic plan may cause frustration, which can lead to total transition failure (Garrison 2011).

Nichols (2008) explored institutional challenges of e-learning diffusion among 14 HLIs in New Zealand. Results revealed a significant association between an institutional ICT policy and an institutional e-learning adoption (Nichols 2008). To some institutions with the policy, e-learning was absorbed into daily activities, whereas for other institutions, e-learning adoption was treated to be an external activity (Nichols 2008). Farrell and Isaacs (2007) note that the problem to most institutions is not the policy but rather, they lack integration strategies of e-learning into pedagogical practice. To address the problem, institutions should align ICT policies with their e-learning activities. Practical plans that clearly specify responsibilities for each individual involved and timeline for each step arrive from a clear policy (Glen 2008; Saekow and Samson 2011).

However, to accelerate and manage implementation of an institutional policy requires a strong as well as highly committed leadership (Garrison 2011). If leaders are not supportive or are not involved in strategic matters about e-learning adoption, then that becomes a problem. In order to achieve Millennium Development Goals (MDGs), institutional leaders need to recognise e-learning as fundamental to create a high quality learning environment. Therefore, their engagement in developing a sound policy, sense of collaborative ownership of e-learning technology and a safe environment for addressing challenges as well as sharing ideas are crucial during and after the policy is set up and initial implementation and evaluation stages are executed (Glen 2008; Saekow and Samson 2011; Garrison 2011).

Support from the head of an institution

It was also reported that a successful transformation demands a strong leader with a clear vision to support the adoption of e-learning (Rogers 2003; Newton 2003; Glen 2008; Nichols 2008; Garrison 2011). Gambari and Okoli (see Onasanya, *et al.,* 2010) identify institutional administrators as one of the obstacles in introduction and utilization of ICTs in African Universities. Administrators were also found to be non-supportive on integrating ICT in the education system because of costs associated with ICT training to teachers and purchasing technologies as well as equipment for e-learning (Nasser and Abouchedid 2000; GESCI 2009).

Similarly, Moore (see Newton 2003) argues that barriers toward realization of e-learning in HLIs are also associated with administrators, that is, the way administrators perceive and prioritize change to e-learning. Heads of institutions are capable of allocating resources particularly on matters related to staff training in use of technology, ICT infrastructure, and on matters related to educational practice in e-learning environment as a whole. However, this can only happen when e-learning is given a higher priority at a strategic managerial level (GESCI 2009; Garrison 2011). Supports provided to teachers from their institutions have been found to inspire their involvement in e-learning by providing their students with opportunities that enhance their learning process (Smarkola 2008).

To achieve successful adoption of e-learning, heads of institutions should lead on developing a clear vision and implementation strategy that can position their institutions to move forward as well as realize new challenges brought by diverse learners' needs (Weller 2007; Garrison 2011). Leading does not mean imposing, but it means involving all stakeholders so that they, together as a unit, understand why and what is transformed to meet the intended goals (Avidov-Ungar and Eshet-Alkakay 2011). To realize these challenges, institutions need an "…insightful and resourceful institutional leadership" (Garrison 2011, p. 113).

Financial constraints

Another main barrier to adoption of e-learning in HLIs is cost (Guri-Rosenblit 2009; Unwin, *et al.,* 2010; Chien, *et al.,* 2014). Costs can be seen in terms of the following aspects:

i. initial set-up costs;
ii. purchasing of ICT equipment and maintenance costs;
iii. cost of proprietary software;
iv. costs of digital bandwidth;
v. ongoing e-learning course development expenses;
vi. teachers training costs; and
vii. support staff salaries and many more (Mnyanyi, *et al.,* 2010; Saekow and Samson 2011).

Glen (2008) conducted a survey among 289 university participants and observed that 70% of respondents cited cost to be the biggest factor that influenced e-learning adoption. Guri-Rosenblit (2009, p. 115) claims that "setting the appropriate infrastructure and maintenance of e-learning is costly." This is supported by results from Saekow and Samson's (2011) study that initial set-up and implementation of e-learning require considerable investments in order to put ICT infrastructure and human resources in place. Therefore, to achieve successful transformation of learning and teaching in education, cost implication is unavoidable. Nevertheless, strategies to reduce the impact can help institutions account for the large investments in adopting e-learning (Salleh 2005).

Therefore, the government, as an overseer of quality learning and teaching, can intervene by providing financial assistance to institutional transformation. Government's participation in developing national ICT policies alone cannot help institutions if contents of such policies are not put into practice. The survey conducted by Saekow and Samson (2011) in Thailand shows that there are no universities that receive any financial support from the government. It implies that the whole burden is left with the respective institutions to manage e-learning, resulting into a barrier.

ii. Individual Factors

Teachers' understanding of e-learning

Literature shows that teachers play a key role when it comes to integrate e-learning into education (see Sub-section 2.2.2, p. 89). However, most studies on teachers' attitudes towards e-learning have been quantitative investigations (see Sub-section 1.2, p. 54) such that teachers' understanding of e-learning has been given little attention.

Teachers' understanding of e-learning has a significant impact on their attitudes about it and hence, their behaviour towards it. Studies show that if teachers do not understand the meaning and impact brought about by e-learning to education, then they are likely to resist or avoid using it (see Sub-section 2.2.1, p. 87). This could lead to institutional failure to change resulting into a barrier.

Teachers' resistance to change

Available literature attributed teachers' resistance to change among factors that impinge upon e-learning adoption into education (Newton 2003; Glen 2008; Mnyanyi, *et al.,* 2010; Garrison 2011). Rolfe, *et al.,* (2008) refers to it as a culture of resistance where teachers accustomed to traditional modes of instruction refuse to change, that is, they are reluctant to put their courses into an electronic format (Glen 2008; Rolfe, *et al.,*2008; Nihuka and Voogt 2011).

Rolfe, *et al.,* (2008) explored teachers' attitudes towards e-learning in the United Kingdom. They found that teachers were reluctant to change because they did not want to be alienated from their traditional culture. Teachers were unwilling to work outside their normal pattern in which they felt comfortable (Rolfe, *et al.,* 2008). Garrison (2011) adds that learning new emerging and dynamic-technologies could be another challenge to teachers.

The literature associates teachers' reluctance to change with self-confidence toward e-learning (Ong and Lai 2006; McConell 2011), lack of ICT skills (Cavas, *et al.,* 2009; Buabeng-Andoh 2012), lack of incentives that motivate adoption (Mnyanyi, *et al.,*2010; Saekow and Samson 2011) and generational division between older and younger teachers in responding to technology (Microsoft Scholar report, see Newton 2003; Jones and Shao 2011). Others cited attitudinal factors (Teo and Ursavas 2012; Pynoo, *et al.,* 2012). Avidov-Ungar and Eshet-Alkakay (2011) report that teachers' resistance to adopt new technology is considered to be among the reasons for the failure of processes that involve change in the education systems.

Teachers' attitudes towards e-learning

Teachers' attitudes towards e-learning have significant impacts on the transformation of learning and teaching in HLIs. Several models have been developed to investigate how an individual comes to accept or reject a technology (see Sub-section 2.1.3, p. 74). Sub-section 2.2.2, p. 89 further describes factors that may influence teachers' attitudes towards e-learning, which when happened to be negative, that is, with some degree of disfavour may also lead to a barrier for e-learning adoption in HLIs.

In summary, challenges of adopting e-learning in education are spread between the stakeholders of education and the education institutions themselves. However, education institutions cannot stand by themselves if people working in these institutions are not part of the changes. For instance, the reviewed problems above can also be eliminated if the attitudes of all education stakeholders are supportive to e-learning initiatives. Changes have to start at the individual level if the potential of e-learning in education are to be realized. Addressing barriers of e-learning adoption in education is a combined effort that requires involvement of all education stakeholders (Nagunwa and Lwoga 2012). The next sub-section discusses involvement of teachers and students in e-learning to achieve a high quality learning outcomes.

2.2.5 Teachers and students' involvement in e-learning

A successful e-learning programme depends, to a greater extent, on how actively teachers and students are involved in preparing, accessing, managing and distributing educational content (Mwanza and Engestrom 2005). In the educational process *involved* means learners' participation with highly interactive progression of learning experiences geared towards achieving educational goals (Garrison and Vaughan 2008).

In other words, *involvement* features learners seeking and responding to information, teachers sending and receiving feedbacks, teachers and students participating to asynchronous as well as synchronous discussions including sharing of experiences (Mwanza and Engestrom 2005; Garrison and Vaughan 2008). Garrison and Anderson (2003) view the value of interaction within the educational process as learning activities among teachers, students and content. Literature holds that learners, in e-learning, can construct their own meaning and can remain involved in e-learning in which they feel a sense of educational community with their teachers, other learners and the content (Garrison and Vaughan 2008; Anderson 2008a; Garrison 2011; Mason 2011).

Garrison and Anderson (2003) outline six forms of interaction supported in e-learning that included teacher-to-student, student-to-student, student-to-content, teacher-to-content, teacher-to-teacher and content-to-content interactions. They are presented in the following sub-sections.

i. Teacher-to-student interaction

Teacher-to-student interaction is a dual interaction between a teacher as a subject expert as well as facilitator of learning and students as learners or knowledge seekers (Miyazoe and Anderson 2010). In this sort of interaction, teachers are involved in a mediated dialogue with each student (Garrison and Anderson 2003).

Advancements in e-learning technologies have made it possible to support a quality teacher-to-student interaction in both asynchronous and synchronous communication

(Garrison and Anderson 2003; Anderson 2008b). However, the extent of this interaction depends on technology used. For example, with print-based distance learning, the teacher-to-student interaction is confined to teleconferencing technologies where students can contact teachers for issues related to misconception on subject matter or queries in their assignments and extension of submission times (Hase and Ellis 2001). In online learning, interaction is extended to e-mail and chat rooms where students can discuss important issues from problem-solving, learning from others while clarifying issues to convey their views (Anderson 2008a). For example, in blended learning students are engaged with an online discussion forum and use of communication networks with their peers as well as teachers, supported by face-to-face sessions where teachers respond to students' queries and can diagnose students' misconceptions on special issues or topics in group discussions or tutorials (Garrison 2011).

However, the challenge is to establish a student-centred approach to learning instead of teacher-centred approach. In a student-centred approach, teachers do not have to quickly respond to students' queries because knowledge is constructed by students and the teacher is a facilitator of learning rather than a presenter of information (Salmon 2003). Yengin, *et al.,* (2010) refer to student-centred approach as an *active learning* where students become responsible in their learning and not just knowledge receivers. In this way, students' involvement is increased in terms of commitment, participation and motivation (Salmon 2003; Anderson 2008b).

ii. Student-to-student interaction

Student-to-student interaction or interaction among students was not in practice during early phases of distance learning due to constraints on availability of technology (Garrison and Anderson 2003). With advancement of technology, student-to-student interaction has become very useful because it broadens students' knowledge and increases their satisfactions through the support of other learners (He 2013). In his analysis on a theory and practice of online learning, Anderson (2008b) found a higher level of students' knowledge, social interactivity and teaching presence in student-led teams than those led by teachers. In line with this, He (2013, p. 98) argues that "students were much more active in interacting with their peers than with their instructors." This was also suggested by Rourke and Anderson (see Anderson 2008b, p. 57).

In an e-learning context, student-to-student interaction is supported through a variety of technologies such as instant messaging, peer-to-peer file sharing and hand-held mobile technologies (Garrison and Anderson 2003). These technologies can be used in both synchronous and asynchronous learning formats (Garrison and Anderson 2003; Garrison 2011).

Findings from analysing the studies above show that e-learning has expanded the old definition of an independent study associated with the earlier phases of distance learning by providing new levels of learner-led interaction. However, proper amounts of student-to-student interactions should be handled and integrated with care, depending on expectations and capacity for interaction expressed by students themselves (Garrison and Anderson 2003).

iii. Student-to-content interaction

Student-to-content interaction occurs when a student is interacting with content for the purpose of gaining knowledge and understanding (Miyazoe and Anderson 2010). One of the leading challenges to development of e-learning programmes is the easy access to learning materials. In traditional face-to-face learning, this is attained by using texts and library resources (Garrison and Anderson 2003). In e-learning context, this is transformed to reading contents expressed on text on the screen or on paper (Garrison and Anderson 2003). This is also supported with a variety of online computer-assisted instructions, simulations and presentation creation tools (Garrison and Anderson 2003; Anderson 2008b).

In the traditional system, content was assumed to be static, waiting for students to consume it (Garrison and Anderson 2003). In e-learning context, students' involvement means using their ICT skills to identify appropriate information evaluate it and effectively use it so as to achieve their educational goals (ibid.).

iv. Teacher-to-content interaction

In all forms of education, teacher-to-content interaction refers to teachers' role in creation of content, that is, development of learning objects, complete courses and associated learning activities (Anderson 2008b; Miyazoe and Anderson 2010). Hase and Ellis (2001) note that the content should be designed such that it not only develops competency but also aspects of capability like independent learning skills, creativity and working in teams. Teacher-to-content interaction allows teachers to continuously evaluate and up-date their materials through research, reading different books and publications as well as receiving contributions from other experts for continuing learning (Anderson 2008b).

v. Teacher-to-teacher interaction

Teacher-to-teacher interaction implies that the teacher is in an active interaction with the other teacher for the purpose of professional developments in their own disciplines (Miyazoe and Anderson 2010). For instance, in e-learning, teachers can share knowledge via textual discussion such as instant messaging in a synchronous mode and message boards or Internet forums in an asynchronous mode (Anderson 2008b). They can also share knowledge via audio, video or other Internet-supported media (Ally 2008). Teacher-to-teacher interaction is essential in knowledge growth as well as discovery in their subject domains and in developing quality instruction that meets students' learning expectations and outcomes (Garrison and Anderson 2003; Anderson 2008b).

vi. Content-to-content interaction

Anderson (2008b, p. 59) describes the content-to-content interaction as an emerging "…mode of educational interaction wherein content is programmed to interact with other automated information sources that constantly refreshes itself and acquires new capabilities, through updates and interaction with other content sources." With rapid change on technology, the current Web technology has been extended to the

Semantic Web, which aims at enabling automatic retrieval (machine-accessible/understandable), extraction, integration, sharing and re-use of information on the World Wide Web (McIlraith, *et al.,* 2001; Jindal, *et al.,* 2014).

Anderson (2003) argues that the semantic web technology offers an environment whereby content can be stored, searched and computed automatically through autonomous agent technologies. The *autonomous agents* are software systems (such as autonomous robots) used to perform some set of operations on behalf of a user or another programme so as to effect what it senses in future (Tumer, *et al.,* 2002). Effective use of such systems in e-learning will encourage migration to content-based forms of interaction where content or learning resources will be able to interact, update and improve without direct human intervention (Anderson 2003; Miyazoe and Anderson 2010).

vii. Teachers and students' roles in e-learning

With all these aspects of interactions possible in e-learning environments, roles of teachers and students need to change if meaningful as well as dynamic learning is to be achieved. On one hand, Anderson, *et al.,* (2001) as well as Anderson (2008a) describes two critical roles that a teacher performs in the process of creating and maintaining a dynamic learning environment. First, is to design and organise the learning experience before and during the operational process that encourages an independent study and educational community building (Anderson 2008a). Second, teachers need to devise and facilitate activities that encourage all aspects of interactions explained before (Anderson 2008a). Similarly, Garrison (2011, p. 60) describes the role of a teacher as a moderator of learning experiences in terms of "identifying a concept, provide the conceptual order, organise and guide learning activities, inject knowledge from different sources and respond to technical problems." In general, the teacher's role can simply be summarized as facilitation of learning and assisting learners in producing new knowledge with a high degree of interactivity as well as participation for realizing meaningful and educationally worthwhile learning outcomes (Salmon 2003; Brown 2003; Salmon 2011; Garrison 2011).

On the other hand, students would not only receive knowledge but also would act as explorers and seekers for knowledge (Brown 2003). Students' role should not be to memorise or understand everything, but to have the capacity to identify appropriate information, evaluate it and effectively use it when and where it is needed (Anderson and Dron 2011).

Therefore, the rapid development of ICT has witnessed HLIs adopting e-learning techniques in their learning and teaching process (Salmon 2003; Glenn 2008; Mason 2011; Meenakshi 2013). Through e-learning, HLIs can establish effective support mechanisms, which enable students to interact with teachers, content and other students through face-to-face tutorials and ICTs (Guri-Rosenblit 2009). For example, Mason (2011) suggests for an online discussion forum as a popular interactive environment in e-learning that can increase students' participation and improve their critical thinking.

2.3 Mixed methods

2.3.1 Introduction

The present study used mixed methods as a research approach for data collection, analysis and interpretation of findings. This sub-section describes the meaning of, and similar research studies that used mixed methods approach. A brief rationale of using this approach is also presented.

2.3.2 Defining mixed methods

Denscombe (2010) and Bryman (2012) define mixed methods as a research approach that combines quantitative and qualitative sampling, data collection and analysis as well as interpretation of findings. It is also a kind of triangulation termed as *methodological triangulation* (see Sub-section 3.7.2, p. 157), which combines quantitative and qualitative methods to corroborate each other (Robson 2011). Integration of quantitative and qualitative methods in research studies began in late 1980s and early 1990s and has brought about the use of different terms, such as multimethods, integrated/combine research, multi-strategy research and mixed methodology, which are rarely used today (Denscombe 2010; Creswell and Plano Clark 2011; Creswell 2014).

2.3.3 Mixed methods studies

Several studies are known today that have used both strands. For example, Sanchez, *et al.,* (2012) used a mixed methods approach to investigate teachers' attitudes towards the use of ICT in classroom. Twenty five close-ended questions that measured teachers' attitudes were used among 170 teachers supplemented by semi-structured interviews to 11 teachers. In their study, interview questions aimed to explore teachers' major motivations and beliefs towards ICT, which enable the researchers to capture reasons for their differences in attitudes towards ICT established from the close-ended questions.

Recently, Bloomfield and Jones (2013) conducted a mixed method research to explore students' perceptions and experiences on the use of e-learning. In their study, they used data generated from focus group discussion to develop and administer 28-item questionnaire in their second phase of research. Similarly, Karaca, *et al.,* (2013) used a sequential mixed methods approach to propose and test a technology integration model that involves critical factors from teachers' perspectives. Their study was conducted in three phases. In the first phase they used face-to-face semi-structured interviews among 20 teachers to obtain a comprehensive list of factors affecting technology integration. Findings from this phase were used to develop a survey instrument scale in phase two, which was then administered to 1080 teachers in phase three. Results shows that teachers' attitude to technology integration in education were directly influenced by their competency in technology, which further supported their findings obtained from qualitative data.

Most recently, Ndibalema (2014) used a mixed methods approach to investigate teachers' attitudes towards the use of ICT as a pedagogical tool in secondary schools in Tanzania. The first phase of his study used quantitative approach which was used to inform the researcher on the characteristics of participants relevant for the second phase of study, which used qualitative approach. Furthermore, the two research questions in his study were analysed using data obtained from both approaches which further enhanced their findings.

The main rationale of using both quantitative and qualitative methods in a single research study is based on the limitation associated with the close-ended questionnaires which could not provide in-depth understanding of research participants' knowledge to the question under investigation. To overcome this limitation, researchers included open-ended questions and/or interviews so that respondents would be free to describe their beliefs, opinion and experiences about aspects under investigation. The combination of qualitative and quantitative data in a research project helps researchers to enhance their findings' validity and utility to all education stakeholders. Further discussion on the rationale for using mixed methods and its challenges is presented in sub-section 3.2.1 in Chapter three.

2.4 Synthesis and the research gap

2.4.1 Synthesis

A comprehensive literature review (see Section 2.2) has presented the impact of teachers' understanding of, and attitude towards e-learning and also described factors that can influence teachers' attitudes towards e-learning. Literature shows that teachers tend to have a positive attitude towards e-learning if they believe it to be useful and/or easy to use (Davis 1986; Venkatesh, *et al.,* 2003; Rogers 2003; Teo 2011).

The review of literature showed that among factors that can influence teachers' attitude towards e-learning *exposure to computers* was highly cited (see Sub-section

2.2.2, p. 89). Repeated exposure to stimuli was well explained by social psychologists through a psychological phenomenon known as the mere exposure effect, and shows how an individual gets to like things or people when they are repeatedly exposed to them. It implies that the more teachers are exposed to computer functions, the more they will get to like it. Also it is argued that individuals with a positive attitude towards an object are more likely to evaluate a similar object with the same attitude through association of current attributes with the previous one (as outlined in sub-section 2.1.2, p. 69).

Moreover, education transformation is more than examination of teachers' attitude and factors associated with their attitudes. It also includes an exploration of other factors that could hinder such transformation. Literature (see Sub-section 2.2.4, p. 106) shows that challenges that can significantly hinder the adoption of e-learning in HLIs are associated with ICT infrastructure, institutional policies, support from administrators, costs and teachers' culture of resistance.

Similarly, education transformation needs to establish how e-learning can be integrated and implemented into education. This includes a critical examination of how teachers and students will be involved in an e-learning. In e-learning, teachers acquire new technological assisted roles to facilitate learning and assist learners in producing new knowledge with a high degree of involvement, whereas students' roles are changed to explorers and seekers for knowledge through the use of ICT.

2.4.2 Research gap

The literature shows that many studies conducted on teachers' attitude toward e-learning have focused their attention on investigating the behavioural intention to use or to the actual use of e-learning (for example, Zhang, *et al.,* 2008; Al-Busaidi and Al-Shih 2010; Mtebe and Raisamo 2011; Teo, *et al.,* 2011; Pynoo, *et al.,*2012; Gibson, *et al.,* 2014; Chien, *et al.,* 2014), where attitude was used as a causal factor or an independent variable. In addition, most research has been quantitative in nature (see Sub-section 1.2, p. 54) that described teachers' attitudes towards e-learning but did not incorporate qualitative aspects for participants to express their opinions and understanding on the phenomenon under investigation.

Furthermore, studies that focused on teachers' attitudes towards e-learning were conducted in other parts of the world (see Sub-section 1.2, p. 54) and an empirical implication in Tanzania was yet to be established. Studies conducted in Tanzania have mainly tended to focus on challenges for integrating ICT into the education system rather than teachers' attitudes towards e-learning (see Sub-section 1.2, p. 54). A study conducted solely in this subject involved teachers from secondary schools from one district in Dodoma region in Tanzania. So far, however, there has been little consideration given to research that examines teachers' attitudes towards e-learning in Tanzanian HLIs and consequently, no standard attitude scale has been developed to measure their attitudes. Scales discussed in the review of literature were developed for different geographical and educational settings such that their generalisability to other domain could be problematic.

For example, Ndibalema (2014) investigated teachers' attitudes towards the use of ICT as a pedagogical tool in Tanzanian secondary schools, whereas Mtebe and Raisamo (2011), Nihuka and Voogt (2011) and Ndume, *et al.,* (2008) used surveys to establish the acceptance and challenges of implementing e-learning in Tanzanian HLIs. However, no particular scale was developed to measure teachers' attitude/acceptance of e-learning for which validity and reliability could be established. Therefore, knowledge based on teachers' attitudes towards e-learning in Tanzanian HLIs is limited, and so is a valid and reliable measure.

Since teachers play a major role in all forms of formal education, their attitudes towards e-learning demand more empirical explanation consequently both quantitative and qualitative data were essential to investigate the phenomenon. Therefore, in order to respond to these knowledge gaps, this study investigated attitudinal factors that influence the transition from face-to-face to e-learning in Tanzanian HLIs. It also developed and validated an attitude response scale that measured teachers' attitudes towards e-learning in Tanzanian HLIs (see Sub-section 3.6.1, p. 149).

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents Research Methodology under the following headings;

i. Research paradigm;
ii. Research design;
iii. Study area;
iv. Sample type and size;
v. Sampling procedures;
vi. Data collection methods;
vii. Validity and reliability; and
viii. Data analysis procedure.

This chapter aims to demonstrate where, why and how data were collected and analysed. The methodology adopted in this study was designed to collect data based on the seven research questions outlined in sub-section 1.3.3, p. 60.

3.1 Research paradigm

A paradigm is defined as a model of inquiry underpinning researchers, particularly on "what should be studied, how research shall be done and how results should be interpreted" (Bryman 2012, p. 714). In other words, paradigm focuses on "…the way in which reality is understood (ontology) and the production of knowledge (epistemology)" (Burton, *et al.,* 2008, p. 60). Others have used both *paradigm* and a *worldview* interchangeably to mean beliefs as well as practice that guide researchers on the selection of both questions they study and methods they use to study them (Teddlie and Tashakkori 2009; Creswell 2014).

Educational research has two competing philosophical views, which underpin the way a research enquiry can be approached, namely, interpretive and normative views (Cohen, *et al.,* 2011). The interpretive view emphasises how individuals differ from inactive natural phenomena and from each other (Cohen, *et al.,* 2011). The paradigm believes that individuals would always hunt for understanding the world in which they live and work (Robson 2011; Bryman 2012). Interpretivists perceive social research to be *subjective* with the researcher and participants working together to construct knowledge (Edmonds and Kennedy 2013). In contrast, the normative view takes an *objective* perspective of evidence whereby it focuses on measurement of outcomes in order to predict and identify patterns (Burton, *et al.,* 2008). In this paradigm, knowledge is developed based on careful observations and measurement of objective reality that exists in the world (Creswell 2009).

The central question that divides the two views is based on whether or not the methodology of natural sciences can be applied to study of individuals and their social behaviour (Robson 2011; Kumar 2011). These competing views lead to the two main paradigms that form the basis for research in social sciences. They are constructivism and post-positivism (Cohen, *et al.,* 2011; Creswell and Plano Clark 2011).

3.1.1 Constructivism

Windschitl (1999) defines constructivism as the belief developed and interpreted by individuals through social interactions with the environment. Social constructivists (or interpretevists) believe that individuals, in their creation of a social world, develop multiple meanings about an object based on their past experiences and interaction with others (Creswell and Plano Clark 2011; Bryman 2012). It can imply that knowledge is constructed as a result of peoples' interactions in social events (Rickert 2009; Robson 2011). Thus, knowledge consists of not only facts, theories and principles gathered through interaction with the environment but also interpretation of the meaning gathered.

Constructivists argue that researchers, in the study of social phenomena, must reject the scientific method when conducting their social research (Creswell and Plano Clark 2011). They believe that in social research knowledge is constructed through interaction between the researcher and participants (Edmonds and Kennedy 2013). Edmonds and Kennedy (2013, p. 116) argue that constructivism "recognizes that knowledge emerging from the data is not only discovered but also created." For example, Travis and Lord (2004) illustrate how student teams created their own definitions of terms in a biology experiment and then explained them to others.

To account for this view, research participants, through their past experiences and interactions with others (social influences), can construct multiple meanings about e-learning, which can, in turn, shape their attitude toward it (Ajzen and Fishbein 1980; Fazio 2007). When they provide their understanding about e-learning, they speak from meaning. Thus meanings, perceptions and attitudes about e-learning were extracted in this study through open-ended questions and interviews such that multiple perspectives about e-learning were interpreted. A social constructivist paradigm lends itself to qualitative research (Burton, *et al.,* 2008; Teddlie and Tashakkori 2009; Creswell 2009; Creswell and Plano Clark 2011; Cohen, *et al.,* 2011; Robson 2011).

However, constructivism has some limitations. Rickert (2009) argues that scientists reject constructivism because of its inability to generate facts; "…no one can fly to the moon if we socially construct physics" (p. 14). This leads to the discussion of post-positivism in the next sub-section.

3.1.2 Post-positivism

Interpretations of different opinions constructed by participants through open-ended questions and interviews alone were not sufficient to identify and assess the possible causes of attitudes. Identification and assessment of possible causes of attitudes are governed by post-positivism deterministic philosophy in which it is assumed that causes probably determine outcomes (Creswell 2009). Post-positivism amended the positivistic belief of objectivity, that the researcher and research participants are independent of one another. Positivism argues that knowledge is acquired through scientific observations and measurement, beyond that is impossible (Cohen, *et al.,* 2011). By contrast, post-positivism, like constructivism, argues that the researcher's knowledge and experience can influence observation and thus, necessitate a need to go beyond and measure the impact of that influence. Thus, post-positivism asserts that all measurements are subjected to errors and therefore it put emphasis on multiple measurements and observations for triangulation.

Post-positivism involves identifying and measuring statistical associations among causal factors including their outcomes (Teddlie and Tashakkori 2009). If there is repeated association among variables, which can be explained, then one has evidence of causation (Teddlie and Tashakkori 2009). Thus, post-positivists perceive research to be *objective*, with separation existing between the researcher and participants, but goes beyond that by viewing that knowledge exists in multiple pluralistic views and not in a singularity view (Cohen, *et al.,* 2011).

In the present study the researcher used the Test of e-Learning Related Attitudes (TeLRA, see Appendix I) scale to measure teachers' attitudes toward e-learning. Then, multiple regression was used to determine a particular group of variables that performed better (or had high predictive power/causation factor) on an outcome than another variables. The post-positivist paradigm lends itself to quantitative research (Burton, *et al.,* 2008; Teddlie and Tashakkori 2009; Creswell and Plano Clark 2011; Robson 2011).

In summary, both constructivism and post-positivism paradigms represent world views concerning the way in which reality is understood and production of knowledge is perceived (Burton, *et al.,* 2008). Furthermore, both paradigms are recognised and, indeed, have their place in social science research although they are not free of some limitations. Whilst constructivism fails to generate facts, post-positivism gives less attention to an in-depth understanding of any particular individual's knowledge. However, it was best to consider the strengths of both constructivism and post-positivism in a single research study. Thus, a need arises that required both an in-depth understanding of phenomena from participants, ability to determine factors as well as reasons that influence their understanding of, and attitudes towards e-learning.

This was achieved by combining both quantitative and qualitative data in a single study (Teddlie and Tashakkori 2009; Creswell and Plano Clark 2011; Robson 2011; Creswell 2014).

3.1.3 Pragmatism

The fact that both qualitative and quantitative methods have their own set of assumptions on how they view social reality has led to a theoretical debate as to which single method can best fit all situations (Denscombe 2003). However, Denscombe (2003, p. 132) argues that "different methods can be used to collect data on the same thing". That is, by combining both strands it creates an opportunity to look at the same data from different perspectives, which can enhance data analysis and interpretation thereby increasing knowledge about the phenomenon under investigation.

The combination of qualitative and quantitative research approaches in types of research questions, data collection, analysis and interpretation is termed *mixed methods* (Creswell and Plano Clark 2011; Bryman 2012; Creswell 2014). The epistemology underpinning mixed methods as the approach to research enquiry is a pragmatic assumption which recognizes the fact that the world is not exclusively qualitative or quantitative but rather, a mixed world (Teddlie and Tashakkori 2009; Cohen, *et al.,* 2011). This suggests that, on some occasions, the researcher and participants may require an interactive relationship to answer a research question while on other occasions they may not.

Pragmatism is a practice-driven paradigm rather than theory-driven because it enables the researcher solve practical problems regardless of whether the methodology is quantitative or qualitative (Denscombe 2010; Cohen, *et al.,* 2011; Robson 2011). It focuses on "*what works"* (Teddlie and Tashakkori 2009, p. 7; Denscombe 2010, p. 148; Robson 2011, p. 28) best for the particular research question under investigation. Combining quantitative and qualitative methods enhances the quality of the research (Denscombe 2003). Kumar (2011, p. 14) argues that to "…apply one approach to all research problems can be misleading and inappropriate." Research questions can determine the mode of inquiry and hence the paradigm. This study supports Kumar's (2011) argument and that of Biesta's (2012) that there are no distinctive researches which are categorized for mixed methods rather it is the research questions that determines data collection methods. Silverman (2013, p. 125) adds that, "there are no right or wrong methods. There are only methods that are appropriate to your research topic and the model with which you are working."

Therefore, the pragmatic paradigm was found to be appropriate for this study due to the nature of the research questions, which required explanation from both quantitative and qualitative research approaches. Research questions in this study required a probabilistic selected sample of participants, multiple instruments (close and open-ended questionnaires, interviews and documentary review) for data collection and a range of numerical as well as qualitative data analysis together with interpretation of results (Creswell and Plano Clark 2011; Cohen, *et al.,*2011; Creswell 2014). Justification of this argument is elaborated in sub-section 3.5 and 3.6.

3.2 Research design

Research design is a procedure that explains how data will be collected, analysed, interpreted and reported in a research undertaking (Burns 2000; Kumar 2011). This study used a cross-sectional survey. A cross-sectional survey was considered to be an appropriate method for this study than a longitudinal design because of its ability in collecting data from respondents of different characteristics and backgrounds within a short period of time (Cohen, *et al.,* 2011; Edmonds and Kennedy 2013). In addition, the nature of the research questions (see Table 1.3.1, p. 60), required to examine knowledge and attitudes towards e-learning from a relatively large number of participants with different variables of interest. In this regard, the focus was the representative sample from a particular population and not an in depth investigation of individuals or HLIs as it could be in a case study (Yin 2014). Therefore, this could best be achieved through questionnaires-based survey than other potential research design approaches.

The main limitation of cross-sectional survey is that population from which data is to be extracted has different characteristics and backgrounds (Becker and Bryman 2004). To address this limitation, this study used stratified sampling as well as random sampling techniques (see Sub-section 3.5) to obtained sample whose characteristics clearly reflected the entire population.

3.2.1 Mixed methods as a strategy of inquiry

In order to provide a comprehensive analysis of the research problem, the study used a *concurrent* mixed methods approach in which the researcher simultaneously collected both quantitative and qualitative data, analysed them separately and finally, combined the two in interpretation of results (Teddlie and Tashakkori 2009; Creswell and Plano Clark 2011; Robson 2011; Edmonds and Kennedy 2013; Creswell 2014). Mixed methods do not imply “anything goes” (Denscombe 2010, p. 147), it requires significant rationale to combine the two competing methods in a single research study.

The rationale for using mixed methods was suggested by the type of research questions that needed to identify not only the scale of issues on selected factors such as number/percentage involved in terms of gender, computer experience, qualification and teaching experience but also explored participants’ views in depth in order to develop a highly complete picture of the phenomenon under investigation. Thus, the researcher found that both the qualitative and quantitative methods were useful to capture a complete understanding of teachers’ attitudes towards e-learning and, hence, provided richer data than expected.

Practically, a mixed methods research approach helped the researcher to offset limitations of one method by strengths of the other method (Denscombe 2010) because studying a few individuals qualitatively, the ability to statistically determine causes is lost, whereas studying a wider population quantitatively, the in-depth understanding of any particular individual’s knowledge is given less attention (Creswell and Plano Clark 2011; Yin 2014). Evidence shows that when quantitative research approach is integrated with conversational nature of semi-structured interview and open-ended responses, it provides a more complete understanding of the research problem rather than either approach by itself (Richards 2009; Denscombe 2010; Creswell and Plano Clark 2011; Biesta 2012; Creswell 2014).

Although mixed methods research has its potential in the inquiry of truth, there have been arguments against it. There are those (for example, Cohen, *et al,* 2011 and Bryman 2012) who argue that research methods are embedded into epistemological and ontological principles such that it is not possible to integrate qualitative and quantitative research approaches, which have different views and approaches on investigating social reality. However, this study focused its attention on the *practical* power of integrating the two approaches in terms of data collection, analysis and interpretation practices in answering research questions rather than epistemological and ontological principles (Edmonds and Kennedy 2013). Robson (2011, p. 27) refer to mixed methods as an approach “guided by practical experience rather than theory.” Thus, mixed methods research was found useful for this study and it was used to triangulate findings so as to enhance their validity, integrity as well as utility to education stakeholders (Caracelli and Greene 1993).

Moreover, mixed methods research has practical challenges. It requires extensive data to be collected and hence requires plenty of time. In addressing this situation, time schedules for both strands were pre-planned and allocated six months for completion. To avoid disappointments, prior arrangements were made via email and over the telephone on all occasions before arriving at the research site. Another challenge of a mixed methods approach was its requirement for the researcher to be equipped with skills in both quantitative and qualitative forms of research and in combining two different sets of data during interpretation of results. To overcome these limitations, the researcher attended a six month Research Methods course provided at the Nottingham Trent University. This is also supported by wider reading (for example Denscombe 2010; Creswell and Plano Clark 2011; Robson 2011; Creswell 2014).

A further challenge of mixed method research approach was the possibility of arriving at inconsistent inferences emerging from qualitative and quantitative strands. To address this, interview questions (see Appendix II and III) were designed in such a way that they addressed similar concepts as that from the questionnaire. This attempted to minimize the validity threats and also assisted the researcher to find quotes (or themes) that matched as well as those which did not match statistical results during the interpretation of results (Creswell and Plano Clark 2011).

3.3 Study area

The study was conducted at six Tanzanian HLIs all of which were involved in qualitative research approach and only four institutions, out of those six, were involved in quantitative research approach (see Table 3.3.1). Reasons and criteria for selection of these six institutions and a research approach used are detailed under Section 3.5.

Institutions involved in the study

S/No	Name of Institution	Research Approach	Region
1	I1	Quantitative & Qualitative	Dar es Salaam
2	I2		Dar es Salaam
3	I3		Arusha
4	I4		Mbeya
5	I5	Qualitative	Dar es Salaam
6	I6		Dar es Salaam

Table 3.3.1: Institutions involved in the study

3.4 Sample type and size

3.4.1 Sample type

A sample is a representative segment of the study population in which the researcher is interested in gaining information and drawing conclusion from (Burns 2000; Kumar 2011).

Foremost, teachers were considered the main respondents in this study for two major reasons. First, they are catalysts for learning in any type of education system (as outlined in Chapter Two) and therefore, their attitude towards e-learning is essential. Second, teachers can have a strong impact on the success of e-learning since their perceptions regarding the adoption of e-learning can have a significant impact on the formation of students' attitude toward the technology (see Sub-section 1.2, p. 54).

Secondly, principals of HLIs were involved in order to capture information on their understanding, opinions and attitudes towards e-learning, including strategies they used to address barriers that hinder the adoption of e-learning in their institutions. Their perceptions on e-learning can have a significant role on teachers' attitude toward e-learning. If they are supportive of e-learning, consequently, they can influence teachers to use it (see Sub-section 2.2.4, p. 106).

Finally, e-learning experts were selected because of the key role they play in e-learning design and development. Bates (2007) argues that design and development of e-learning programmes requires input not only from subject teachers, but also from content designers and Web programmers. Similarly, Anderson (2008) argues that the quality of e-learning relies on both technology use and the quality of designed instructions. Therefore, their involvement in this study was essential.

In summary, teachers, principals and e-learning experts were involved in this study because of their professional, managerial roles and expertise as well as influence in education in HLIs. In addition, Rogers (2003, p. 402) argues that “in many cases, an individual cannot adopt a new technology until an organization has previously adopted it”. Thus, for these reasons, other categories of respondents such as students were not involved in the study.

3.4.2 Sample size

The study population was estimated to be 900 teachers from 30 fully registered HLIs under the Engineering and other Sciences category of the National Council for Technical Education (NACTE 2012). These estimates included teachers who were working and those on study leave. Therefore, using Cohen, *et al.,* (2011, p. 148) sample size statistical table with sampling error of 5% and confidence level of 95%, the sample size for the proposed study population of 900 was 269, out of whom 258 were teachers, four principals and seven e-learning experts all together from six HLIs (Tables 3.4.1 and 3.4.2).

Number of teachers in the selected institutions.

		Number at 95% confidence level, 5% confidence interval		Actual Number of Teachers involved in the Study	
Institution	Actual Population*	N	%	N	%
I1	174	120	33.7	86	33.3
I2	118	90	25.3	74	28.7
I3	85	70	19.7	39	15.1
I4	95	76	21.3	59	22.9
Total	472	356	100.0	258	100

Key Note: *I1 to I4 represent Institutions 1 to 4 respectively*

**Source: NACTE (2011)*

Principals & E-learning experts

Institution	Actual Number of Respondents
Principals (N=4)	
I1	1
I2	1
I3	1
I4	1
E-learning experts (N=7)	
I5	2
I6	5
Total	11

Key Note: *I1 to I6 represent Institutions 1 to 6 respectively.*

Table 3.4.1 and **3.4.2:** Number of participants involved in the study

3.5 Sampling procedures

Sampling procedures were used to select some elements of a population in order to have an actual characteristic of the total population (Cohen, *et al.,* 2011). This study used purposive sampling, stratified random sampling and simple random sampling procedures to select respondents including institutions to be involved in the study (Cohen, *et al.,* 2011; Kumar 2011; Robson 2011; Bryman 2012).

The purposive sampling was used in this study in order to obtain data from principals and e-learning experts who had in-depth knowledge by virtue of their professional roles, status and expertise. Similarly, stratified random sampling was used in order to capture a sample representative of characteristics of the whole population because variables of interest were unevenly distributed across the population, whereas simple random sampling technique was used in order to have unbiased representativeness of the population.

3.5.1 Purposive sampling technique

The following samples were selected using purposive sampling procedures based on the prior information relevant to the study.

i. Institutions

Institutions involved in this study were selected based on two criteria. The first criterion was to include institutions that were not engaged in "formal" (see Sub-section 1.5, p. 61) e-learning programme, but have indications that may lead towards adopting e-learning. The aim of involving these institutions was to capture teachers' understanding of, and attitudes towards e-learning as well as factors that influence their understanding of, and attitudes towards e-learning prior adoption of e-learning programmes in their institutions.

Four fully registered institutions (see Table 3.3.1) under Engineering and other Sciences board of the NACTE were selected. Institutions under this board were selected because they are pioneers of ICT programmes and researches compared to institutions under other boards (NACTE 2012). Furthermore, the nature of their curriculum mandated a component of an ICT related module/subject to every programme provided in their institutions (I4 2009; I2 2010; I1 2011; I3 2012), and finally, teachers from these institutions were mostly using computers for communication and personal learning, processing students' records, preparing lecture notes as well as presentation (I4 2009; I2 2010; I1 2011; I3 2012). All the three reasons could suggest a possibility of transition from face-to-face to e-learning.

The second criterion was to include institutions that were formally engaged in e-learning programmes. The aim of involving these institutions was to capture real life barriers to the adoption of e-learning in HLIs and the best practice used to address them. Moreover, the researcher aimed to capture strategies that can optimise involvement of teachers and students in e-learning programmes. Two institutions (see Table 3.3.1), registered under Tanzania Commission for Universities (TCU) that met this criterion were selected and, also were the only HLIs with formal e-learning programmes leading to a degree award.

ii. Principals

Purposive sampling technique was also used to select principals from the four HLIs that were not conducting formal e-learning programmes. This selection was based on the assumption that they have relevant key information for the study and due to their management positions. Moreover, there is only one principal in each institution. The four selected principals (see Table 3.4.2) were only involved in qualitative research approach.

iii. E-learning experts

Similarly, purposive sampling technique was used to select e-learning experts from the two HLIs which provide formal e-learning programmes. Selection of e-learning experts was based on their academic qualifications (minimum of a Bachelor degree) and that they were practically involved in e-learning programmes. Seven e-learning experts (see job titles in Table 3.5.1) were selected and involved in qualitative research approach. Since the focus of the researcher was not to capture teachers from institutions providing e-learning programmes, neither teachers nor principals from the two institutions were involved in this study.

Job Titles of the Seven E-learning experts
Instructional Designer
Director of Computer Services
Multimedia Producer
Computer Programmer
Online Programmes Coordinator
Telecommunication Engineer
System Administrator

Table 3.5.1: Job titles of the seven e-learning experts

3.5.2 Stratified random sampling procedure

Stratified random sampling procedure involves dividing the population into homogeneous groups, where each group contains respondents with similar characteristics. Therefore, using this technique, the researcher divided teachers into four strata in terms of the following patterns:

i. exposure to computers (that is, previous use of computers);
ii. gender;
iii. academic qualifications and
iv. teaching experience.

To achieve this, lists of teachers' names (sampling frames) were collected from the four institutions selected for quantitative research and randomly copied into a spreadsheet. They were 472 teachers altogether. All teachers were provided with ID numbers ranging from 1 to 472.

The first stratification was to divide teachers based on their computer experiences. However, data from the principals prior to the main study revealed that a teacher-to-computer ratio in their institutions range from one-to-one to five-to-one (see Table 3.5.2), and also all the studied institutions are using SIMS (see Table 4.2.1, p. 219) indicating that most teachers were exposed to computers. Therefore, the researcher decided to involve all teachers in the study (see Table 3.5.3).

Principals' responses to the question: "*What is the teacher-computer ratio at your institution?*"

Respondent ID	Representative Quotations
P1	"Teacher to computer ratio I don't know. However, we did put up a scheme, which allowed them to buy computers (or lap tops) for their own and pay in phases. By now all may have one" *(Male, PhD, YoE: 33)*
P2	"If there are ten staff members we place two computers in the department. So, teachers computer ratio is 5:1." *(Male, MSc, YoE: 10)* .
P3	"Mmmmm, teacher computer ratio is one to one. Yah. Some have lap tops and desk top even more. ". *(Male, PhD, YoE:16).*
P4	"It is about 1 computer to 3 or 4 teachers." *(Male, PhD, YoE: 20).*

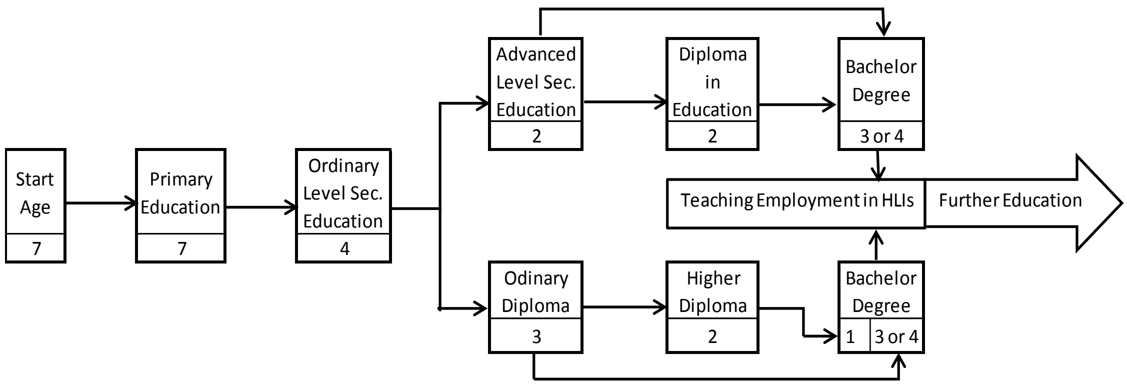
Key Note: *P1 to P4 represent Principals 1 to 4.*

Table 3.5.2: Extracts from principals' responses on teachers-computer ratio

The second stratification was to divide teachers based on their gender. Since female teachers in the said institutions were fewer than male teachers (I4 2009; I2 2010; I1 2011; I3 2012; Modu 2012), all female teachers were involved in the study (Table 3.5.3). Analysis of female teachers in terms of their computer experiences, academic qualifications and years of teaching experiences is presented in Chapter Four (see Table 4.0.2, p. 200). Male teachers were therefore further divided based on their qualifications.

In the third stratification, all male teachers with lower qualifications (Higher Diploma, Bachelor's degree as well as *other* qualification holders) were involved in the study because they were relatively fewer than teachers with higher qualifications (Masters and Doctorate degrees holders). Therefore, male teachers with higher qualifications were further categorized based on their years of teaching experience.

For the purpose of this study, the researcher divided years of teaching experience into two; that is, a group of teachers with less or equal to 10 years and those with above 10 years. A choice of 10 years as a point of demarcation was based on two reasons. First, with the current system of education in Tanzania where a child starts primary education at age seven (URT 2010a) and takes at least 16 years of formal classroom education (7 years of primary education, 4 years of ordinary level secondary education and between 5 to 8 years of tertiary level education, see Figure 3.5.1), it can imply that, an individual can therefore be employed at an average age of 24 years.



NB: *Numbers displayed in terms of years.*

Figure 3.5.1: A schematic representation of years spent in education in Tanzania

Second, which is the implication of the first, is that, with the current retirement age of 60 years (URT 2003b), a person can work for an average of 36 years giving a half working time of 18 years. If the point of demarcation could be set to be 18 years, then very few teachers could be categorized into the group of years of teaching experience greater than 18. For this reason, the researcher decided to use 10 years to split between teachers with fewer and many years of teaching experience (see also Tuparova, *et al.,* 2006).

Although the point of demarcation was brought down to 10 years, still the researcher found that teachers with more than 10 years of teaching experience were relatively fewer than those with less than 10 years, therefore they were all involved in the study (Table 3.5.3). Analysis of teachers in terms of their years of teaching experiences is presented in Table 4.0.2, p. 200 in Chapter Four.

Lastly, 159 male teachers with exposure to computers having higher qualifications with less than 10 years of teaching experience composed the last stratum as summarized in Table 3.5.3.

Stratification procedure

Population	Sampling Procedure	Computer Exposure	Gender	Qualification	Teaching Experience	Final Stratum	Simple Random Sampling Output	No. of Question-naires Distributed
472	Direct selection	All = 472	Female = 72	Lower = 174	>10 yrs: 67	313	313	426
	Further Stratification	All = 472	Male = 400	Higher = 226	<10 yrs: 159	159	113*	

**Simple random number generator (at 95% confidence level and 5% confidence interval) picked 113 teachers from the 159.*

Table 3.5.3: Stratified random sampling procedure

3.5.3 Simple random sampling procedure

Teachers in the last stratum were re-assigned consecutive numbers from 1 to 159. Using Cohen, *et al.,* (2011, p. 147) sample size statistical table with sampling error of 5% and confidence level of 95%, the sample size for the population of 159 was 113. A simple random number generator (www.randomizer.org, see Robson 2011, p. 271, Accessed: 06/08/2012) was used to draw 113 teachers from the final stratum of 159 male teachers. The list was combined with the former list of 313 teachers (Table 3.5.3) and their serial numbers were used to identify names of teachers including their respective departments.

Finally, 426 questionnaires (see Table 3.5.3) were distributed to the heads of department with the list of names to be involved in the study. The actual number of teachers involved in the study by institution and by teachers' demographic characteristics is displayed in Table 3.5.4.

Actual Number of Teachers involved in the Study by Institution

Institution ID No.	Computer Exposure		Gender		Qualification					Teaching Experience (Years)			
					Lower			Higher		Less or equal 10 yrs		More than 10 yrs	
	Yes	No	Female	Male	Other*	Higher Diploma	Bachelor	Masters	Doctorate	0 to 5	6 to 10	11 to 15	Over 15
I1 (N=86)	81	5	15	71	0	8	13	42	23	23	18	11	34
I2 (N=74)	71	3	12	62	0	0	4	69	1	63	7	2	2
I3 (N=39)	37	2	9	30	2	7	17	10	3	21	9	3	6
I4 (N=59)	49	10	12	47	0	0	24	33	2	24	19	5	11
Total	238	20	48	210	2	15	58	154	29	131	53	21	53
	258		258		75			183		184		74	
					258					258			

** "Other" qualification include academic qualifications which were neither a Higher Diploma nor Bachelor, Masters and Doctorate degrees.*

Table 3.5.4: Actual number of teachers involved in the study

3.6 Data collection methods

Data collection methods in this study reflected both quantitative and qualitative practices. Quantitative data were collected from close-ended paper-and-pencil questionnaire, whereas qualitative data were collected from face-to-face semi-structured interviews and descriptive responses from open-ended questions in the questionnaires. Documentary review was used to extract both descriptive and numerical data where information on teachers' background characteristics was also verified. Since English is the medium of instruction in secondary and tertiary education in Tanzania (Swarts and Wachira 2010), all instruments for data collection and responses were written in English and interviews were conducted in English.

Other data collection methods such as postal, online and telephone surveys were avoided because of low response rate, unreliable power supply as well as Internet connectivity and sometimes respondents may not treat the survey seriously (Robson 2011). Similarly, in order to capture non-verbal responses and contextual information from respondents, which can suggest further exploration of the topic under investigation face-to-face semi-structured interviews were used rather than telephone/online interviews. Detail for each research instrument is presented in the following sub-sections.

3.6.1 The questionnaire

Questionnaires are very useful instruments for collecting survey information because of their flexibility in administration (Kumar 2011). In this study, questionnaires included both close and open-ended questions administered to teachers. Closed questions consisted of questions focused on teachers' background information and teachers' attitudes towards e-learning. Open-ended questions were used to collect information on teachers' understanding and opinion about e-learning including barriers that can hinder the adoption of e-learning in their institutions.

i. Close-ended questions: The Test of e-Learning Related Attitudes (TeLRA) scale

Fraser's (1981) Test of Science-Related Attitudes (TOSRA, see Appendix XI) scale was adapted in this study to develop Test of e-Learning Related Attitudes (TeLRA) scale (see Sub-section 2.2.3, p. 102). TOSRA has accepted internal reliability, discriminating validity and has undergone test-retest to 238 students administered in two-week period between the two studies (Fraser, 1981). Cronbach's alpha value varied between 0.64 and 0.93, whereas test-retest coefficients ranged from 0.69 to 0.84 (ibid.). Cronbach's alpha indicates the extent to which all items in the scale measure the same underlying attribute, that is, the coefficient of inter-items correlations or internal consistency (Cronbach 1951; Pallant 2010; Bryman and Cramer 2011). Cronbach's alpha value greater than 0.7 indicates a greater reliability (Pallant 2010; Bryman and Cramer 2011).

Development of TeLRA scale had four phases. Phase one included *items development* through review of literature and assessment of TOSRA scale items guided by conceptual framework adapted from Davis' (1986) Technology Acceptance Model (TAM, see Sub-section 2.1.4, p. 82). Phase two composed of *face and content validity* from experts (see Sub-section 3.7.3, p. 158). Phase three was *reliability testing* (see Sub-section 3.7.4, p. 159) and phase four involved the *pilot study* (see Sub-section 3.7.5, p. 160). The main study describing results of reliability and the Principal Component Analysis (PCA) of the TeLRA scale are presented in Sub-section 3.8.2, p. 168, Part ii and v respectively).

ii. TeLRA scale's items development

TeLRA scale's items development were guided by the four constructs of the conceptual framework (see Sub-section 2.1.4, p. 82) as well as the TOSRA scale. In addition, two questions, "I believe using e-learning will improve my job performance" and "Using computer systems requires a lot of mental efforts," which had previously been extensively experimented, were adapted from journal articles of Davis (1989), Legris, *et al.,* (2003), Turner, *et al.,* (2010) and Teo (2010b).

Six separate sub-scales of the TeLRA scale were constructed. For the purpose of this study six sub-scales with 78 items were found relevant and they included:

i. Social implication of e-learning (13 items);
ii. Attitude toward e-learning (13 items);
iii. Benefits from e-learning (15 items);
iv. Enjoyment of computer experiences (13 items);
v. Leisure interest in e-learning affairs (11 items); and
vi. Interest in teaching through e-learning technologies (13 items).

The purpose of starting with six themes and 78 items in the scale was to include as many aspects as possible related to attitudes towards e-learning. It implies that the researcher could be able to maximize its face and content validity as well as other analysis.

The first sub-scale was intended to measure teachers' general belief about e-learning. The second scale aimed to measure teachers' affective and cognitive evaluation towards e-learning. The third construct aimed to measure teachers' cognitive information about e-learning. That is, knowledge they have about value of e-learning to education and their career as a whole. The last three constructs were intended to examine teachers' affective evaluation about e-learning in terms of their interaction with computers, interest in e-learning innovations and teaching using e-learning technologies.

The TeLRA scale consisted of four-point Likert-like response format with degrees of agreement ranging from 1- *strongly disagree* (SD), 2- *disagree* (D), 3- *agree* (A) to 4- *strongly agree* (SA). The removal of a neutral response was aimed to avoid a 'no commitment' response or social desirability bias from respondents (Garland 1991). Garland (1991, p. 66) provides evidence that "social desirability bias, arising from respondents' desire to please the researcher or appear helpful or not be seen to give what they perceived to be a socially unacceptable answer" can be minimised by omission of neutral response. It means that participants, either purposely or by being unsure of their response can respond to a question in a way they think will be socially accepted by the researcher (Garland 1991). These types of misinformation in responding to research items can affect reliability of results. Thus, this study supports Krosnick's (2002) claims that results cannot be affected by omitting a neutral point because if respondents are truly neutral, then they will randomly choose either of the available options.

iii. Open-ended questions

The questionnaire also had open-ended questions, which allowed freedom of expression from respondents and provide richer data. In this method, respondents were able to express their opinions resulting in a greater variety of information that was used to validate and elaborate quantitative survey findings (Kumar 2011; Creswell and Plano Clark 2011). Open-ended questions were useful in this study because they enabled the researcher to capture detailed information, which could not be caught in closed-ended questions (for example, "What do you understand by the term *e-learning*?" Or "Why is e-learning important in HLIs?"). Responses from these open-ended items provided explanations for participants' understanding and perceptions on items under investigation.

In order to avoid irrelevant and redundant information that may emerged from open-ended questions, the researcher ensured that questions were understandable to respondents so as they provide accurate information. In addition, questions were made shorter to attract willingness as well as saving time to respond.

The questionnaire with 78 TeLRA scale close-ended questions including four open-ended questions was submitted to experts to determine their face and content validity (see Sub-section 3.7.3, p. 158).

Administration of questionnaires

Questionnaires were administered only to teachers. All questionnaires were handed to head of departments who distributed to their respective teachers. Although a questionnaire took around 10 minutes to complete, submission of completed questionnaire scripts to their heads of departments were done in the same or one day later.

3.6.2 Semi-structured interview

An interview is a flexible tool for data collection that enables multi-sensory channels (verbal, non-verbal, spoken and heard) to be used (Cohen, *et al.,* 2011). This study used semi-structured interviews because it permitted flexibility on sequence of discussed issues and they also enabled participants as well as the researcher raise issues that were not included in a pre-devised interview schedule (Burns 2000; Becker and Bryman 2004; Silverman 2011). Kumar (2011) argues that semi-structured interviews are flexible in such a way that they facilitate probing, especially through asking questions so as to gain deeper understanding of phenomena under investigation. Semi-structured interview was preferable to this study than unstructured interview because it allowed respondents freedom to talk what was significant to them, but maintained the structure that ensure all important topics to the study are covered (Bell 2005). Through the guiding questions of a semi-structured interview, the researcher was able to control the scope of the interview around the area in question, clarified the meaning of some questions and adjusted time given to different questions which could not be the case to unstructured interviews (Becker and Bryman 2004).

One major limitation of interviews is that reliability of data depends on what was said by interviewees (Bryman 2012). However, use of questionnaires (close and open-ended questions) and documentary reviews in this study narrowed down the limitation to an insignificant level.

Administration of interviews

Semi-structured interviews were administered with both principals and e-learning experts. For principals, interviews were used to gather information about their understanding and attitudes on e-learning as well as to capture issues related to management practice when need to adopt an innovation including implementation strategies and challenges. For e-learning experts, the interviews attempted to capture their understanding of e-learning, strategies they used to optimise teachers and students' involvement in e-learning and also barriers that hindered the adoption of e-learning in HLIs as well as strategies they used to address such barriers.

Semi-structured interviews were conducted in their offices at their own suggested time and lasted for about 35 minutes. With participants' permission, each interview session was digitally audio recorded, and later transcribed for theme analysis. Guiding questions used in the interviews are presented in Appendix II and III.

3.6.3. Documentary review

Cohen, *et al.,* (2011, p. 249) define a document as a record of an event or process produced by individuals or organisations. Documents such as institutions' prospectus and strategic plans in either printed materials or electronic format were used as sources of evidence to support arguments or facts given by participants in other research instruments (Johnson 1994; Bell 2005; Burton, *et al.,* 2008). Such documents were used to strengthen data obtained from questionnaires and semi-structured interviews. Johnson (1994, p.161) argues that "…a single source of data must always be to some extent suspect: effort must be made to check the accuracy of data by using a combination of research tools" also known as *data triangulation* (see Sub-section 3.7.2, p. 157). Data extracted from institutional documents are presented in Chapter Four.

To ensure credibility of data obtained from documentary sources, the researcher mainly used recent published institutional prospectus, which represent typical instance of respective institutions.

3.7 Validity and reliability

3.7.1. Respondent validation

To ensure that the interview data collected are correct, the researcher conducted a member check (respondent validation) by sending a transcript of a conducted interview to the original participant to be confirmed. Member checking provided interviewees opportunity to determine accuracy and challenge what were perceived as wrong interpretations and thus it was essential for establishing reliability (Denscombe 2003; Bell 2005; Richards 2009; Mears 2012). All interviewees accepted their respective transcriptions without alterations. In order to ensure trustworthiness and validity, the interview data were corroborated with other sources of data obtained from questionnaires and documentary sources (data triangulation).

3.7.2. Data and methodological triangulation

Denscombe (2010, p. 346) describe triangulation as "the practice of viewing things from more than one perspective" through "the use of different methods, different sources of data or even different researchers within the study." Earlier, Denscombe (2003, p. 133) claims that "seeing things from a different perspective and the opportunity to corroborate findings can enhance the validity of the data." Research findings from this study need to demonstrate credibility of data and methods used in the study. Both terms, *trustworthiness* as commonly used in qualitative research and *validity* in quantitative research, demonstrates some confidence of the research findings, which are not tied up with a particular method used for data collection (Denscombe 2003).

Scholars have suggested different strategies that can be used to test as well as maximize trustworthiness and validity of a research. Among them, *triangulation* strategy has been highly recommended (Denscombe 2003; Becker and Bryman 2004; Cohen, *et al.,* 2011; Robson 2011; Creswell 2014). When the same research question is examined using more than one method or data source (such as interviews and documents) then it is termed as *data triangulation*, whereas, *methodological triangulation* combines more than one approach to answer different research questions within a single research study (Denscombe 2010; Robson 2011). This study used both data and methodological triangulations to realize trustworthiness and validity.

Data triangulation assisted the researcher to see the same data from different standpoints and later examined its meaning to make sense of it (Bell 2005). Methodological triangulation assisted the researcher to corroborate findings obtained from qualitative and quantitative approaches (Robson 2011) to provide a complete understanding of the phenomenon under investigation than either method alone (Creswell 2014). To realize data triangulation, this study used teachers, principals and e-learning experts as sources of data, also known as "informant triangulation" (Denscombe 2010, p. 347). In addition, some questions appeared across all groups through open-ended questions and semi-structured interviews. Such questions included, "What do you understand by the term e-learning" and "What are barriers that can hinder the adoption of e-learning in higher learning institutions?" As shown earlier, qualitative and quantitative methods (mixed-methods, see Sub-section 3.2.1, p. 135) were employed to realize methodological triangulation.

Triangulation has its limitation, which emerges when a need to combine different methods in a single research study arises. In this study, limitations and strategies used to address them have been presented in Sub-section 3.2.1, p. 135.

3.7.3 Face and content validity

Wording in interviews and questionnaires is very important such that pre-testing them is essential for success (Cohen, *et al.,* 2011). Seventy eight TeLRA scale items, four open-ended questions and sixteen semi-structured interview questions (see Sub-section 3.6, p. 148) were developed by the researcher at the Nottingham Trent University (NTU) in the United Kingdom and submitted to the three experts to determine their face and content validity before they were adopted in the study. Evaluation of such instruments was conducted in terms of language clarity of the questions (asking one thing at a time), adequacy as well as representative coverage of the domain, readability and complexity level of the questions including appropriate time taken to complete the questions (Cohen, *et al.,*2011).

Eighteen items of the TeLRA scale were found to be either ambiguous, a repetition of another item or measured a different concepts, therefore, they were deleted. In addition, three items in both the TeLRA scale and interview guiding questions were slightly revised. There were no changes to open-ended questions. The new 60 TeLRA scale items and revised interview questions were re-evaluated and all three experts reported back with the judgment that they appear to be measuring the intended construct. The TeLRA scale was further tested at NTU to determine its reliability.

3.7.4 Reliability test of the TeLRA scale

The 60 items TeLRA scale was field tested with 30 pre-service trainee teachers at the NTU to establish its reliability, before it was adopted in the pilot and main study. Cronbach (1951) argues that "any research based on measurement must be concerned with the accuracy…or, as we usually call it, reliability of measurement." Reliability of the scale was measured by computing Cronbach's coefficient alpha (Cronbach 1951; Bryman and Cramer 2011). In this reliability test, TeLRA scale scored a Cronbach coefficient alpha of 0.877.

Further analysis of data from respondents revealed 24 items with low item-total correlation value, less than 0.25. A value less than 0.25 indicates that the item was measuring different concept from the scale (Bryman and Cramer 2004; Pallant 2010). Removal of these items boosted reliability to 0.888 (Table 3.7.1). The refined TeLRA scale with 36 items (see Appendix I) was then used in the pilot study.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.888	0.894	36

Table 3.7.1: Reliability test of the TeLRA scale
(Source: Reliability test study data, 2012)

3.7.5 Pilot study

A pilot study was conducted at the University Computing Centre (UCC) in Tanzania which has similar characteristics to those involved in the main study. Both the questionnaires (with 36 items of the six-theme TeLRA scale and 4 open-ended questions) as well as semi-structured interview questions were used in the pilot study. One principal and e-learning expert as well as twenty six teachers out of thirty participated in the study. The TeLRA scale scored a Cronbach's coefficient alpha of 0.871 (Table 3.7.2). No ambiguities were reported in either of the test instruments.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.871	0.885	36

Table 3.7.2: Reliability test of the TeLRA scale
(Source: Pilot study data, 2012)

Coefficient values obtained from the reliability test and the pilot study demonstrated that the TeLRA scale behaved as was theoretically expected to. A small change in coefficient from that obtained in the reliability test can be attributed to participants being from two different cultural backgrounds. However, it was still highly reliable. Therefore, all TeLRA scale items, open-ended questions as well as interview guiding questions were retained for the main study so as to measure a possible change that would be brought about by an impact from a bigger sample.

3.7.6 Ethical considerations

It is considered unethical to collect information without knowledge, willingness and consent of participants (Kumar 2011; BERA 2011). The researcher recognised the participants' entitlement to privacy and thus, all ethical issues such as informed consent, anonymity, confidentiality and use of personal data were adhered to prior, during and after data collection (DPA 1998; BERA 2011).

Ethics research clearance (Appendix VI) and research approval letter (Appendix VI) were obtained from the Graduate School, Nottingham Trent University. Permission to conduct the study in the selected institutions was obtained from NACTE (Appendix VIII) who directed the principals to allow the researcher conduct the study in the selected institutions. In each selected institution, informed consent was sought from all of respondents who participated in the study.

In order to avoid or minimize disruption to institutional activities, such as lectures, examinations and vacation periods, data collection was conducted between early weeks to the mid-weeks of an academic calendar. All questionnaires were handed to the head of departments who distributed them to their respective teachers in their departments. Follow-ups were done through telephone calls. All questionnaires were finally collected by the researcher in person.

Regarding the interviews, communication through emails and telephone calls were carried out with all interviewees to set appointments for the interviews. During such communications, all interviewees were informed about the purpose of this research, reasons of involving them in the study as well as where and to whom their data will be disclosed (DPA 1998). Prior to the interviews, the researcher asked interviewees' voluntary informed consent to participate in the study and to be recorded. All participants in this study were informed about the right to withdraw from the study before or during the data collection process.

In order to guarantee the anonymity of a research site and its participants as well as to protect roles of participants, the researcher disassociated names from responses by using aliases during all data analysis and interpretation processes. In order not to cause damage or distress to research participants, the researcher adhered to ethical issues for data processing and storage such that data were processed only for the purposes for which they were obtained (DPA 1998, p. 32). Further, no vulnerable participants had access to data analysis after the project.

3.8 Data analysis procedure

This section presents data preparation techniques used prior to the statistical and thematic analyses. It is divided into two parts, qualitative and quantitative data. The latter is further divided into two parts. The first part presents data screening and cleaning, while the second part presents verification of basic assumptions required for statistical tests used in the study.

Qualitative and quantitative data analysis procedures were conducted separately, but concurrently. Inferences from both analyses were integrated during interpretation of results and conclusion to capture a complete understanding of research questions and hence provided richer data (Creswell 2014).

3.8.1 Qualitative data analysis procedure

Qualitative data were analysed using thematic analysis (Braun and Clarke 2006; Fereday and Muir-Cochrane 2006; Bryman 2012). Braun and Clarke (2006, p. 6) define thematic analysis as "a method for identifying, analysing, and reporting patterns (themes) within data" extracted from research participants. Recurrent themes in interviews and open-ended questions enhance credibility of data since they indicate that the idea is shared among a wider group of participants (Denscombe 2003). Thematic analysis in this study was used because of its flexibility when examining data for emerging topics or ideas relevant to the research questions (Bryman 2012). Braun and Clarke (2006, p. 8-9) argue that, "thematic analysis does not require the detailed theoretical and technological knowledge of approaches such as grounded theory and discourse analysis." It implies that thematic analysis is not bounded to theoretical frameworks and, therefore, it was highly preferable.

Thematic analysis has disadvantage especially when it is poorly used in the analysis, or when it has been used to unsuitable research questions (Braun and Clarke 2006). To avoid this limitation research questions and instruments were submitted to three experts to determine their face and content validity before adopted in the study (see Sub-section 3.7.3, p. 158).

i. Data Transcription

All audio recorded interviews from the digital sound recorder were transcribed into a Microsoft Word 2010 document. During transcription confidentiality and anonymity were assured throughout data recording. All speakers were given false names (see Sub-section 3.7.6, p. 161). For example, identification of a research case, abbreviations such as, P1, P2, P3 and P4 were used respectively to mean Principal of higher learning institution one, two, three and four. Similarly, abbreviations E1 to E7 were used respectively to mean e-learning expert one to seven. Moreover, identification of research sites, for example, I1 to I6 was also used to mean institution one to six respectively. Likewise, abbreviations I1.1 to I4.258 were used to represent teachers' identification numbers from institution one to 4. Teachers' identification numbers were preceded by an institution number to indicate institution to which they belong. In all cases, identification numbers were assigned in no specific order.

Information about each participant's attributes such as gender, work title, years of work experience, qualification, date and duration of interviews were also recorded and for safety reasons, all electronic data were stored in external computer hard disc after the analysis. Transcription process assisted in gaining greater familiarity with the data as well as deeper insight easing the process of searching for meanings and patterns.

ii. Thematic analysis

Thematic analysis involved summarizing responses from open-ended questions and interview transcripts through data coding, categorizing and comparing in order to establish emerging themes (Bryman 2012). After examining each response from the open-ended questions and interview transcripts in turn, data were organised according to research questions. For each research question data were analysed manually for recurring topics or patterns and then coded. This method of analysis contained features of inductive (bottom-up) approaches in the sense that themes were left to emerge themselves from participants' responses, also known as data-driven themes (Fereday and Muir-Cochrane 2006). Data coding involved giving a label to different categories of responses to a question that contained a recurring topic for the purpose of reviewing and analysing their meaning they bring to the research (Richards 2009). All coded data extracts were then sorted into potential themes, whereas those which did not seem to fit into any theme were assigned into a temporary theme labelled "other" (see Table 3.8.1).

Themes Development

Initial Analysis			**Final Analysis**		
Code No.	Code Label	Potential Theme	Code No.	Code Label	Theme
1	Infrastructure	Poor infrastructure:-Inadequate Internet connectivity, power and computers	1	Infrastructure	Poor infrastructure:-Unstable/lack of electric power, internet connectivity,insufficient computers labs and computers
2	Financial	Financial constrains (insufficient funds)	2	Financial	Financial constraints:-Insufficient funds to implement e-learning
3	Technical Support	Inadequate professionals and technical support	3	Support	Inadequate support: Technical, managerial and government support. Can not support practical oriented subjects.
4	Knowledge	Lack of knowledge/awareness about e-learning	4	Knowledge	Lack of knowledge:- Users are not well informed (unaware) about e-learning, unclear policy, startegies ownership rights & quality assurance issues.
5	Resistance	Resistance to change: fear, poor mind-set/attitude about e-learning	5	Resistance	Resistance to change:- Fear, poor mind-set and attitude about e-learning
6	Content and Ownership	No comprehensive content and ownership rights	6	Infra-Fin-Kdg-Res	Poor infrastructure, Financial constraints, Lack of knowledge and Resistance to change.
7	Policy and Strategies	Unclear Educational policy and strategies	7	No Bariers	There are no barriers
8	Managerial Support	Lack of managerial and government support			
9	Infra-Kdg-Res	Poor infrastructure, lack of knowledge and resistance to change			
10	Infra-Fin	Poor infrastructure and inadequaate funds			
11	Fin-Res	Financial constraints and resistance to change			
12	Infra-Res	Poor infrastructure and resistance to change			
13	Infra-Kdg	Poor infrastructure and lack of knowledge about e-learning			
14	Fin-Kdg	Lack of funds and knowledge			
15	QA	Lack of quality assurance in evaluation and assessment			
16	No Barriers	There are no barriers			
17	Other	Other			

*NB: **Infra** -Infrastructure; **Kdg** -Knowledge; **Fin** -Financial; **Res** -Resistance; **QA** -Quality Assurance*

Table 3.8.1: Themes development: Initial and final analysis

Contents from Table 3.8.1 are responses from teachers to the research question “What are the barriers which can hinder adoption of e-learning in higher learning institution?” and has been used here to demonstrate development of themes. Each potential theme was reviewed to see if data have the same contextual meaning and that each theme is different in context from another theme. At this stage, some themes were collapsed to form one strong theme.

Table 3.8.1 shows initial emerged themes and final themes extracted from the data. For example, in the initial analysis code number 3, *Technical support* and number 8, *Managerial support* were collapsed to form a code labelled *Support* (see Final Analysis column). Similarly, items with code labels *Knowledge*, *Content and ownership* as well as *Policy and strategies* were collapse to new code labelled *Knowledge*. Items with code numbers 9 to 14 were combined to form a code labelled *Infra-Fin-Kdg-Res* (meaning problems related to infrastructure, financial, knowledge and resistance to change), because respondents mentioned more than one barrier, whereas items with code numbers 16 and 17 formed a code labelled *No barriers*. Potential themes were further refined to ensure no overlapping between themes. Finally, appropriate themes that expressed all ideas held by the respondents to this particular research question were generated and named accordingly (see the Final Analysis column, Table 3.8.1).

Furthermore, coded responses from the open-ended questions obtained from teachers were subjected to SPSS software for counting the number of instances (see Chapter 4, Table 4.4.1, p. 242). Frequency of codes and themes may provide an indication of their significance (Seale 2010; Silverman 2011; Gibbs 2012) as well as learning more to extract meaning (Richards 2009; Saldana 2013).

In this study, verbatim quotations from interview transcripts were also used so that respondents can be heard as well as to demonstrate evidence, illustration and deepen understanding to an argument under investigation (Corden and Sainsbury 2006; Bryman 2012). Corden and Sainsbury (2006, p. 13) argue that "giving people a voice by using their spoken words was also a way of demonstrating the value of what they said." Verbatim quotations are included in Chapter 4.

3.8.2 Quantitative data analysis procedure

Quantitative data were analysed using statistical analysis procedures. Statistical analysis is the analysis of numeric data using descriptive and inferential statistical methods (Teddlie and Tashakkori 2009). Descriptive analysis assisted in understanding the data and detecting patterns that could efficiently describe an independent variable in relation to an outcome, whereas inferential statistics were used to make inferences and predictions based on gathered data (Pallant 2010). Both descriptive and inferential statistical tests were appropriate for this study than other methods for two reasons. First, data used was non-parametric, that is, they made no assumptions about the characteristics of the population and second, the scales of data used were both nominal (categorical) as well as ordinal, which classifies but also introduces an order into the data from weakest to strongest (Pallant 2010). Cohen, *et al.,* (2011) argue that the choice of statistical tests depends to the type of data, which can either be nominal, ordinal, interval or ratio.

i. Use of Statistical Package for Social Sciences (SPSS)

In this study all statistical tests were conducted using a Statistical Package for Social Sciences (SPSS) Version 21 (IBM 2012). As a software package capable of manipulating, analysing and presenting data, SPSS continue to receive a wider usage in both social and behavioural sciences (see also Landau and Everitt 2004; Tabachnick and Fidell 2013). In this study, the SPSS was found appropriate because of its ability to store, process and analyse large quantity of data quickly and efficiently (Weinstein 2011). Thus, all quantitative data were entered and stored as a data file in the SPSS (see Appendix V, Part a).

Before performing statistical data analysis with the SPSS, the researcher performed an error checking (data screening) test. The measure involved checking each of the variables for scores that were out of range and finding as well as correcting any data error observed in the data file. Error check was performed to avoid distortion to statistical analysis conducted in the study (Pallant 2010). In this study, all scores were examined and found to be within the expected range.

The SPSS was also used to perform other statistical tests. They include: the reliability test, logistic regression, principal component analysis, Chi-square test, multiple regression, cluster analysis and analysis of variance (Pallant 2010). The tests are presented in the following sub-sections.

ii. Internal reliability of the TeLRA scale

In order to ensure that items of the TeLRA scale measured the same underlying construct for all participants, the scale was subjected to Cronbach alpha test for internal consistency. In the current study, number of cases accounted for were 258, whereas the number of items was 36. The Cronbach alpha coefficient in this study was

0.857 (Table 3.8.2) meaning that items in an instrument measured the same underlying concept. Therefore, it was reliable.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.857	0.863	36

Table 3.8.2: Reliability test of the TeLRA scale
(Source: Field data, 2012)

iii. Assessing predictors of teachers' understanding of e-learning: *Logistic regression*

In this study, the logistic regression was conducted in order to assess the predictive power of each independent variable (IV) to teachers' understanding of e-learning. In particular, the aim was to determine strength of influence IVs (computer exposure, gender, qualification and teaching experience) had on outcome. In this study the outcome was *understood e-learning/not understood e-learning*. Logistic regression was more appropriate than multiple regression because the dependent variable of interest was categorical (Pallant 2010). Prior to the analysis, assumptions that governed logistic regression were cross-checked to determine if they were adhered by data in this study.

Although logistic regression is relatively free from assumptions, nevertheless, the nature and size of the sample are crucial to enhance validity of findings (Pallant 2010; Tabachnick and Fidell 2013). Therefore, assumptions that govern multiple regression were used prior to conducting logistic regression.

Sample size

Tabachnick and Fidell (2013) suggest a formula to determine a minimum sample size required to conduct multiple regression as:

Sample size > 50 + (8 x number of independent variables)

Sample size > 50 + (8x4)

Sample size > 82.

In this study, there were four independent (predictor) variables and the sample size was 258, which is by far greater than the required sample size of 82. The significance of a sample size is the ability to generalize results to other samples. Pallant (2010) argues that small samples cannot generalize to other samples making the results to be "of little scientific value" (p. 150).

Number of cases in a category

Ideally, the minimum number of cases required in each predictor variable is 5 (Pallant 2010). In this study, the minimum number of cases was 19 and therefore, it was higher than the required number. This test was also necessary because of the threat that logistic regression fails to converge when predictor variables have limited cases in each category (Tabachnick and Fidell 2013).

Outliers

Tabachnick and Fidell (2013, p. 72) define an outlier as "a case with such an extreme value on one variable or a strange combination of scores on two or more variables that it distorts statistics." Pallant (2010) suggests examining cases with residual values greater than 2.5 (or less than -2.5) as they are typical outliers. Pallant (2010) defines residuals as "the differences between the obtained and the predicted dependent variable scores" (p. 151). That is, "a case that actually is in one category of outcome may show a high probability for being in another category" (Tabachnick and Fidell 2013, p. 445) resulting in a poor fit of the model. In this study only 2 cases were found to have residuals greater than 2.5 and thus, they were all removed in the study and repeated the analysis.

This test was necessary because a relatively higher number of outliers may influence and even distort statistical results (Tabachnick and Fidell 2013). It means that the scores predicted for outliers cases by logistic regression solution would be very different from their actual scores (Tabachnick and Fidell 2013).

Multicollinearity

Multicollinearity is a problem that occurs when variables are very highly correlated (Tabachnick and Fidell 2013). Logistic regression is sensitive to extremely high correlation among predictor variables, which can lead to failure tolerance test (Tabachnick and Fidell 2013). Multicollinearity test was conducted and results showed that all predictor variables were strongly unrelated to each other (see Table 3.8.9, p. 187). Therefore, data were suitable for logistic regression. Results and their interpretations are provided under sub-section 4.1.4, p. 212.

iv. Teachers' attitudes towards e-learning

The study aimed at finding teachers' attitudes towards e-learning. In particular, it required to establish percentage of teachers who favored (or had positive attitude towards) e-learning and those who did not, that is had negative attitudes. In order to achieve that, all questionnaire items were entered into SPSS. Statistics on teachers' attitude towards e-learning were obtained by adding all scores of responses from the scale items and compared with the median score. However, before calculating the total score, negative worded statements were reversed accordingly such that low scores indicated negative attitude and high scores indicated positive attitude, that is SD=1; D=2; A=3; SA=4 (see Sub-section 3.6.1, p. 149). Reversing negatively worded items minimizes response bias (Frazer 1981; Pallant 2010).

Thus, a computed total score for each respondent was compared with the median score. Median is useful for continuous data and unlike the mean; median was used because it is not affected by outliers (Field 2009; Bryman 2012). The median was computed to be 105 and for the purpose of this study, those who scored greater or equal to the median were considered to have a positive attitude, because their average scores were either 3 (agreed) or 4 (strongly agreed) and those subjects who scored below the median were considered to have negative attitudes because their average scores were either 1, strongly disagree or 2,disagree (see also Qureshi, *et al.,* 2002; Honda, *et al.,* 2011; de Vargas 2012 and Mills, *et al.,* 2013). Results and their interpretations are presented under section 4.2, p. 217.

v. Assessing themes of the TeLRA scale: *Principal component analysis*

The study also needed to establish the extent to which themes of the developed TeLRA scale performed on explaining teachers' attitudes towards e-learning. However, prior to that the researcher needed to obtain a small but conceptually significant number of themes that could be used not only to explain teachers' attitudes but also to examine performance of their corresponding items.

Therefore, all 36 items of the TeLRA scale were subjected to Principal Component Analysis (PCA) using SPSS. PCA is a tool that can explore a large set of variable items for underlying patterns and reduce them using smaller sets of themes or factors (Bryman and Cramer 2011; Cohen, *et al.,*2011). Prior to performing PCA, suitability of data for analysis was assessed. It involved inspection of the correlation matrix, which its value should exceed 0.3; Kaiser-Meyer-Olkin's measure of sampling adequacy, which requires a value greater than 0.6 and a Bartlett's test of sphericity to be significant at a significant value $\rho < 0.05$ (Tabachnick and Fidell 2013). The Kaiser-Meyer-Olkin measure is appropriate when the number of participants exceeded 250, whereas Bartlett's test of sphericity is useful to test whether the correlations between variables differs significantly from zero (Bryman and Cramer 2011).

Inspection of the correlation matrix in this study revealed the presence of many coefficients of 0.3 and above as well as the Kaiser-Meyer-Olkin value was 0.82, exceeding the recommended value of 0.6 and Bartlett's Test of Sphericity was statistically significant at ρ=0.000 (Table 3.8.3).

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.817
Bartlett's Test of Sphericity	Approx. Chi-Square	2601.708
	df	630.000
	Sig.	0.000

Table 3.8.3: Kaiser-Mayer-Olkin and Bartlett's test

To determine the number of themes to extract, Pallant (2010) as well as Bryman and Cramer (2011) recommend accepting components with eigenvalue greater or equal to 1. Eigenvalue represents variance that each standardized variable contribute to a PCA extraction whereby a component with value less than 1 is irrelevant (Tabachnick and Fidell 2013). Variance provides a measure of how the data spread out around the mean/expected value. The PCA revealed the presence of 10 themes with eigenvalue exceeding 1 (see Table 3.8.4), explaining 18.7%, 9.6%, 5.0%, 4.9%, 4.3%, 3.9%, 3.6%, 3.3%, 3.0% and 2.9% of the total variance, respectively.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.741	18.725	18.725	6.741	18.725	18.725
2	3.463	9.620	28.345	3.463	9.620	28.345
3	1.808	5.023	33.368	1.808	5.023	33.368
4	1.752	4.867	38.235	1.752	4.867	38.235
5	1.563	4.343	42.578	1.563	4.343	42.578
6	1.400	3.889	46.468	1.400	3.889	46.468
7	1.298	3.607	50.074	1.298	3.607	50.074
8	1.204	3.344	53.418	1.204	3.344	53.418
9	1.079	2.996	56.415	1.079	2.996	56.415
10	1.027	2.853	59.268	1.027	2.853	59.268
11	0.962	2.672	61.940			
12	0.905	2.515	64.455			
13	0.868	2.411	66.865			
14	0.810	2.250	69.116			
15	0.768	2.134	71.249			
16	0.749	2.081	73.331			
17	0.733	2.037	75.367			
18	0.717	1.993	77.360			
19	0.679	1.887	79.247			
20	0.643	1.785	81.032			
21	0.614	1.706	82.738			
22	0.563	1.564	84.301			
23	0.541	1.502	85.803			
24	0.522	1.451	87.254			
25	0.502	1.395	88.649			
26	0.487	1.354	90.002			
27	0.471	1.307	91.309			
28	0.445	1.237	92.546			
29	0.427	1.187	93.733			
30	0.399	1.107	94.840			
31	0.349	0.969	95.809			
32	0.342	0.949	96.758			
33	0.334	0.927	97.685			
34	0.292	0.811	98.497			
35	0.279	0.775	99.272			
36	0.262	0.728	100.000			

Extraction Method: Principal Component Analysis.

Table 3.8.4: Principal component analysis

Table 3.8.4 shows a sum of 59.3% of the total variance explained. The eigenvalue criterion has its limitations in that it overestimates the number of themes in the data set (Tabachnick and Fidell 2013).

To address this limitation a scree test, which plots eigenvalues against themes was conducted. An inspection of the scree plot revealed a clear break after the third component (Figure 3.8. 1).

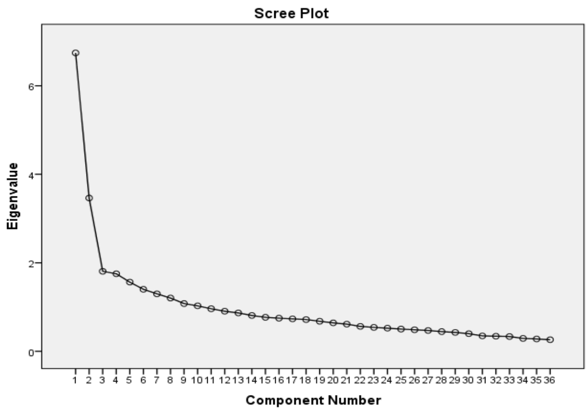


Figure 3.8.1: A scree plot showing eigenvalues for 36 items of TeLRA scale

However, to determine a correct number of themes for retention by looking only at a scree plot can be subjective (Bryman and Cramer 2004; Beavers, *at al.,* 2013) and a solution with only one or two themes provides a poor representation of the structure (Beavers, *at al.,* 2013). Therefore, a Parallel Analysis (Watkins 2000) was conducted. Parallel analysis compares the size of eigenvalues obtained by the SPSS output with eigenvalue obtained from a randomly generated data set of the same number of attitude scale variables and sample size (Pallant 2010). Actual eigenvalues from PCA which were larger than their corresponding values from the random results generated by parallel analysis were retained resulting in five themes (Table 3.8.5).

Component	Actual eigenvalue from PCA (SPSS output)	Parallel Analysis Randomly Generated eigen value (N=258, Items=36, Replications=100)	Decision
1	6.741	1.7865	Accepted
2	3.463	1.6845	Accepted
3	1.808	1.6118	Accepted
4	1.752	1.5503	Accepted
5	1.563	1.4903	Accepted
6	1.4	1.4354	Rejected
7	1.298	1.3855	Rejected
8	1.204	1.3395	Rejected
9	1.079	1.2983	Rejected
10	1.027	1.2578	Rejected

Table 3.8.5: SPSS's eigenvalues Vs random generated eigenvalues

The five-theme solution explained a total of 42.6% of the variance with Theme 1 contributing 18.7%, Theme 2 contributing 9.6%, Theme 3 contributing 5.0%, Theme 4 contributing 4.9% and Theme 5 contributing 4.3%. The factor loadings are presented in Table 3.8.6.

Item	Pattern Matrix					Structure Matrix					Communalities
	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Extraction
Att1	-0.024	**0.552**	-0.046	-0.014	0.125	0.055	**0.533**	-0.094	0.119	0.051	0.302
Att2	-0.131	**0.735**	-0.016	-0.104	0.111	-0.029	**0.675**	-0.055	0.068	0.035	0.498
Att3	0.080	**0.546**	-0.042	0.088	0.112	0.163	**0.570**	-0.123	0.223	0.019	0.351
Att4	0.031	**0.508**	0.135	0.093	-0.072	0.098	**0.529**	0.055	0.207	-0.136	0.308
Att5	-0.193	**0.552**	-0.049	0.020	-0.206	-0.054	**0.559**	-0.087	0.154	-0.252	0.378
Att6	0.060	0.412	-0.121	0.245	-0.295	0.215	0.534	-0.226	0.360	-0.376	0.459
att7_rev	0.300	0.060	0.094	-0.153	-0.275	0.331	0.099	0.004	-0.132	-0.325	0.215
Att8	0.045	0.268	0.192	0.401	-0.453	0.134	0.411	0.082	0.461	-0.488	0.538
att9_rev	0.173	0.047	-0.077	0.053	**-0.689**	0.320	0.191	-0.186	0.087	**-0.733**	0.589
att10_rev	**0.610**	-0.180	0.035	0.052	-0.012	**0.575**	-0.070	-0.093	0.024	-0.091	0.362
att11_rev	0.457	0.269	0.084	-0.121	-0.200	0.512	0.332	-0.064	-0.046	-0.306	0.384
att12_rev	0.478	-0.082	-0.067	0.157	-0.336	0.543	0.088	-0.211	0.162	-0.416	0.432
att13_rev	0.377	0.343	0.099	-0.291	-0.144	0.426	0.343	-0.021	-0.203	-0.242	0.370
Att14	0.000	**0.624**	-0.136	0.118	-0.132	0.161	**0.686**	-0.230	0.280	-0.230	0.522
Att15	-0.215	0.026	-0.257	**0.504**	-0.017	-0.132	0.144	-0.248	**0.523**	-0.014	0.360
Att16	-0.084	0.204	0.077	**0.583**	0.030	-0.057	0.316	0.033	**0.623**	0.013	0.435
att17_rev	0.132	0.105	-0.349	-0.117	-0.444	0.305	0.200	-0.421	-0.054	-0.508	0.440
att18_rev	**0.527**	0.081	-0.051	-0.125	-0.167	**0.578**	0.166	-0.191	-0.084	-0.271	0.384
att19_rev	**0.527**	-0.041	-0.164	0.289	-0.183	**0.599**	0.158	-0.321	0.309	-0.287	0.503
att20_rev	**0.605**	-0.122	-0.186	0.121	-0.061	**0.643**	0.036	-0.329	0.124	-0.167	0.471
att21_rev	**0.609**	0.056	-0.055	-0.002	0.088	**0.616**	0.150	-0.198	0.032	-0.030	0.392
Att22	0.135	0.281	0.299	0.116	0.509	0.025	0.227	0.269	0.156	0.471	0.405
Att23	0.107	**0.553**	-0.146	0.257	0.298	0.188	**0.609**	-0.230	0.398	0.188	0.548
Att24	0.063	0.243	-0.170	**0.553**	0.069	0.147	0.396	-0.249	**0.624**	0.001	0.493
Att25	0.106	0.042	-0.014	**0.707**	0.019	0.134	0.229	-0.095	**0.721**	-0.019	0.535
att26_rev	**0.699**	0.067	-0.057	0.020	0.117	**0.704**	0.177	-0.223	0.059	-0.019	0.516
att27_rev	**0.582**	-0.016	-0.299	0.074	0.146	**0.627**	0.113	-0.429	0.107	0.021	0.503
att28_rev	0.061	0.183	**-0.677**	-0.067	-0.124	0.271	0.274	**-0.719**	0.031	-0.215	0.578
att29_rev	0.120	-0.069	**-0.572**	0.227	0.001	0.251	0.073	**-0.609**	0.257	-0.063	0.432
att30_rev	0.051	0.004	**-0.655**	0.090	-0.043	0.217	0.117	**-0.678**	0.142	-0.109	0.473
Att31	0.004	0.278	-0.337	0.195	-0.159	0.163	0.387	-0.399	0.290	-0.229	0.336
Att32	0.230	-0.006	0.380	**0.536**	-0.006	0.156	0.116	0.286	**0.513**	-0.022	0.419
att33_rev	0.400	-0.001	-0.334	-0.080	0.305	0.424	0.044	-0.398	-0.049	0.209	0.370
Att34	0.109	0.475	-0.063	0.122	-0.134	0.229	0.548	-0.166	0.246	-0.225	0.356
att35_rev	0.083	0.110	-0.492	-0.034	-0.116	0.237	0.189	-0.532	0.034	-0.186	0.323
att36_rev	0.232	0.049	-0.472	-0.185	0.104	0.328	0.085	-0.511	-0.133	0.021	0.348

Table 3.8.6: Pattern and Structure matrix for PCA with Oblimin Rotation

To enhance interpretation of themes, only items with factor loadings 0.5 or higher (disregarding the sign of the correlation) in both pattern and structure matrix were selected for inclusion. Tabachnick and Fidell (2013, p. 654) remark that "the greater the loading, the more the variable is pure measure of the factor." Consequently, four themes were obtained. The themes are, named, respectively: *Challenges of implementing e-learning; Benefits from e-learning*; *Attitude on using computer systems* as well as *Leisure interest on e-learning innovations and use of computers.* Table 3.8.7 displays the four selected themes with items that made up these themes.

Item No.	Item	Pattern Matrix Component 1	2	3	4	5	Structure Matrix Component 1	2	3	4	5	Communalities Extraction
Challenges of implementing e-learning												
att26_rev	Supporting learners in an e-learning environment is very difficult.	**0.699**	0.067	-0.057	0.020	0.117	**0.704**	0.177	-0.223	0.059	-0.019	0.516
att10_rev	E-learning requires expensive technical support.	**0.610**	-0.180	0.035	0.052	-0.012	**0.575**	-0.070	-0.093	0.024	-0.091	0.362
att21_rev	Discussions on e-learning technologies are uninteresting.	**0.609**	0.056	-0.055	-0.002	0.088	**0.616**	0.150	-0.198	0.032	-0.030	0.392
att20_rev	Using computer systems requires a lot of mental effort.	**0.605**	-0.122	-0.186	0.121	-0.061	**0.643**	0.036	-0.329	0.124	-0.167	0.471
att27_rev	E-learning infrastructure is very expensive for the government to afford.	**0.582**	-0.016	-0.299	0.074	0.146	**0.627**	0.113	-0.429	0.107	0.021	0.503
att18_rev	E-learning increases learners' social isolation.	**0.527**	0.081	-0.051	-0.125	-0.167	**0.578**	0.166	-0.191	-0.084	-0.271	0.384
att19_rev	E-learning technologies are difficult to use.	**0.527**	-0.041	-0.164	0.289	-0.183	**0.599**	0.158	-0.321	0.309	-0.287	0.503
att12_rev	Interacting with the computer system is often frustrating.	0.478	-0.082	-0.067	0.157	-0.336	0.543	0.088	-0.211	0.162	-0.416	0.432
att11_rev	E-learning reduces quality of knowledge attained.	0.457	0.269	0.084	-0.121	-0.200	0.512	0.332	-0.064	-0.046	-0.306	0.384
att33_rev	E-learning is a threat to teachers' employment.	0.400	-0.001	-0.334	-0.080	0.305	0.424	0.044	-0.398	-0.049	0.209	0.37
att13_rev	A face-to-face method is more learner-centred than E-learning methods.	0.377	0.343	0.099	-0.291	-0.144	0.426	0.343	-0.021	-0.203	-0.242	0.37
att7_rev	I feel uncomfortable reading a text book on a computer screen than a physical text book.	0.300	0.060	0.094	-0.153	-0.275	0.331	0.099	0.004	-0.132	-0.325	0.215

Item No.	Item	Pattern Matrix Component 1	2	3	4	5	Structure Matrix Component 1	2	3	4	5	Communalities Extraction
Benefits from e-learning												
Att2	I believe using e-learning will improve the quality of my work.	-0.131	**0.735**	-0.016	-0.104	0.111	-0.029	**0.675**	-0.055	0.068	0.035	0.498
Att14	I believe using e-learning technologies will improve my job performance.	0.000	**0.624**	-0.136	0.118	-0.132	0.161	**0.686**	-0.230	0.280	-0.230	0.522
Att23	E-learning will increase teachers' efficiency.	0.107	**0.553**	-0.146	0.257	0.298	0.188	**0.609**	-0.230	0.398	0.188	0.548
Att1	E-learning is very economical for educational institutions to adopt.	-0.024	**0.552**	-0.046	-0.014	0.125	0.055	**0.533**	-0.094	0.119	0.051	0.302
Att5	It is easier to revise electronic educational materials than printed material.	-0.193	**0.552**	-0.049	0.020	-0.206	-0.054	**0.559**	-0.087	0.154	-0.252	0.378
Att3	Computers make work more interesting.	0.080	**0.546**	-0.042	0.088	0.112	0.163	**0.570**	-0.123	0.223	0.019	0.351
Att4	I prefer reading articles in e-learning.	0.031	**0.508**	0.135	0.093	-0.072	0.098	**0.529**	0.055	0.207	-0.136	0.308
Att34	E-learning will provide me with better learning opportunities than traditional means of learning.	0.109	0.475	-0.063	0.122	-0.134	0.229	0.548	-0.166	0.246	-0.225	0.356
Att6	I prefer using a computer to prepare my lessons.	0.060	0.412	-0.121	0.245	-0.295	0.215	0.534	-0.226	0.360	-0.376	0.459
Attitude on using computer systems												
att28_rev	It will be difficult for me to become skilful in the use of e-learning tools.	0.061	0.183	**-0.677**	-0.067	-0.124	0.271	0.274	**-0.719**	0.031	-0.215	0.578
att30_rev	Using a computer at home is very frustrating.	0.051	0.004	**-0.655**	0.090	-0.043	0.217	0.117	**-0.678**	0.142	-0.109	0.473
att29_rev	I make errors frequently when using a Computer.	0.120	-0.069	**-0.572**	0.227	0.001	0.251	0.073	**-0.609**	0.257	-0.063	0.432

		Pattern Matrix					Structure Matrix					Communalities
Item No.	Item	Component					Component					Extraction
		1	2	3	4	5	1	2	3	4	5	
att35_rev	I find computer online interaction unexciting.	0.083	0.110	-0.492	-0.034	-0.116	0.237	0.189	-0.532	0.034	-0.186	0.323
att36_rev	Communicating through electronic mails is annoying.	0.232	0.049	-0.472	-0.185	0.104	0.328	0.085	-0.511	-0.133	0.021	0.348
Att31	Using e-learning technologies will allow me to accomplish more work than would otherwise be possible.	0.004	0.278	-0.337	0.195	-0.159	0.163	0.387	-0.399	0.290	-0.229	0.336
Leisure interst on e-learning innovations and use of computers												
Att25	I like discussing about new e-learning innovations.	0.106	0.042	-0.014	**0.707**	0.019	0.134	0.229	-0.095	**0.721**	-0.019	0.535
Att16	I like reading magazines on new technology innovations.	-0.084	0.204	0.077	**0.583**	0.030	-0.057	0.316	0.033	**0.623**	0.013	0.435
Att24	Working with computers is exciting.	0.063	0.243	-0.170	**0.553**	0.069	0.147	0.396	-0.249	**0.624**	0.001	0.493
Att32	I enjoy computer games very much.	0.230	-0.006	0.380	**0.536**	-0.006	0.156	0.116	0.286	**0.513**	-0.022	0.419
Att15	Communicating through social networks is fun.	-0.215	0.026	-0.257	**0.504**	-0.017	-0.132	0.144	-0.248	**0.523**	-0.014	0.36
att9_rev	Delivering a lecture through electronic technologies is very difficult.	0.173	0.047	-0.077	0.053	**-0.689**	0.320	0.191	-0.186	0.087	**-0.733**	0.589
Att22	My institution has enough teaching-learning resources to carry out e-learning.	0.135	0.281	0.299	0.116	0.509	0.025	0.227	0.269	0.156	0.471	0.405
Att8	I enjoy teaching using computers.	0.045	0.268	0.192	0.401	-0.453	0.134	0.411	0.082	0.461	-0.488	0.538
att17_rev	Teaching through e-learning is tiresome.	0.132	0.105	-0.349	-0.117	-0.444	0.305	0.200	-0.421	-0.054	-0.508	0.44

Table 3.8.7: Selected themes for the TeLRA scale (cut-off-point=0.5)

Half of the themes composing TeLRA scale were maintained in themes that emerged after the analysis. The theme *Interest in teaching using e-learning technologies* emerged with one item, therefore, it was excluded.

The PCA was repeated after deleting items with factor loadings less than 0.5. Results show that all items loaded perfectly well in the same themes (see Table 3.8.8) except *att13*, "A face-to-face method is more learner-centered than E-learning methods." On rechecking the reliability of the scale, only *att13* was found to have a higher *alpha value if item deleted* than the rest of the items. Removal of this item yielded a Cronbach's alpha coefficient of 0.806.

The PCA has its limitation. It has no criteria to test the obtained solution and that the final choice of themes to include in the factor solution depends entirely on the researcher's ability to asses and interpret the solution (Tabachnick and Fidell 2013). To offset these limitations while enhancing interpretation of themes, the researcher included items with factor loadings 0.5 or higher in both pattern and structure matrix. Thus, the extracted themes after PCA could be described as highly representative of the whole concept of attitude measure towards e-learning and are presented under sub-section 4.3, p. 234.

Item No.	Item	Pattern Matrix[a] Component 1	2	3	4	Structure Matrix Component 1	2	3	4	Communalities Extraction
Challenges of implementing e-learning										
att26_rev	Supporting learners in an e-learning environment is very difficult.	**0.682**	0.045	0.019	-0.031	**0.695**	0.153	0.061	-0.161	0.487
att20_rev	Using computer systems requires a lot of mental effort.	**0.664**	-0.091	0.048	-0.177	**0.684**	0.038	0.079	-0.291	0.506
att19_rev	E-learning technologies are difficult to use.	**0.650**	0.001	0.225	-0.108	**0.680**	0.157	0.266	-0.253	0.530
att10_rev	E-learning requires expensive technical support.	**0.627**	-0.160	-0.034	0.000	**0.602**	-0.075	-0.041	-0.089	0.391
att27_rev	E-learning infrastructure is very expensive for the government to afford.	**0.618**	-0.012	-0.010	-0.299	**0.669**	0.113	0.050	-0.408	0.534
att18_rev	E-learning increases learners' social isolation.	**0.618**	0.146	-0.161	0.046	**0.624**	0.199	-0.110	-0.063	0.429
att21_rev	Discussions on e-learning technologies are uninteresting.	**0.603**	-0.005	0.069	0.034	**0.599**	0.094	0.089	-0.082	0.364
att13	A face-to-face method is more learner-centred than E-learning methods.	-0.396	-0.366	0.307	-0.107	-0.418	-0.348	0.228	-0.029	0.366
Benefits from e-learning										
att2	I believe using e-learning will improve the quality of my work.	-0.115	**0.713**	-0.058	0.013	-0.014	**0.682**	0.082	-0.045	0.483
att14	I believe using e-learning technologies will improve my job performance.	0.095	**0.670**	0.112	-0.073	0.212	**0.716**	0.263	-0.184	0.543
att1	E-learning is very economical for educational institutions to adopt.	-0.037	**0.575**	-0.030	-0.065	0.058	**0.571**	0.094	-0.124	0.331
att5	It is easier to revise electronic educational materials than printed material.	-0.109	**0.572**	0.013	-0.036	-0.017	**0.563**	0.130	-0.087	0.329
att4	I prefer reading articles in e-learning.	0.038	**0.555**	0.078	0.102	0.105	**0.564**	0.181	0.020	0.333
att3	Computers make work more interesting.	0.065	**0.530**	0.128	-0.018	0.151	**0.568**	0.242	-0.109	0.344
att23	E-learning will increase teachers' efficiency.	0.106	0.483	0.321	-0.099	0.209	0.577	0.437	-0.215	0.462
Leisure interest on e-learning innovations and use of computers.										
att25	I like discussing about new e-learning innovations.	0.122	0.061	**0.696**	0.002	0.160	0.222	**0.713**	-0.112	0.529
att32	I enjoy computer games very much.	0.217	-0.031	**0.619**	0.458	0.157	0.073	**0.567**	0.347	0.542
att16	I like reading magazines on new technology innovations.	-0.113	0.219	**0.610**	0.051	-0.064	0.322	**0.644**	-0.029	0.469
att24	Working with computers is exciting.	0.077	0.241	**0.546**	-0.200	0.172	0.389	**0.623**	-0.309	0.509
att15	Communicating through social networks is fun.	-0.174	0.041	**0.512**	-0.248	-0.102	0.150	**0.543**	-0.283	0.373
Attitude on using computer systems										
att30_rev	Using a computer at home is very frustrating.	0.097	0.030	0.021	**-0.716**	0.231	0.134	0.118	**-0.740**	0.558
att28_rev	It will be difficult for me to become skilful in the use of e-learning tools.	0.175	0.192	-0.114	**-0.684**	0.321	0.276	0.016	**-0.724**	0.602
att29_rev	I make errors frequently when using a Computer.	0.138	-0.094	0.161	**-0.678**	0.253	0.041	0.229	**-0.711**	0.550

Table 3.8.8: Themes of the TeLRA scale after running a second PCA

vi. Assessing association between IVs and attitude towards e-learning: *Chi-square test*

The present study also needed to examine if there were any statistical significant association between the IVs and the dependent variable. In particular the researcher wanted to establish variable(s) that influenced the occurrence of the dependent variable. Thus, a Chi-square test was used in order to to explore the association between the independent variables (IVs) *teaching experience, teachers' qualifications, gender, exposure to computers, teachers' understanding about e-learning* and the dependent variable *teachers' attitude towards e-learning*. The Chi-Square test is useful because of its ability to compare observed frequencies with the statistically generated values that would be expected if there was no relationship between the two variables under investigation (Pallant 2010). Moreover, the type of variables was categorical, which make this test more appropriate.

To achieve Chi-square test, the dependent variable *attitude* was collapsed into positive and negative, making it a categorical variable. In addition, some general assumptions concerning data were observed, that is, the minimum allowed frequency in any cell had to be greater or equal to 5 (Pallant 2010). In this study, it was 8, and therefore, greater than the required standard.

In order to establish whether or not there was any association, the observed data were subjected to a Chi-square (with Yate's Continuity Correction) test for independence. Yate's Correction for Continuity was used to compensate for an overestimate of the obtained Chi-square value when used with a 2 by 2 table (Pallant 2010). Through chi-square test, the researcher was able to discover if there was any statistically significant association between variables of interest and attitudes towards e-learning. Results of this test are presented in Sub-section 4.2.1, p. 221).

vii. Assessing predictors of teachers' attitudes towards e-learning: *Multiple regression*

The next stage of analysis after determined the associations between IVs and the dependent variable was to assess the predictive power of each IV (*computer exposure, years of teaching experience, qualification, gender* and *teachers' general understanding of e-learning*) to predict the occurrence of a dependent variable, *attitude*. In order to perform the assessment, standard multiple regression was found appropriate because it allowed the researcher enter all IVs at once and assess contribution of all variables as a group, and also assess contribution of each independent variable to the prediction of the dependent variable (Pallant 2010; Tabachnick and Fidell 2013). It also allows the use of categorical IVs and a continuous dependent variable (Tabachnick and Fidell 2013).

Before such analysis, assumptions that govern multiple regression were cross-checked so as to determine if they were adhered to by this study.

Sample Size

Using the Tabachnick and Fidell's (2013) sample size formula (see computation of Logistic regression presented in Part iii in this sub-section), the sample size should be greater than 82. In this study, the sample size was 258, which is by far greater than the required sample size of 82.

Multicollinearity

As defined earlier, multicollinearity occurs when variables are very highly correlated. Multiple regression requires a low correlation among predicator variables, that is, the Pearson's *r* value should be less than 0.7 (Pallant 2010; Bryman and Cramer 2011). In order to determine the relationship among predictor variables, all four variables were subjected to correlation analysis (see Table 3.8.9).

Correlations

		Total Scale Scores	gender	comp_exp	qualification	t_exp	General understanding of e-learning
Pearson Correlation	Total Scale Scores	1.000	0.017	0.209	-0.034	-0.016	0.133
	gender	0.017	1.000	0.085	-0.043	0.017	-0.046
	comp_exp	0.209	0.085	1.000	0.070	-0.040	-0.042
	qualification	-0.034	-0.043	0.070	1.000	0.142	-0.138
	t_exp	-0.016	0.017	-0.040	0.142	1.000	0.145
	General understanding of e-learning	0.133	-0.046	-0.042	-0.138	0.145	1.000
Sig. (1-tailed)	Total Scale Scores		0.394	0.001	0.301	0.399	0.022
	gender	0.394		0.087	0.247	0.394	0.237
	comp_exp	0.001	0.087		0.132	0.259	0.257
	qualification	0.301	0.247	0.132		0.011	0.016
	t_exp	0.399	0.394	0.259	0.011		0.012
	General understanding of e-learning	0.022	0.237	0.257	0.016	0.012	
N	Total Scale Scores	243	243	243	243	243	230
	gender	243	258	258	258	258	242
	comp_exp	243	258	258	258	258	242
	qualification	243	258	258	258	258	242
	t_exp	243	258	258	258	258	242
	General understanding of e-learning	230	242	242	242	242	242

Table 3.8.9: Correlation among predictor variables

Table 3.8.9 shows that there is no relationship among predictor variables. The recorded correlation values ranged from 0.017 to 0.145 which are far less than the suggested 0.7. To determine whether or not the observed correlation values were correct, all predictor variables were subjected to collinearity statistics test. Such tests can detect multicollinearity that could not be detected by correlation analysis. To detect multicollinearity, Pallant (2010, p. 158) define a tolerance value as "an indicator of how much of the variability of the specified IV is not explained by the other IVs in the model." A value less than 0.1 suggest multicollinearity exists (ibid.).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	93.150	3.825		24.355	0.000	85.613	100.687					
	gender	0.136	1.786	0.005	0.076	0.939	-3.383	3.655	0.017	0.005	0.005	0.987	1.014
	comp_exp	8.617	2.601	0.216	3.312	0.001	3.490	13.743	0.209	0.216	0.214	0.984	1.016
	qualification	-0.594	1.563	-0.025	-0.380	0.704	-3.673	2.486	-0.034	-0.025	-0.025	0.946	1.057
	t_exp	-0.587	1.566	-0.025	-0.375	0.708	-3.674	2.499	-0.016	-0.025	-0.024	0.949	1.054
	General understanding of e-learning	5.203	2.414	0.143	2.155	0.032	0.446	9.960	0.133	0.143	0.139	0.950	1.053

a. Dependent Variable: Total Scale Scores

Table 3.8.10: Multicollinearity test for predictor variables

Table 3.8.10 shows that there were no correlations among predictor variables. All predictor variables displayed a *Tolerance* value of higher than 0.90. Variables with tolerance values between 0.01 to 0.0001 causes statistical instability in calculations requiring division in the sense that they produce very large and unstable numbers when used as denominators (Tabachnick and Fidell 2013). Therefore, all variables were retained for further analysis.

Outliers

A scatterplot (Figure 3.8.2) was used to identify outliers on all independent and dependent variables. Tabachnick and Fidell (2013) suggest that outliers are cases with *regression standardized residuals* greater than 3.3 or less than -3.3. Pallant (2010, p.

151) define residuals as “the differences between the obtained and predicted dependent variable scores.”

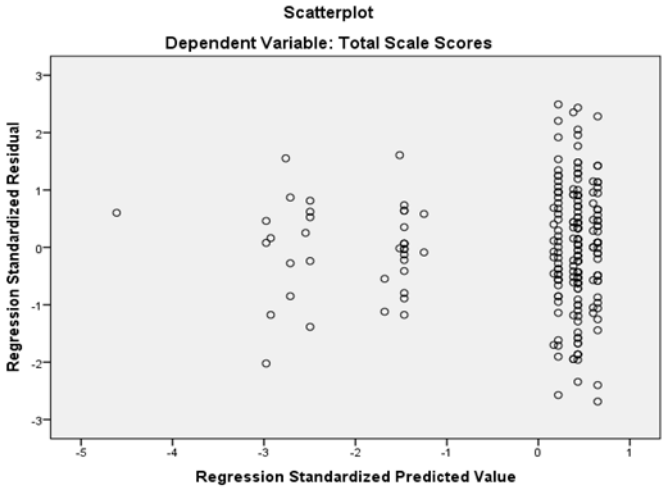


Figure 3.8.2: Scatterplot showing independent and dependent variables

Figure 3.8.2 shows no observed outliers. All scores concentrated between 3 and -3 on the standardized residual measure.

Normality and linearity

Normality is attained when residuals are roughly rectangularly distributed but highly concentrated along zero point (Pallant 2010). Figure 3.8.2 above displays scores which are not rectangularly distributed but roughly concentrated along zero point. A highly deviation of scores from the zero point may suggest some violation of the assumptions for multiple regression.

Linearity can be inspected through the Normal Probability Plot (Pallant 2010). Pallant (2010, p. 151) argues that for a perfect linearity, “residuals should have a straight-line relationship with predicted dependent variable scores.”

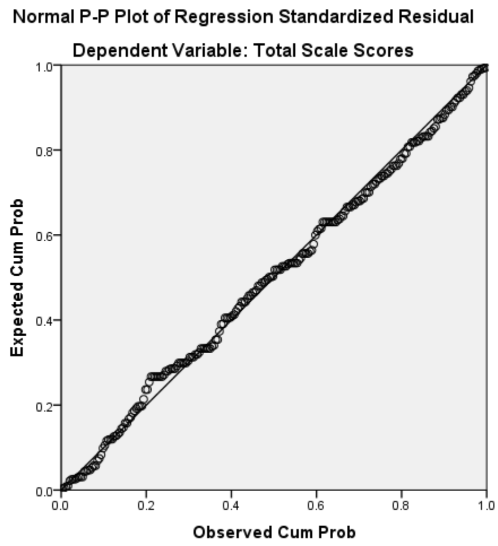


Figure 3.8.3: Normal P-P plot

Figure 3.8.3 shows a reasonably diagonal straight line from the bottom left to the upper right corner. This suggests that there are no major deviations from normality, implying that the relationship between residuals and predicted dependent variable scores is approximately linear. Therefore, data were suitable for multiple regression. Results and their interpretations are presented under sub-section 4.2.2, p. 231.

viii. Investigating other cases relationships: *Cluster analysis*

Apart from the established association between the variables of interest presented above, it was also required to determine other associations among the studied sample. In order to achieve this, cluster analysis test was found appropriate because of its ability to detect new commonalities in the sample or validate and, possibly, extend commonalities presented before in terms of teachers' demographic characteristics. Cluster analysis has the ability to generate homogeneous cases within the group and relatively heterogeneous to other groups (Cohen, *et al.,* 2011). Since the demographic characteristics (denoted as IVs) of the sample in this study were all categorical and their scores on attitude scales were continuous, a Two-step cluster analysis was used in order to classify the sample into smaller and homogeneous sets of groups. The Two-step cluster analysis, assumes a categorical (multinomial) distribution {0, 1} for each categorical variable and a normal distribution for a continuous variable (Tabachnick and Fidell 2013).

All categorical variables were recoded to be {0, 1}, where 0 means absence of characteristic in question and 1 means its presence. For a continuous variable, a normal distribution was measured in terms of kurtosis, *peakedness of the distribution* and skewness, *symmetry of distribution* (Cohen, *et al.,* 2011). Field (2009, p. 19) describes kurtosis as “the degree to which scores cluster at the ends of the distribution (known as the tails) and how pointy a distribution is”, whereas skewness occurs when “the most frequent scores (the tall bars on the graph) are clustered at one end of the scale and the frequency of scores tailing off towards the other end of the scale.” Ideally, data should be normally distributed, that is, not too skewed, and not too many or too few scores at the extremes (Field 2009). Therefore, for a perfect normal distribution, values of skewness and kurtosis should be zero or nearly zero (Pallant 2010; Bryman and Cramer 20110). In this study, values of skewness and kurtosis were found to be 0.006 and 0.085, which are close to zero, suggesting a nearly normal distribution of scores as displayed in Figure 3.8.4.

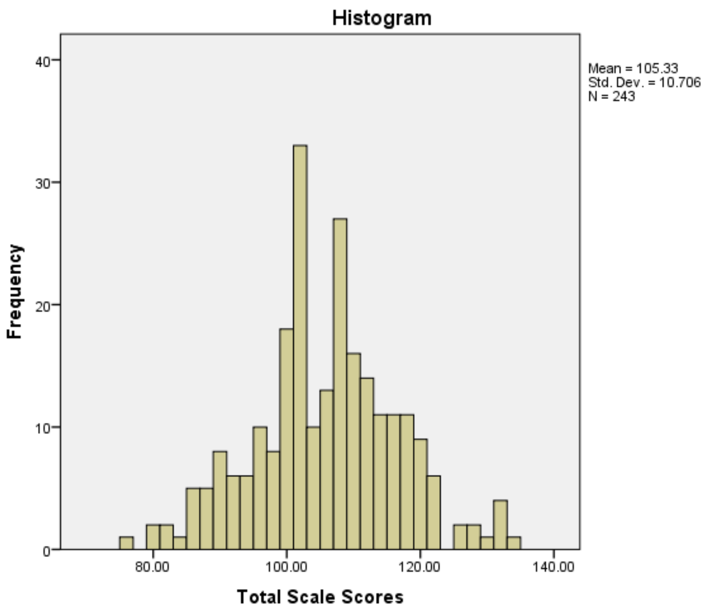


Figure 3.8.4: Distribution of teachers' total attitude scores

Therefore, data were suitable for cluster analysis.

Two-step Cluster Analysis

All IVs *gender, qualifications, teaching experience, computer exposure* and dependent variable *total attitude scores* were subjected to a Two-step cluster analysis procedure. A 4-cluster solution (Figure 3.8.5) that identified cluster members was created.

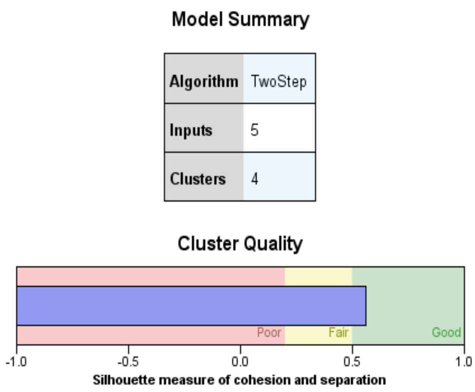


Figure 3.8.5: A 4-cluster solution model summary

Figure 3.8.5 indicates that four clusters were formed based on the five inputs features (variables) selected. The cluster quality chart indicates that the overall model quality was *good.* Further classification of clusters in terms of cluster size and profile was summarized in Figure 3.8.6.

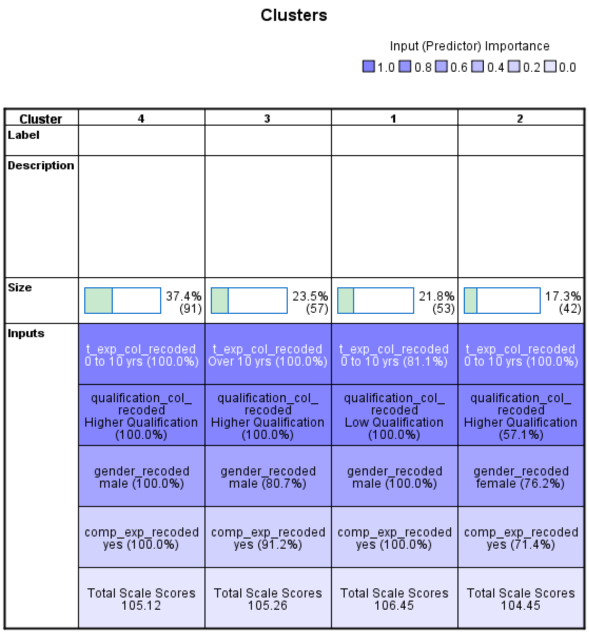


Figure 3.8.6: Cluster profile

Figure 3.8.6 shows clusters sorted out from left to right by cluster size. Therefore, they were ordered 4, 3, 1 and 2 and they are interpreted as follows;

Cluster 4 was composed of male teachers who were exposed to computers, holders of higher qualifications with teaching experience between 0 to 10 years. These teachers had positive attitude towards e-learning (Total Scale Scores > median 105).

Cluster 3 was dominated by male teachers with higher qualifications and teaching experience greater than 10 years. These teachers had positive attitude towards e-learning (Total Scale Scores > median 105).

Cluster 1 was composed of male teachers who were exposed to computers possessing lower qualifications. These teachers had positive attitude towards e-learning (Total Scale Scores > median 105).

Cluster 2 was dominated by female teachers with teaching experience between 0 to 10 years. These teachers had negative attitude towards e-learning (Total Scale Scores < median 105).

One-way ANOVA

Since cluster analysis is an exploratory technique, further statistical techniques to supplement its results were needed. One-way between-groups analysis of variance (One-way ANOVA) was used in order to compare the mean scores obtained from the four cluster groups. This analysis requires one independent variable with a number of different levels which corresponds to the different groups or clusters and one dependent continuous variable (Pallant 2010). In this analysis the new variable *TSC_9234* (created after the Two-step cluster analysis), which assigned cases into a particular cluster was used as an independent variable and the variable *Tot_scale_scores* as a dependent variable. One-way between-groups ANOVA was found appropriate because the term *one-way* indicated a presence of one independent variable and *between-groups* indicated the presence of different cases in each of the groups (Pallant 2010).

Two variables *TSC_9234* and *Tot_scale_scores* were subjected to one-way between groups ANOVA to determine if there was a significant difference in the mean scores on the dependent variable across the four clusters. Preliminary analyses were conducted to ensure no violation of assumptions of homogeneity of variance as summarized in Table 3.8.11.

Test of Homogeneity of Variances

Total Scale Scores

Levene Statistic	df1	df2	Sig.
1.58	3	239	0.195

Table 3.8.11: Test of homogeneity of variance

Levene's test for homogeneity of variances checks whether the variance in scores is the same for each of the four clusters (Pallant 2010). Levene's test requires $\rho > 0.05$ (ibid.). Data in Table 3.8.11 shows $\rho = 0.195$ which is greater than 0.05. Therefore the assumption of homogeneity of variance was not violated.

A one-way between-groups ANOVA was conducted to compare the mean scores obtained from the four clusters defined earlier. The analysis shows that there was no statistically difference at the $\rho < 0.05$ level in the mean scores on the dependent variable across the four clusters, $F(3, 239) = 0.298$, $\rho = 0.827$ (Table 3.8.12).

ANOVA

Total Scale Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	103.403	3	34.468	0.298	0.827
Within Groups	27634.260	239	115.625		
Total	27737.663	242			

Table 3.8.12: One-way between-groups ANOVA

The actual difference in mean scores between the clusters was quite very small. The effect size, calculated using eta squared, was 0.0037:

$$\text{Eta squared} = \frac{\text{Sum of squares between groups}}{\text{Total sum of squares}} = \frac{103.403}{27737.663} = 0.0037$$ (Cohen, *et al.,* 2011, p. 619).

Post-hoc comparisons using the Tukey HSD test indicated that the mean scores for Cluster 1 (*M* = 106.45, *SD* = 9.56), Cluster 2 (*M* = 104.45, *SD* = 10.31), Cluster 3 (*M* = 105.26, *SD* = 12.50) and Cluster 4 (*M* = 105.12, *SD* 10.40) were not statistically different from each other (see Table 3.8.13).

Total Scale Scores

Tukey HSD [a,b]

TwoStep Cluster Number	N	Subset for alpha = 0.05
		1
Cluster 2	42	104.45
Cluster 4	91	105.12
Cluster 3	57	105.26
Cluster 1	53	106.45
Sig.		0.758

Means for groups in homogeneous subsets are displayed.
a Uses Harmonic Mean Sample Size = 56.172.
b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table 3.8.13: Homogeneous groupings in the Tukey HSD test

Although the clusters created in the sample would appear to be quite distinct, their mean scores on attitude towards e-learning were noticeably low and statistically not significant and therefore, found irrelevant for further analysis and interpretations.

CHAPTER FOUR

RESULTS

4.0 Introduction

The aim of this study was to investigate attitudinal factors towards the transition from face-to-face to e-learning in Tanzanian HLIs. This chapter presents findings from the study in accordance with the objectives outlined in Chapter One. The chapter is organised into the following six sections, namely:

i. respondents' understanding of e-learning;
ii. teachers' attitudes towards e-learning;
iii. performance of themes of the Test of e-Learning Related Attitudes (TeLRA) scale;
iv. barriers that can hinder the adoption of e-learning in HLIs;
v. strategies to address barriers of e-learning adoption in HLIs; and
vi. strategies that can be used to optimise teachers' and students' involvement in e-learning.

The study addressed the following research questions (see Table 4.0.1):

Objectives			Research Questions
A	To examine teachers' understanding of e-learning.	1	What do teachers understand about e-learning?
		2	To what extent can teaching experience, teachers' qualifications, gender, and exposure to computers predict teachers' understanding of e-learning?
B	To examine teachers' attitudes towards e-learning.	3	What are teachers' attitudes towards e-learning?
		4	Is there any association between teaching experience, teachers' qualifications, gender, exposure to computers, teachers' understanding of e-learning and teachers' attitude towards e-learning?
C	To develop an attitude scale for measuring teachers' attitudes towards e-learning.	5	To what extent do themes of the developed attitude scale performed on explaining attitudes towards e-learning?
D	To explore barriers that can hinder the transition from face-to-face to e-learning.	6	What are the barriers that can hinder the adoption of e-learning in Tanzanian HLIs?
		7	What strategies can be used to address the barriers that can hinder the adoption of e-learning in Tanzanian HLIs?
E	To identify strategies that can optimise teachers' and students' involvement in e-learning.	8	What are the best strategies that can be used to optimise teachers' and students' involvement in e-learning?

Table 4.0.1: Research objectives and questions

Respondents' demographic characteristics

The study collected data from 269 respondents of whom 258 were teachers, four were principals and seven were e-learning experts, all from six HLIs in three regions of the country. The teachers completed the questionnaires, whereas the remaining eleven participants responded to semi-structured interviews.

Teachers

Analysis of data collected about teachers is given in Table 4.0.2. Out of the 258 teachers involved in the survey, females accounted for only 48 (18.6%) whereas 210

(81.4%) were males. In terms of teachers' qualifications, results demonstrated that 15 (5.8%) teachers had Higher Diploma, 58 (22.5%) teachers had Bachelor's degree and 154 (59.7%) teachers had Master degrees. Teachers with Doctorate degrees were 29 (11.2%) and only two (0.8%) teachers had none of the above mentioned qualifications, so they were categorized as teachers with *other* qualifications.

Data on teaching experience revealed that there were 131 (50.8%) teachers with teaching experience less than 6 years and 53 (20.5%) teachers with teaching experience from 6 to 10 years. Furthermore, 21 (8.1%) teachers had 11 to 15 years of teaching experience and the last category had 53 (20.5%) teachers with more than 15 years of teaching experience.

Data on teachers' computer exposure indicated that 238 (92.2%) teachers had exposure in using computers, whereas only 20 (7.8%) teachers had no such exposure. Further information on exposure to computers revealed that 245 (95.0%) teachers had access to computers in their offices and 214 (82.9%) at their homes. For those who had computers in offices, 179 (69.4%) had access to the Internet and 79 (30.6%) had no access. In a similar way, for those who had computers at their homes, 179 (69.4%) teachers had Internet access, whereas 79 (30.6%) teachers had none.

Teachers' Characteristics

Characteristics	Category	Frequency & Percentage in the Study		Frequency & Percentage by gender within Category			
		N	%	Female	%	Male	%
Gender	Female	48	18.6	48	100.0	210	100.0
	Male	210	81.4				
Qualification *(Highest)*	Higher Diploma	15	5.8	5	33.3	10	66.7
	Bachelors' Degree	58	22.5	7	12.1	51	87.9
	Masters' Degree	154	59.7	30	19.5	124	80.5
	Doctorate Degree	29	11.2	6	20.7	23	79.3
	Other	2	0.8	0	0.0	2	100.0
Teaching Experience	0 - 5 years	131	50.8	25	19.1	106	80.9
	6 - 10 years	53	20.5	10	18.9	43	81.1
	11 - 15 years	21	8.2	5	23.8	16	76.2
	Over 15 years	53	20.5	8	15.1	45	84.9
Exposure to Computers	Yes	238	92.2	42	17.6	196	82.4
	No	20	7.8	6	30.0	14	70.0
Total No. of Teachers		258	100	48	100.0	210	100.0
Other Characteristics							
Computer in the office	Yes	245	95.0	45	18.4	200	81.6
	Connected to Internet	179	69.4	34	19.0	145	81.0
	Not connected	79	30.6	14	17.7	65	82.3
	No	13	5.0	3	23.1	10	76.9
Computer at home	Yes	214	82.9	41	19.2	173	80.8
	Connected to Internet	179	69.4	35	19.6	144	80.4
	Not connected	79	30.6	13	16.5	66	83.5
	No	44	17.1	7	15.9	37	84.1

Table 4.0.2: Basic characteristics of teachers
(Source: Field data, 2012).

Generally, information from Table 4.0.2 suggests that majority of teachers in this study were males, holding a Master degrees, with teaching experience from 0 to 5 years as well as had computers both at their offices and homes with Internet access.

Principals and e-learning experts

Analysis of data collected about principals and e-learning experts is given in Table 4.0.3. A face-to-face semi-structured interview was carried out with 11 interviewees.

Out of those, four were principals of institutions where the survey was conducted and seven were e-learning experts from the two HLIs which provide e-learning programmes. All but one principal had a Doctorate. All principals were males with work experience from 10 to 33 years.

Of the seven e-learning experts, five were male and two female. In terms of their qualifications, only one had a Doctorate, two had Master degrees and the remaining four had Bachelor degrees. Their years of experience ranged from 3 to 16 years. Their actual job titles are displayed in no specific order in Table 3.5.1, p. 144.

	Characteristics				
ID No	Job Title	Gender	Qualification	YoE	Tot No.
P1	Principal	Male	Doctorate	33	4
P2			Masters	10	
P3			Doctorate	16	
P4			Doctorate	20	
E1	E-learning expert	Female	Masters	7	7
E2			Bachelors	3	
E3		Male	Bachelors	3	
E4			Bachelors	6	
E5			Bachelors	8	
E6			Doctorate	16	
E7			Masters	10	
Total No. of principals and e-learning experts					**11**

Key Note 1: ***P*** *:-Principal;* ***E*** *:- E-learning expert;* ***YoE*** *:-Years of Experience*

Key Note 2: *All respondents used computers with Internet connectivity at home and office.*

Table 4.0.3: Basic characteristics of principals and e-learning experts *(Source: Field data, 2012)*.

4.1 Respondents' understanding of e-learning

The first research question (see Table 4.0.1) explored respondents' understanding of e-learning. All participants were required to respond to the question, which asked, "what do you understand by the term e-learning?" Data were obtained from teachers through a questionnaire, while principals and e-learning experts responded through semi-structured interviews. Out of 258 teachers, only 242 (93.8%) responded to this question. All principals and e-learning experts responded.

Responses from teachers were analysed in order to identify highly repeated topics (see Sub-section 3.8.1, p. 163). The most recurring responses were coded as summarized in Table 4.1.1.

What do you understand by the term *e-learning*?

Analytic Coding			Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
	Code No.	Representative Quotations				
Valid	1	All forms of electronically supported learning and teaching	87	33.7	36	36
	2	Learning through the Internet (online learning)	77	29.8	31.8	67.8
	4	A computer and network enabled transfer of skills and knowledge	24	9.3	9.9	77.7
	5	Method of acquiring knowledge and skills using electronic technologies, regardless of time and location	12	4.7	5.0	82.6
	7	Is a distance learning supported by ICT	19	7.4	7.9	90.5
	8	Other	23	8.9	9.5	100.0
		Total	242	93.8	100	
Missing	99	Missing value	16	6.2		
Total			258	100		

***NB**: Code No. 99 was used to represent non-responded items.*

Table 4.1.1: Teachers' understanding about e-learning
(Source: Field data, 2012).

Criteria used to categorise participants definitions of e-learning was the same as to those used in the pilot study (see Table 4.1.2).

Involvement in Learning Interaction	Definition of e-Learning																																						
	Independent Learning				Face-to-face Learning					Computer-based Learning					Distance Learning					Blended Learning					Online Learning					Internet Learning					Electronically supported Learning				
Teacher		√				√	√		√		√	√		√		√	√		√		√	√		√		√	√		√		√	√		√		√	√		√
Students			√			√		√	√		√		√	√		√		√	√		√		√	√		√		√	√		√		√	√		√		√	√
Content				√			√	√	√			√	√	√			√	√	√			√	√	√			√	√	√			√	√	√			√	√	√
Understanding Level	Poor									Partial																									Good				

Table 4.1.2: Definitions of e-learning based on understanding categories
(Source: Pilot study, 2012)

Table 4.1.2 summarizes definitions of e-learning based on the type of learning interaction, which involves all or some of the combination between teachers, students and content. Each definition is preceded with un-ticked boxes which mean respondents did not mention either type of learning interaction in their definitions of e-learning. Such definitions include e-*learning is independent learning*; *e-learning is face-to-face learning*; *e-learning is computer-based learning* likewise up to *e-learning is electronically supported learning*. Further, ticked boxes indicate type of learning interaction included in the definition, which include either of the two or all interactive combinations. Therefore, each definition was examined and all keywords (in terms of interaction and type of learning) highlighted. Finally, definitions were categorised as either poor, partial or good. By exploring the coded items, three main themes were identified. These are briefly outlined as follows:

Theme 1: *All forms of electronically supported learning and teaching*

Responses under this theme contained all definitions of e-learning that were fully related to the operational definition that defined e-learning to mean “all kinds of electronically supported learning (whether in networked or non-networked environments) where the learner is interacting with the teachers, content and other learners regardless of place and time.” This theme embrace definitions with code numbers 1, 4 and 5 (see Table 4.1.1).

These definitions concurred with the operational definition because they explicitly emphasised *learning supported electronically*, which is the core feature underlined by an operational definition. Therefore, in accordance with the operational definition of e-learning, responses under this theme portrayed a *good* understanding of e-learning.

Theme 2: *Learning through the Internet or distance/online learning*

This theme contained all definitions which were partially related to the operational definition. The term *partially* was used to show that such definitions emphasized learning mainly supported in networked environments. Such definitions included those with code numbers 2 and 7 (see Table 4.1.1).

Since the operational definition of e-learning in this study also incorporated learning in networked environment, responses under this theme revealed *partial* understanding of e-learning.

Theme 3: *Inconsistent definitions of e-learning*

This theme included all definitions that were not related to the operational definition of e-learning. Such definitions included items with code number 8, labelled as *other* (see Table 4.1.1). Compared with the operational definition of e-learning, definitions provided in this theme indicated a *poor* understanding of e-learning.

The frequency and percentage of responses from teachers under these themes are presented in Figure 4.1.1.

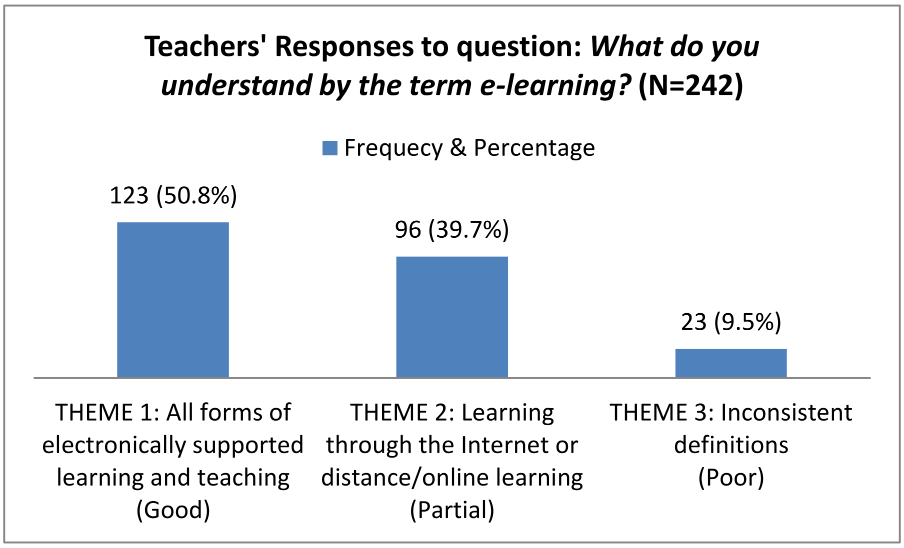


Figure 4.1.1: Teachers' understanding of e-learning
(Source: Field data, 2012).

Figure 4.1.1 reveals a slight majority of teachers (50.8%) had *good* understanding, 96 (39.7%) had *partial* understanding and 23 (9.5%) teachers had *poor* understanding.

Further analysis of responses from the interview question shows that all responses converged to Theme 1, which was "*all forms of electronically supported learning and* *teaching."* Representative quotations from all participants and the category which best represents understanding are shown in Table 4.1.3.

Participants' responses to the question: ***What do you understand by the term, e-learning?***

Respondent ID	Representative Quotations	General Understanding of e-learning
Theme 1: All forms of electronically supported learning and teaching		
I1.8	"Is involving compter and other electronic means to support learning/teaching activities" *(Male,MSc, YoE: > 15,Comp Exp).*	Good
I1.9	"E-learning includes all forms of electronically supported learning and teaching" *(Male, PhD, YoE: > 15, Comp Exp).*	
I1.27	"Is the use of ICT technologies to enable people to learn anywhere and at anytime" *(Male, PhD, YoE: > 15, Comp Exp)*	
I2.131	"E-learning means nothing but making use of electronic devices and computer technologies to learn efficiently" *(Male, MSc, YoE: 0-5, Comp Exp)*	
I4.205	"Delivering of teaching or learning via electronic systems (computers, mobile phones, etc)" *(Male, BSc, YoE: 0-5, Comp Exp).*	
P1	"E-learning, which is electronic (pause), well I would say is a modality of learning through or using or with support of (pause), or with facilitation of electronic technology, yeah. There are those who use it offline in the sense that somebody may send CDs or somebody may access that information. There are those who deposit that information (amm) on the Intranet where people can access it, but there are those who (amm) access information through the Internet, you know, So, I mean, in my views all those are modalities." *(Male, PhD, YoE: 33)*	
P2	"E-learning is the technology to make the pupil learn (pause) anywhere in the world, may be through the Internet, or video conferencing or may be through multimedia, or CD-ROM". *(Male, MSc, YoE: 10)* .	
P3	"E-learning is the use of Information and Communications Technology to deliver learning contents to recipients. It encompasses all forms of media that are used and the infrastructure, the content itself, but also the learners themselves have to be trained and understand this. So it includes use of television, computers, the Internet, materials recorded in CDs, electronic key box, iPods, smart board and all similar devices. It is not necessarily online learning (pause), yes (pause), but online could be (pause), it is part of e-learning ". *(Male, PhD, YoE:16).*	
P4	"E-learning is an approach of (amm) I mean learning, whereby people use (pause) internet and other similar types of media for learning purposes". *(Male, PhD, YoE: 20).*	
E1	"E-learning is any instructional teaching and learning experience that makes use of an electronic device (amm) this is enhanced by the use of technologies". *(Female, MSc, YoE: 7).*	
E2	"E-learning means learning through electronic devices, such as through mobile phones, computers, CDs, the Internet connections, radio and TVs". *(Female, BSc, YoE: 3).*	
E3	"E-learning is electronic learning (pause) is delivering of learning through technology (pause) for example, through the Internet where students and teachers can meet online or through CDs where teachers burn their materials through CDs and distribute them to students". *(Male, BSc, YoE: 3).*	
E4	"E-learning is a provision used to provide education through the Internet or electronic devices such as CDs and so on". *(Male, BSc, YoE: 6).*	
E5	"E-learning is learning through a networked computers whereby you can download materials and access other available materials through a network (pause) or learning through CDs in places where there are scarcity of internet connectivity". *(Male, BSc, YoE: 8).*	

Table 4.1.3: Extracts from respondents' definitions of e-learning

E6	"For most of the time, we define it using computers but it is not about computers is about using ICTs to facilitate learning, whether in a formal or informal environment, but the main issue is to ensure that learners, educators and knowledge gathering are well facilitated by the means of ICT. Thinking of distance currently is not relevant because when you get materials from Singapore, that is a distance, but when I get material from my library as well obtained electronically is also by distance (pause), when somebody associates learning with distance, he still embraces the understanding that there is knowledge somewhere and there is learning position somewhere". *(Male, PhD, YoE: 16).*	
E7	"E-learning is a learning process that is facilitated by electronic devices or systems. So it can be computer mediated directly by using CDs, DVDs and such devices or it can go further to the extent that the access to the learning materials and the learning process can also be mediated by the Internet connections using Learning Information Systems, Learning Information Management and the likes". *(Male, MSc, YoE: 10).*	
	Theme 2: Learning through the Internet or distance/online learning	
I2.111	"E-learning is a way of learning through video and online lecturing" *(Male, MSc, YoE: 0-5, Comp Exp)*	Partial
I2.119	"E-learning means online lecturing through computer with the help from the Internet" *(Male, MSc, YoE: 6-10, Comp Exp)*	
I2.155	"By the term e-learning I understood as the way of gaining knowledge through the Internet with appropriate solution as best" *(Male, MSc, YoE: 0-5, Comp Exp).*	
I3.162	"E-learning is a distance learning through computers" *(Male, BSc, YoE: >15, Comp Exp).*	
I3.174	"E-learning is a type of learning whereby learners do not interact with the instructor face-to-face. They use internet, like distance learning" *(Male, BSc, YoE: 6-10, Comp Exp)* .	
I3.177	"Is a form of education whereby a student can attend a course far away from the college by using Internet access while be able to perform other duties" *(Male, BSc, YoE: 0-5, Comp Exp).*	
	Theme 3: Inconsistent defintions	
I1.57	"E-learning is a process of learning when teacher/instructor and students are not seeing each other" *(Male, BSc, YoE: 6-10, Comp Exp).*	Poor
I1.75	"Is learning through computer connected to emails" *(Male, BSc, YoE: > 15, Comp Exp).*	
I2.93	"Is a consistent pattern in our response to new technologies is we simultaneously overestimate the short-term impact and underestimate the long-term impact" *(Male, MSc,YoE: 0-5, Comp Exp).*	
I2.96	"E-learning are computer programmes to upgrade our skills and learn new ways to perfection in this constantly changing technological world" *(Male, MSc, YoE: 6-10).*	
I2.102	"E-learning is an advanced level learning which should be implemented for the students for their gorgeous future" *(Male, MSc, YoE: 0-5, Comp Exp).*	
I2.103	"E-learning is an existing method which has been improved its methodology over any institution and college" *(Male, MSc, YoE: 0-5, Comp Exp).*	
I2.121	"E-learning is learning something out of books" *(Male, MSc, YoE: 0-5, Comp Exp.*	
I2.129	"E-learning is developing oral sharing information" *(Male, MSc, YoE: 0-5, Comp Exp).*	
I2.145	"E-learning is one of any ways to get the study material from various places" *(Female, MSc, YoE: 0-5, Comp Exp).*	
I4.210	"E-learning means learning through e-mails" *(Male, BSc, YoE: 6-10, Comp Exp).*	
I3.173	"I do not understand" *(Male, MSc, YoE: 11-15, Comp Exp).*	

Key Note: ***I1.1*** *to* ***I4.258*** *represent Teachers ID Number from institutions 1 to 4;* ***P1*** *to* ***P4*** *represent Principals 1 to 4;*
E1 *to* ***E7*** *represent e-learning experts 1 to 7.*

Table 4.1.3: Extracts from respondents' definitions of e-learning
(Source: Field data, 2012).

Table 4.1.3 displays extracts obtained from participants' responses when defining e-learning. Each identified theme is presented in detail in the following sections.

4.1.1 E-learning as all electronically supported learning and teaching

Generally, all definitions provided by the principals and e-learning experts in Table 4.1.3 revealed a *good* understanding of e-learning because they were relatively similar to the study's operational definition. This can be demonstrated by the following two quotations:

> For most of the time, we define it using computers but it is not about computers is about using ICTs to facilitate learning, whether in a formal or informal environment, but the main issue is to ensure that learners, educators and knowledge gathering are well facilitated by the means of ICT (E6, see Table 4.1.3).

> Use of Information and Communications Technology to deliver learning contents to recipients. It encompasses all forms of media that are used and the infrastructure, the content itself, but also the learners themselves have to be trained and understand this. So it includes use of television, computers, the Internet, materials recorded in CDs, electronic key box, iPads, smart board and all similar devices. It is not necessarily online learning (pause), yes (pause), but online could be (pause), it is part of e-learning (P3, see Table 4.1.3).

These were expected from e-learning experts due to the nature and requirements of their jobs. E-learning experts are expected to be conversant with e-learning systems so as to provide technical and pedagogical support to all system users. Similarly, principals demonstrated a good understanding of e-learning mainly because they are caretakers of all learning and teaching processes in their institutions as well as ultimate quality assurance controllers. The nature of their jobs motivates them not only to be aware but also conversant with different approaches used for high quality learning and teaching, including e-learning. In addition, all principals and e-learning experts had computers, both at their homes and offices with access to the Internet (see Key note 2, Table 4.0.3).

Consistent with advantages of semi-structured interviews reported in the literature, findings from this study demonstrated that descriptions about e-learning provided by interviewees were highly detailed and accurate. Thus, they provided an insight about e-learning than those provided by teachers (in the open-ended question of the questionnaire). That could be attributed to a more realistic opportunity for detailed elaborations and clarifications obtained by interviewees rather than through the questionnaires (Bell 2005; Richards 2009; Bryman 2012).

Further, teachers' general understanding of e-learning under this theme was consistent with the operational definition provided by this study. This is illustrated by teacher with identification number I1.27 who defined e-learning as "…the use of ICT technologies to enable people to learn anywhere and anytime" (see Table 4.1.3). This was also supported by several teachers who defined e-learning as "delivering of teaching or learning via electronic systems (computers, mobile phones, and so on)" or e-learning "involves computer and other electronic means to support learning/teaching activities" (teachers I4.205 and I1.8 respectively, see Table 4.1.3).

In summary, respondents under this theme associated e-learning with learning that uses ICT as a medium of delivery, which acknowledged use of any electronic device, regardless of communications media such as Internet. The Internet here was used as a medium that can support asynchronous or synchronous learning. However, one potential problem identified by this study was that some teachers defined e-learning as distance or Internet learning. This is illustrated in the next Sub-section.

4.1.2 E–learning as learning through the Internet or distance/online learning

Findings from the study show that 96 (39.7%) teachers (see Figure 4.1.1) linked their definition of e-learning to the Internet and distance learning. It implies that in e-learning, learners and educators are physically separated, but what joins them is network connectivity. This is exemplified by teacher I2.119 who defined e-learning to mean "…online lecturing through computer with the help from the Internet." A similar definition was given by teacher I3.174 that "E-learning is a type of learning whereby learners do not interact with the instructor face-to-face. They use internet, like distance learning." Such definitions and many more obtained from teachers clearly indicated some conflicting views on the term e-learning among teachers of HLIs in Tanzania.

However, interviewee E6 concurs with this study's perception that distance is not a major characteristic of e-learning:

> Currently thinking about distance is not relevant because when you get materials from Singapore, that is a distance, but when I get materials from my library as well obtained electronically is also by distance (pause), when somebody associates learning with distance, he/she still embraces the understanding that there is knowledge somewhere and there is learning position somewhere (E6, see Table 4.1.3).

This study suggests that such conflicting definitions of e-learning portrayed by teachers could be attributed to teachers' engagement to some kind of either formal or informal online learning activities at or away from the workplace. This view can be demonstrated by data from Table 4.0.2 which shows about 69% of teachers had Internet access at home and in the office.

4.1.3 Inconsistent definitions

Responses from 23 (9.5%) teachers (see Figure 4.1.1) revealed lack of understanding of e-learning because they were unrelated to the operational definition: for example, "E-learning is learning something out of books" and "E-learning is developing oral sharing information" (teachers I2.121 and I2.129 respectively, Table 4.1.3). Such definitions clearly do not have features that characterize understanding of e-learning. However, teacher I2.102 went much further by associating e-learning and future prospects of students by asserting that, "E-learning is an advanced level learning, which should be implemented for students for their gorgeous future" (teacher I2.102).

Indication of lack of understanding of e-learning is further evident when another teacher defined e-learning as "a consistent pattern in our response to new technologies is, we simultaneously overestimate the short-term impact and underestimate the long-term impact" (teacher I2.93, Table 4.1.3). Interestingly, this respondent could be making a point here when associated the impact of a new technology and how users respond to such a technology. However, the description was irrelevant to the question under investigation.

Generally, such responses and many more under this theme could imply any of the following four aspects: teachers truly expressed what they understood about e-learning, teachers tried to impress the researcher by filling out all gaps, teachers were being deliberately unhelpful and, finally, they were not very good at expressing themselves in writing.

Though the debate on a clear definition that can reflect all features of learning, teaching and content in e-learning technologies is still on-going, findings from this study demonstrated a strong evidence that most teachers (more than 50%) in Tanzanian HLIs have a good understanding of e-learning. The term *good* was used to comprise all definitions near or equivalent to the operational definition. However, there was also a need to investigate factors that contribute to such descriptions and measured their predictive power towards their understanding of e-learning. This is covered in the next sub-section.

4.1.4 Examining predictors of teachers' understanding of e-learning

The second research question (see Table 4.0.1, p. 198) examined the predictive ability of the independent variables (IVs) *computer exposure, gender, years of teaching experience* and *qualification* to measure teachers' understanding of e-learning. In order to collect nominal data and ease coding of responses (Pallant 2010; Cohen, *et al.,* 2011), the three themes described earlier were further collapsed into two major categories to become a dichotomous variable. Category one was named '*understood'* e-learning, which contained all definitions under themes one and two. The second category was called '*not understood'* e-learning, and contained all definitions under theme three as summarized in Table 4.1.4.

Gender, Computer exposure, Qualification, Teaching experience * General understanding of e-learning Crosstabulation

			General understanding of e-learning		Total
			Not Understood	Understood	
gender	female	Count	3	42	45
		% within gender	6.7%	93.3%	100.0%
	male	Count	20	177	197
		% within gender	10.2%	89.8%	100.0%
comp_exp	no	Count	1	18	19
		% within comp_exp	5.3%	94.7%	100.0%
	yes	Count	22	201	223
		% within comp_exp	9.9%	90.1%	100.0%
Qualification	Low Qualification	Count	2	65	67
		% within qualification	3.0%	97.0%	100.0%
	Higher Qualification	Count	21	154	175
		% within qualification	12.0%	88.0%	100.0%
Teaching_exp	0 to 10 yrs	Count	21	151	172
		% within t_exp	12.2%	87.8%	100.0%
	Over 10 yrs	Count	2	68	70
		% within t_exp	2.9%	97.1%	100.0%

Key Note: *1) Low Qualification include Higher Diploma, Bachelor degree and "Other" certificates*
2) High Qualification include Master and Doctorate degrees.

Table 4.1.4: Teachers' e-learning understanding by demographic characteristics *(Source: Field data, 2012).*

The percentage within group comparisons in Table 4.1.4 showed that female teachers were by 3.5% more in e-learning understanding than male teachers. Somewhat interestingly, data in terms of computer exposure show that teachers who had no exposure to computers were by 4.6% more in e-learning understanding than teachers with exposure to computers. Although they were 18 teachers out of 19, findings suggest that being exposed to computer does not exclusively mean good understanding of e-learning.

Percentage within qualification comparisons revealed that teachers with lower qualifications exceeded teachers with higher qualifications by 9% in understanding of e-learning. In this study, teachers with lower qualifications were Higher Diploma (HD), Bachelor degree as well *other* certificates holders, whilst teachers with higher qualifications were Master and Doctorate degrees holders (see Table 4.0.2, p. 200). In terms of teaching experience, teachers with more than 10 years of teaching experience demonstrated e-learning understanding by 9.3% higher than teachers with 10 or less than 10 years of teaching experience. Results from the study imply that teachers with long experience had more opportunities for learning new aspects exposed to them.

Direct logistic regression (see Sub-section 3.8.2, p. 168, Part iii) was performed to assess the impacts of the four IVs (Table 4.1.4) on teachers' understanding of e-learning. Results revealed that the full model containing all predictor variables was statistically significant, χ^2 (4, N = 242) = 14.0, ρ = 0.007 (Table 4.1.5c), indicating that the model was able to distinguish between teachers with and without e-learning understanding.

(a) Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	137.998[a]	0.056	0.121

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

(b) Classification Table[a]

Observed			Predicted: General understanding of e-learning: Not Understand	Predicted: General understanding of e-learning: Understand	Predicted: Percentage Correct
Step 1	General understanding of e-learning	Not Understand	0	23	0.0
		Understand	0	219	100.0
	Overall Percentage				90.5

a. The cut value is 0.500

(c) Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	14.002	4	0.007
	Block	14.002	4	0.007
	Model	14.002	4	0.007

Table 4.1.5: Result of logistic regression
(Source: Field data, 2012).

Table 4.1.5a show that the model as a whole explained between 5.6% (or 0.056 Cox and Snell R square) and 12.1% (or 0.12 Negelkerke R square) of variance in general understanding of e-learning status. The *Cox and Snell R Square* and the *Negelkerke R Square* values indicates the level of variation in the dependent variable *general understanding of e-learning* explained by the model (Pallant 2010; Tabachnick and Fidell 2013). These values range from 0 to approximately 1 (Pallant 2010). Furthermore, Table 4.1.5b provides an indication of how well the model is able to predict the correct category (not understand/understand e-learning) for each participant. The model predicted 100% of teachers who understood e-learning to have e-learning understanding and 0% of teachers with no e-learning understanding predicted not to have e-learning understanding. In addition, Table 4.1.5b displays an overall predictive accuracy of 90.5%, indicating that of the teachers predicted to have an e-learning understanding the model accurately picked 90.5% of them. The contribution of each IV to the outcome is displayed in Table 4.1.6.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	gender	-0.497	0.655	0.575	1.000	0.448	0.609	0.169	2.196
	comp_exp	-0.370	1.079	0.117	1.000	0.732	0.691	0.083	5.724
	qualification	-1.641	0.760	4.657	1.000	0.031	0.194	0.044	0.860
	t_exp	1.703	0.759	5.034	1.000	0.025	5.489	1.240	24.290
	Constant	4.055	1.342	9.128	1.000	0.003	57.666		

a. Variable(s) entered on step 1: gender, comp_exp, qualification, t_exp.

Table 4.1.6: Contribution of predictors to the outcome
(Source: Field data, 2012).

Table 4.1.6 shows only two IVs *qualification* and *t_exp* (teaching experience) made a unique statistically significant contribution to the model ($\rho < 0.05$). Teaching experience was the strongest predictor of reporting understanding e-learning with an odds ratio of 5.489. This indicated that teachers with more than 10 years of teaching experience were over 5 times more likely to have a good understanding of e-learning than those teachers with teaching experience less than 10 years, controlling for all other factors in the model. Odds ratio is change in outcome caused by change in one unit of a predictor variable (Tabachnick and Fidell 2013). When odds ratio is greater than 1, it implies an "increase in odds of a response category '1' by a one-unit increase in the predictor variable and when it is less than 1 it implies the decrease in odds of that outcome with a one-unit change" (Tabachnick and Fidell 2013, p. 463).

In terms of qualification, the odds ratio of 0.194 was less than 1, indicating that teachers with higher qualifications were 0.194 times less likely to report understanding of e-learning than teachers with lower qualifications, controlling for other factors in the model. Lastly, the variables, *gender* and *computer exposure* were not statistically significant ($\rho > 0.05$) implying that they had poor contribution to the model.

Therefore, findings from this study demonstrated that there is a statistically significant association between teachers' qualifications, teaching experience and teachers' understanding of e-learning. It implies that with experience, teachers are exposed to different forms of knowledge, including e-learning that can enhance their understanding.

4.2 Teachers' attitudes towards e-learning

The third research question (see Table 4.0.1, p. 198) was about teachers' attitude towards e-learning: In particular, the study aimed at answering the research question, "what are the teachers' attitudes towards e-learning?" Teachers' attitudes were determined using a Test of e-Learning Related Attitudes (TeLRA) scale (see Appendix I). Out of 258 teachers who participated in the research, only 243 (94.2%) responded to all items.

In order to measure attitudes, total scores were computed for each respondent and compared with the median (see Sub-section 3.8.2, p.168, Part iv). The median was computed to be 105 where half the numbers in the list were less and half the numbers were greater than 105. For the purpose of this study, those who scored greater or equal to the median were considered to have a positive attitude, because their average scores were either 3 (agreed) or 4 (strongly agreed) and those subjects who scored below the median were considered to have negative attitudes because their average scores were either 1-strongly disagree or 2-disagree (see Sub-section 3.8.2, p. 172, Part iv).

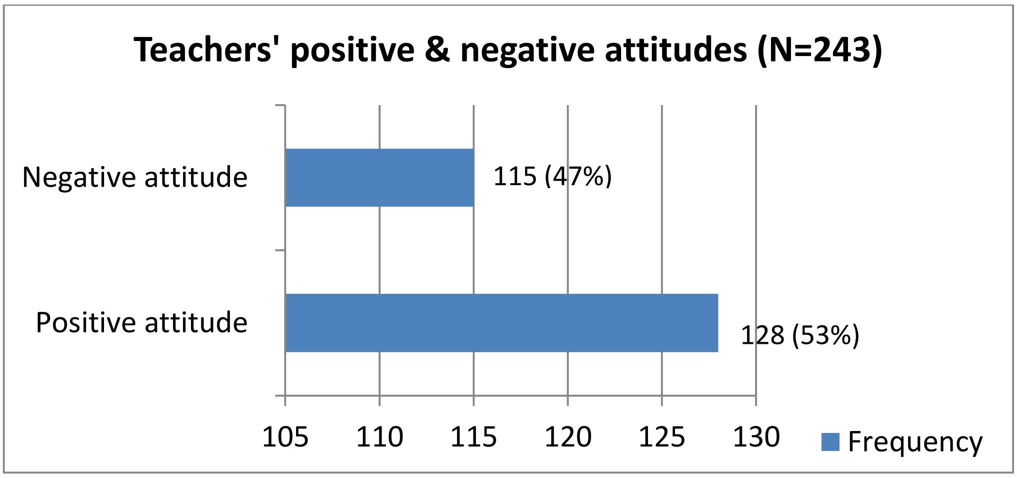


Figure 4.2.1: Teachers' positive and negative attitude
(Source: Field data, 2012).

Figure 4.2.1 shows that 128 (53%) teachers had positive attitudes towards e-learning, and the remaining 115 (47%) teachers had negative attitudes towards e-learning. On one hand, there is some evidence from this study that teachers' positive attitudes could be attributed to their computer experiences. Teachers' experiences on computers at their workplaces was mainly contributed by policy to use computers enforced by the management, introduction of Student Information Management Systems (SIMS) and ICT training programmes conducted at their institutions. These three assertions are exemplified by principal P2 when responding to an interview question that asked, "Do you have any ICT literacy skill programmes in your institution?":

> Actually, we used to give faculty staff development programmes. Sometimes the programmes covers ICT related aspects deemed at identifying technology such as multimedia and internet services (pause). For every month there is staff (pause) faculty development programme and sometimes, aspects cover ICT area. In addition, all staff members are insisted to teach from 10% to 15% of their delivery only through PPT (P2, see Table 4.2.1).

The quotation implies that certainly from the principals' perspective, teachers were motivated to use computers; however the focus of study was not to establish if they really used them. Nevertheless, computers present teachers with new alternatives of solving problems and rapid processing of records. Motivating them to use computers might gradually show that the new system is flexible and easier to use than the previous system. The more teachers use new technology, the more they could be motivated to seek for further information about it so as to cope up with challenges created by it (Rogers 2003).

Responses from the principals to the question: *Do you have any ICT literacy skill programmes in your institution?*

Respondent ID	Representative Quotations
P1	"We did have them, but finally we realised that most of them have. We…yah…I mean when we started there was a programme which we called IT Fundis. In the IT Fundis we taught one of the issues that (pause) what we did was to say ok let us have an elementary (aamm) class in IT for staff… yah we did it I think twice, yah, but then we realised, I mean, some of these things people can learn, I mean they are not that much difficult, yah" *(Male,PhD, YoE: 33).*
P2	"Actually, we use to give faculty staff development programmes. Sometimes the programmes covers ICT related aspects deemed at identifying technology such as multimedia and internet services (pause). For every month there is staff (pause) faculty development programme and sometimes, aspects cover ICT area. In addition, all staff members are insisted to teach from 10 percent to 15 percent of their delivery only through PPT" *(Male, MSc, YoE: 10).*
P3	"Oh yes. Actually this is a primary role. We are a learning institution and we train in ICT from the literacy to advanced skills…and our staff are very much interested, have been trained and we always do the re-training for our staff in ICT …so that they can keep pace with the ever changing technology.(Aamm) we have (aamm) different modes in which we conduct. Of course they are (pause) more than 95% face-to-face. We have an e-learning programme but is not there yet due to the challenges I have been mentioning. Some they don't believe in it, so we have to change their mind-set in the first place ... we are trying to persuade them to understand that e-learning is also another alternative way of providing education (pause) yes" *(Male, PhD, YoE:16).*
P4	"… we introduce the e-learning with 'B' and 'F' that is the "Blended and Flexible" skills of learning. When you talk of e-learning most people know that e-learning is just to prepare the PPT slides and you give to the students….giving student electronic version of notes. That is not enough. It should comprise of B and F … Together with those notes you should put the videos and other technology that would enable the students to understand even if he is alone. If you give electronics notes and also a video to see exactly…for example we in engineering field, you show him exactly…if you are talking of powder metallurgy line processes for example I am a Mechanical engineer, then you give him a video showing a powder metallurgy line processes because you involve seeing and that is what I mean with B and F system...in addition to that,we have just installed SIMS in our institution whereby everything now will be processed online. Even examination results, one just records results in the computer and the examination officer just downloads and displays the results " *(Male, PhD, YoE: 20).*

Table 4.2.1: Extracts from principals' responses about ICT programmes
(Source: Field data, 2012).

In line with principal P2, P4 responded that:

> We have just installed SIMS in our institution whereby everything now will be processed online. Even examination results, one just records results in the computer and the examination officer just downloads and displays the results (P4, see Table 4.2.1).

The comment implies that teachers could not escape using computers because institutional policy insisted on teachers processing students' academic records through computers. Training was provided for those who were not conversant with the system. On the other end, there is some evidence from this study that teachers' negative attitudes could be attributed to poor facilitating conditions or environmental factors as illustrated in Figure 4.4.1 (see Section 4.4, p. 244). Thus, possibly due to barriers that can hinder the adoption of e-learning in their institutions some respondents were not in favour of e-learning. To demonstrate these findings, teachers' responses to the question, "what are barriers that may hinder adoption of e-learning in your institution?" were categorized into two major groups. Group one comprised of teachers' responses with one or more barriers and the second group comprised of teachers' responses who wrote, "there are no barriers" as presented in Figure 4.4.1 (see Section 4.4, p. 244). The majority of teachers (204, 90.7%) agreed that there were many barriers that hindered the adoption of e-learning. These findings suggest that barriers could possibly be the reason for other teachers to have negative attitude towards e-learning.

Although more than half (53%) of teachers had a positive attitude towards e-learning (see Figure 4.2.1), there was a need to investigate if there was any association between teachers' demographic characteristics and their attitudes toward e-learning. Evidence from literature, as outlined in Chapter Two, shows that peoples' attitude formation towards an entity can also be influenced by their demographic characteristics. This is presented in the next Sub-section.

4.2.1 Examining association between IVs and attitude towards e-learning

The fourth research question (see Table 4.0.1, p. 198) sought to identify if there were any associations between the IVs *exposure to computers, teaching experience, teachers' qualifications, gender, teachers' understanding about e-learning* and the dependent variable, *teachers' attitude towards e-learning*. To establish an association, the observed data were subjected to a Chi-square (with Yate's Continuity Correction) test for independence (see Sub-section 3.8.2, p. 168, Part vi).

i. Computer exposure and teachers' attitudes toward e-learning

The study examined whether or not teachers' exposure to computers determined teachers' attitude toward e-learning. In particular, the study examined if there was a statistically significant difference in attitudes towards e-learning between teachers with computer exposure and those without. A total of 243 (94.2%) teachers responded to 36 attitude items in the questionnaire. Data are summarized in Table 4.2.2.

Computer exposure * Total Scale Scores Crosstabulation

			Total Scale Scores		Total
			Negative Attitude	Positive attitude	
Computer exposure	Yes	Count	102	124	226
		% within Computer exposure	45.1%	54.9%	100.0%
		% within Total Scale Scores	88.7%	96.9%	93.0%
		% of Total	42.0%	51.0%	93.0%
	No	Count	13	4	17
		% within Computer exposure	76.5%	23.5%	100.0%
		% within Total Scale Scores	11.3%	3.1%	7.0%
		% of Total	5.3%	1.6%	7.0%
Total		Count	115	128	243
		% within Computer exposure	47.3%	52.7%	100.0%
		% within Total Scale Scores	100.0%	100.0%	100.0%
		% of Total	47.3%	52.7%	100.0%

Table 4.2.2: Computer exposure and attitude towards e-learning
(Source: Field data, 2012).

Table 4.2.2 shows that there were differences in teachers' attitude towards e-learning by exposure to computer. Percentage within group comparisons showed that teachers with exposure to computer had more positive attitudes towards e-learning by 31.4% higher than teachers with no exposure to computers.

A Chi-square test for independence (with Yate's Continuity Correction) was performed to determine whether or not the revealed difference was statistically significant. Findings indicated that there was a statistically significant difference between computer exposure and attitudes towards e-learning. Teachers with exposure to computers showed more favorable attitudes towards e-learning than those with no exposure as exhibited by χ^2 (1, n=243) = 5.04, ρ = 0.025, *phi* = -0.16 tests (Table 4.2.3).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.229[a]	1	0.013		
Continuity Correction[b]	5.035	1	0.025		
Likelihood Ratio	6.466	1	0.011		
Fisher's Exact Test				0.021	0.012
Linear-by-Linear Association	6.203	1	0.013		
N of Valid Cases	243				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.05.

b. Computed only for a 2x2 table

Table 4.2.3: Chi-square test: Computer exposure Vs attitude towards e-learning *(Source: Field data, 2012).*

The conventionally accepted minimum level of significance is ρ = 0.05 or smaller (Pallant 2010; Cohen, *et al.,* 2011). However, the effect size of -0.16 (the correlation coefficient) indicated a modest association (Cohen, *et al.,* 2011), between teachers' exposure to computers and their attitudes towards e-learning.

Therefore, findings from the study demonstrate that there was a statistically significant association between computer exposure and teachers' attitudes towards e-learning. Thus, it implies that teachers' exposure to computer functionalities both at their homes and work places played a significant role in constructing positive attitudes towards e-learning. It means that the higher the frequency of familiarity in computer systems use, the more positive the attitude towards e-learning can be achieved.

ii. Teaching experience and teachers' attitudes toward e-learning

The next variable under investigation was years of teaching experience. The study needed to examine if there was a statistically significant difference in attitudes towards e-learning between teachers with long years of teaching experience (that is, over 10 years) from those with less years of teaching experience (that is, less than or equal to 10 years). A total of 243 (94.2%) teachers responded to 36 attitude items in the questionnaires. Table 4.2.4 summarizes the data.

Teaching Experience * Total Scale Scores (Collapsed) Crosstabulation

			Total Scale Scores		Total
			Negative Attitude	Positive attitude	
Teaching experience	0 to 10 yrs	Count	80	96	176
		% within Teaching experience	45.5%	54.5%	100.0%
		% within Total Scale Scores	69.6%	75.0%	72.4%
		% of Total	32.9%	39.5%	72.4%
	Over 10 yrs	Count	35	32	67
		% within Teaching experience	52.2%	47.8%	100.0%
		% within Total Scale Scores	30.4%	25.0%	27.6%
		% of Total	14.4%	13.2%	27.6%
Total		Count	115	128	243
		% within Teaching experience	47.3%	52.7%	100.0%
		% within Total Scale Scores	100.0%	100.0%	100.0%
		% of Total	47.3%	52.7%	100.0%

Table 4.2.4: Teaching experience and attitude towards e-learning
(Source: Field data, 2012).

Table 4.2.4 shows that there were differences in teachers' attitude towards e-learning by years of teaching experience. Percentage within group comparisons showed that teachers with less years of teaching experience had more positive attitudes towards e-learning by 6.7% higher than teachers with long years of teaching experience.

A Chi-square test for independence (with Yate's Continuity Correction) was performed to determine whether or not the difference revealed was statistically significant. Results indicated that there was no statistically significant association between teaching experience and attitudes towards e-learning as revealed from statistical tests: χ^2 (1, n=243) = 0.644, ρ = 0.422, *phi* = -0.061 (Table 4.2.5). An effect size of -0.061 indicated that the association of the two variables was very small.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.896[a]	1	0.344		
Continuity Correction[b]	0.644	1	0.422		
Likelihood Ratio	0.895	1	0.344		
Fisher's Exact Test				0.389	0.211
Linear-by-Linear Association	0.892	1	0.345		
N of Valid Cases	243				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 31.71.

b. Computed only for a 2x2 table

Table 4.2.5: Chi-square test: Teaching experience Vs attitude towards e-learning *(Source: Field data, 2012).*

Thus, it implies that the difference illustrated in Table 4.2.4 was caused by chance or by other pre-existing external variables, which can affect e-learning.

iii. Qualification and teachers' attitudes toward e-learning

The third variable investigated was teachers' academic qualification. The study examined if there was a statistically significant difference in attitudes towards e-learning between teachers with higher qualifications (Master and Doctorate degrees holders) from those with lower qualifications (Bachelor's degree, Higher Diploma and *other* qualifications holders).Two hundred and forty two (94.2%) teachers responded to all items as summarized in Table 4.2.6.

Qualification * Total Scale Scores Crosstabulation

			Total Scale Scores		Total
			Negative Attitude	Positive attitude	
Qualification	Lower qualification	Count	29	42	71
		% within Qualification	40.8%	59.2%	100.0%
		% within Total Scale Scores	25.2%	32.8%	29.2%
		% of Total	11.9%	17.3%	29.2%
	Higher qualification	Count	86	86	172
		% within Qualification	50.0%	50.0%	100.0%
		% within Total Scale Scores	74.8%	67.2%	70.8%
		% of Total	35.4%	35.4%	70.8%
Total		Count	115	128	243
		% within Qualification	47.3%	52.7%	100.0%
		% within Total Scale Scores	100.0%	100.0%	100.0%
		% of Total	47.3%	52.7%	100.0%

Table 4.2.6: Qualification and attitude towards e-learning
(Source: Field data, 2012).

Table 4.2.6 shows that there were minor differences in teachers' attitude towards e-learning by qualifications. Percentage within group comparison showed that teachers with lower qualifications were slightly higher in favour of e-learning by 9.2% more than teachers with higher qualifications.

A Chi-square test for independence (with Yate's Continuity Correction) was performed and results indicated no significant association between teachers' qualifications and attitudes towards e-learning as revealed from the following statistical tests: χ^2 (1, n=243) = 1.342, *ρ* = 0.247, *phi* = -0.083 (Table 4.2.7). An effect size of -0.083 indicated that the association between the two variables was very small.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.690[a]	1	0.194		
Continuity Correction[b]	1.342	1	0.247		
Likelihood Ratio	1.698	1	0.193		
Fisher's Exact Test				0.206	0.123
Linear-by-Linear Association	1.683	1	0.195		
N of Valid Cases	243				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 33.60.

b. Computed only for a 2x2 table

Table 4.2.7: Chi-square test: Qualification Vs attitude towards e-learning *(Source: Field data, 2012).*

Findings from the study portrayed no statistically significant association between teachers' qualifications and their attitudes towards e-learning. It implies that the difference in teachers' attitude towards e-learning by qualification displayed in Table 4.2.6 is down to other factors.

iv. Gender and teachers' attitudes toward e-learning

The fourth variable under investigation was gender. The study aimed at establishing if there was a statistically significant difference in attitude towards e-learning between male and female teachers. A total of 243 (94.2%) teachers responded to 36 attitudes items in the questionnaire (see Table 4.2.8).

Gender * Total Scale Scores Crosstabulation

			Total Scale Scores		Total
			Negative Attitude	Positive attitude	
Gender	Male	Count	94	106	200
		% within Gender	47.0%	53.0%	100.0%
		% within Total Scale Scores	81.7%	82.8%	82.3%
		% of Total	38.7%	43.6%	82.3%
	Female	Count	21	22	43
		% within Gender	48.8%	51.2%	100.0%
		% within Total Scale Scores	18.3%	17.2%	17.7%
		% of Total	8.6%	9.1%	17.7%
Total		Count	115	128	243
		% within Gender	47.3%	52.7%	100.0%
		% within Total Scale Scores	100.0%	100.0%	100.0%
		% of Total	47.3%	52.7%	100.0%

Table 4.2.8: Gender and attitude towards e-learning
(Source: Field data, 2012).

Table 4.2.8 shows that both (106, 53%) male and (22, 51.2%) female teachers had positive attitudes towards e-learning. However, further analysis on percentage difference reveals that percentage of male teachers with positive attitudes outnumbered that of the female teachers by only 1.8%. Although the percentage difference would appear to be quite small, findings indicated that there was a difference in attitudes toward e-learning between male and female teachers. Male teachers had slightly more positive attitudes than female teachers.

A Chi-square test for independence (with Yate's Continuity Correction) was performed to determine whether or not the observed findings were statistically significant. Results indicated that there was no statistically significant association between gender and attitudes towards e-learning as revealed by the following statistical tests: χ^2 (1, n=243) = 0.003, ρ = 0.96, *phi* = -0.014 (Table 4.2.9). An effect size of -0.014 indicated that the association between the two variables was very small.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.048[a]	1	0.827		
Continuity Correction[b]	0.003	1	0.960		
Likelihood Ratio	0.048	1	0.827		
Fisher's Exact Test				0.867	0.479
Linear-by-Linear Association	0.048	1	0.827		
N of Valid Cases	243				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.35.

b. Computed only for a 2x2 table

Table 4.2.9: Chi-square test: Gender Vs attitude towards e-learning
(Source: Field data, 2012).

The study suggests that the data in Table 4.3.12 could be caused by chance or other personal and technological characteristics.

v. E-learning understanding and teachers' attitudes toward e-learning

The last variable was teachers' understanding of e-learning. In particular, the study examined if there was a statistically significant difference in attitudes towards e-learning between teachers with e-learning understanding and those without.

A total of 230 (89.1%) teachers responded to the open-ended question, "what do you understand by the term e-learning?" Data were categorized into two major themes, *understanding* and *not-understanding* e-learning (see Sub-section 4.4.1, p. 212). Cross-tabulation of these two themes with teachers' attitudes towards e-learning is shown in Table 4.2.10.

General understanding of e-learning * Tot_Scores Crosstabulation

			Tot_Scores		Total
			Negative attitude	Positive attitude	
General understanding of e-learning	Not Understood	Count	16	6	22
		% within General understanding of e-learning	72.7%	27.3%	100.0%
		% within Tot_Scores	14.5%	5.0%	9.6%
		% of Total	7.0%	2.6%	9.6%
	Understood	Count	94	114	208
		% within General understanding of e-learning	45.2%	54.8%	100.0%
		% within Tot_Scores	85.5%	95.0%	90.4%
		% of Total	40.9%	49.6%	90.4%
Total		Count	110	120	230
		% within General understanding of e-learning	47.8%	52.2%	100.0%
		% within Tot_Scores	100.0%	100.0%	100.0%
		% of Total	47.8%	52.2%	100.0%

Table 4.2.10: E-learning understanding and attitude towards e-learning *(Source: Field data, 2012).*

Table 4.2.10 shows that there were differences in teachers' attitude towards e-learning by their e-learning understanding. Percentage within group comparisons shows that teachers with e-learning understanding had positive attitudes towards e-learning by 27.5% higher than teachers without.

A Chi-square test for independence (with Yate's Continuity Correction) was performed so as to determine whether or not the revealed difference was statistically significant. Findings indicated that there was statistically significant difference between teachers' general understanding about e-learning and their attitudes towards e-learning. Teachers with e-learning understanding showed more favorable attitudes towards e-learning than those with no understanding through the following statistical tests: χ^2 (1, n=230) = 4.99, ρ = 0.025, *phi* = 0.16 (Table 4.2.11). The effect size of 0.16 (the correlation coefficient) indicated a modest association (Cohen, *et al.,* 2011) between the two variables.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.045[a]	1	0.014		
Continuity Correction[b]	4.992	1	0.025		
Likelihood Ratio	6.208	1	0.013		
Fisher's Exact Test				0.023	0.012
Linear-by-Linear Association	6.019	1	0.014		
N of Valid Cases	230				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.52.

b. Computed only for a 2x2 table

Table 4.2.11: Chi-square test: E-learning understanding Vs attitude towards e-learning *(Source: Field data, 2012).*

Thus findings from this study suggest that teachers' understanding of e-learning was significant in determining their attitudes towards e-learning. With due regard, the more teachers understands e-learning, the more they will develop positive attitude towards it.

Conclusively, the study demonstrated a statistically significant association between teachers' computer exposure and e-learning understanding with their attitudes towards e-learning. Thus, it is suggested that other variables should be considered alongside the variables *gender, teaching experience* as well as *qualification* when explaining the difference in teachers' attitudes toward e-learning. However, there was also a need to investigate variables that highly predicted teachers' attitudes towards e-learning. This is covered in the next Sub-section.

4.2.2 Examining predictors of teachers' attitudes towards e-learning

The second level of analysis focused on examining predictors of teachers' attitudes towards e-learning. Standard multiple regression analysis was conducted in order to assess the predictive power of each of the following IVs: *computer exposure, years of teaching experience, qualification, gender* and *teachers' general understanding of e-learning* to predict *teachers' attitudes towards e-learning*. Multiple regression allows use of dichotomous IVs and continuous dependent variables in its model (Pallant 2010; Bryman and Cramer 2011; Tabachnick and Fidell 2013). To satisfy this requirement, the two categorical IVs *teaching experience* and *qualification* were collapsed into teachers with many (over 10 years) and few years (10 or less than 10 years) of teaching experience and into higher (Master and Doctorate degrees) and lower qualification (Higher Diploma, Bachelor degree and *other* qualification) and became dichotomous. A continuous variable *total_scale_scores* (denoting teachers' total attitude scores) was used in the model as a dependent variable.

A total of 242 (93.8%) cases were analysed. Prior to conducting the multiple regression, preliminary analyses were conducted so as to ensure that there was no violation of assumptions of normality, linearity, and multicollinearity (see Sub-section 3.8.2, p. 168, Part vii). All predictor variables were entered at once and the *R square* of 0.066 was obtained (Table 4.2.12).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.256[a]	0.066	0.045	10.464

a. Predictors: (Constant), General understanding of e-learning, comp_exp, gender, t_exp, qualification

b. Dependent Variable: Total Scale Scores

Table 4.2.12: Multiple regression: Model summary

The value indicated that about 7% of variance in the dependent variable was explained by the IVs, $F(5, 224) = 3.14$, $\rho = 0.009$ (Table 4.2.13).

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1719.842	5	343.968	3.141	0.009[b]
	Residual	24527.781	224	109.499		
	Total	26247.623	229			

a. Dependent Variable: Total Scale Scores

b. Predictors: (Constant), General understanding of e-learning, comp_exp, gender, t_exp, qualification

Table 4.2.13: Analysis of variance test
(Source: Field data, 2012).

In this model, *computer exposure* and *general understanding of e-learning,* were statistically significant with standardized beta values β = 0.216 and β = 0.143 respectively ($\rho < 0.05$, see Table 4.2.14). The *Beta* value provides "the amount of standard deviation unit of change in the dependent variable for each standard deviation unit of change in the independent variable" (Cohen, *et al.,* 2011, p. 663). It implies that attitude towards e-learning will rise by 21.6% and 14.3% of one standard deviation unit for every one unit rise in *computer exposure* and *general understanding of e-learning* respectively.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	93.150	3.825		24.355	0.000	85.613	100.687					
	gender	0.136	1.786	0.005	0.076	0.939	-3.383	3.655	0.017	0.005	0.005	0.987	1.014
	comp_exp	8.617	2.601	0.216	3.312	0.001	3.490	13.743	0.209	0.216	0.214	0.984	1.016
	qualification	-0.594	1.563	-0.025	-0.380	0.704	-3.673	2.486	-0.034	-0.025	-0.025	0.946	1.057
	t_exp	-0.587	1.566	-0.025	-0.375	0.708	-3.674	2.499	-0.016	-0.025	-0.024	0.949	1.054
	General understanding of e-learning	5.203	2.414	0.143	2.155	0.032	0.446	9.960	0.133	0.143	0.139	0.950	1.053

a. Dependent Variable: Total Scale Scores

Table 4.2.14: Predictors of attitude towards e-learning
(Source: Field data, 2012).

Table 4.2.14 summarizes information on the predictive ability of each IV to *teachers' attitudes toward e-learning*. The IV, *comp_exp,* had a relatively stronger positive effect ($\beta = 0.216$) on attitude towards e-learning and was statistically significant at $\rho = 0.001$. The contribution of the variable to the total R square was computed by squaring its *Part* correlation coefficient of 0.214 (Pallant 2010), which gave a value of 0.0458, indicating that *comp_exp* uniquely explained about 4.6% of the variance in the dependent variable (Table 4.2.14).

Similarly, *general understanding of e-learning,* had a relatively stronger positive effect ($\beta = 0.143$) on attitude towards e-learning and was statistically significant at $\rho = 0.032$ (Table 4.2.14). The contribution of this variable to the total R square was computed by squaring its *Part* correlation coefficient, 0.139 (Table 4.2.14), which gave a value equal to 0.0193, indicating that *general understanding of e-learning* explained about 2% of the variance in the dependent variable. The IVs *qualification* and *t_exp* had a negative effect ($\beta = -0.025$) each on the attitude towards e-learning. However, they were not statistically significant ($\rho > 0.05$, see Table 4.2.14). The IV, *gender*, was the least with poor effect ($\beta = 0.005$) on attitudes towards e-learning.

Therefore, findings from this study demonstrated that there was a statistically significant association between e-learning understanding and computer exposure to teachers' attitudes towards e-learning. The study suggests that teachers' computer experiences and their general understanding about e-learning were the most determining factors for their positive attitudes towards e-learning. That is, the more teachers are exposed to different functionalities of computers and the more they understand e-learning, the more favorable will their attitudes be towards e-learning.

Although e-learning understanding and computer exposure were found to have a significant impact to teachers' attitudes towards e-learning, contributions of themes from the TeLRA scale to teachers' attitudes were yet to be known. In order to respond to this inquiry, further analysis on association of teachers' attitude and themes of the TeLRA scale were performed. Results are presented in the next sub-section.

4.3 Performance on themes of Test of e-Learning Related Attitudes (TeLRA) scale

The fifth research question (see Table 4.0.1, p. 198) sought to investigate teachers' responses to each theme of the attitude scale. Teachers were requested to express their degree of agreement with each statement on a four-point TeRLA scale consisting of responses *Strongly Agree (SA), Agree (A), Disagree (D)* and *Strongly Disagree (SD)*. In order to obtain teachers' responses to each theme of the TeLRA scale, the four-point scale was reduced to two points (that is, *agree* and *disagree*) so that it had to become a dichotomous variable which could also be used for another analysis in the study. The four themes of the TeLRA scale after Principal Component Analysis (PCA, see Sub-section 3.8.2, p. 168, Part v) include the following:

i. Benefits from e-learning;
ii. Attitude towards using computer systems;
iii. Leisure interest on e-learning innovations and use of computers; and
iv. Challenges of implementing e-learning (see Sub-section 3.8.2, p. 168, Part v).

Figure 4.3.1 shows teachers' general responses on each theme.

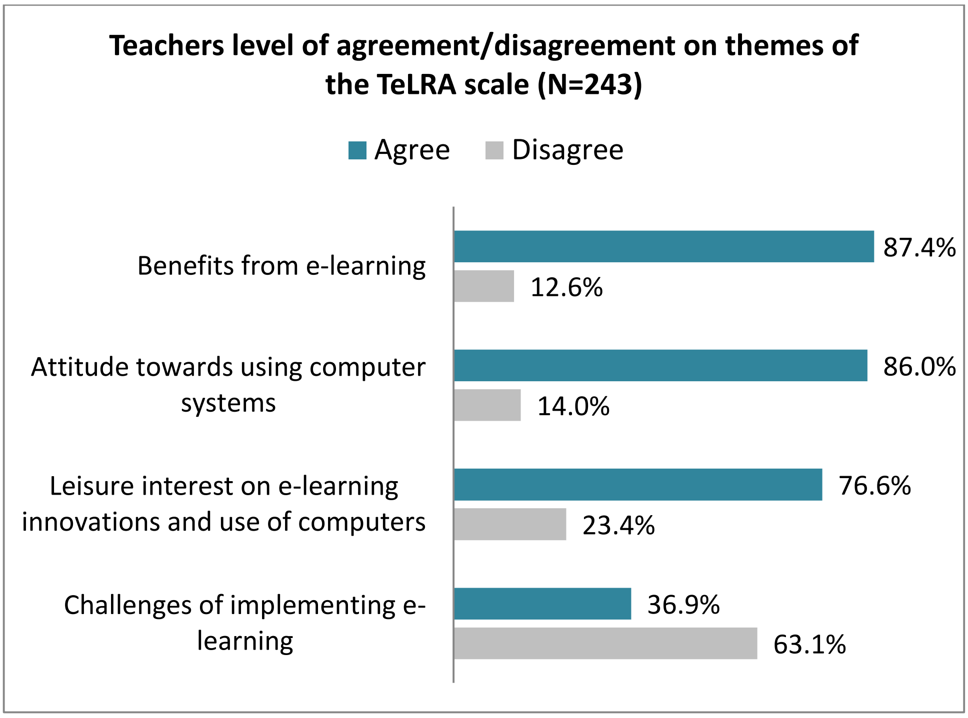


Figure 4.3.1: Teachers' average percentage of agreement/disagreement to TeLRA themes (N=243).
(Source: Field data, 2012).

Figure 4.3.1 shows how the four themes of the TeLRA scale performed after teachers had responded to all items of the scale. Generally, findings imply that teachers were highly aware and supportive of benefits from e-learning to their career and to education in particular. This is evident from the Figure 4.3.1 which shows more positive responses (87.4%) to items under the theme *benefits from e-learning* compared to other themes. The following sections provide analyses of each theme.

i. Teachers' responses on *benefits from e-learning*

Of all themes under investigation, teachers' responses to items on benefits from e-learning were highly favourable. Analysis of data collected under this theme is given in Table 4.3.1.

Item No	Item	AGREE		DISAGREE	
		Frequency	%	Frequency	%
att1	E-learning is very economical for educational institutions to adopt	228	88.4	30	11.6
att2	I believe using e-learning will improve the quality of my work.	242	94.2	15	5.8
att3	Computers make work more interesting.	249	96.5	9	3.5
att4	I prefer reading articles in e-learning	203	80.2	50	19.8
att5	It is easier to revise electronic educational materials than printed material	186	72.7	70	27.3
att14	I believe using e-learning technologies will improve my job performance.	237	91.9	21	8.1
att23	E-learning will increase teachers' efficiency.	226	87.9	31	12.1

Table 4.3.1: Teachers' responses on benefits from e-learning (N=243).
(Source: Field data, 2012).

Table 4.3.1 shows that 249 (96.5%) teachers agreed to the statement that "*computers make work more interesting"* followed by 242 (94.2%) teachers who agreed on the statement that *"I believe using e-learning will improve the quality of my work."* In line with this, 237 (91.9%) teachers agreed that using e-learning technologies will improve job performance.

The next two statements were agreed by roughly the same number of teachers. These include *"E-learning is very economical for educational institution to adopt"* (228, 88.4%) and *"e-learning will increase teachers' efficiency"* (226, 87.9%). This was followed by 203 (80.2%) teachers who agreed that, "*I prefer reading articles in e-learning.*" The last group composed of 186 (72.7%) teachers who agreed that, *"it is easier to revise electronic educational material than printed material."*

Of all items under this theme, item labelled *att3* was highly favoured. This can be attributed to their experiences in computers of which the results from the study shows 238 (92.2%) teachers were exposed to computers (see Table 4.0.2, p. 200). Moreover, this item could also influence teachers' positive attitude towards using computers as demonstrated in Figure 4.3.1. General results from Figure 4.3.1 shows that 86% of teachers had favourable attitudes towards using computer systems. This is further illustrated in the next sub-section.

ii. Teachers' responses on *attitude towards using computer systems*

Table 4.3.2 shows teachers' responses to items that measured their attitude towards using computer systems.

Item No	Item	AGREE		DISAGREE	
		Frequency	%	Frequency	%
att28_rev	It will be difficult for me to become skilful in the use of e-learning tools.	38	14.7	220	85.3
att29_rev	I make errors frequently when using a Computer.	38	14.8	219	85.2
att30_rev	Using a computer at home is very frustrating.	32	12.5	224	87.5

Table 4.3.2: Teachers' responses on attitude toward using computer systems (N=243).
(Source: Field data, 2012).

The strongest response was to the statement that, *"using computer at home is very frustrating"* where 224 (87.5%) teachers disagreed. It was followed by two closely scored statements where 220 (85%) agreed that they do not make errors frequently when using computers and that it would not be difficult to become skilful in use of e-learning tools.

There was some evidence that teachers' positive attitudes toward computer systems were influenced by teachers' access to computers at home (214, 83%, see Table 4.0.2). This was demonstrated by findings from the study that revealed the majority of teachers had no difficulties in using computers and were not frustrated using them at their homes.

iii. Teachers' responses on *leisure interest on e-learning innovations and use of computers*

Analysis of data collected under this theme is shown in Table 4.3.3. Of all items under this theme, *att24* was highly favoured.

Item No	Item	AGREE		DISAGREE	
		Frequency	%	Frequency	%
att15	Communicating through social networks is fun	210	82.0	46	18.0
att16	I like reading magazines on new technology innovations.	210	82.4	45	17.6
att24	Working with computers is exciting.	215	84.0	41	16.0
att25	I like discussing about new e-learning innovations.	211	82.7	44	17.3
att32	I enjoy computer games very much.	132	51.8	123	48.2

Table 4.3.3: Teachers' responses on leisure interest on use of computers and e-learning innovations (N=243).
(Source: Field data, 2012).

Table 4.3.3 shows 215 (84%) teachers were of the view that working with computers was exciting. This was followed by 211 (82.7%) of teachers who supported the statement that *"I like discussing about new e-learning innovations."* In line with that, 210 (82%) teachers had favourable views to the two statements that, "*I like reading magazines on new technology innovations*" and *"communicating through social networks is fun.*" Only 132 (51.8%) teachers favoured playing computer games indicating that they would prefer engaging in different activities other than computer games.

Generally, teachers' responses under this theme indicated that they were highly in favour of working with computers and acquire new knowledge on e-learning technologies.

iv. Teachers’ responses on *challenges of implementing e-learning*

Analysis of data collected under this theme is shown in Table 4.3.4.

Item No	Item	AGREE		DISAGREE	
		Frequency	%	Frequency	%
att10_rev	E-learning requires expensive technical support.	138	53.7	119	46.3
att18_rev	E-learning increases learners’ social isolation.	153	59.5	104	40.5
att19_rev	E-learning technologies are difficult to use.	47	18.4	209	81.6
att20_rev	Using computer systems requires a lot of mental effort.	84	32.7	173	67.3
att21_rev	Discussions on e-learning technologies are uninteresting.	59	23.0	197	77.0
att26_rev	Supporting learners in an e-learning environment is very difficult.	85	33.1	172	66.9
att27_rev	E-learning infrastructure is very expensive for the government to afford.	97	37.7	160	62.3

Table 4.3.4: Teachers' responses on challenges of implementing e-learning (N=243). *(Source: Field data, 2012).*

Table 4.3.4 shows teachers’ responses to items that measured challenges of e-learning. The majority of teachers (209, 81.6%) believed that e-learning technologies are not difficult to use and 197 (77%) teachers finds discussion on e-learning technologies are interesting. Similarly 173 (67.3%) teachers disagree with the statements that, *“using computer systems requires a lot of mental effort”*, *“supporting learners in e-learning environment very difficult”* (172, 66.9%) and *“e-learning infrastructure is very expensive for the government to afford”* (160, 62.3%).

Further, 153 (59.5%) teachers agreed that *“e-learning increases leaners’ social isolation”* and 138 (53.7%) teachers agreed that *“e-learning requires expensive technical support.”* These findings suggests that slightly more than half of the teachers perceived that technical support and leaners’ social interaction can be among the challenges of implementing e-learning.

In summary, an average of 37% (see Figure 4.3.1, p. 235) of teachers agreed that there are challenges on implementing e-learning. The data might imply that there are teachers who are more used to traditional face-to-face mode of learning and teaching. Teachers perceived e-learning as a learning approach that would demand expensive infrastructure and technical support for their institutions as well as the government to afford (Table 4.3.4). They also perceived it as a learning method where it will be relatively difficult to support learners and would require a lot of efforts to implement.

In contrast, an average of 63% (see Figure 4.3.1, p. 235) of teachers disagreed to the said challenges. In their opinions, they believed that supporting learners in e-learning environment is not as difficult as it is perceived and that e-learning does not require expensive technical support. In addition, they believed that using computer systems do not require any effort and that government can afford to support e-learning by providing provision for the required infrastructure (Table 4.3.4).

Although an average of 37% of teachers who agreed that there were challenges implementing e-learning would appear relatively small, their opinions cannot be neglected. This suggests that teachers could be provided with e-learning awareness and access to practical e-learning environments focused on demonstrating benefits from e-learning to education so as to reduce the noted gap.

Generally, findings from this study demonstrated that themes of the TeLRA scale performed well in examining teachers' attitudes towards e-learning with the highest performance recorded on *benefits from e-learning*. The next section explores other variables that can hinder the adoption of e-learning in Tanzanian HLIs.

4.4 Barriers to adoption of e-learning

The sixth research question (see Table 4.0.1, p. 198) attempts to identify the barriers which can hinder the adoption of e-learning in Tanzanian HLIs. In particular, all participants were required to respond to the question, “What are barriers which can hinder the adoption of e-learning?” Data were obtained from teachers through open-ended questions provided in the questionnaire, while principals and e-learning experts responded through semi-structured interviews. From the teachers, there were 225 (87.2%) responses, whereas all principals and e-learning experts responded in interview.

It should be noted here that, findings regarding to barriers hindering the adoption of e-learning in Tanzanian HLIs arrived from two different stand-points. The first stand-point involved teachers and principals from HLIs, which were not providing formal e-learning programmes (see Sub-section 3.5.1, p. 142). However, the presence of SIMS systems and a reasonable teacher-to-computer ratio in these institutions could indicate a possibility of transition from face-to-face to e-learning. Therefore, teachers reported factors that can impinge upon the adoption of e-learning based on their personal knowledge as well as experiences in using SIMS, computers and the Internet, whereas principals, through semi-structured interviews, reported practical challenges experienced when technologies such as SIMS were introduced in their institutions.

The second stand-point involved e-learning experts from HLIs providing formal e-learning programmes. Contrary to teachers and principals, they provided practical and existing challenges encountered in operating and supporting e-learning in their institutions. Therefore, findings reported by them further enhanced understanding of factors that need to be addressed if e-learning is to be realized in Tanzanian HLIs.

In this study, thematic analysis (see Sub-section 3.8.1, p. 163) was used to identify, analyse and record themes from data extracted from respondents. In addition, coded responses from the open-ended questions obtained from the teachers were analysed using SPSS for counting frequency of occurrence to establish their significance. This is summarized in Table 4.4.1.

What are the barriers that may hinder adoption of e-learning in your institution?

Analytic Coding				Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
	Code No.	Code Label	Theme				
Valid	1	Infrastructure	Poor infrastructure:-Unstable/lack of electric power, internet connectivity,insufficient computers labs and computers	73	28.3	32.4	32.4
	2	Financial	Financial constraints:-Insufficient funds to implement e-learning	29	11.2	12.9	45.3
	3	Support	Inadequate support: Technical, managerial and government support. Can not support practical oriented subjects.	24	9.3	10.7	56.0
	4	Knowledge	Lack of knowledge:- Users are not well informed (unaware) about e-learning, unclear policy, startegies ownership rights & quality assurance issues.	17	6.6	7.6	63.6
	5	Resistance	User resistance to change:- Fear, poor mind-set and attitude about e-learning	5	1.9	2.2	65.8
	6	Infra-Fin-Kdg-Res	1, 2, 4 and 5	56	21.7	24.9	90.7
	7	No Bariers	There are no barriers	21	8.1	9.3	100.0
			Total	225	87.2	100.0	
Missing			System	33	12.8		
Total				258	100.0		

*NB: **Infra**-Infrastructure; **Fin**-Financial; **Kdg**-Knowledge; **Res**-Resistance*

Table 4.4.1: Teachers' responses on barriers that can hinder e-learning adoption
(Source: Field data, 2012)

Table 4.4.1 shows that barriers associated with *infrastructure* were highly cited than the rest. Data showed that 73 (32.4%) teachers cited problems related to infrastructure. In this study infrastructure include sources of electric power, Internet connectivity (bandwidth capacity) and computer laboratories together with their associated equipment. Financial constraints were the second largest cited challenge with 29 (12.9%) teachers followed by inadequate support cited by 24 (10.7%) teachers. Barriers related to lack of e-learning knowledge to education stakeholders and resistance to change were cited respectively by 17 (7.6%) and 5 (2.2%) teachers.

However, another figure of a particular interest was the item with code number 6, which was responded to by 56 (24.9%) teachers (Table 4.4.1). Teachers in this category listed problems related to *poor infrastructure, financial constraints, lack of knowledge and user resistance to change*. It implies that teachers were mainly concerned with these challenges as a unit for measuring successful adoption of e-learning.

In general, 204 (90.7%) teachers reported barriers that are likely to hinder the adoption of e-learning in their institutions, whilst 21 (9.3%) teachers reported that *there were no barriers* as summarized in Figure 4.4.1.

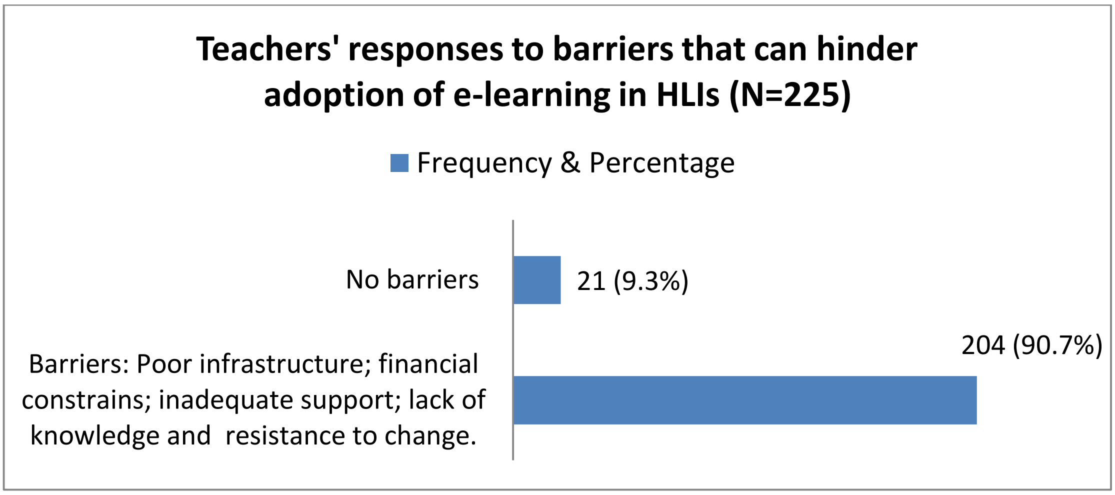


Figure 4.4.1: Teachers' responses to barriers on adopting e-learning in Tanzanian HLIs *(Source: Field data, 2012)*.

In exploring responses from the semi-structured interview five main themes emerged (see Table 4.4.2). They include; according to the level of priority, poor infrastructure, financial constraints, inadequate support, lack of e-learning awareness, and resistance to change. These findings further supported themes that emerged from teachers' responses to open-ended questions in Table 4.4.1. Some representative quotations extracted from all participants' responses to the question "What are barriers, which can hinder adoption of e-learning?" are summarized in Table 4.4.2.

	Theme	Revealed Problems	Representative Extracts
1	Poor infrasturcture	(a) Inconsistent power supply (b) Poor Internet connectivity (c) Insufficient computer laboratories and computers	*"We have no enough facilities . We have the problem of power and Insufficient Internet bandwidth **.** Currently we have 2mbps which is very small... " (P4, Male, PhD, YoE: 20).*
2	Financial constraints	(a) High cost of ICT equipment (b) Running cost of Internet services (c) Low budget allocation to public HLIs (d) Low economic status of students	*"...the second reason is high initial cost for installations of ICT related facilities and their cost of maintenance. The third reason is affordability of individuals to buy and maintain computers..." (I4.236, Male, MSc, YoE: >15).*
3	Lack of support	(a) Lack of technical support (b) Lack of managerial support (c) Lack of government support	*"Lack of enough finance to facilitate this technology, because all of these issues we have been talking needs a financial support to implement". (E5, Male, BSc, YoE: 8).*
4	Lack of knowledge of e-learning to	(a) Teachers (b) Students (c) Decision makers eg. Policy makers and the Ministry of Education officials	*"One of the challenge that is institutional, is the understanding of the term itself, e-learning **."** (P3, Male, PhD, YoE:16).*
5	Resistance to change	(a) Techno-phobia (b) Poor mind-set (c) Old Age (d) Subject discipline (e) Extra load perception	*"Mind-set of the instructors, students and the general public that, you can still deliver the same quality of the content by e-learning in the absence of instructors..." (P3, Male, PhD, YoE:16).*

NB: ***P1*** *to* ***P4*** *represent Principals 1 to 4 ;* ***E1*** *to* ***E7*** *represent e-learning experts 1 to 7 and* ***YoE*** *mean Years of Experience.*

Table 4.4.2: Extracts from participants' responses about barriers to e-learning adoption in their institutions.

[For more details refer Appendix V(b)]

Table 4.4.2 displays extracts obtained from interview with the participants. Each theme is presented in detail in the next Sub-sections.

4.4.1 Poor infrastructure

Further analysis revealed that problems with infrastructure are categorized in terms of electrical power supply, Internet connectivity (bandwidth capacity) and computer laboratories including computers.

Data from Table 4.4.1, code number 1 and 6, show that 129 (57.3%) teachers were concerned that power supply, Internet connectivity and computer laboratories could hinder the adoption of e-learning in their institutions. This theme is exemplified by teacher I3.170 who commented that "we don't have enough infrastructures such as the Internet connectivity with promising bandwidth and ensured power supply." This was also supported by teacher I3.183 who asserted that "Internet service provision also is not good to an extent providers do not care much about their customers."

Concerning Internet connectivity, the cost of Internet bandwidth was stated to be another barrier, which can hinder the adoption of e-learning as teacher I1.20 commented that "initial investments to buy computers and establish reliable network connections together with purchase of bandwidth is another big barrier in expansion." This was also remarked by principal P3:

> Yeah in terms of infrastructure there is more (pause). Even if today you have a national backbone covering up to village level, still it is not enough because one has to pay for the bandwidth within that national infrastructure, which is (aamm) too high to afford. That is one. But two, once you have that bandwidth then you need to pay for the content provider, that is the service providers (pause) and then there is an issue of electricity. I am not so sure of the exact figure but I am sure it is less than 15% of the country, which is on the (aamm) National Grid. So, that means more than 85% are not…So you can see the chunk of the population is out of National Grid … and a few parts, less than 5% I guess, they are on generators and solar power (Table 4.4.2).

From these observations, it became apparent that power supply and Internet connectivity were seen to be particularly crucial issues not only to the institutions but also to teachers' attitudes towards e-learning itself:

> Hopefully, you will find that we don't have enough computers or the Internet is slow. So, normally it is one of the bigger ones I think it needs to be addressed. There is a problem of power too, and in most cases this problem helps to create the negative attitudes...because if you go and you get a group of lecturers together and you are positively talking about e-learning they will tell you… *we don't know anytime from now electricity might be cut. So why do you want me to put in through that hassle of creating my content and putting it online if electricity is no good to move in anything.*..Thus, you find such mind-set helps to propel the whole negative (E1, see Table 4.4.2).

Such a typical comment from teachers cannot be undervalued since it can be used to cover other weaknesses, which could be resolved if they complied with e-learning requirements.

Despite insufficient power supply and Internet bandwidth, teachers were able to evaluate available resources in their institutions with potential for carrying out e-learning. For example, teacher I1.41 commented that, “infrastructure such as laboratories and electric power … and other supporting equipment are the main challenges.” Such data are consistent with another finding from this study, which demonstrated that 97 (37.7%) teachers agreed that, “e-learning infrastructure is very expensive for the government to afford” (see Table 4.3.4, p. 239), which to their opinion, the perception suggest doubts to the e-learning uptake in HLIs.

Findings from this study also revealed that there are inadequate computer laboratories in the studied institutions:

> There is an extension of laboratories and other equipment that can enable us eradicate these problems. For example, we have been provided an area for only technological field at Kijitonyama area. So by migrating from here to Kijitonyama we will get an enough space, enough laboratories and enough equipment, which have been donated by the World Bank (E5, Table 4.4.2).

This comment further suggests the practical reality on scarcity of buildings including computer laboratories in most HLIs in the country.

Generally, there is a perception that the existing infrastructures in studied institutions are not supportive for e-learning. Buildings, institutional structures and education system as a whole were traditionally meant to support face-to-face learning and teaching such that teachers in institutions are rather more comfortable in face-to-face than e-learning approach (E6, Table 4.4.2). The dominance of infrastructural problems voiced by teachers, principals and e-learning experts calls for a critical consideration required to address them if e-learning is to be achieved in these institutions.

4.4.2 Financial constraints

Financial constraints were the second most highly cited factor by teachers that can hinder adoption of e-learning in Tanzanian HLIs. Eighty five (37.8%) teachers were reported to have cited problems related to finances (see code number 2 and 6, Table 4.4.1). Quotations from some of the teachers show that the problem dominated on costs associated with purchasing and installing ICT related facilities, operating costs of Internet services and students' economic status when it came to purchasing tools for e-learning. The theme is exemplified by teacher I4.236 who asserted that, "...the second reason is high initial costs for installation of ICT related facilities and maintenance. The third reason is affordability of individuals to buy and maintain computers."

The same aspects were remarked by teacher I1.27 that "operating costs for Internet are on the high side to be afforded." Not only teachers had these views but also e-learning experts had similar views as E5 responded "there is lack of enough finance to facilitate this technology because all of these issues we have been talking about need financial support to implement" (Table 4.4.2).

In contrast, E6 did not view finance as a problem to most institutions in the country but said that *planning* was the problem:

> In my previous research I have never seen that money is a big problem but planning is a big problem. So, for most of the time solutions are already there, but the thing is then how to get the solution and customize them in your environment (Table 4.4.2).

This comment brought to light issues regarding institutional ICT policy and strategic plans. Currently, the government has its National ICT Policy (URT 2003a), which aims at encouraging local content development for electronic activities and promoting adoption as well as use of ICTs in education. In order to achieve e-learning, education institutions need to align the ICT Policy with their e-learning activities, including adoption and implementation strategies. There is some evidence from institutional strategic plans showing how they are going to realize e-learning as exemplified by a quotation from one institutional strategic plan, which stipulates that:

> ICT will be a major driving force in realizing the Vision and Mission of [I1] and hence, will be harnessed persistently both in terms of training of professionals at different levels as well as securing modern resources for training, research and community services (I1 2003, p. 36).

However, this study revealed that a successful implementation of institutional strategic plans, particularly, in the public institutions, needs a financial support from the government. According to the principal P4's view, current support is not enough. This is exemplified by his comment when requested to give a general remark on this research had responded that:

> Just my advice, maybe it is not on your side, but the government should implement what it has planned (pause). You see, I have been in this position for four years now and actually, what I can say we are operating the institution with our own efforts…No support from the government, just very little. You can imagine for the last two years we were getting one point something billion Tanzanian shillings while our real budget is 3.7 billion shillings… This is not enough because catering services [alone] cost us around 168 million shillings for every month and for 10 months, we need 1.68 billion shillings…and we are getting 1.07 or 1.1 billion shillings a year….This will be a challenge to e-learning, especially if we have no support from the government.

This view also concurs with I5's (2013, p. 66) claim that "…it is obvious that the [I5] is underfunded by the Government in terms of both recurrent costs and in particular the other charges (OC) as well as development budget from internal sources."

Although financial constraints by themselves can cause a barrier to e-learning adoption, there is a perception among teachers that the government can afford costs associated with e-learning to education institutions. Findings from this study showed that 160 (62.3%) teachers disagreed that "e-learning infrastructure is very expensive for the government to afford" (see Table 4.3.4, p. 239). Inadequate financial support from the government might further hinder adoption of e-learning to its HLIs.

4.4.3 Lack of support

While principals cited lack of government support on operating their institutions including adoption of e-learning, teachers cited both poor managerial and government support as barriers that can hinder adoption of e-learning in their institutions. Table 4.4.1 show 24 (10.7%) teachers cited challenges related to lack of support. Teachers' responses such as, "lack of readiness by top leaders in my institution to see e-learning is adopted" (Teacher I4.213, Table 4.4.2), "low budget allocated by the government for that purpose" (Teacher I1.43, Table 4.4.2) and "management or political issues might play part in hindering adoption" (Teacher I1.37, Table 4.4.2) can raise an alarm that needs attention if these institutions need to realize e-learning.

In addition, problem related to lack of professionals to provide technical support for e-learning users was also cited:

> Technical support is also a big problem...Our centre supports around 10,000 students across the University. So it is very difficult to support them, while there are very few technical staff in the centre. Roughly, we are about 15 (E4, see Table 4.4.2).

This was also reported by E5 that "there is lack of enough experts to implement these technologies because as you know (pause) these technologies need good experts in animations, network and other technologies, which are embedded in e-learning" (Table 4.4.2). In line with this, E7 remarked that there was "lack of e-learning expertise...Most institutions do not have instructional designers to facilitate processing and content creation" (Table 4.4.2). Although findings from this study revealed inadequate e-learning experts to support users of e-learning technology in HLIs, most teachers (172, 66.9%) believes that there is no difficulties in supporting users in e-learning environment (see Table 4.3.4, p. 239).

In general, findings from this study suggest three perspectives on the problem: one, there is lack of professionals who can provide technical support to end users including the entire system as a whole and second, there is lack of expertise in instructional design to facilitate the content. The third perspective emerge from earlier statements such as *lack of readiness, low budget allocation to HLIs* and *unsupportive management to e-learning issues* indicating that there is a lack of e-learning knowledge to some education stakeholders. Lack of e-learning knowledge is further described in the next sub-section.

4.4.4 Lack of knowledge

Lack of knowledge or awareness on e-learning of most education stakeholders was also cited among barriers of e-learning adoption in HLIs. Data from Table 4.4.1 (see code number 4 and 6) show that 73 (32.5%) teachers cited this problem. This theme is exemplified by a response from teacher I4.235 who commented that “awareness among stakeholders is a problem” to adoption of e-learning in HLIs (see Table 4.4.2). In education, stakeholders include, but not limited to teachers, students, curriculum developers, heads of institutions, policy makers and the government represented by the Directorate or the Ministry responsible for Education.

Teacher I3.159 went further and focused to two key stakeholders that “skills gap with some members of staff and hence, students are also a barrier.” Comments made by teachers brought into light the point that knowledge is a key factor when it comes to e-learning adoption in education. This assertion was supported by the e-learning expert E6 and all principals during the interview sessions exemplified by principal P1’s comment that “lack of IT skills can be a barrier.” For example, principal P2 emphasized on the importance of understanding the term e-learning by asserting that “…one of the challenges, that is institutional is an understanding of the term itself, e-learning.".

Knowledge about e-learning can have an impact not only on the successful adoption of e-learning in an institution but also on teachers’ attitude towards e-learning. Evidence from this study revealed that teachers who understood e-learning had a more positive attitude towards e-learning than teachers with no understanding of e-learning at ρ <

0.05 (Table 4.2.10, p. 229). The data further confirmed the need for e-learning awareness among teachers for successful adoption:

> The other challenge is the point of awareness in the HLIs. Most people are unaware of this mode of learning. So by (aamm) enabling Tanzanians to get awareness on this technology, (aamm) we can succeed in implementing it (E5, see Table 4.4.2).

Although findings from this study revealed lack of knowledge as one of the challenges to the adoption of e-learning in Tanzanian HLIs, there is a perception among teachers that there are no difficulties in using e-learning technologies. This is demonstrated by 209 (81.6%) teachers who disagreed to the statement “e-learning technologies are difficult to use” (Table 4.3.4, p. 239).

4.4.5 Resistance to change

Teachers’ resistance to change was also found to be one of the determining factors for adoption of e-learning in HLIs. Table 4.4.1 (see code number 5 and 6) show that 61 (27.1%) teachers cited challenges related to resistance to change.

In this study, resistance to change has been associated with fear of adopting new technologies, fear of exposing one’s ignorance, poor mind-set and low attitude towards e-learning. For example, teacher I1.45 commented that there is “fear from adopting new technology (technophobia) and mind-set…People are used to traditional ways of learning since baby classes up to universities.” However, P1 reported fear from exposing one’s weaknesses, “…some may fear that they can be exposed when using out-of-date teaching notes” (Table 4.4.2). This was also reported by E1 that:

> You will find that, some of the lecturers are reserved; probably they don’t want to show that they don’t know. As a lecturer you are a guru in your own field,

> and expose your weakness and show that you don’t know ICT as much as the rest is a shame, so sometimes the reaction is just to ignore e-learning as if it is not an important aspect (Table 4.4.2).

Similarly, in terms of poor mind-set findings from this study shows that this factor could not influence only teachers and students, but it could also influence the general public:

> Mind-set of instructors, students and the general public, that you can still deliver the same quality of content by e-learning in absence of instructors. There is a cultural problem too...we are used traditionally to a face-to-face learning but now changing to e-learning is a problem (P3, Table 4.4.2).

This comment implies that there are some people who can perceive e-learning negatively because of the absence of a teacher in delivering process.

Further analysis on factors leading to resistance to change, showed that the revealed problem can also be associated with old age and a subject discipline. Reporting on the old age factor, P1, commented that “…others may feel well, I am too old for this so I don’t have time to learn new skills." In line with this, P4 remarked that, “…people of my age are too resistant to changes. They don’t want to change at all." Similarly, E6 asserted both old age and subject discipline as main factors of resistance to change that:

> The more age advanced tutors will be more reluctant to go ICT. But again even in some fields…suppose…you’d imagine that somebody who is teaching Mathematics it will be difficult for him to just use MS Word or Excel or PowerPoint to be able to teach that or to be able to teach by Skype, or Videoconferencing,… but for me, for instance, when I want to teach Database, I create databases here. So it is easy for me to explain how database is…because it is already an ICT product. So field and age are quite some important aspects (Table 4.4.2).

This was also supported by E5 who commented that:

> Teachers who are coming from Arts discipline…do not easily adopt this technology because they rely on conventional pedagogical face-to-face teaching,...others (pause) even do not know how to use computers…Professors who have learnt in the previous ages…they say "*it is not necessary for me to know computers, only blackboard and chalk are enough to me to deliver materials."* You see…So this has come to be a challenge to our university community (Table 4.4.2).

The two comments suggest further investigation on teachers' age and their subject discipline and whether there is any statistically significant association with teachers' resistance to change as well as attitude towards e-learning.

Further evidence from the study showed that some respondents associated e-learning with an extra work load, "some of them might just have a negative mind-set that they find e-learning as extra work. They will argue that, *as I already have enough on my workload, don't add unnecessary things*" (E1, Table 4.4.2). This was also supported by E4 that "some of the teachers think is like additional or extra work. They don't need to sit down and uploaded their materials…they think it is like wastage of time" (Table 4.4.2).

Generally, fear from adopting new technologies, poor mind-set, negative attitude towards e-learning, old age, subject discipline and a perception that e-learning is an extra load are substantial factors that need proper measures to address them. Measures should start at individual levels as teacher I3.170 asserted that "…we need committed teachers and learners since e-learning needs people with a hardworking and self-learning attitude" (Table 4.4.2).

In brief, findings obtained from this study provided rich insight regarding challenges that hinder adoption of e-learning in Tanzanian HLIs. The main critical issue were those related to infrastructure and financial constraints. Other barriers were lack of technical support and managerial level supports, lack of knowledge as well as teachers' resistance to change. The next section presents strategies that can be used to address these barriers.

4.5 Strategies to address barriers toward adoption of e-learning

The seventh research question (see Table 4.0.1, p. 198) sought to identify strategies that can be used to address barriers of e-learning adoption in Tanzanian HLIs. The research question stated, "what strategies can be used to overcome barriers, which can hinder adoption of e-learning?" This question was given to interviewees through semi-structured interviews. Teachers were not involved because the question aimed to retrieve strategies from technical and managerial levels' perspectives that can be learnt by future e-learning adopters. All responded to the question.

An analysis of their responses revealed strategies highly dominated in addressing problems related to infrastructure, e-learning awareness and resistance to change (see Tables 4.5.1). However, e-learning experts extended further to include matters related to support in terms of technical as well as managerial support (see Tables 4.5.1).

	Theme	Revealed Strategies	Representative Extracts
1	Strategies related to infrastructure	(a) Use of renewable energy, eg. solar power and electric generators (b) strengthening Internet bandwidth (c) use of intranet (d) extension of computer laboratories and equipment (e) Creation of regional centres to increase education access.	*"We have started radio services. We are now looking for a possibility of buying a big generator and planning to have a solar power system .... Again, we have 2 mbps and very soon we will be getting either 9 or 10 free mbps from TTCL ", (P4, Male, PhD, YoE: 20).*
2	Strategies to address financial constraints	(a) Collaboration with private sectors and donor organizations (b) Seek for an increase in Government financial support.	*"... from the government perspective, they should be some budget for that...this year or every year a token amount of the budget should be put in the e-learning initiatives,..."(P3, Male, PhD, YoE:16).*
3	Strategies to address lack of support	(a) Technical staff training (short and long term) (b) Establishment of independent support unit.	*"We are taking the technical staff to short courses on multimedia productions, animation, and also the academic staff for instructional design courses ... So we are trying to fill the gaps ". (E7, Male, MSc, YoE: 10).*
4	Strategies on awareness raising	(a) Teachers professional development trainings (b) Training through individual consultations.	*"We give staff faculty different development programmes. Sometimes the programmes covers ICT related issues; example multimedia and internet services.These programmes are provided every month". (E1, Male, MSc, YoE: 10).*
5	Strategies to address resistance to change	(a) Educating teachers through trainings (b) Authoritative policy (c) Financial motivation.	*"One way is through policy, you just push people, to deposit some of the stuff in the Internet for students to be able to do it...."(P1, Male,PhD, YoE: 33).*

***NB:* *P1* to *P4* represent Principals 1 to 4 ; *E1* to *E7* represent e-learning experts 1 to 7 and *YoE* mean Years of Experience.**
***TTCL* meanTanzania Telecommunications Company Ltd.**

Table 4.5.1: Interviewees' responses on measures to address barriers
(Source: Field data, 2012).
[For more details refer Appendix V(c)]

Table 4.5.1 displays extracts obtained from interviewees. Each identified strategy is presented in detail in the next Sub-sections.

4.5.1 Strategies related to infrastructure

Findings from this study identified three main problems related to infrastructure. These include inconsistent power supply, poor/slow Internet connectivity and insufficient computer laboratories including computers (see Sub-section 4.4.1, p. 245). The next sub-sections presents some strategies adopted by the studied institutions to address these challenges.

i. Power supply

Findings from this study revealed strategic measures employed by the studied institutions to combat the challenge of unreliable power supply. They included use of renewable energy (particularly solar power) and electric generators. Findings shows that some institutions had plans to invest in power backup systems, whereas other institutions (for example institution I2 and I6), have already invested in it as E7 from I6 had commented "…in our case we have tried to have a backup generator instead of relying on the national electrical power supply" (Table 4.5.1). This was also supported by P2 from I2 who presented the following experience:

> To minimize this problem, we have enough generator service. On these generators we have one generator with capacity of 100kV, another one has 65kV and another two generators have 10kV each. So, we have in total 185kV generators services. Thus, we have uninterrupted electricity and so far we have no difficulties in electricity supply (Table 4.5.1).

These views were also reflected by Principal P1's comment that,

> ...But also you find most of modern technologies do not use a lot of (aamm) energy, which means you have batteries, which last for more than 12 hours, … I mean 24 hours, …with our infrastructure and problems of power…people are trying to look for renewable energies (solar) and you will find if you can (aamm) power your phone it should not be an issue to power your lap top (Table 4.5.1).

The comment made by P1 cannot be neglected. With the existing situation of unpredictable power supply in the country education stakeholders can also focus their attention to batteries driven electronic devices, such as lap tops and hand held digital devices rather than electrical driven devices like the existing desk-top computers. In such a case, learning can be able to carry on to a certain substantial amount of time after experiencing a power failure and therefore avoid a time lag when switching over power supply to other power back up systems.

Unreliable power supply has been a reality to most HLIs in Tanzania (Sife, *et al.,* 2007; Unwin, *et al.,* 2010; Sanga, *et al.,* 2013). The problem can generate a new challenge related to purchasing, operating, servicing as well as maintenance costs of other alternative sources of power supply, which could be minimized if not avoided by having in place reliable sources of power supply.

ii. Internet connectivity

Internet connectivity (bandwidth capacity), was reported to be a problem in the studied HLIs. E-learning experts were keen to this particular problem because it touches on core functions of e-learning, most particularly, online learning. One strategy used to combat the situation was to simulate online learning in offline environments:

> Presence of Internet is not very much of a concern because you can develop a system as a local host….and normally we conduct on offline system. As a training person, you are one who has the network. So, you stay in front to tell them how to do it. They do it locally at the end of the day they take a backup on their flash (disks) and then they restore on online courses (E2, see Table 4.5.1).

The strategy gave students insight of practical activities that can be experienced in online environment. Another strategy was creating regional centres in the country for learners who would not be able to attend courses at a college or university campus:

> Students in remote areas do not have electricity and they don't have access to… computers per se. But as an institution we have organised various centres that can help such students and provided some centres with the laboratories. So having put a ground work, we can see how e-learning can also be implemented at such centres (E1, Table 4.5.1).

This was also supported by P4:

> We signed a memorandum of understanding with VETA centres to use their regional centres and of course we were lucky that those four centres which we have now have facilities although not enough, but at least they have the Internet (Table 4.5.1).

This strategy has two advantages. One, each centre would not depend entirely on the Internet services to access content based at the host institution. Content were distributed to leaners via CDs, which could be used in stand-alone computer systems. Second, each centre would have their own intranet for content access and delivery such that leaners can be able to share not only knowledge, but also other devices such as printers and scanners. However, regional centres have some limitations when it comes to Internet accessibility. This study suggests that Internet bandwidth capacity was still a constraint for a successful e-learning in such centres as well as their host institutions. When Internet was available, then the speed would be remarkably slow. Most institutions are struggling to increase the bandwidth capacity to meet essential needs for operating e-learning programmes. For example, P2 remarked that, "…we are trying to strengthen the Internet bandwidth from [the current] 256Kbps up to 2Mbps." Similar situation was observed in institution I4:

> Currently, we have 2 Mbps which is very small…Actually, very soon we will be getting either 9 or 10 free Mbps from TTCL because we are one of the institutions in their pilot program…But the infrastructure does not allow now because we have to get the fibre cable near our place (P4, Table 4.5.1).

These are noticeable strategies with measurable effects as one e-learning expert whose institution had already connected to the National backbone commented that:

> For the Internet, the problem is solved because of the SEACOM, yes, the submarine cable...So we have a dedicated 165Mbps fibre link from here to the UCC, and from the UCC it is distributed to the whole university (E3, see Table 4.5.1).

Although the cost associated with expanding bandwidth to a sufficient capacity cannot be avoided, the impact on such expansions could play a significant role toward successful adoption and later operating e-learning in Tanzanian HLIs.

iii. Computer laboratories and computers

To date, all studied institutions have computer laboratories, although not sufficient enough to meet the growing demand of users, particularly students. Computer access for students had remained to be a major problem, especially with increasing student enrolment in these institutions (Sanga, *et al.,* 2013). Current strategies are the extension of laboratories and construction of new buildings that will accommodate laboratories, classes as well as staff offices. This measure has already been taken by some institutions, for example in I6:

> There is an extension of laboratories and other equipment that can enable us to eradicate these problems. For example, we have been provided an area for only technological field at Kijitonyama area. So by migrating from here to Kijitonyama we will get enough area, laboratories and equipment donated by the World Bank (E5, see Table 4.5.1).

On contrary, the existing situation regarding computer access by teachers in the studied institutions shows a significant improvement. There was some evidence from principals of the studied institutions that strategies employed to eradicate teachers' accessibility to computers had yielded positive results. Among strategies was a support given to teachers to buy their own lap tops and pay in phases "we did put up a scheme, which allowed them to buy computers (or lap tops) for their own and pay in phases" (P1 Table 4.5.1). This data is consistent with another findings from this study which shows that 245 (95%) teachers have access to computer at their offices and 214 (82.9%) have access at their homes (see Table 4.0.2, p. 200).

Despite all institutional strategies that aimed at addressing challenges caused by inconsistent power supply, poor Internet connectivity and inadequate computer laboratories, operations of all public HLIs in Tanzania depends highly on the government budget. The effective fight to combat these problems might be possible if there were to be a substantial financial support from the government and other donor organisations. This assertion is also supported by 160 (62.3%) teachers who believed that the government can afford to put in place e-learning infrastructure to its HLIs (see Table 4.3.4, p. 239). Strategies to address financial constraints are presented in the next sub-section.

4.5.2 Strategies to address financial constraints

There was some indication from the findings that the extent and priorities for combating financial constraints in public institutions depended on how much money allocated to them by the government. However, among initiatives aimed at reducing financial burdens in education sector taken by the government was waving off the value added tax on supply and import of computers as well as their accessories. This was also remarked by P1's comment that, "I think…nature has always its own way of doing things. If you look at prices of computers and lap tops have been going down (aamm) ok, so that is one way."

The other way identified by this study showed that institutions would also seek financial support from donor organisations through different development projects:

> The Moodle which we are using was sponsored by SIDA (pause) yeah, that is how we got it, from SIDA funds...So we must make sure that first of all there is a financial support. You can have like (pause) a kind of proposal that will assist to set financials. So if you know that you are being funded for certain kind of

> task, then to be on the safe side is to make sure that thing happened and that will facilitate the e-learning (E2, see Table 4.5.1).

Generally, in order to realise strategies identified in this study we need education institutions as well as the government with a vision focused into realizing e-learning potential including a self-evaluative discipline in implementing their own established plans, regardless of their associated costs. Although money has always been in short supply, HLIs can begin by getting away with spending as little as possible and also use the limited available resources efficiently.

4.5.3 Support strategies

Support strategies can be viewed in two perspectives: strategies suggested by e-learning experts and those suggested by principals. Strategies suggested by the e-learning experts were directed to institutional management teams to support all aspects of e-learning in terms of infrastructure, capacity building and maintenance. However, strategies suggested by principals focused on the government in terms of budget allocated to operate their institutions. Regardless of either perspectives awareness of e-learning need to be a stepping stone towards e-learning adoption in HLIs.

Several e-learning experts recommended that the institution management team need to be aware of e-learning because they have power to influence teachers. In their views, once the management team is aware of different functionalities and benefits from e-learning, then their support would be guaranteed:

> Before we can establish something, we are trying to face some people whom we think they can assist to implement it. We tell them; just the same as if you

> want to do your research, you have to write a proposal and present. The same also applies here for the managerial part (E4, see Table 4.5.1).

This remark was also reported by e-learning expert E2:

> The management should also get involved (pause). They should also be the first to wish having the e-learning system and prepare a strategic plan on which they have to accomplish. The strategic plan should show infrastructure, may be computers are needed, training are needed and they need to support them, may be in phases. They need to start by the technical staff to make sure that the system is there and functions properly (Table 4.5.1).

Findings also suggested that when support from management is established then, the next strategy was to develop a technical support unit. This assertion was made by E1:

> Another thing is, having a support unit…okay? If you have got a top management having the sight…the full sight of seeing that e-learning is a crucial and part of teaching and learning experience but you don't have support team to give the operational bit then, you end up with (pause), may be a failure again (Table 4.5.1).

Having a support unit aimed at supporting users and entire operations of the system was also advocated by P2:

> What I can tell you is when we introduce this e-learning it would be better to open a separate department (aamm) so that we can operate through that department successfully and minimize interruptions with the existing departments. So, that would be highly successful I think (Table 4.5.1).

After the support unit is established, training of trainers and users' schedules need to be instituted. These can be conducted frequently to support new users of the system and new advances in the technology. Such claims were supported by E4 that:

> For the technical support, first, we are trying to take technical people from other colleges or schools and they will be provided with special training in order to assist their colleagues in colleges or schools they are coming from (Table 4.5.1).

Another strategy was providing expertise. Findings revealed that institutions were also supporting both teachers and e-learning experts with professional training:

> We are taking people for studies. We are taking the technical staff, for instance, to short courses, multimedia productions, animation and whatever, but also we are taking some of the academic member of staff for instructional design courses and we have people who have done Master degree in Instructional Design so far and Multimedia Production. We are trying to fill the gaps like that (E7, see Table 4.5.1).

Having trained users of the system reduces the perceived difficulties in using the system and also the frequency of support from the technical team. Findings from this study shows that 172 (66.9%) teachers agreed to the perception that supporting learners in e-learning environment would not be very difficult (see Table 4.3.4, p. 239) and particularly when training has been conducted.

This study established that as most institutions in the country are public institutions, their e-learning adoption has to be supported by the government. Unless these institutions opt for other sources of finance or authorities responsible for higher education in the government are fully aware of the benefits from e-learning, support from the government is usually minimal, such that most institutions operate at their own efforts and are consequently underfunded (I5 2013).

4.5.4 Strategies on awareness raising

Strategies used to bring teachers' awareness on e-learning in the studied institutions varied, depending on teachers' level of familiarity in the use of ICT. Responses from principals concurred with statistical data obtained from teachers' survey, which showed that most of them were not in need of basic ICT skills training. Data showed that 238 (92.2%) teachers had familiarity with computer functionalities (see Table 4.0.2, p. 200) and thus, very few teachers reported attendance at training on basic ICT skills, as exemplified by principal P1:

> We had a programme which we called IT 'Fundis'. In the IT 'Fundis', we had elementary class on IT…for staff. We did it I think twice, but then we realised that, some of these aspects people can learn by themselves (Table 4.5.1).

The IT 'Fundis′ programme was intended to give teachers basic skills on computer application packages including word processor, database, spread sheet and presentation. The word *Fundi* is a Kiswahili singular noun word used to represent a skilful or a skilled worker such as a technician, mechanic and a craftsperson. This programme is no longer conducted for teachers. A similar problem was identified by P4 that "ICT course programmes were conducted, unfortunately, very few attended." This study suggest that teachers' lack of need to attend these programmes could possibly be the reason because data shows that most of them (238, 92.2%) were exposed to basic functionalities of computers (see Table 4.0.2, p. 200) and all the studied institutions had SIMS for processing all students' academic matters (P4, see Table 4.2.1, p. 219) implying that all teachers were obliged to use.

Based on familiarity of ICT basic skills of most teachers, data from this study showed that training on professional ICT programme was one of the best strategic options preferred by most institutions. However, interviewees' comments differed in emphasis depending on level of ICT skills portrayed by teachers and type of e-learning platform acquired by their respective institutions. Programmes included, but not limited to applications such as multimedia, Internet services and orientation to different functionalities of Learning Management Systems. These strategies are illustrated by E3:

> Most people have ICT skills. However, because we are more interested on the learning platform, what we do is that, we undertake sensitization training to instructors on the e-learning platform. First of all, before the new semester begins, for like two to three days we hold workshops and go through the platform with the instructors. They have to update their materials, dates, assignments and stuff like that....Also apart from this programme, the Centre for Virtual Learning (CVL) is also dealing with creating capacity for instructors to use the online learning platform (Table 4.5.1).

In other studied institutions, the sensitization programme does not end there. Teachers were encouraged to practice what they had learnt in the workshop followed by follow-up consultations to evaluate their progress:

> We give them basic training on how to upload the content to the system and how to navigate the LMS, principles on how to facilitate online activities and then we give them obviously an opportunity to go back home and implement what they have gone through in the workshop. Then we also…hold…another form of training through consultation (pause). So the team is involved with…physically visiting the lecturers and see how they could go through their courses... (E1, see Table 4.5.1).

Although this strategy seemed to be appropriate, it also encountered some setbacks. In some institutions there were some teachers who, without specific reasons, resisted attending such professional training programmes. In order to solve the problem, the coordinating team and the institution management introduced some incentives as means to increase participation:

> For teachers, it is difficult unless there is some incentive…to support them ... Like here we also do something like competition, and the winners are awarded. They do it and they like it. But incentives are what matters. So it is possible, we train them and at the same time, they develop their courses...Thus, when they get back, at least three quarters or 50% of their courses are developed (E2, see Table 4.5.1).

It is suggested that for e-learning to be effective, institutions could perform a situational analysis aimed at examined the level of ICT skills acquired by teachers and what they can afford to provide so as to come up with a strategic plan appropriate in achieving e-learning.

4.5.5 Strategies to encounter resistance to change

Findings from this study revealed that there were two main strategies used to combat teachers' resistance to e-learning by these institutions. As mentioned earlier in Sub-section 4.4.4, they are teachers' awareness training on e-learning platforms and financial motivation (incentive) that focused on encouraging them to be involved in e-learning:

> The problem is there because they are asking about copyright issues. If they convert their materials in any way and put them in the Web, how are they going to benefit. But what we did for our case for our distance courses we entered into agreement with them. First of all because the copyright issue says that if you are an employee whatever you produce belongs to your employer in your institution. But we said no, it won't go like that. Thus, we had a short contract and gave them some remunerations that you create your materials, of course it will belong to the university but, at least you shall be paid a token…So that has motivated some of them (E7, see Table 4.5.1).

However, when awareness training and motivation through incentives failed, the management team came up with a policy that reinforced the use of e-learning:

> One way is through policy of course. Policy in the sense that you just push people, you know, to deposit some of the stuff if you have a platform … in the Internet for students to be able to do it (pause). I mean we need at least to push people to be using the Internet. Say we are going to transmit all pieces of information through emails. So that means everybody must have an email address and everybody would be able to communicate through that (pause). So, I mean…putting policies in place, and requiring aspects that you can really monitor and follow-up (P1, see Table 4.5.1).

This comment highlights the fact that *change* is a personal decision that cannot necessarily be removed only by awareness training and incentives. In some occasions a push from authority was inevitable:

> Computer literacy skills programmes were conducted, unfortunately very few attended. Then what I told them is that for any person who is going to be resistant I will make sure that he won't get monthly salary if he/she has not uploaded this semester results into the network. Next, I had to formulate a team, which assisted in implementing the SIMS programme. I mean teaching people how to enter data, how to upload and how to retrieve. For others it was a problem. But it was just a week ago when these things were possible. Otherwise, people were very resistant (P4, see Table 4.5.1).

Although this push from authority seemed to work as the last two interviewees commented, findings suggest putting in place a strategy which is multidimensional in nature, that is, a strategy that can combat barriers for adopting e-learning in all aspects.

In brief, the study suggests that institutions can enhance all strategies that are focused on providing awareness of e-learning to all stakeholders of higher education since awareness deepens perception on usefulness of e-learning approaches in education, which is a favourable condition toward a positive attitude to e-learning.

4.6 Strategies to optimise teachers and students' involvement in e-learning

The eighth and final research question (see Table 4.0.1, p. 198) attempts to identify strategies that optimise involvement of teachers and students in e-learning. The research question asks, "what are the best strategies that can be used to optimise teachers and students' involvement in e-learning?" This issue was raised during semi-structured interviews with e-learning experts. They all responded to the question.

It should be noted here that, the question was neither raised to principals nor to teachers because principals were not involved in *supporting* learning and teaching in actual e-learning environments, whereas, teachers in this study were obtained from the four HLIs that were not conducting *formal* e-learning programmes. Therefore, this question was raised to e-learning experts so as to extract their views based on current experiences and technologies.

On exploring their responses, two main themes emerged: teacher-to-student interaction and student-to-content interaction (see Table 4.6.1).

E-learning experts' responses to the question: ***"what are the best strategies that can be used to optimize teachers and students' engagement in e-learning?"***

Respondent ID	Representative Quotations
	Theme 1: Teacher-student interaction
E1	"I think the key aspect there is having a good facilitator who can direct students to open up and talk between students and students, but also as a facilitator because of the tools that exist in the system that have to do with collaboration and interaction. One can use them to communicate with the students, give them feedback…[and] can watch the students as they discuss and intervene at some level. That is, creating interactions between students and the lecturer" *(Female, MSc, YoE: 7).*
E2	"Tutor on joining his course and wishes to send any message to students can do so using Moodle text. He just writes a message [and] all students with the registered phone on the system will receive the message, though they will not be able to reply...we don't want them to reply because we don't want the system to start accepting the jargon" *(Female, BSc, YoE: 3).*
E3	"In our learning platform ...we have a *chart* tool; *forum* , where an instructor can post something like a question or a discussion topic; the *announcement* [where] instructor can send an announcement [for example] *"there is an exam tomorrow at 11 am"* , or may be "let us meet tomorrow at this time online"…something like that [and] • emails. Now we have developed a system through which instructors can log-in and send sms directly to the students' mobile phones. So this is the most effective way we have found so far, because most students can be reached at any place and at any time" *(Male, BSc, YoE: 3).*
E4	"the only strategy we have started is with teachers because I believe teachers can influence students to use online materials and so on. Thus for most of the time, we are encouraging teachers to use all tools, for example, in the LMS. ... Also we are encouraging teachers to create an interactive content, which can encourage students to access "*(Male, BSc, YoE: 6).*
E5	"we are using Moodle, which contains tools that can be used for interaction between teachers and students, among students themselves and the content. Available tools are Wikis and other blogs which can enable interaction from teacher to students or from students to teachers. In addition, we have tele-education system, others are calling teleconferencing, which is used to conduct live lectures from India. This mode of learning is interactive as students can follow the lecture, ask questions and get answers during the session" *(Male, BSc, YoE: 8).*
E7	"The teacher must be involved to create an environment where students will be able to be involved in discussions and sharing material resources in various places. But I think teachers should play part to make sure that the materials provide all kind of questions that foster interactions among students " *(Male, MSc, YoE: 10) .*
	Theme 2: Student-content interaction
E1	"Again I think emphasis should be that if you are a good facilitator, you can design content in such a way that students can learn how to consume the content that they have got. They learn how to create content for themselves in their activities and therefore create a relationship between the student and the content. But I think that it is necessitated a lot by obviously the system that offers different tools but also the lecturer who is a facilitator to replicate that ." *(Female, MSc, YoE: 7).*
E2	"Faculty-lead system: The system is designed in such way content is accessed after student has entered his faculty speciality. This choice will enable the student to get access to all material assigned to that log-in preferences. All slides and files saved in PDF format are accessible. Currently, we have developed few slides for trial in multimedia, so students can use both audio and video. In addition, we have added a clip for sign translation to accommodate those who cannot hear. So students can interact with the content depending on their subject specialization." *(Female, BSc, YoE: 3).*
E3	"Because everything is online, is in the learning platform. If they have internet connection and they have computers they get everything." *(Male, BSc, YoE: 3).*
E4	"For the students we are trying to train them and to take necessary tools within the system compared to those done outside. For example we are using gmail, yahoo, etc…So we are trying to educate them on these, and if they see that there are teachers who are using these tools they also do the same. So we start to tell teachers to use all tools, and also we are trying to tell students the importance of using those tools. At the end the interaction between teachers and students becomes available" *(Male, BSc, YoE: 6).*
E6	"… One thing which is very important for some people to be able to advance that interaction is value. Why would somebody go 'e'? If that is addressed, people would be attracted. Let us take a simple example. Currently we have these mobile money facilities, M-pesa, TIGO-pesa and the like. The problem here is not that people are forced to engage with M-pesa. No, it is because they see the value. So if in e-learning as well value will be integrated in e-learning initiatives then, people will be attracted to use …If we don't put value in that we will just force people to use because we have powers " *(Male, PhD, YoE: 16).*
E7	"The content will depend on expertise of creating those contents. If the content will have animations, for instance, or simulations that allows students to be involved in some practical ways, I think, it can help students to be involved with the content. But also if the instructors will create some practical oriented activities or content that requires students to have some hands on, yes, also they will foster interaction of students with learning materials ." *(Male, MSc, YoE: 10) .*

Key Note: *E1 to E7 represents e-learning experts 1 to 7 respectively.*

Table 4.6.1: E-learning experts' responses about interaction in e-learning
(Source: Field data, 2012)

Table 4.6.1 displays extracts of responses from e-learning experts about their experiences on how teachers, students and the content are involved in an e-learning environment. Data from this Table show that involvement is mainly enhanced between teachers and students and between students and content. However, interactive tools in the existed platforms were also open to accommodate other modes of interactions such as student-to-student and teacher-to-teacher interactions.

4.6.1 Teacher-to-student interaction

Data revealed that the open source Modular Object-Oriented Dynamic Learning Environment (Moodle) was the LMS used in both institutions I5 and I6. Moodle is a free source e-learning software platform used to facilitate online learning programmes (Weller 2007; Salmon 2011; Cahir, *et al.,* 2014). Responses from interviewees outlined tools that were used to achieve teacher-to-student interactions. They included chat, forum, announcement, wiki and email. However, interviewees reported that teachers' participation played a greater role in attaining effective teacher-to-student interaction:

> If you are a good facilitator you will be able to use tools like discussion forums to help students be involved with one another to create dialogues and conversation between students. So, I think the key aspect there is having a good facilitator who can direct students to open up and talk between students and students, but also as a facilitator because of the tools that exist in the system that have to do with collaboration and interaction. One can use them to communicate with the students, give them feedback…regular feedback...can…watch the students as they discuss and intervene at some level. That is, creating interactions between students and the lecturer (E1, see Table 4.6.1).

Such an assertion was also supported by E7:

> The teacher must be involved to create an environment where students will be able to be involved in discussions and sharing material resources in various places. But I think teachers should play part to make sure that the materials provide all kind of questions that foster interactions among students. Teachers

> can use tools such as Wiki and give an exercise that will require students from various points to contribute to the Wiki... But also a forum, teachers can come up with a topic that require students to have their contributions and challenge each other's and that way again you will find students participate and understand each other's' ideas and interact (Table 4.6.1).

In both comments, teachers have been mentioned as potential facilitators of learning in teacher-to-student mode of interaction and, in view of this, they were highly encouraged to fully participate. In this regard, E4 commented that:

> We have strategies, but the only strategy we have started is with teachers because I believe teachers can influence students to use online materials and so on. Thus for most of the time, we are encouraging teachers to use all tools, for example, in the LMS…Also we are encouraging teachers to create an interactive content, which can encourage students to access (Table 4.6.1).

In summary, it is suggested that one of the strategies that can be used to encourage teachers participate in learning interaction with students is professional training either short-term or long-term especially in Instructional Design and Multimedia Production (E7, see Table 4.6.1).

4.6.2 Student-to-content interaction

Most respondents reported that the quality of content that can foster interactions with students plays a significant role in the e-learning environment. Respondent E7 suggested that the content should have features that attract learners to engage:

> The content will depend on expertise of creating those contents. If the content will have animations, for instance, or simulations that allows students to be involved in some practical ways, I think, it can help students to be involved with the content. But also if the instructors will create some practical oriented activities or content that requires students to have some hands on, yes, also they will foster interaction of students with learning materials (Table 4.6.1).

These data imply that for effective student-to-content interactions there must be sense of a relationship between the content and the learner. The developed content should be able to promote a conversational environment with the learner:

> I think emphasis should be that if you are a good facilitator, you can design content in such a way that students can learn how to consume the content that they have got. They learn how to create content for themselves in their activities and therefore create a relationship between the student and the content (E1, see Table 4.6.1).

In contrast, interviewee E6 asserted that for any effective e-learning programme, learners are not forced to attend rather, they are attracted to attend because of the value associated with the programme itself,

> One thing which is very important for some people to be able to advance that interaction is value. Why would somebody go 'e'? If that is addressed, people would be attracted. Let us take a simple example. Currently we have these mobile money facilities, M-pesa, TIGO-pesa and the like. The problem here is not that people are forced to engage with M-pesa. No, it is because they see the value. So if in e-learning as well value will be integrated in e-learning initiatives then, people will be attracted to use …If we don't put value in that we will just force people to use because we have powers (Table 4.6.1).

Generally, findings revealed strategies focused on equipping teachers with new roles in the e-learning environment through professional training and workshops since they are the key stakeholders in education. In addition, content developers were advised to design learning platforms that foster all aspects of interaction so that leaners are attracted to it.

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter presents a discussion based on the major findings from the study. The chapter is organised into the following six Sub-sections, namely:

i. respondents' understanding of e-learning;
ii. teachers' attitudes towards e-learning;
iii. performance of themes from the Test of e-Learning Related Attitudes (TeLRA) scale;
iv. barriers that can hinder the adoption of e-learning in HLIs;
v. strategies to address barriers of e-learning adoption in HLIs; and
vi. strategies that can be used to optimise teachers and students' involvement in e-learning.

5.1 Respondents' understanding of e-learning

In order to understand why participants hold certain attitudes towards e-learning, the researcher assessed the salient beliefs that participants hold about e-learning by asking them to define the term *e-learning*. The survey that was conducted in the six Tanzanian HLIs revealed different patterns in their descriptions. Whereas principals and e-learning experts clearly defined e-learning, teachers' descriptions revealed mixed understandings of e-learning.

Three main themes emerged from participants' description of e-learning. They included *e-learning as all forms of electronically supported learning and teaching*; *e-*

learning as learning through the Internet or distance/online learning and *inconsistent definitions of e-learning*. These themes have enlightened understanding on how respondents, particularly teachers in Tanzanian HLIs developed their understanding of e-learning. The three themes are discussed in the following Sub-sections.

5.1.1 E-learning as all forms of electronically supported learning and teaching

Respondents' general understanding of e-learning under this theme have not only concurred with the operational definition provided by this study that defined e-learning to mean "all kinds of electronically supported learning (whether in networked/non-networked environments) whereby the learner interacts with the teachers, content and other learners regardless of place and time", but also they concurred with similar definitions reported in literature. For example, definitions such as "a*ll forms of electronically supported learning and teaching," "a computer and network enabled transfer of skills and knowledge"* and *"method of acquiring knowledge and skills using electronic technologies"* have been suggested by Brown (2003); Tavangarian, *et al.,*(2004); Bates (2007); Moore, *et al.,*(2011) as well as Sangra, *et al.,* (2012).

Respondents under this theme associated e-learning with the use of ICT as a medium of delivery which acknowledges the use of any electronic devices regardless of any particular electronic medium. Findings from this study under this theme concurred with four general categories of definition of e-learning described by Sangra, *et al.,* (2012, p. 148-150) as:

Technology driven: where learning is conducted by the use of electronic media such as Internet, intranets, hand-held mobile devices, video or audio devices, and computers;

Delivery system: e-learning is defined as a method of delivering and accessing knowledge through ICT;

Communication, interaction and collaboration tool: that is learning that supports all forms of interaction between and among learners, teacher and content facilitated by the use of ICT;

Educational paradigm: where e-learning is defined as a means to supplement or enhance the traditional educational methods through the use of ICT.

Findings reported from Table 4.1.3 (p. 207) provided an empirical support for this theme in that all principals and e-learning experts demonstrated a clear understanding of e-learning. This is a significant step in educational transition from face-to-face to e-learning in Tanzanian HLIs because principals' clear understanding of e-learning can have a significant role to play in successful adoption of e-learning in their institutions. Principals have power to allocate resources particularly on matters related to staff training, ICT infrastructure and on matters related to the quality of educational practice in e-learning. Therefore, if they have a clear understanding of e-learning, then they are likely to be supportive. Similarly, e-learning experts who by the nature of their roles are expected to be conversant with e-learning, their understanding is crucial because the quality of e-learning relies on the use of technology as well as the quality of instructional design (Anderson 2008). E-learning experts need to provide user friendly learning platforms that meet learners' preferences and styles of learning. This study (see Section 5.2.1) shows how the understanding of e-learning has influenced the construction of a positive attitude towards e-learning.

Despite the fact that the debate on the clear definition that reflects all features of learning, teaching and content in e-learning technologies is on-going, the obvious aspect from this study was that there was a strong evidence that 51% of teachers in surveyed Tanzanian HLIs had a good understanding of e-learning (see Figure 4.1.1, p.205). The term *good* was used to include all definitions near or equivalent to the operational definition of e-learning presented in this study. Therefore, findings from this study provided a significant baseline for education stakeholders when it comes to design, adoption and later on implementation of e-learning in Tanzanian HLIs.

5.1.2 E-learning as learning through the Internet or distance/online learning

Findings from this study provided evidence that there were teachers who used the terms e-learning, online learning and distance learning interchangeably to mean the same aspect. It implies that teachers have mixed conceptions about these terms. From the nature of their definitions, it is evident that they associated e-learning with a physical distance whereby learners, teachers and content are separated in terms of physical location as well as time and what joins them is the Internet connectivity.

Such definitions can also imply that some teachers are used to the traditional face-to-face classroom learning such that they would only relate learning in the absence of a teacher to be online learning (when connected to the Internet), and distance learning (when learners are in different location). The present study does not support these forms of definition which exclusively identify communication media and distance as the only features of e-learning. In addition, the usage of communication media may not necessarily imply physical separation of the learner from the teacher in any particular education process. However, the study supports Guri-Rosenblit (2009) argument that rejected distance as a main characteristic of e-learning.

Conflicting definitions of e-learning provided by teachers can hinder not only the researcher when building a sound conclusion from these inconsistent definitions, but also curriculum developers, particularly e-learning instructional designers because they need to design a useful set of learning instructions to users who are free from multiple descriptions of e-learning. This argument is consistent with Rolfe, *et al.,* (2008, p. 4) who claim that inconsistent definitions of e-learning could hinder implementation strategies when teachers “do not share a common understanding or a uniform vision” of e-learning.

Furthermore, conflicting understandings of e-learning can also hinder e-learning acceptance by teachers themselves and as a result impede its adoption in HLIs. Findings from this study revealed that teachers’ understanding on e-learning can influence their attitude toward it and consequently can influence their decision on whether to accept or reject it. Rogers (2003) claims that knowledge is the first stage towards decision-making about technology, implying that teachers’ e-learning understanding is essential to attain favourable decision about it.

Confusion about the term *e-learning* compared to other approaches of learning has been reported in the literature (for example, Unwin, *et al.,* 2010; Guri-Rosenblit and Gros 2011; Moore, *et al.,* 2011; Sangra, *et al.,* 2012). Guri-Rosenblit and Gros (2011) argue that the term e-learning has been defined differently and most surprisingly in higher education. They argue that these confusing definitions arose due to different abilities and functions available in the changing technology. For example, with regard to all teachers' definitions, in the present study, which were linked with online learning led this study to suggest that such teachers associated e-learning with access to knowledge through Internet. Moreover, having 179 (69.4%) teachers' computers connected to the Internet both at workplaces and their homes (see Table 4.0.2, p. 200), this study further suggests that some teachers could be involved in some kind of either formal or informal online learning activities, at or away from the workplace.

In line with Guri-Rosenblit and Gros (2011), Moore, *et al.,* (2011) argue that inconsistent definitions used to describe the terms distance learning, online learning and e-learning, are somehow attributed to the undescribed features found in learning platforms. Different learning platforms are developed by different e-learning experts so as to achieve learning styles and preferences of users in a particular environmental context (Moore, *et al.,* 2011). It can imply that, it is more likely to experience learning platforms with different features associated to them, which can make new users of the system difficult to understand them. For example, Moore, *et al.,* (2011, p. 134) argue that "…the specific context of the learning environment is not described in sufficient detail." Thus, this study suggests that teachers could have assumed any meaning, which according to their perceptions, clearly explains their experiences with computers and the Internet.

This study concurs with the argument set out by Unwin, *et al.,* (2010, p. 19) that for many people in Africa, e-learning means "…access to the Internet and the use of e-mail to share information." Findings reported in Table 4.1.3 (p. 207) provided practical evidence that to date, teachers are explicitly linking e-learning with the Internet or online learning only. This could be attributed to a perception that 69% of them had computers connected with the Internet both at their homes and their work places (see Table 4.0.2, p. 200).

5.1.3 Inconsistent definitions of e-learning

Teachers' responses under this theme, which accounted for 9.5%, indicated lack of understanding of e-learning because their responses were unrelated to the operational definition. Findings provided in Table 4.1.3 (p. 207) give empirical evidence that there are few teachers who did not understand e-learning. Although they were quite few in numbers, their descriptions and meanings about e-learning did not characterize any understanding of e-learning. For example, one of the teachers explicitly wrote that, "I don't understand."

Generally, responses under this theme could imply any of the four aspects. One, teachers truly expressed their understanding about e-learning. Second, teachers tried to impress the researcher by filling out all gaps. Third, they were deliberately unhelpful or possibly they were not very good at expressing themselves in writing.

In summary, the three main themes that emerged demonstrated how participants, particularly teachers, described e-learning in education. Findings from this study not only open up the existing situation but also showed the frequency of teachers' understanding of e-learning, which can help education stakeholders to plan accordingly for a successful uptake of e-learning in HLIs.

In order to understand how teachers got to understand e-learning, this study further investigated factors that contributed to such descriptions and measured their predictive power towards their understanding of e-learning. Findings are presented in the next sub-section.

5.1.4 Examining predictors of teachers' understanding of e-learning

Findings from this study showed that there is a statistically significant association between teachers' academic qualifications, years of teaching experience and their understanding of e-learning. For example, percentage within group comparisons showed that teachers with lower qualifications were by 9% more in e-learning understanding than teachers with higher qualifications (see Table 4.1.4, p. 213). The study suggests that a higher qualification does not necessarily mean an individual has a good understanding of e-learning. Rather, it can imply a wider and deeper ability individuals should be expected to demonstrate in their area of professional practice (UK-QC4HE 2011).

Bloom's taxonomy of educational objectives (Bloom 1984; Mayer 2002) defines *understanding* to mean grasping the meaning of informational material, which can be measured by the ability to describe the phenomenon under investigation. In view of that, it can be suggested that e-learning is a concept, which its understanding can be enhanced by other demographic and external factors rather than only an academic qualification. Moreover, most of teachers with lower qualifications (who in this study are Higher Diploma, Bachelor degrees as well as *other* qualifications holders) graduated from the studied institutions (I4 2009; I2 2010; I1 2011; I3 2012), in which their programmes in all fields includes computer related subjects.

In addition, findings reported in Table 4.1.4 (p. 213) shows that teachers with more than 10 years of teaching experience were by 9.3% more in e-learning understanding than teachers with with 10 or less than 10 years of teaching experience. The study suggests that with experience, teachers get an opportunity to learn many aspects that they get exposed to. In other words, teachers were exposed to knowledge for more than 10 years of their teaching experience. This is consistent with literature in educational theory and research on learning, which claim that some individuals can acquire understanding of a phenomenon through experience and with age (Pintrich 2002). In that regard, the longer individuals are exposed to knowledge, the more they get experience and the more they achieve understanding.

In summary, the analysis of teachers' understanding of e-learning in this study enhanced knowledge on how teachers defined e-learning. In addition, the study revealed how teaching experience and qualifications contributed to their understanding of e-learning. Furthermore, the themes derived from open-ended questions and semi-structured interviews helped to explain how teachers associated different experiences and functionalities of computers to describe the same term, e-learning. Although, the overall findings from the study portrayed a better understanding of e-learning for some teachers, there was still a strong indication that teachers in Tanzanian HLIs need to be equipped with knowledge of e-learning stressing clearly its boundaries that differentiate e-learning from other similar approaches of learning.

5.2 Teachers' attitudes towards e-learning

Generally, findings reported in Figure 4.2.1 (p. 218) revealed that 53% of the teachers had positive attitudes towards e-learning, whereas 47% had a negative attitude. On one hand, there is some evidence that positive attitudes demonstrated by teachers could be attributed to their computer experiences, e-learning understanding as well as awareness of the benefits from e-learning. The first two aspects are further expounded in sub-section 5.2.1 and the last aspect in section 5.3.

On the other hand, results from the study suggest that teachers' negative attitudes towards e-learning could be attributed to barriers that can hinder its adoption in HLIs. Responses from 204 (90.7%) teachers (see Figure 4.4.1, p. 244) remarked some challenges that could impinge e-learning uptake in their institutions of which their presence possibly could have influenced their attitudes towards it. The results concur with Teo's (2009) study that the presence of external variables such as poor ICT infrastructure and support on system use had a significant influence on teachers' attitudes towards technology. This is also in line with Legris', *et al.,* (2003) argument that external variables can enhance understanding of what influences attitudes and their presence can contribute to the explanation of individuals' differences towards using the technology.

Teachers' general attitudes towards e-learning obtained from a sample of teachers from Tanzanian HLIs provided a useful data for e-learning adoption in HLIs as well as further investigation of teachers' *behavioral intention* and later their *action* towards using e-learning because majority of them (53%) were found to possess a positive attitude towards e-learning.

5.2.1 Examining association between IVs and attitude towards e-learning

i. Computer exposure and teachers' attitudes towards e-learning

Results from this study concur with results from Cavas, *et al.,* (2009), Krishnakumar and Kumar (2011) as well as Karaca, *et al.,* (2013) which found association between computer exposure and attitude towards e-learning. Findings reported in Table 4.2.2 (p. 221) significantly demonstrated that teachers with exposure to computers had more positive attitudes towards e-learning than those with no exposure ($\rho < 0.05$). It implies that computer exposure has a strong influence on teachers' attitudes towards e-learning. In addition, the data reported in Table 4.0.2 (p. 200) in this study, shows a higher number of teachers with computer exposures both at their work places (245, 95%) and homes (214, 82.9%) further enhancing the association between computer exposures and attitudes.

Similarly, results from semi-structured interviews with the principals (see Table 4.2.1, p. 219) further supports the findings that teachers in Tanzanian HLIs have experiences in using computers, particularly, in processing students' academic records, which was mandatory to every institution that participated in the study. In that regard, this study suggests that teachers' exposure to different experiences in computers made them like using computers, which also enhanced in developing positive attitudes towards e-learning. This assertion concurs with Ajzen (2001) as well as Ajzen and Fishbein (2005) that familiarity can lead to positive feelings and when such positive feelings are activated, their effect would be expected to influence an attitude, which, in turn, has an impact on actions. The assertion is also in line with the theory of the mere exposure effect (see Sub-section 2.1.2, p. 69), which holds that exposing an individual repeatedly to a particular stimulus enhances the individual's attitude towards the stimulus (Burgess and Sales 1971; Young and Claypool 2010).

Results from this study are also in line with the developed conceptual framework of this study adapted from the TAM theoretical model, which explains the relationship between individual's perceived ease of use (EoU) and attitude (A) towards a stimulus. The TAM theory suggests that the more that an individual perceives technology to be free from effort, the more favourable that individual's attitude will be (Davis 1986; Venkatesh, *et al.,* 2003). Free from effort can be measured in terms of an individual's perceived ease of use, usability and flexibility of that technology (Holden and Rada 2011). In this study, 209 (81.6%) of teachers agreed that e-learning technologies are not difficult to use, whereas 173 (67.3%) of teachers agreed that using computer systems does not require a lot of effort (see Table 4.3.4, p. 239). These findings can be interpreted that teachers in the studied institutions found computers easy to use.

Overall, these findings provide empirical support cited in literature that exposure to computers has a positive impact on attitude formation towards e-learning. Findings further extend validation of the theoretical framework adapted from the TAM theory to be a useful model to explain teachers' attitudes towards e-learning when more than half of teachers of HLIs in Tanzania with computer exposures demonstrated positive attitudes towards e-learning. The study suggests that if proper support to provide more teachers with accessibility to computers and further enhancing awareness on benefits from e-learning, their attitudes towards e-learning could improve significantly, easing adoption of e-learning in HLIs.

ii. Teaching experience and teachers' attitudes toward e-learning

Findings from this study (see Table 4.2.4, p. 223) showed that teachers with less years of teaching experience (that is, 10 or less than 10 years) had positive attitudes towards e-learning by 6.7% more than teachers with long years of teaching experience. However, such results were not statistically significant.

Results from this study concur with that from Males' (2011) study that found no significant association between years of teaching experience and attitudes towards technology. The present study suggests that teachers' attitudes towards e-learning by less experienced teachers could be attributed to other factors, where years of teaching experience were found to play an insignificant role. Nevertheless, the perception that most new graduates and less experienced teachers were taught by long experienced teachers cannot be neglected. Nevertheless, this study suggests that teachers with long years of teaching experience could be more focused on their jobs rather than keeping pace with technological changes.

Furthermore, Inan and Lowther (2010) argue that long experienced teachers may have less confidence in adopting new technologies in their classrooms limiting changes in their traditional practices. For example, findings from semi-structured interview show that teachers with relatively older age were reluctant to adopt e-learning, “I am too old for this so I don’t have time to learn new skills” (P1, see Table 4.4.2, p. 245). Although an old age and long years of teaching experience may not necessarily imply the same aspect, such findings invite a further research to establish their association and impact in e-learning adoption. However, results from this study are not surprising because most of the teachers were found to be more exposed to computers such that their differences in attitudes by years of teaching experience were narrowed down to an insignificant level.

Studies that investigated association between teachers’ years of teaching experience and attitude towards e-learning revealed conflicting results. For example, Shin (2010) found that teachers with relatively long years of teaching experiences significantly had higher attitudes towards technology integration in their classrooms than inexperienced teachers. A factor that attributed to his findings was educational technology policy, which required teachers to use ICT in at least 10% of their teaching activities. That was highly responded by long experienced teachers rather than inexperienced teachers because of fear of acting against the policy and its implication to their jobs (Shin 2010). On the contrary, Tuparova, *et al.,* (2006) found that teachers with more than ten years of teaching experience were less inclined to develop and apply e-learning materials than those with less than ten years. Nevertheless, their findings differed with those of the present study because they did not examine whether or not their findings were statistically significant.

Inan and Lowther (2010) found a statistically significant association between years of teaching experience with technology integration in education. They argued that teachers' attitude to integrate technology decreases when years of teaching experience increase. They argue that long experienced teachers "may have less computer proficiency and confidence to integrate technology" (p. 147). A similar result was obtained by Karaca, *et al.,* (2013) who found that teaching experience had negative direct effects on teachers' attitudes towards e-learning. Contrary to the present study, teachers in this study were exposed to computers narrowing down the relevance of years of teaching experience in attitude formation towards e-learning.

Conflicting results discussed above could be attributed to cultural difference, type of the study and the applied sample. For example, the study by Inan and Lowther (2010) was a quantitative investigation involving 1,382 teachers from 54 secondary schools in Tennessee, USA to examine direct and indirect effect between teachers' individual characteristics and their perception on e-learning integration into classrooms. Contrary to the present study, the study by Inan and Lowther (2010) was conducted in secondary schools in one city and data were collected in spring semesters of two different years. Like the present study, Shin (2010) was a mixed methods study that investigated factors that influence teachers' use of ICT among 661 teachers from 31 Korean elementary schools. Contrary to the present study which used probability sampling (see Sub-section 3.5.2, p. 144 and 3.5.3, p. 147) to obtain its participants, Shin's (2010) study used non-probability convenience sampling method. Convenience sampling is a continuous process of selecting most suitable individuals available to the researcher until the required sample size has been attained (Robson 2011; Bryman

2012). Robson (2011, p. 275) argues that “it is probably one of the most widely used and least satisfactory methods of sampling,” whereby findings may also be non-representative.

In conclusion, findings from this study call for different strategies and motivations to be used to all teachers so as to improve their attitudes on e-learning regardless their years of teaching experiences. The most potential findings, which can be used as the basis for improving their attitudes is their exposure to computers as well as awareness on the benefits of e-learning in education as a whole.

iii. Qualifications and teachers’ attitudes toward e-learning

Findings from this study reported in Table 4.2.6 (p. 225) shows teachers with relatively lower qualifications had positive attitudes towards e-learning by 9.2% more than teachers with higher qualifications. However, such results were not statistically significant. Similarly, this study suggests that with most of the teachers being more exposed to computers, their differences in attitudes by academic qualifications were narrowed down to an insignificant level.

Findings from the present study support those from Demuth’s (2010) study who found no statistically significant association between teachers’ qualification levels and their adoption of e-learning in education. This can be interpreted that teachers’ qualifications may not have any association with their attitudes towards e-learning. However, results from other studies found a significant association (for example, Males 2011; Rahimi and Yadollahi 2011). The study by Males (2011) was quantitative that explored for a possible relationship between 228 teachers' demographic characteristics and their attitude towards technology usage conducted at urban classrooms only. The lowest teachers' qualification in his study was a Bachelor degree and the highest qualification was a doctorate degree. Frequency of teachers with Master degrees was relatively higher (29.2%) than the remaining qualifications (ibid.). Such pattern increased the probability of teachers with higher qualifications performed better in the attitude test. In addition, Males' survey was administered online suggesting biases as only teachers with ICT skills (computer exposures), could easily participate in the survey (Unwin, *et al.,* 2010).

The study by Rahimi and Yadollahi (2011) was a quantitative investigation that examined the effect of 248 teachers' personal and technological characteristics with their e-learning usage conducted at schools from one city only. Like Males' study, the lowest qualification recorded in Rahimi and Yadollahi's (2011) study was a Bachelor degree though they differed in that the highest was a Master degree. Both studies, Males (2011) as well as Rahimi and Yadollahi (2011), used teachers from secondary schools in one city.

Since the impact of teachers' qualification on teachers' attitudes towards e-learning produced inconsistent results, the present study suggests that other variables as well (such as cultural backgrounds) may be considered alongside this variable when explaining the difference in teachers' attitudes toward e-learning.

iv. Gender and teachers' attitudes toward e-learning

Findings from the present study are consistent with previous studies by Cavas, *et al.,* (2009), Onasanya, *et al.,*(2010) , Demuth (2010), as well as Wong, *et al.,*(2012), which found that there was no significant difference between teachers' gender and their attitudes towards e-learning. Findings reported in Table 4.2.9 (p. 228) show that non-significant association between gender and attitudes towards e-learning could be attributed due to the fact that most teachers, regardless of their gender differences, had full access with computers in their everyday lives (that is, at their homes and work places, see Table 4.0.2, p. 200). In due regard, their accessibility had narrowed down their differences in attitudes towards e-learning to an insignificant level (Wong, *et al.,* 2012). Thus, results from this study confirm that both female and male teachers in Tanzanian HLIs have similar access to computers in their daily lives, which led to similar attitudes towards e-learning.

Nevertheless, other studies that examined the influence of gender differences and attitude towards e-learning found a significant difference among female and male teachers. However, such studies reported inconsistent results where Venkatesh, *et al.,* (2000), Ozdamli, *et al.,* (2009) and Zhou, *et al.,* (2010) found that male teachers had a relatively positive attitude towards e-learning compared to female teachers. A study by Zhou, *et al.,* (2010) was quantitatively conducted to examine the influence of culture, technological and personal characteristics from 210 middle school teachers' to their attitude towards e-learning in education, whereas, Ozdamli, *et al.,*(2009) conducted a quantitative research that examined 120 university student teachers' attitude towards e-learning.

Although the current study demonstrated that there was no statistically significant association between gender and teachers' attitude towards e-learning, it is suggested that other variables such as age and subject disciplines, can be considered alongside the variable, *gender,* when explaining the difference in teachers' attitudes toward e-learning.

v. E-learning understanding and teachers' attitudes toward e-learning

Themes derived from open-ended questions that investigated teachers' understanding of e-learning helped to explain how teachers in Tanzanian HLIs described and hence, understood e-learning. The Bloom's taxonomy of educational objectives defines *understanding* to mean the ability to construct meaning from informational materials including oral or written description of phenomenon under investigation (Mayer 2002). This study demonstrated the potential informational materials that enhanced teachers' understanding about e-learning that included teachers' familiarity with computers and their awareness on potential benefits from e-learning to their carriers and education as a whole. Findings from this study revealed that, teachers associated e-learning with the presence rather than absence of computers and the Internet (see Table 4.1.3, p. 207). These findings were consistent with literature on impression formation and social perception that individuals have abilities to associate an object and attributes that characterizes that object (Fazio 2007) and hence, enhanced their understanding.

Literature shows that *understanding* is developed when new knowledge is associated with previous knowledge through cognitive processes (Mayer 2002), which, in turn, can trigger evaluative judgments or attitudes (Rogers 2003; Ajzen 2005; Fazio 2007). The salient cognitive process in this study was portrayed by teachers' abilities to describe e-learning, which, in turn, constructed their attitudes towards it. Findings reported in Table 4.2.11, p. 230 provide empirical support for the assertion when demonstrated that teachers' e-learning understanding had statistically significant association ($\rho < 0.05$) with their attitudes towards e-learning. This finding also concur with Rogers' (2003) claim that associated knowledge with attitude formation towards a technology, implying that e-learning understanding can also influence teachers' attitude towards it.

The assertion that understanding evolved as a result of associating new knowledge with previous knowledge is also found in a similar study by Probert (2009). She investigated teachers' understanding of information literacy and their associated classroom practices. Results revealed that some teachers had a reasonably good understanding of the concept of information literacy (Probert 2009). Teachers' understanding of information literacy was found to be connected with literacy, reading or ICT where all three factors constituted teachers' previous knowledge they related to information literacy (Probert 2009).

Although there is lack of empirical investigation regarding association between teachers' e-learning understanding and their attitudes towards e-learning, findings from this study suggest that teachers' understanding of e-learning is significant in determining their attitudes towards e-learning. It implies that the more teachers are imparted with knowledge about e-learning, the more likely can develop a positive attitude towards it. Moreover, the findings can also provide a useful springboard for further research to explain the relationship between e-learning understanding and attitudes towards e-learning in different cultural and education settings.

5.2.2 Examining predictors of teachers' attitudes towards e-learning

In general, results from this study showed that computer exposure and general understanding of e-learning made a unique and statistically significant positive contribution to the prediction of teachers' attitudes toward e-learning. This implied that experiences in computers and general understanding of e-learning have been the most significant determining factors for their positive attitudes towards e-learning. That is, the more teachers are exposed to computers and the more they understand e-learning, the more favorable their attitudes will be towards e-learning.

5.3 Performance on themes from the Test of e-Learning Related Attitudes (TeLRA) scale

Findings reported in Figure 4.3.1 (p. 235) show that themes of the TeLRA scale performed well in examining teachers' attitudes towards e-learning with the highest performance (87.4%) recorded on *benefits from e-learning*. It implies that if teachers are made aware of e-learning and its benefits, then they can construct positive attitudes towards it. This is consistent with one construct of Davis' (1986) TAM theory (see Sub-section 2.1.3, p. 74) termed as perceived usefulness (U), which suggests that when users are presented with new technology, their decision on how and when to use will depend on the degree to which they believe that using that technology would enhance their job performance. The relationship between U and attitude (A) suggests that the more an individual perceives the technology to be useful, the more favourable that individual's attitude toward it will be (Venkatesh, *et al.,* 2003). Findings reported in Table 4.3.1 (p. 236) clearly provide empirical support for this theory when 242 (94.2%) teachers believed that using e-learning will improve the quality of their work and 237 (91.9%) teachers believed that e-learning technologies will improve their job performance. The implication is that teachers were highly aware and supportive of the benefits e-learning could bring to their careers and thus, their perceived usefulness led them to a positive attitude toward it.

Attitude towards using computer systems was the second well performed theme (86%) of the TeLRA scale (see Figure 4.3.1, p. 235). Other results from this study have demonstrated how teachers' previous experiences in using computers has influence their attitudes towards e-learning. Findings from Table 4.3.2 (p. 237) concur with the second construct of the TAM theory that using that technology would be free from efforts when 219 (85.5%) teachers disagree with the statement that "I make errors frequently when using computers." This was also reflected in the third theme *leisure interest on use of computers and e-learning innovations* when 215 (84%) teachers agreed that working with computers is exciting. Apart from *challenges of implementing e-learning* highlighted in the fourth theme, computer use among teachers had played a significant role in developing teachers' attitudes towards e-learning (see Tables 4.3.1, 4.3.3 and 4.3.4, p. 236 - 238).

Although teachers' exposure to computers, understanding of e-learning as well as awareness on benefits from e-learning in education had a positive impact on their attitudes towards e-learning, these factors cannot stand by themselves if Tanzanian HLIs are to implement e-learning in their education system. As this learning approach is spreading across most institutions in the country, the need for a favourable environment ready for its adoption and later implementation is essential. The section that follows presents other factors that can hinder the adoption of e-learning in Tanzanian HLIs.

5.4 Barriers to adoption of e-learning

Findings from open-ended questions and semi-structure interviews reported in Table 4.4.2 (p. 245) provided a richer picture of the barriers that can hinder the adoption of e-learning in Tanzanian HLIs. Factors found to be hindering the adoption of e-learning in HLIs have also been explored in several studies (for example, Newton 2003; Sife *et al.,*2007; Ndume, *et al.,*2008; Unwin, *et al.,*2010; Mnyanyi, *et al.,*2010; Nihuka and Voogt 2011; Mtebe and Raisamo 2011; Nagunwa and Lwoga 2012; Sanga, *et al.,* 2013; Kisanga and Ireson 2014).

Overall, findings from this study revealed several barriers, both at institutional and individual levels. The major *institutional barriers* that were recorded included poor infrastructure, financial constraints as well as insufficient support, both technical and managerial, whereas *individual barriers* reported included lack of knowledge about e-learning and teachers' resistance to change. The following sub-sections provide details for each factor.

5.4.1 Poor infrastructure

Consistent with Sife, *et al.,* (2007), Ndume, *et al.,* (2008), Unwin, *et al.,* (2010), Mnyanyi, *et al.,* (2010), Nihuka and Voogt (2011), Mtebe and Raisamo 2011, Sanga, *et al.,* (2013) as well as Chien, *et al.,* (2014) it was evident from this study that there was still huge infrastructural problems that need to be addressed if these institutions are to achieve e-learning. Results from this study revealed that the leading infrastructural problems were inadequate or inconsistent electrical power supply, inadequate Internet connectivity (bandwidth capacity) as well as insufficient computer laboratories and computers.

i. Inconsistent power supply

E-learning needs constant and reliable power supply. Limitations in power supply in Tanzania as a whole remain a prohibitive constraint to the adoption of e-learning in HLIs. Despite the government's efforts to enhance power generation and supply, electricity supply in the country is yet to be consistent, most particularly in terms of irregular power supply, low voltage, unpredictable power rationing and sometimes complete power outage (CTI 2011). These limitations have impacts not only on the country's economic performance, but also on its education sector, including higher education.

It is known that inconsistent power supply can cause damage not only to humans but also to electrical equipment such as computers and their peripherals. When this problem persists for too long, it can lead to behavioural change to some people. Findings from this study revealed that inconsistent power supply developed teachers' resistance to adopting e-learning (E1, see Table 4.4.2, p. 245). Teachers from one institution resisted uploading their lecture notes for reasons related to inconsistent power supply that propelled the whole idea of e-learning negatively. In that institution some comments were very common such as, “why involve me in the hassles of uploading my lecture notes while the power is unreliable?” (E1, see Table 4.4.2, p. 245).

Power inconsistency can also threaten the quality of education provided by these institutions, particularly, in online learning. Ndume, *et al.,* (2008) report that there is uncertainty among people about certificates obtained from online programmes. Although the major factor they pointed out was based on the university/college that offered certificate, such university/college could also be evaluated in terms of the entire structure of operating online programmes including reliability of its sources of power.

Findings reported from semi-structured interviews provided practical support that unreliable power supply can impinge upon conducting online examinations for students located in remote areas. Such results were consistent with what Myanyi, *et al.,* (2010) reported that the most affected areas for e-learning are rural areas where power supply and Internet connectivity are the major problems. Although the problem of inconsistent power supply still persists, all interviewees were of opinions that e-learning is possible to achieve if this problem is properly addressed.

ii. Inadequate Internet bandwidth

Limitations in bandwidth and high costs of Internet services were also reported to hinder the adoption of e-learning in Tanzanian HLIs. Limited bandwidth was also referred to by Unwin, *et al.,* (2010), Mnyanyi, *et al.,* (2010), Mtebe and Raisamo (2011), Nagunwa and Lwoga (2012), and most recently by Sanga, *et al.,* (2013) as well as Mtebe and Raphael (2013). Results showed that problems ranged from high cost fixed by Internet service providers to installation costs encountered by respective institutions, and when such service was available, the Internet speed was remarkably slow (Unwin, *et al.,*2010; Sanga *et al.,* 2013).

Although most institutions are trying to improve their Internet connectivity, their available bandwidth capacity is too small to support e-learning. Findings recorded from two principals demonstrated frustrations in terms of online communication caused by inadequate bandwidth capacity when confirmed to have a bandwidth capacity of 256 kbps and 2Mbps respectively. This is also consistent with findings from Mtebe and Raphel (2013) who found that students were unable to access multimedia enhanced content properly through the Internet due to insufficient Internet connectivity. Although in-campus intranet can be among strategies to minimize the said challenge, Internet connectivity as a medium for online interaction to global knowledge and as a means for communication should still be in the high level of priority for effective e-learning programmes (Unwin, *et al.,* 2010).

iii. Insufficient number of computer laboratories and computers

Results from this study showed that all studied institutions have computer laboratories, although not sufficient to meet the growing demand of users, particularly students. However, the most common computer problems identified in the studied institutions was unequal student to computer ratio caused by either insufficient fund to increase the available number of laboratories and computers or mismanagement of the available computers in the laboratories themselves. For example, it was not surprising in institution I1 to see ten or even less working computers in a computer laboratory of 30 machines.

Results from this study revealed that problems related to computers, in general, were mainly categorized into two perspectives: computer access by students and computer access by teachers. Findings revealed that until to date computer access by students remained to be a major problem, especially with increasing student enrolment in these institutions. This assertion has also been reported by Nagunwa and Lwoga (2012) as well as Nyaranda (2012). Recently, Sanga, *et al.,* (2013, p. 93) report that "many students crowded for sharing a single computer during practical sessions in computer laboratory" resulting in "only a single student taking a control of the computer and others have to watch what he/she is doing." In one reputable University in Tanzania computer-to-student ratio was found to be 1:15 (Nagunwa and Lwogwa 2012).

Student enrolment in Tanzanian HLIs appears to be increasing at a greater rate (see Sub-section 1.1.11, p. 51) resulting in a high student-to-computer ratio. Review of the studied institutions' prospectus on long-term programmes offered showed that each programme had one or more module related to ICT (I4 2009; I2 2010; I1 2011; I3 2012). It implies that each student must have some hours per week of being involved into practical works in the computer laboratory. With increasing student enrolment rate yearly, these institutions cannot accommodate in-campus students within the available computer laboratories, which further decelerates strategies focused on achieving e-learning.

Nevertheless, in terms of teachers' access to computers, evidence from principals reported in Table 3.5.2 (p. 145) showed that there were more efforts focused on eradicating computer access by teachers through different schemes such as teachers buying laptops and paying in instalments. Findings further revealed that every staff office had at least one computer with a teacher to computer ratio varying from one-to-one up to five-to-one.

In summary, the reported infrastructural problems demonstrate a painful reality to most HLIs in Tanzania. The report provided by URT (2011, p. 47) claims that "the education sector continues to face major challenges including mismatch between increased enrolment and the supply of physical structures as well as human and financial resources." Findings reported by teachers, principals and e-learning experts provided clear evidence that these institutions are facing similar problems in terms of adoption of e-learning. Proper efforts should be taken by the government to address the problem of inconsistent power supply particularly that caused by overdependence on hydro-power production, which is affected by weather variations, particularly drought conditions (CTI 2011). Costs of Internet connectivity should also be reduced, particularly now after receiving the first of the three competing submarine fibre optic cables as an alternative technology to satellite (Kasper 2009). Finally, building computer laboratories and providing computers should be a joint effort between the government and institutions themselves. On one hand, the government should increase the budget allocated to these institutions to enable them cope with their needs, including adoption of e-learning. On the other hand, institutions should look for alternative sources of funds, including those from developmental projects and other national/international donors.

5.4.2 Financial constraints

Consistent with Sife, *et al.,* (2007), Ngugi, *et al.,* (2007) and Chien, *et al.,* (2014), findings reported in Table 4.4.2 (p. 245) provide empirical support on financial constraints to be one of the major factors that hinder adoption of e-learning in HLIs in Tanzania. Findings from this study showed that the problem was dominated by costs associated with purchase and installation of ICT related facilities, operating costs of Internet services as well as students' economic status when it comes to purchase of tools for e-learning. Students' economic status was also revealed by Sanga, *et al.,* (2013) who explored the potential of e-learning in promoting participations of female students in Science, Technology and Mathematics disciplines in Tanzanian HLIs.

A survey report on Internet and data services in Tanzania (URT 2010b) showed that the number of Internet users in organisations/institutions has been decreasing from 69% in 2008 to 55% in April 2010 due to reasons associated with high Internet services costs. The high cost of Internet services not only demoralizes strategies for effective e-learning to teachers but also demoralizes e-learning experts who claim that there is "lack of enough finance to facilitate this technology" (E5, Table 4.4.2, p. 245).

Results from this study also revealed that public HLIs are constrained by inadequate budget allocation. Funds allocated to these institutions do not reflect the actual requirements and, on most occasions, institutions operate on their own efforts. Although financial constraint by itself is a barrier to the e-learning adoption, the perception that “e-learning infrastructure is very expensive for the government to afford” has been disagreed by 160 (62.3%) teachers (see Table 4.3.4, p. 239). Inadequate financial support from the government can further hinder the adoption of e-learning in HLIs. Aspects regarding lack of support are presented in the next section.

5.4.3 Lack of support

While principals cited lack of government support on operating their institutions including adoption of e-learning, teachers and e-learning experts cited both poor managerial and poor government support to be barriers that can hinder adoption of e-learning in their institutions. Results from open-ended questions revealed that teachers were concerned about top leaders’ readiness to e-learning adoption. In their views, principals and higher authority in the ministry were not supportive of e-learning. Their comments were mainly based on low budget allocation from the government to their institutions. This is consistent with the argument raised in the earlier section that the budget allocated by the government to these institutions is inadequate.

Another challenge that affects the adoption of e-learning in HLIs is lack of technical support. Findings reported in Table 4.4.2 (p. 245) provide a practical support for this suggestion in that teachers particularly in institution I6 were not promptly attended to whenever they had technical problems in matters related to ICT. However, evidence from the e-learning experts reported in the same Table enhanced the understanding about this problem. They commented that such experts are few in numbers such that it is hardly possible to attend all staff and students.

These findings are consistent with those from Sife, *et al.,* (2007) study who argue that “in most of the developing countries including Tanzania, there are very few technical experts to implement and maintain ICTs.” For example, results from this study revealed that I6 has 15 technical staff in ICT who are required to supports about 10,000 students (E4, see Table 4.4.2, p. 245). This problem is intensified when an institution has technical staffs with different qualifications and professionalisms, which limit their support capabilities. For example, in the same institution there are some technical staff who can only manage computer laboratories and most of them were Diploma holders with expertise in computer systems maintenance, service, repair and networking skills, whereas the remaining administered issues related to LMS installation, operation and support.

Lack of technical support has a significant impact when these institutions become fully operational with e-learning. Both teachers and students will frequently need support provided by the technical staff. Principals of these institutions need to take note of this issue such that clear strategies aimed at eliminating this problem are given priority even by identifying/labelling it to be a rare profession so as to retain them from seeking for other highly paying jobs outside HLIs.

However, a significant finding from this study is that principals were highly aware (see sub-section 5.1.1, p. 276) and supportive of e-learning (see Appendix VI). All were supportive to e-learning adoption when they were asked about their opinion on whether to accept or reject adoption of e-learning in their institutions. This result provide a useful step towards the e-learning adoption in Tanzanian HLIs as Rogers (2003) claims that support from institutional management has a significant role in determining technology adoption in the institutions. For example, Shin (2010) found a statistically significant association between administrators' support and teachers' use of e-learning in their classrooms. Therefore, focus should be on creating awareness to the authority in the government and most particularly the Ministry of Education and Vocational Training so as to draw their attention to the benefits from e-learning approaches in education and provide support accordingly.

5.4.4 Lack of knowledge

Lack of knowledge was also reported by Mtebe and Raisamo (2011). In the present study, lack of knowledge included lack of ICT skills and awareness about e-learning in terms of its meaning, abilities and benefits. Lack of knowledge about e-learning reported in this study included teachers, students and those on decision making level such as principals, policy makers and the Ministry of Education and Vocational Training. Contrary to other results from this study, principals of the studied institutions had good understanding and also are supportive to e-learning initiatives.

Findings reported in Figure 4.1.1 (p. 205) demonstrate that teachers of HLIs in Tanzania have different understanding levels of e-learning. It was evident that some teachers had a mixed understanding about e-learning, however to date the majority of teachers are aware of it. The findings are consistent with that from Mtebe and Raisamo (2011) who found that 83% of teachers were aware of open education resources. Different levels of teachers' understanding of e-learning reported by this study had significant association with teachers' attitudes towards e-learning. Teachers with e-learning understanding had positive attitudes towards e-learning by 27.5% higher than teachers without at a significant value $\rho < 0.05$. It implies that the more the teachers lack knowledge about e-learning, the more negative their attitude could be, which might impinge institutional strategies to achieve e-learning in HLIs.

Although the number of teachers who lacked e-learning understanding was relatively small, it is crucial that they should be provided with appropriate awareness training and opportunities so as to practice e-learning systems as well as accelerate adoption of e-learning in these institutions. Sife, *et al.,* (2007) report that training programmes have a significant "contribution in raising awareness and changing attitudes of stakeholders" (p. 63) towards e-learning.

However, in terms of basic ICT skills, findings reported in Table 4.0.2 (p. 200) demonstrate that majority of teachers of HLIs in Tanzania are experienced with use of computers connected to the Internet both at their homes and work places. It implies that teachers are aware of basic functionalities of computers and the Internet, which was also found to have a significant association with their positive attitudes towards e-learning.

Although this study was limited to teachers, principals and e-learning experts, findings from this study suggest that there is a need for imparting e-learning awareness particularly to students as well as decision-makers in the government. That was evident from some responses from teachers that “awareness among students and stakeholders is also a problem,” which can hinder the adoption of e-learning in HLIs (I4.235, see Table 4.4.2, p. 245).

5.4.5 Resistance to change

Teachers’ resistance to change was also found to be one of the determining factors for adoption of e-learning in HLIs. These findings were referred to before by Mnyanyi, *et al.,* (2010), Garrison (2011) and Bates (2011). Several factors associated with resistance to change were reported in this study. They included techno-phobia (that is, fear from adoption of new technology), poor mind-set, old age, subject discipline, extra load perception and embarrassment of exposing one’s level of ICT skills.

Results reported in Table 4.4.2 (p. 245) revealed that most teachers were reluctant to adopt new technology because of technophobia and fear from exposing their ICT skills. Although it was evident from this study that majority of teachers were equipped with basic ICT skills and experiences in computers, they were reluctant to acquaint to SIMS until they were subjected to conditions from the management team. Principals of the studied institutions, in their views, were doubtful that teachers' reluctant to SIMS might also influence e-learning adoption in their institutions.

Nevertheless, the findings reported by the e-learning experts revealed a different situation. The main factors associated with resistance to change were teachers' negative mind-set, old age, subject disciplines (where teachers from Arts disciplines were more reluctant than sciences teachers), copyright issues as well as poor perception that e-learning brought about extra work. The e-learning experts reported statements such as "I already have enough on my workload do not add unnecessary things," "I am too old for this so I don't have time to learn new skills" and "only blackboard and chalk is enough for me to deliver materials" to be common among teachers from their institutions (see Table 4.4.2, p. 245). Such comments imply that teachers were unaware of the flexible and easy to use tools available on the e-learning platforms further confirming the need for practical e-learning training among teachers of HLIs in Tanzania.

In terms of subject disciplines, findings revealed that teachers from social sciences disciplines lagged behind teachers of other disciplines in supporting e-learning. In view of the e-learning experts this was "…because they rely on conventional pedagogical face-to-face teaching" (E5, Table 4.4.2, p. 245). This study suggests that such teachers might have perceived that the type and mode of delivering their subjects could not be achieved electronically. Results from this study are consistent with Rolfe's (2008) results who reported that Arts teachers (that is, teachers from the Schools of Politics and American Studies), viewed that their subject disciplines could not be supported by e-learning. The findings further provide support for the suggestion given earlier that teachers need e-learning awareness training that demonstrates presence of different tools and functionalities available in the e-learning platforms.

Finally, ownership of materials uploaded to e-learning systems was reported by the e-learning experts to be among the factors that led to teachers' resistance to change. Teachers wanted assurance on how they were going to benefit when their work became public in the e-learning platforms and to the Internet users as a whole. This was also reported by Mtebe and Raisamo (2011, p. 260) who found that teachers "do not know which resources should be shared in the public domain, and which rights should be reserved to the institution or to the authors". This was a challenge not only to the e-learning experts, but also to the management team of these institutions to come up with appropriate strategies, which can be used to address such issues so as to eradicate resistance to e-learning.

In brief, findings from this study provided a rich insight into the challenges that can hinder the adoption of e-learning in Tanzanian HLIs. Foremost, it was no surprising that structures for most of these institutions are not supportive of e-learning, rather they were meant to teach face-to-face. Other barriers were financial constraints and e-learning technical as well as managerial level support. The next section presents strategies that can be used to address them.

5.5 Strategies to address barriers toward adoption of e-learning

Findings from this study show that responses from principals and e-learning experts on strategies to be used to address these challenges had different levels of priority. Whilst principals' strategies dominated more on infrastructures, awareness and resistance to change, the e-learning experts' responses were highly focused on matters related to infrastructure, awareness and support in terms of technical as well as managerial (Kisanga and Ireson 2014). Each strategy is presented in detail in the next Sub-sections.

5.5.1 Strategies related to infrastructure

i. Power supply

Findings from this study revealed several strategic measures that have been employed by Tanzanian HLIs to combat the problem of inconsistent power supply. They include use of renewable energy (particularly solar power) and electric generators. For example, one institution had, on different occasions, purchased four electric generators with capacity equivalent to 185kV altogether. On one hand, they seemed to have solved the problem. However, services, maintenance and fuel costs to operate electric generators can be another challenge. On the other hand, installation costs for solar power that can operate the entire institution were again on high side where most institutions could hardly afford. This is a hard reality to most HLIs in Tanzania, which are facing a common challenge of inconsistent power supply as well as a new challenge of purchasing and operating costs for other alternative sources of power.

In this study, these strategies were taken to be temporary solutions. In order to entirely eradicate this problem, the government should accelerate its efforts on realizing other alternative sources of power including thermal and gas.

ii. Internet connectivity

Slow Internet speed due to small bandwidth was reported to be a problem to most of these institutions. One strategy used to combat this situation as found from this study was to simulate online learning in offline environments. This strategy, which does not rely on the Internet connections, is within control of any institution. The strategy gives teachers as well as students insight on practical activities that can be experienced in online environments.

Another strategy reported in this study was creation of regional centres in the country that can involve learners who cannot attend courses at college or university campuses. Hosting institutions would distribute content through external storage devices such as CDs. For example, institution I5 has been sending materials to their regional based students using CDs instead of a previous method that used hard copies. Use of regional centres was seen to be one of the reliable strategies in both offline and online environments. Two out of the four institutions involved in the survey were in the implementation stage of opening regional centres focused on both, addressing challenges of Internet connectivity and increasing student enrolment. However, regional centres have similar limitations when it comes to Internet accessibility. Results from this study found that the Internet bandwidth remained to be a constraint.

Despite the constraints in the Internet connectivity, the studied institutions were struggling to enhance bandwidth capacity that can meet essential needs of operating e-learning programmes. For example, institution I2 has a strategic plan to improve their bandwidth capacity from the current 256 kbps to 2 Mbps, whereas I4 aimed at attaining 9 or 10 Mbps. However, the arrival of a submarine fibre optic cable in 2009 has the potential to increase bandwidth and reduce Internet connection costs. A recent survey by the Tanzania Communication Regulatory Authority (URT 2010b) shows that Tanzania has a total available Internet and data capacity of 3,459 Mbps where 1,475 Mbps are from the satellite and 1,984 Mbps from fibre optic. As by June 2010, only 2,239 Mbps were used, this accounts for only 65% of the total available capacity (URT 2010b). In addition, the available capacity from fibre optic is underutilised because only 49% is used “compared to 91% of satellite capacity for downlink and 80% for uplink” (URT 2010b, p.16). Therefore, proper planning on improving bandwidth by these institutions is possible.

iii. Computer laboratories and computers

In this study, problems related to computers, in general, were mainly categorized into two perspectives: computer access by teachers and by students. Evidence from principals of these institutions shows that strategy undertaken to eradicate teachers’ accessibility to computers yielded positive results (see Table 3.5.2, p. 145). Among these strategies there was support given to teachers to buy their own lap tops and pay in phases.

However, computer accessibility with students remained to be a major problem, especially with the annual increase in students' enrolment figures in these institutions. Strategies that are currently taking place are the extension of existing computer laboratories and construction of new buildings that will accommodate new laboratories, classes and staff offices. However, this strategy would be realised if there is a substantial financial support from the government and other donor sources.

5.5.2 Strategies to address financial constraints

Although financial constraints were highly cited as one of the major barriers for the adoption of e-learning, data from this study shows that most of the public institutions were highly dependent on the annual budget allocation from the government. It can imply that, the priority and degree of combating financial problems would highly depend on how much money is allocated to these institutions by the government.

Being a developing country, the government which oversees education from primary to tertiary level, has been trying to minimize financial problems in the education sector through different schemes. For example in 2006, the government revised its Value Added Tax Act of 1997 by exempting the value added tax on the supply and importation of computers and their accessories so as to ease the purchasing cost and enhance the use of e-learning in education (URT 2006). In addition, the budget allocation to the education sector has been enhanced annually, though its impact is yet to bring a significant change as one principal, P4 commented that "…no substantial support from the government, just very little…" (see Table 4.4.2, p.245).

Nevertheless, these institutions need to seek for other alternative financial sources that could help them generate funds to sustain their requirements. The surveyed institutions have strong departments that are able to design and develop marketable products, engage in consultancies with different private and public sectors as well as designing projects aimed in solving real life problems, which can attract funds from different donor organization. If these aspects are well planned and with strong and supportive leaders both at institutional and governmental levels, with a keen interest in integrating e-learning in education, e-learning will become a reality rather than a myth.

5.5.3 Support strategies

Support strategies can be viewed from two perspectives. These are strategies suggested by e-learning experts and those suggested by the principals. Strategies suggested by the e-learning experts were directed at institutional management teams that necessitate support to all aspects of e-learning in terms of infrastructure, capacity building and maintenance. However, strategies suggested by principals were directed to the government in terms of an increase budget allocated to operate their institutions. Regardless of either perspective, awareness to e-learning seemed to provide a significant impact.

Findings from this study suggest that the top institutional management team need to be aware of e-learning because once they are aware of different functionalities and benefits from e-learning, they can fully support e-learning. Studies reveal that high authority in organisations can influence teachers' technology adoption process (see

Sub-section 2.2.4, p. 106). Price (2012, p. 68) argues that, “teacher attitudes improve when principal-teacher relationships in schools create positive, intrinsic affective responses among the staff.” Findings also suggest that when support from management is established, the next strategy is to develop a technical support unit with staff capable of handling e-learning systems administration such as installation, operation, services, repair and security. In addition, the support unit should also consider issues related to instructional design and professional training programmes. The next strategy after establishing support unit can be training of trainers and users and in a continuous manner so as to support new users of the system and new advances in the technology. Findings also revealed another strategy aimed at supporting both teachers and the e-learning experts with short and long-term training programmes, both in the country and outside the country to enhance knowledge and skills.

5.5.4 Strategies on awareness raising

Strategies used to bring about awareness on e-learning in these institutions varied, depending on individuals’ level of familiarity on the use of ICT. However, the most predominant awareness programmes revealed by this study were the basic ICT skills and professional ICT skills. Basic ICT skills were provided to teachers who did not have any previous background on ICT skills before they were employed although the programme was found to be fading away. For example, one institution came up with an *IT Fundis* programme in 2004, which was focused on giving teachers basic skills on computer application packages including word processor, database, spread sheet and presentation. Recall, the word *Fundi* is a Swahili singular noun used to represent a skilful or a skilled worker such as a technician, mechanic and a craftsperson. The programme was conducted only once and thereafter, it was cancelled after the poor turn-out of teachers.

Responses from principals concurred with findings obtained from the survey, which revealed that most teachers did not require basic ICT skills training. Findings reported in Table 4.0.2 (p. 200) show that familiarity level with computers among teachers of HLIs in Tanzania was very high. It indicated that teachers did not require basic ICT skills training programmes. The only strategy suggested by this study is to provide professional e-learning training programmes that can accurately align teachers' understanding about e-learning, on one hand, and, providing awareness on potential benefits from using e-learning in education on the other.

Findings from the study showed that teachers were provided with training on professional ICT depending on the level of ICT skills portrayed by them and type of e-learning systems or platforms existing in that institution. Such programmes included applications such as multimedia, Internet services and orientation to different functionalities of LMS. Teachers were encouraged to practice what they had learnt in such training programmes and were monitored by follow-up consultations to evaluate their progress. Although this strategy seemed to be appropriate, it encountered some challenges. Findings from this study revealed that there were some teachers who, for no specific reasons, resisted attending such professional training programmes. In order to solve the problem, the coordinating team and the institute's management introduced incentives as a means of motivating/persuading teachers to attend.

In summary, this study suggests that for e-learning to be effective, institutions should do a situational analysis aimed at examining the level of ICT skills acquired by teachers and what they can afford to provide so as to come up with a strategic plan appropriate in both, raising e-learning awareness and achieving it.

5.5.5 Strategies to encounter resistance to change

Findings from this study found that there were mainly two strategies used to deal with teachers' resistance to e-learning. They included teachers' awareness training on e-learning platforms and financial motivation (incentive) that focused on encouraging them to use e-learning. Financial motivation, to some extent, solved another factor associated to teachers' resistance to change, that is, ownership of their developed materials. Teachers were encouraged to develop their e-learning modules and later on, they were provided with remunerations after uploading to the LMS.

However, when awareness training and motivation through incentives failed, institution's top management would come up with the policy that reinforces use of e-learning, as one principal remarked that, "…putting policies in place, and requiring things that you can really monitor and follow up." This is what Rogers (2003) calls *authority innovation-decision* whereby the choice for whether to adopt or reject e-learning is made by high authority in the organization. Although this approach seemed to work, it was time consuming because it involved teachers with different perceptions about the said technology as well as different technology adoption periods. The approach can also threaten its sustainability and quality of education as a whole (Rogers 2003).

Despite all those patterns, this study supports the suggestion provided by one principal that the government should lead efforts that focus on developing a positive perception of e-learning among its people by starting it from the grassroots. That is, e-learning should be integrated in education gradually from the primary education level to tertiary education level so that "people could be trained that learning is not only face-to-face, but could be via e-learning so that one grows with that in mind" (P3, Table 4.5.1, p. 257).

In summary, findings from this study found that as long as most of these institutions are public owned institutions, their entire operating costs including adoption of e-learning have to be highly supported by the government. Thus, appropriate measures should be taken by the government to see to it that budget allocated to higher education is significantly improved. This is only possible by providing awareness of e-learning to all stakeholders of higher education since awareness deepens perception on the usefulness of e-learning approaches in education, which is a favourable condition to the creation of positive attitude towards e-learning.

5.6 Strategies to optimise teachers and students' involvement in e-learning

Findings reported in Table 4.6.1 (p. 271) show that involvement in e-learning was mainly enhanced between teachers and students and between students and content. However, interactive tools in their LMS platforms were also open to accommodate other modes of interactions such as student-to-student and teacher-to-teacher interactions.

5.6.1 Teacher-to-student interaction

Findings revealed that the open source Modular Object-Oriented Dynamic Learning Environment (Moodle) was the LMS used in these two institutions which offered e-learning programmes in Tanzania. As a free source e-learning software platform, Moodle was particularly used to facilitate online programmes. Findings from this study revealed five tools that were used to achieve teacher-to-student interactions. They included chat, forum, announcement, wiki and email.

Findings further revealed that teachers' participation played a greater role in attaining an effective teacher-to-student interaction. Students were organised into groups to work as a team. The teachers' role was to use LMS tools such as discussion forums so as to help students involve amongst themselves and give them regular feedbacks. In terms of teacher-to-student interaction, the e-learning experts encouraged teachers to use all provided tools in the LMS effectively in order to get good interactions with students. Teachers were further encouraged to create an interactive content that fosters interactions among students.

Generally, findings from this study revealed that one of the strategies used to encourage teachers to participate in e-learning interaction with students was through attending workshops and professional training programmes. Training programmes were either short-term or long-term and they were conducted either locally or abroad. In terms of long term programmes, teachers were sponsored to attend degree programmes in instructional design and multimedia production.

5.6.2 Student-to-content interaction

The quality of the content and level of student interaction plays a significant role in the e-learning environment (Ally 2008; Salmon 2011). Results reported in Table 4.6.1 (p. 271) show that e-learning experts in these institutions encouraged teachers to create content with animations or simulations that allow student to be involved in a highly practical manner.

During professional workshops, teachers were encouraged to develop content in such a manner that it promotes a conversational environment with learners. It implies that, for an effective student-to-content interaction, there must be sense of a relationship between the content and the learner. However, this is not only required by the LMS that offers different tools, but also for teachers as facilitators of learning to replicate it.

The study supports the suggestion provided by interviewee E6 that an e-learning programme should be designed in such a way that it attracts leaners to it due to its value associated with the programme itself. In this regard, value in terms of time, flexibility, accessibility, costs and achievements from e-learning programmes should be the basis for all e-learning interactive strategies so that many people would be attracted to use rather than be forced to use.

In summary, findings from this study revealed strategies, which are focused on equipping teachers with new roles in the e-learning environment through professional training programmes and workshops since teachers are the key facilitators in e-learning.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This Chapter presents the summary of the major findings, conclusions and recommendations drawn from the findings. The latter is sub-divided into recommendations for action and recommendations for further research. The Chapter begins by presenting original aspects brought by this study, that is, strengths from the study as well as the theoretical implications from the study.

6.0.1 Strengths from the study

One of the unique aspects brought by this study is development and use of the TeLRA scale, which also added value to the current body of knowledge by providing research evidence as an efficient model that can be used to explain attitudes towards e-learning on a sample of teachers from Tanzanian HLIs. Also it supported the TAM theoretical model adapted for this study (see Sub-section 2.1.3, p. 74, Part iii). Results from the TeLRA scale provided theoretical insights for successful adoption of e-learning in HLIs in Tanzania.

The second distinctive aspect of this study is that the findings added value to the current body of knowledge by providing education stakeholders in Tanzania with thorough researched information about teachers' e-learning understanding levels and their attitudes towards e-learning in Tanzanian HLIs that had not been identified from previous research**.** In addition, the findings add value to the literature on ICT integration in Tanzanian HLIs in that they provided up-to-date information from the e-learning experts about existing barriers that can hinder the adoption of e-learning and suggested strategies to address them. Earlier researches had used teachers and/or students as sources of data to investigate challenges of integrating/using ICT in education.

Another unique feature of this study was an examination of the association between teachers' understanding of e-learning and their attitudes towards e-learning where empirical data were limited. Results from the study revealed a statistically significant association between teachers' understanding of e-learning and their attitude towards e-learning. Such an association is expected to have a practical implication to HLIs in Tanzania aiming at adopting and implementing e-learning.

A final unique aspect, which differentiates this study from other similar studies, is that teachers were directly involved through open-ended questions to voice their opinions on the following aspects:

i. their understanding about e-learning;
ii. their views on importance of e-learning in HLIs; and
iii. barriers that can hinder the adoption of e-learning in their institutions.

The next sub-section presents theoretical implications from the study.

6.0.2 Theoretical implications from the study

The present study responded to knowledge gap that need to investigate attitudinal factors that can influence the transition from face-to-face learning to e-learning in Tanzanian HLIs. An investigation of factors that can influence the transition prompted the researcher with four key questions: How is e-learning understood and perceived by teachers? What factors and how relevant can they influence their understanding of, and attitudes towards e-learning? What are the possible barriers that can impinge the adoption of e-learning in HLIs? What are the best practice strategies that can be used to address challenges of e-learning adoption in HLIs?

To answer these questions, the study adopted a theoretical model, Technology Acceptance Model (TAM) to examine the influence of external and independent variables on teachers' attitudes towards e-learning so as to understand and explain reasons for their differences in attitudes. To date, however, little consideration has been given to conduct research that uses theoretical approach to examine teachers' attitudes towards e-learning in Tanzanian HLIs and thus, there is no standard attitude scale that has been developed to measure teachers' attitudes towards e-learning. Therefore, through the review of literature guided by the four constructs of the conceptual framework adapted from the Technology Acceptance Model (or TAM theory) as well as the cross-cultural validated Test of Science Related Attitudes (TOSRA) scale, the researcher developed a Test of e-Learning Related Attitudes (TeLRA) scale model to examined attitudinal factors (see Sub-section 3.6.1, p. 149).

The findings from this research provided clear evidence that the TeLRA scale can be usefully employed to investigate factors that can influence attitudes towards e-learning and hence help the researcher to explain the transition from face-to-face to e-learning. Findings from the study demonstrated that teachers had moderate knowledge of e-learning with two factors, namely, years of teaching experience and academic qualification significantly influenced their e-learning understanding (see Sub-section 4.1, p. 202). It was also shown that teachers' knowledge of e-learning and their exposure to computers had statistically significant influence to their positive attitudes towards e-learning (see Sub-section 4.2, p. 217).

Through this research five factors have been revealed to impinge the adoption of e-learning in HLIs, where poor ICT infrastructure, financial constraints and inadequate support (here in this study referred to as external variables) were highly cited problems (see Sub-section 4.3, p. 241). The presence of these problems in Tanzanian HLIs also helped our theoretical model to explain differences in teachers' attitudes towards e-learning. However, further investigation can be carried out to measure the impact of these factors through an attitude scale test and evaluate if their presence have a statistical significant association with teachers' attitudes towards e-learning.

Development of the TeLRA scale has two implications: first, researchers in the same field of inquiry can use it to identify attitudes towards e-learning and their associated factors and second, identification of attitudes and their factors can help education stakeholders to plan, implement and manage the education transition process innovatively so as to successfully realise e-learning in HLIs.

6.1 Summary of major findings

The summary of major findings presented in this sub-section is based on the eight research questions presented in Chapter one (see Sub-section 1.3.3, p. 60).

6.1.1 Respondents' understanding of e-learning

The first research question explored respondents' understanding of e-learning. Results from the study revealed that most teachers in Tanzanian HLIs had moderate understanding of e-learning. The term *moderate* was used because 123 (50.8%) teachers defined e-learning to mean all types of electronically supported learning and teaching (see Figure 4.1.1, p. 205). Seen in the proper perspective, these definitions portrayed a good understanding of e-learning and 96 (39.7%) teachers defined e-learning to be learning through the Internet or distance/online learning of which in this study they portrayed partial understanding of e-learning. In this study, the term *good* was used to comprise all definitions, which were near or equivalent to the operational definition, while, the term *partial* was used to mean that such definitions emphasized on learning mainly supported in networked environments. Only 23 (9.5%) teachers had poor e-learning understanding where the term *poor* was used to include all definitions that were not related to the operational definition of e-learning. However, all principals and e-learning experts demonstrated a good understanding of e-learning.

In summary, teachers' understanding of e-learning is found to be essential for two main reasons: first, their understanding has been found to influence positive attitudes towards e-learning, which is an important prerequisite for a favourable decision making in technology adoption in HLIs (Rogers 2003). Second, it has also been reported that teachers' understanding of concept has a direct impact to students' future work and academic carriers. Society can construct negative attitudes to school graduates if the quality of knowledge acquired does not meet the required standards and specifications (Smith 2013). Therefore, the results from this study has enhanced education stakeholders' understanding about teachers' levels of e-learning knowledge, which can help in planning e-learning uptake in higher education.

6.1.2 Examining predictors of teachers' understanding of e-learning

The second research question examined the predictive ability of the independent variables (IVs), namely, *computer exposure, gender, years of teaching experience* and *qualification* to predict teachers' *understanding of e-learning*. Results from the study revealed that only *years of teaching experience* and *qualification* could predict teachers' e-learning understanding at a significant value $\rho < 0.05$ (see Table 4.1.6, p. 216). Teachers with more than 10 years of teaching experience was by 9.3% more in understanding of e-learning than teachers with less than 10 years of teaching experience, whereas teachers with lower qualifications were by 9% more than teachers with higher qualifications in understanding of e-learning (see Table 4.1.4, p. 213). In this study, teachers with lower qualifications were Higher Diploma, Bachelor degree and *other* certificates holders, whilst teachers with higher qualifications were Master and Doctorate degrees holders.

6.1.3 Teachers' attitudes towards e-learning

The third research question examined teachers' attitudes towards e-learning. Findings from the study revealed that 128 (53%) teachers had positive attitudes towards e-learning and 115 (47%) teachers had negative attitudes towards e-learning (see Figure 4.2.1, p. 218). On one hand, the positive attitude could be attributed to their exposure to computers, understanding of e-learning as well as the perceived potential benefits from e-learning to their career and education.

Teachers with exposure to computers had positive attitudes towards e-learning by 31.4% higher than teachers with no exposure at a statistically significant level $\rho < 0.05$ (Table 4.2.3, p. 222). Similarly, teachers with e-learning understanding had positive attitudes towards e-learning by 27.5% higher than teachers without at $\rho < 0.05$ (Table 4.2.11, p. 230). In addition, 228 (87.4%) teachers were supportive of benefits from e-learning to their career and education as a whole (see Figure 4.2.3, p. 235).

On the other hand, teachers' negative attitudes towards e-learning could be attributed to barriers of e-learning adoption in HLIs. Responses from 204 (90.7%) teachers (see Figure 4.4.1, p. 232) remarked existence of barriers that could impinge e-learning uptake in their institutions and literature argues that their presence could possibly influence their attitudes towards it (Legris, *et al.,* 2003; Teo 2009).

6.1.4 Examining association between independent variables and attitude towards e-learning

The fourth research question investigated association between the independent variables (IVs), namely, *computer exposure, gender, years of teaching experience*, *qualification, e-learning understanding* and the dependent variable *teachers' attitude towards e-learning*. Findings from the study indicated that there was a statistically significant association between computer exposure and teachers' attitudes towards e-learning. Similar results has been reported in the literature (for example Cavas*, et al*., 2009; Krishnakumar and Kumar 2011; Karaca, *et al.,* 2013).

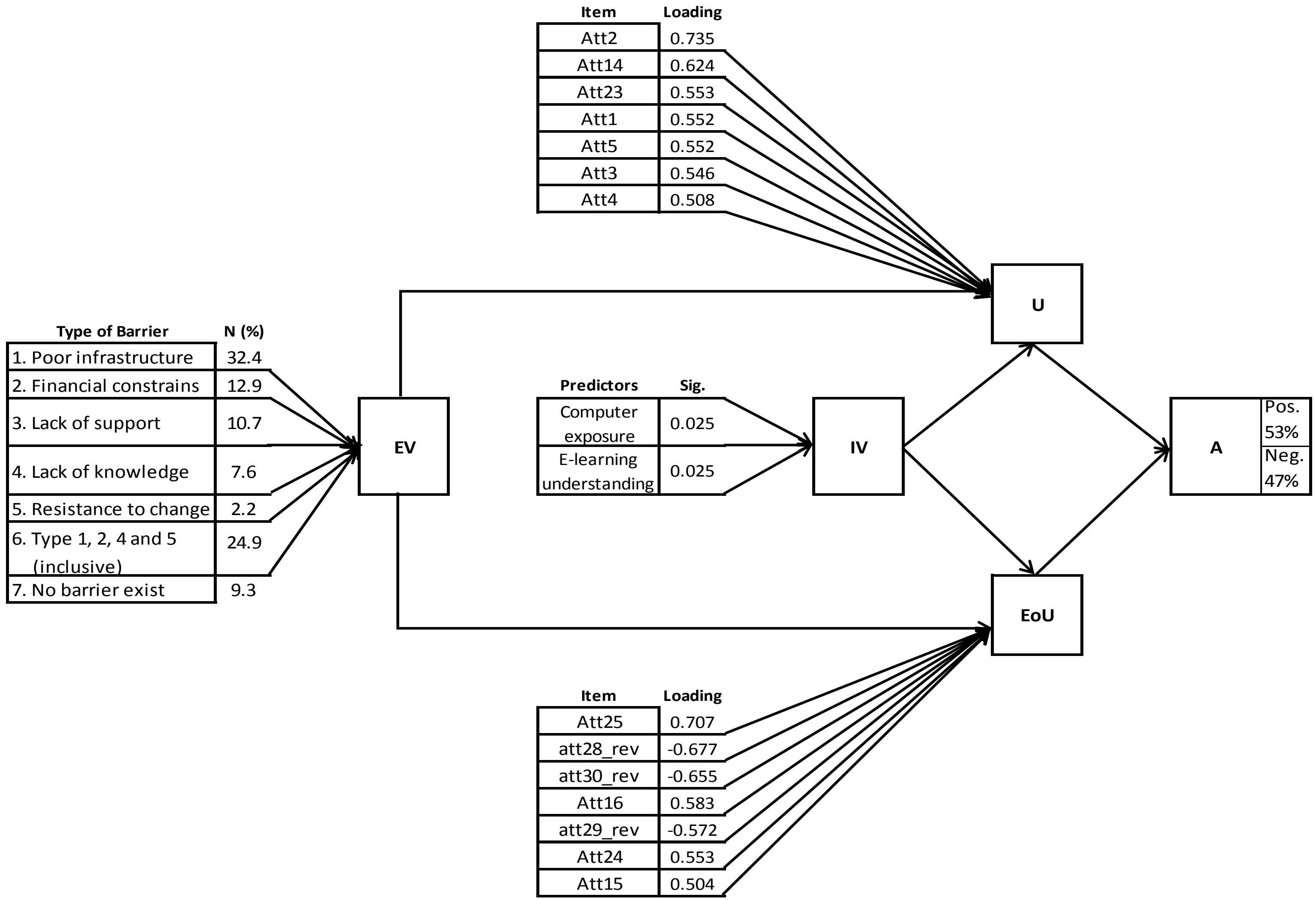
Findings from the study also revealed a statistically significant association between teachers' understanding of e-learning and their attitudes towards e-learning. However, no statistically significant association was found between teaching experience, qualifications, gender and teachers' attitudes towards e-learning ($\rho > 0.05$).

6.1.5 Test of e-learning Related Attitudes (TeLRA) scale

The fifth research question investigated the performance of the developed TeLRA scale on explaining teachers' attitudes towards e-learning. Being initially developed to assess teachers' attitude towards e-learning in Tanzanian HLIs, the TeLRA scale has undergone reliability test at the Nottingham Trent University in the UK and pilot test at the University Computing Centre in Tanzania and scored an accepted internal reliability Cronbach alpha 0.888 and 0.871 respectively (see Sub-sections 3.7.4, p. 159 and 3.7.5, p. 160). Moreover, the Principal Component Analysis (PCA) identified four distinct TeLRA scale themes (Table 3.8.6, p. 178) with factor loadings greater than the absolute value 0.5. The mean inter-Item correlations in each factor were greater than 0.3 indicating unidimensionality in each theme. Similarly, on performing the PCA to each theme separately only one theme was extracted in each case further justifying that items in each case were measuring the same underlying concept.

Findings reported in Figure 4.3.1 (p. 235) show that themes of the TeLRA scale performed well in examining teachers' attitudes towards e-learning whereby 87.4% of teachers supported the theme *benefits from e-learning* followed by *attitude towards using computer systems* (86.0%) and *leisure interest on e-learning innovations and use of computers* (76.6%). However, 37% of teachers agreed that there are *challenges of implementing e-learning* whereas, 63% did not.

The themes of the TeLRA scale after the data analysis and PCA have also conformed to a conceptual framework adapted from the Davis' (1986) Technology Acceptance Model (see Figure 6.1.1). The conceptual framework consisted of four constructs: external variables (EV), teachers' perceived usefulness (U), teachers' perceived ease of use (EoU) and teachers' attitude (A) towards e-learning which depends on the first three constructs.



***NB: EV** -External Variables; **IV** -Independent Variables; **U** - Perceived usefulness; **EoU** -Perceived Ease of Use; **A** -Attitude*

Figure 6.1.1: TeLRA conceptual model after data and PCA

In terms of EV, the model in Figure 6.1.1 displays the presence of barriers that can hinder the adoption of e-learning in Tanzanian HLIs remarked by 204 (90.7%) teachers. The study suggests that their presence could have contributed to the explanation of the revealed differences in teachers' attitude (A) towards e-learning. In this study EVs included factors such as poor ICT infrastructure, financial constraints, lack of technical and managerial support, lack of knowledge about e-learning and teachers' resistance to change. In terms of IV, results from the study demonstrated a statistically significant association ($\rho < 0.05$) between teachers' computer exposure, e-learning understanding and their attitudes towards e-learning.

Furthermore, contribution of each item under the theme *benefits from e-learning,* which in Figure 6.1.1 is reflected by usefulness (U) of e-learning, and contribution of each item in the two themes *attitudes towards using computer systems* and *leisure interest on use of computers and e-learning innovations*, which are reflected by the ease of use (EoU) e-learning tools shows a strong association with the attitude. Factor loading for each item ranged from 0.50 to 0.74. The commonly accepted factor loading level is greater than 0.3 (Bryman and Cramer 2011) or greater than 0.45 as suggested by Comrey and Lee (see Tabachnick and Fidell 2013). Therefore, a value greater than 0.5 show a stronger correlation with the respective belief, further enhancing the construct validity of the TeLRA scale.

In addition, the repeated PCA after deleting items with factor loadings less than 0.5 show that all items loaded perfectly well in the same themes except *att13,* "A face-to-face method is more learner-centred than E-learning methods." On rechecking the reliability of the scale, only *att13* was found to have a higher *alpha value if item deleted* than the rest of the items. Removal of this item yielded a Cronbach's alpha coefficient of 0.806.

In summary, the TeLRA scale used in this study provided research evidence that it is an efficient model which can be used to explain attitudes towards e-learning in a sample of teachers from Tanzanian HLIs. The extracted four themes solution of the TeLRA scale with established reliability and factorial validity could be described as highly representative of the whole concept of attitude measure towards e-learning. The empirical results from this study provide support to the theoretical model proposed in this study and consequently providing a theoretical insight that can be used by educational stakeholders as a basis for a practical transition from face-to-face to e-learning in HLIs.

6.1.6 Institutional barriers to the adoption of e-learning

The sixth research question explored barriers that can hinder the adoption of e-learning in Tanzanian HLIs. Findings identified five major barriers arranged according to the level of priority as poor infrastructure, financial constraints, inadequate technical and managerial support, education stakeholders' lack of e-learning knowledge as well as teachers' resistance to change (see Table 4.4.2, p. 245).

Of all the identified barriers, poor infrastructure was highly cited by all participants involved in the study (see Table 4.4.1, p. 242 and Table 4.4.2, p.245). Identified problems related to infrastructure were poor/inconsistent power supply, insufficient

Internet connectivity and inadequate computer laboratories and computers (see also Sife, *et al.,* 2007; Unwin, *et al.,* 2010; Nihuka and Voogt 2011; Sanga, *et al.,* 2013). Barriers in this study were identified from both the survey questionnaires with teachers and semi-structured interviews with principals and e-learning experts from the surveyed institutions.

6.1.7 Strategies to address barriers toward adoption of e-learning

The seventh research question addressed strategies that can be used to overcome barriers, which hinder the adoption of e-learning in Tanzanian HLIs. Findings from the study revealed three major strategies presented according to the level of priority.

Foremost are strategies related to infrastructure. They included the use of renewable energy through power backup generators and solar power systems; strengthening of Internet bandwidth capacity from their existing capacity to more reliable and faster connections; extension of the existing computer laboratories including construction of new buildings and purchasing of computers.

The second strategy aimed at addressing financial constraints. It should be noted here that the main source of funds for HLIs in Tanzania depends on the type of institution. For public institutions it is mainly from the government annual budgets and tuition fees, whereas for private institutions is mainly the tuition fees. However, funds obtained from the government are not within the control of the public institutions because they have always received less than what was requested (I5 2013). Therefore, strategies to address financial constraints to both public and private institutions would depend on how much they are involved to different funds generating projects, consultancies as well as financial support from national or international friends/donor organisations. One e-learning expert, E2 (see Table 4.5.1, p. 257) remarked that the main challenging process of raising funds is on writing a well funds attracted project proposal.

ICT basic and professional training was identified to be the third main strategy used to address challenges related to inadequate support, lack of e-learning knowledge to education stakeholders and teachers' resistance to change. In terms of support strategies, the study found it to focus on professional training for technical staff and establishment of support unit independent from any other department. Apart from professional training there were no deliberate strategies identified from the studied institutions, aimed at increasing as well as maintaining the number of ICT technical staff including e-learning experts.

In line with support strategies was strategies used on raising e-learning awareness particularly to academic staff. This included professional training programmes in e-learning platforms as well as short and long-term training, both within the country and abroad. In addition, training programmes were also used as a motivation to change teachers' attitudes towards e-learning. This was also supplemented by financial incentives that were used to address teachers' resistance to change.

6.1.8 Strategies to optimise teachers and students' involvement in e-learning

The last research question sought for the best strategies that could be used to optimise teachers and students' involvement in e-learning. Results revealed two main strategies. They included *teacher-to-student interaction* and *student-to-content interaction*. In teacher-to-student interaction, teachers were encouraged to use LMS tools such as discussion forums that help student be involved amongst themselves and giving them regular feedbacks. In addition, teachers were encouraged to create an interactive content that fosters interactions with students.

With regard to student interaction with the content, teachers were encouraged to create content with animations or simulations that allow students to be involved in a highly practical way. In addition, they were also encouraged to create some practical oriented activities that foster student interaction with the content.

6.1.9 Summary

In general, the use of mixed methods approach in this study provided diverse perspectives and useful knowledge in understanding teachers' knowledge of, and attitudes towards e-learning. Also results from the study explained factors associated with teachers' understanding of, and attitudes towards e-learning and also assisted in developing an attitude scale measure. The approach further shed light on factors that can hinder the adoption of e-learning in Tanzanian HLIs and strategies to address them. Finally, findings from this study identified strategies that could be used to optimise teachers and students' involvement in e-learning environment.

Through the use of the TeLRA scale, researchers can identify attitudes towards e-learning and their factors, consequently, enhancing its reliability as well as validating it across a variety of settings and to wider populations. Identification of attitudes and their factors would provide useful knowledge for education stakeholders, which can help in planning and increasing effectiveness of the adoption of e-learning in HLIs by working out factors, which lead to negative attitudes and strengthening those leading to positive attitudes. Furthermore, identification of barriers that hinder adoption of e-learning in HLIs can help education stakeholders in formulating effective measures aimed at eliminating them. Successful adoption of e-learning requires appropriate planning that factors out barriers identified in this study and also which involve education stakeholders including, but not limited to teachers, students, curriculum developers, heads of institutions, policy makers and the government represented by the Ministry of Education and Vocational Training.

Finally, identification of strategies used to optimise teachers' and students' involvement in e-learning is expected to help the HLIs, which plan or are in transition from face-to-face to e-learning while, in turn, expanding access to learning for all.

6.2 Conclusions

This section provides conclusions based on the main findings from the study.

6.2.1 Respondents' understanding of e-learning and teachers' attitude towards e-learning

Currently, e-learning, as a new learning approach, is spreading across most HLIs in Tanzania (Sanga, *et al.,* 2013). Although very few institutions are currently conducting formal e-learning programmes, this study revealed that there was high indication for other institutions to adopt it. Consistent with Mwalongo (2011) all institutions involved in the study reported to use Students Information Management Systems (SIMS) to manage students' records and at some occasions teachers were reported to use presentation tools in their lectures. In addition, most teachers involved in this study reported they have experience in using computers with Internet connectivity both at their homes and work places. Such findings about the level of ICT use in these institutions provide a useful background that enhances teachers' understanding of e-learning.

The study also revealed that 123 (50.8%) teachers from the studied institutions had a good understanding of e-learning. This is a very useful data because through knowledge teachers can deepen their understanding of e-learning, which, in turn, is a favorable condition for building positive attitudes towards e-learning. Similarly, findings from this study indicated that all principals and e-learning experts had a clear understanding of e-learning. These are substantial findings because supporting transition from face-to-face to e-learning approach comes from individuals who have a good understanding of, and a positive attitude towards e-learning (Newton 2003, Glen 2008, Garrison 2011). Thus, if principals of HLIs are supportive of e-learning, consequently, can influence teachers to use it (Jhurree 2005; Price 2012). Likewise, if e-learning experts have clear understanding of e-learning then they are likely to provide user-friendly and quality learning platforms that meet learners' preferences including styles of learning (Moore*, et al.,* 2011).

In terms of teachers' attitudes towards e-learning, findings from this study revealed that a slightly more than half of the teachers involved in the study had positive attitudes towards e-learning. There was some evidence in this study that positive attitudes demonstrated by teachers were attributed to their computer experience, e-learning understanding levels as well as perceived benefits from e-learning (see Sub-section 5.2, p. 284).

In conclusion, findings from this study suggest that teachers' positive attitude to e-learning is essential if Tanzanian HLIs need to successfully transform its education systems from the current classroom face-to-face methods to e-learning. Teachers are the key stakeholders of education and their perception on adopting e-learning also has a significant impact on students' attitude formation towards e-learning (see Sub-section 1.2, p. 54). Although, association of other factors in this study such as gender, qualifications and teaching experience with teachers' attitudes towards e-learning were found to be insignificant, results from this study provided a useful springboard for further investigation of teachers' behavioral intention to use e-learning because majority of teachers were found to have positive attitudes towards e-learning.

6.2.2 Barriers and strategies to adoption of e-learning in HLIs

Although teachers' exposure to computers and their e-learning understanding have played a significant role on their positive attitudes towards e-learning, adoption of e-learning in Tanzanian HLIs faces many challenges. Results from this study discovered several barriers that could possibly hinder the adoption of e-learning in HLIs. One of the biggest challenges that needs to be addressed was infrastructure capable for adopting and implementing e-learning. It was evident from this study that all the surveyed institutions were facing infrastructural problems in terms of inconsistent power supply, inadequate Internet bandwidth capacity as well as inadequate number of computer laboratories and computers.

Despite these limitations, several strategies have been earmarked to be addressed by HLIs. For example, strategies such as use of renewable energy, particularly solar power can be used to minimize if not eradicate inconsistent power supply. Another example that can ease problems on Internet connectivity is developing an institutional intranet that can be used not only for simulating online interaction, but also as means for communication within the institution. In terms of strategy to combat scarcity of computer laboratories this study suggests to have an effective plan that can appropriately allocate, manage and maintain available scarce resources so that they can be shared by all. HLIs should give high priority to strategies that are directed at eradicating these problems from the little budget allocated to them from the government. All these measures are within control of institutional management.

Along with infrastructural problems, were financial problems and inadequate support from the government. Most HLIs in the country are public institutions and therefore, operating them depends, to a large extent, on funds allocated from the government budget. It is evident also that most of these institutions are struggling to meet their needs from other sources so as to supplement the scarce funds. Joint efforts within institutions themselves including support from the governments focused to realize uptake of e-learning in HLIs is the only strategy that need high priority in education development and transformation agenda.

Findings from this study also revealed that lack of knowledge of e-learning to some education stakeholders can also hinder the adoption of e-learning. However, one of useful findings from this study is that all four principals from the surveyed institutions had a better understanding of e-learning. This is a significant step towards realisation of e-learning because principals are the major catalysts for change. They are positioned between teachers in their institutions and high level authorities in the government. For these institutions to adopt e-learning, it is crucial that principals should use their positions to influence teachers and higher authority in the government on the potential benefits from e-learning in education. Appropriate awareness training programmes, particularly on useful tools available on e-learning platforms can also eradicate teachers' resistance to change and therefore, enhance their e-learning acceptance.

One of the strategies suggested by this study is for these institutions to carry out a SWOT analysis so as to identify their strengths, weaknesses, opportunities and threats towards e-learning adoption. In so doing, they could design appropriate strategic plans in realizing e-learning. Strategic plans could include such issues as developing joint projects with other public/private organisations or institutions on e-learning adoption, seek for project sponsorship/support from other national/international donors, plan for teachers and technical staff professional training programmes for capacity development, maintenance and support for e-learning programmes.

The last concluding remarks are on strategies that can be used to optimise involvement of teachers and students in an e-learning environment. This is presented in the next sub-section.

6.2.3 Teachers and students' involvement in e-learning

A key finding disclosed from this research on teachers and students' involvement in e-learning is the effective use of chat, forum, wiki as well as email that foster interactions amongst students, with teachers and content. These are common tools available in many e-learning platforms. The point here is how to use them so as to optimise effective teacher-to-students and students-to-content interactions.

Responses from e-learning experts highlighted that teachers were encouraged to use these tools through developing content that promotes a conversational environment with the learner, that is, content that creates sense of relationship with the learner. Therefore, in order to realize effective interactions, teachers would create content with animations or simulations that allow students to be involved in a highly practical way. In some occasions, teachers would create practical oriented activities that would stimulate student interaction with the content. However, it was evident from this study that teachers' participation in e-learning needs to get first priority, not only in the planning phase, but also during the actual implementation of e-learning programmes. Teachers need to be assured about online copyright issues as well as recognition through different incentive schemes.

Contrary to results from previous studies, there were two key findings from this research to the e-learning planners and scholars as a whole. First, majority of teachers in Tanzanian HLIs are aware of e-learning. This fact is a useful catalyst for adoption of e-learning in HLIs. However, what has remained is to align, through training programmes, their multiple meanings of e-learning for proper e-learning delivery. Second, existence of several barriers identified in this study does not appear to jeopardize e-learning uptake decisions. In this regard, their appearance can be considered to be a checklist for quality e-learning delivery. Despite all factors disclosed by this study about teachers' attitudes towards e-learning as well as barriers on e-learning adoption in HLIs, e-learning is beginning to get proper attention in Tanzanian HLIs.

6.2.4 Practical implications from conclusions

Results from this study provide several practical implications for education stakeholders particularly those at decision-making level. The following Sub-sections present practical implications for heads of institutions, e-learning experts and the government.

i. For heads of institutions

Factors that were found to influence teachers' positive attitudes, that is, e-learning understanding and computer exposure, should be strengthened by providing e-learning training programmes to teachers and technical staff as well as through providing useful tools such as computers as well as necessary support (see Sub-section 6.3.1, p. 346). Staff retention schemes are also required to motivate staff, particularly technical support staff so that they do not seek other highly paid jobs outside HLIs.

ii. For e-learning experts

For e-learning programmes to have value, courses need to be well designed in such a manner that they foster interactions amongst learners, with teachers and with content. This too has practical implications in that e-learning experts should:

i. be provided with short- and long-term training programmes on system administration, multimedia and instruction design to enhance their technical as well as management of e-learning platforms skills;

ii. incorporate practical skills electronically making e-learning more interactive and user friendly.

iii. keep their e-learning platforms up to date by incorporating new features with relevant functionalities that meet learners preferences.

iii. For the government

Identification of barriers that hinder adoption of e-learning has practical implications on planning, adoption, implementation as well as managing e-learning programmes in Tanzanian HLIs. If the government and other supporting agencies are really determined to make a difference, then appropriate measures should be used to address barriers identified in this study. In this regard, the government should:

i. make it possible for the adoption of e-learning through the provision of strong infrastructure in terms of reliable power supply and easy access to the national backbone network to education sector, particularly higher education;

ii. increase its budget allocated to the education sector so that a significant share is directed to higher education;

iii. put more effort on seeing that e-learning is integrated in education gradually from the primary education level to tertiary education level so as to create awareness that learning is not only face-to-face but, could be via electronic media;

iv. spearhead the re-visit of its national ICT Policy of 2003 so that it reflects the current trends in technology, particular attention be focused on the use of e-learning in education;

v. encourage HLIs recruiting technical staff for e-learning support by providing scholarships to support their long-term professional studies in the country as well as outside the country.

Therefore, scholars in education need to understand that managing the transition from face-to-face to e-learning and later on implement it in education requires an holistic approach, which includes:

i. strategic reasons to adopt e-learning;

ii. understand the role of e-learning in supporting learning and teaching for better pedagogical quality (van der Klink and Jochem 2004);

iii. understand factors that can influence teachers' attitudes on e-learning;

iv. addressing challenges facing e-learning uptake in education and finally;

v. recognizing new roles of teachers as well as learners in the e-learning environment.

Although findings from this study were uniquely applicable to the existing situations in the studied institutions, they can also be of a particular interest to other HLIs within the country and to other HLIs in developing countries around the world.

6.3 Recommendations

Based on the findings from this study and the conclusions, the study presents in the next Sub-sections general and specific recommendations as well as recommendations for further research.

6.3.1 General and specific recommendations

i. General recommendations

The first key recommendation for effective transition from face-to-face to e-learning in Tanzanian HLIs suggested by this study is that teachers need to be equipped with the pre-service and in-service awareness training programmes on e-learning technology. Knowledge of e-learning plays a significant role in deciding whether to accept or reject it (Rogers 2003). Although majority of teachers were found exposed to computers, it was evident that teachers had multiple meanings of e-learning which need to be addressed so as to align them for proper e-learning developments and delivery.

In order to emphasize e-learning awareness, it is recommended that professional development programmes on e-learning should be initiated by responsible institutions so as to allow teachers improve skills and knowledge. Programmes can be in any useful format and can include either or both short and long term training, which can be conducted either locally or away. On one hand, short term training may include;

i. Seminar/workshop facilitated by experts in e-learning programmes development and management from institutions that have broad as well as intensive experience in e-learning practice.Training can be conducted in phases beginning with technical staff particularly on aspects related to supporting students and staff in using the system as well as system installation, operation, maintenance, repair, administration and security,

ii. Training can further be extended to teachers, and can focus on how to convert content to an electronic format, familiarity with different functions of an e-learning platform including how to facilitate learning and support learners in the learning platform. This can be supplemented by scheduled individual consultations follow-ups to monitor progress.

Trainings alone can be meaningless if teachers are not equipped with tools such as computers so that they can realise what they have learnt. Moreover, technical support services should be instituted to ensure that the provided tools are always operating and in good order.

On the other hand, long term programmes may include further studies on aspects related to online instruction design, multimedia production and animation, which can involve both teachers as well as technical staff and they can be offered anytime when need arise. These strategies were the success factors used by the two institutions in Tanzania which provide formal e-learning programmes.

The second key recommendation is about the use of older electronic media for learning and teaching which is given less attention today. Findings from this study showed that some teachers related e-learning only with the use of computers, Internet and other new emerging electronic media, which, according to the results from this study, are highly constrained with limited infrastructure and support. It is recommended that, while addressing constraints hindering the adoption of e-learning in HLIs, education stakeholders in Tanzania could also acknowledge the impact of older technologies such as radio, television and CDs, which have a longer and richer history of facilitating the delivery of education to large number of learners in geographically dispersed and socially diverse settings. For example, the famous radio learning programme *School of the Air* from Australia (see Sub-section 1.1.7, p. 32, Part ii). For over 60 years this programme has been using radio as a medium that enabled children located in remote communities to access education and is still in operation today.

Similarly, the use of CDs proved to be a reliable medium of accessing content. On the study that investigated students' experiences as well as challenges of blended learning at the University of Dar es Salaam in Tanzania, Mtebe and Raphael (2013, p. 133) found that "CDs were useful and effective in providing an alternative means to access learning resources" due to the existing slow Internet speed. Other lessons can be obtained from the Open University of the UK, which use print-based material supplemented by radio, television and new emerging technologies (OU 2014).

ii. Specific recommendations

The following are specific recommendations made by this study:

To higher learning institutions

It is evident that e-learning is possible if there are adequate facilities and training programmes to users. To achieve these, HLIs should:

i. incorporate e-learning in their strategic plans;

ii. ensure on-going professional training programmes to both teaching and technical staff; and

iii. ensure the establishment of strong infrastructure that will allow effective use of this learning approach.

To the government

The government should consider comments made by teachers, principals and e-learning experts regarding barriers that can hinder the adoption of e-learning in HLIs by making the adoption possible through provision of infrastructure in terms of power supply and Internet connectivity.

This can be achieved if the government:

i. can quicken its new natural gas generated electricity project (URT 2013a) for electricity supply for the country giving high priority to the education sector;

ii. through its national fibre optic cable project (URT 2010b) ensure that education institutions get affordable and accessible ICT with a potential increase in Internet bandwidth capacity;

iii. can prioritize education by providing adequate financial support to education sector, particularly to HLIs; and

iv. could deliberately decide to set aside a certain percentage of its annual budgets and direct it to e-learning initiatives. This can be learnt from Kenya where transformation of the education system to e-learning and e-teaching approaches is among sub-sectors of the education sector, which is allocated funds from the national annual budgets (IEA-Kenya 2013; ROK 2013).

Thus, with the national fibre optic cable network and the government's 512 kilometre new gas pipeline project from Mtwara to Dar es Salaam that aimed to generate 1,300 MW of electricity and supply for the country (URT 2013a; Simbeye 2014), as well as a tax free on supply and import of computers and their accessories, education institutions in Tanzania have the potential to implement and use e-learning in both education and research activities with reliable Internet connectivity, power supply and affordable e-learning tools.

To teachers and e-learning experts

Based on findings from this research, it is suggested that teachers can be encouraged to accept and make use of e-learning through financial incentives as well as trainings programmes. E-learning experts should make sure that the electronic content is well planned to make sure that students get focused on learning so as to achieve the desired outcomes. E-learning experts can train teachers on several interactive tools available on e-learning platforms including how to design and upload learning contents on these platforms.

6.3.2 Recommendations for further research

This study provides several possible lines for further research. They are summarized as follows:

i. Despite the fact that TeLRA scale has demonstrated an acceptable internal reliability, it need further research to examine its external reliability. Demonstrating external reliability would further informed researchers its reliability over time. In addition, through test-retest examination would have made possible to compute confirmatory factor analysis and further enhancing its validity.
ii. Independent variables *computer exposure, teaching experience, qualification, gender and e-leaning understanding* investigated in this study were not exclusive. In order to further enhance understanding of teachers' attitudes towards e-learning, further researches need to focus on investigating the impact of other variables such as *age, subject discipline* and *cultural backgrounds*.
iii. This study investigated teachers' attitudes towards e-learning from institutions that were not conducting formal e-learning programmes. Furthermore, *attitude* was used as a dependent variable that depends on two personal belief constructs, perceived usefulness of e-learning and perceived ease of use of e-learning tools both of which were mediated by defined independent variables as well as external variables. Further research need to be conducted to examine teachers' *actual use* of e-learning systems from HLIs providing formal e-learning programmes. In this case, *actual use* can be used as a dependent

variable which depends on teachers' behavioral intention to use e-learning, which can be influenced by their attitudes towards e-learning.

iv. This study examined teachers' understanding of, and attitudes towards e-learning. However, transition from face-to-face to e-learning does not exclude other education stakeholders. This study recommends further research to examine students' understanding of, and attitudes towards e-learning so as to capture a wider perspective about e-learning that can enhance knowledge for a better and successful transformation.

v. The main study population was obtained from HLIs coordinated by the National Council for Technical Education (NACTE) under Engineering and other sciences board. Further research can be conducted that can adopt population from institutions under the remaining subject boards of NACTE or obtained from those coordinated by the Tanzania Commission for Universities (TCU).

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APPENDICES

Appendix I: Questionnaire: Including Test of e-Learning Related Attitudes (TeLRA) scale

Test of e-Learning Related Attitudes (TeLRA)

Dear participant,

My name is Dalton Kisanga, a PhD student at the Nottingham Trent University in the United Kingdom. The purpose of this questionnaire is to:

i. collect information on a study entitled, "*Investigation of attitudinal factors towards transition from face-to-face to e-learning in Tanzanian higher learning institutions: A mixed methods approach"*

ii. identify teachers' attitudes towards e-learning and the associated factors. The identification of attitudes and their factors will help to plan and increase effectiveness of the adoption of e-learning in higher learning institutions by working out those factors which lead to negative attitudes and strengthening those which lead to positive attitudes.

This questionnaire contains a number of statements about e-learning. You're kindly requested to read carefully each question and give your response to the best of your knowledge. Your answers are absolutely confidential and anonymous, and will be used for the purpose of this study only. However, you're free to respond or not to respond to any question in this questionnaire.

PART 1: Background Information

Please put a tick (✓) in the correct response in the space provided.
(Do not write your name in this questionnaire).

1. Name of your institution: ……………………………………………………..

2. Gender: Male ☐ Female ☐

3. Qualification: *(Tick the highest qualification you are currently holding)*

Higher Diploma ☐

Bachelor's Degree ☐

Master's Degree ☐

Doctorate Degree ☐

Others *(Please Indicate):* ………………………………………………………………………………….

4. Teaching experience:

0 - 5 years ☐

6 – 10 years ☐

11 – 15 years ☐

Over 15 years ☐

5. Do you have any experience in using computers? …………….. *(Yes/ No)*

6. If the answer to item (5) above is yes, do you have a computer

(a) in your office?…………….*(Yes/No).* If yes, is it connected to the Internet?…………*(Yes/No).*

(b) at home?……… *(Yes/No).* If yes, do you have access to the Internet?…………*(Yes/No).*

PART 2: TeLRA Scale

Information about teachers' understanding of, and attitudes towards e-learning.

Instructions

There is no wrong answer; each response will be treated as a correct one. Your opinion is what is required in this study.

Do not think too long about each statement. It should take you around 10 minutes to complete.

For each statement, put a tick (✓) to show your level of agreement; **Strongly Disagree**, **Disagree**, **Agree,** and **Strongly Agree**.

Do not tick across two boxes.

S/N	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1	E-learning is very economical for educational institutions to adopt.				
2	I believe using e-learning will improve the quality of my work.				
3	Computers make work more interesting.				
4	I prefer reading articles in e-learning.				
5	It is easier to revise electronic educational materials than printed material.				
6	I prefer using a computer to prepare my lessons.				
7	I feel uncomfortable reading a text book on a computer screen than a physical text book.				
8	I enjoy teaching using computers.				
9	Delivering a lecture through electronic technologies is very difficult.				
10	E-learning requires expensive technical support.				
11	E-learning reduces quality of knowledge attained.				
12	Interacting with the computer system is often frustrating.				
13	A face-to-face method is more learner-centred than E-learning methods.				
14	I believe using e-learning technologies will improve my job performance.				
15	Communicating through social networks is fun.				
16	I like reading magazines on new technology innovations.				
17	Teaching through e-learning is tiresome.				
18	E-learning increases learners' social isolation.				
19	E-learning technologies are difficult to use.				
20	Using computer systems requires a lot of mental effort.				
21	Discussions on e-learning technologies are uninteresting.				
22	My institution has enough teaching-learning resources to carry out e-learning.				
23	E-learning will increase teachers' efficiency.				
24	Working with computers is exciting.				
25	I like discussing about new e-learning innovations.				

S/N	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
26	Supporting learners in an e-learning environment is very difficult.				
27	E-learning infrastructure is very expensive for the government to afford.				
28	It will be difficult for me to become skilful in the use of e-learning tools.				
29	I make errors frequently when using a Computer.				
30	Using a computer at home is very frustrating.				
31	Using e-learning technologies will allow me to accomplish more work than would otherwise be possible.				
32	I enjoy computer games very much.				
33	E-learning is a threat to teachers' employment.				
34	E-learning will provide me with better learning opportunities than traditional means of learning.				
35	I find computer online interaction unexciting.				
36	Communicating through electronic mails is annoying.				

Appendix II: Interview guiding questions for Principals

Interview guiding questions for the Principals		
Respondent ID: …………….. (M or F) Venue:……………………. Date:…………………….. Job title:………………………. Years of Experience:………….. Qualification:……………..		
S/N	**Question**	**Remark**
1	What do you understand by the term e-learning?	
2	In your own view/experience do you think e-learning is important in higher learning institutions? *Prompt for reasons: If 'yes' (How important is it? If 'not' (Why not?)*	
3	If you were to give your opinion as a principal on whether to accept or reject the adoption of e-learning in your institution, what will be your stand and why?	
4	Are there any institution barriers that may hinder adoption of e-learning? What are they? *Prompt for more examples if necessary.*	
5	Can you suggest any measures to overcome these barriers? *Prompt for any institutional/management strategies (or practice)*	
6	If your staff are interested in learning about ICT. Do you have any ICT literacy skill programmes in your institution? *Prompt for how are they conducted (ask for any particular examples)*	
7	In your opinion, do you think your teachers are ready to implement e-learning? *Prompt for reasons: If 'yes' (How ready? If 'not' (Why not?).*	
8	What is the teacher-computer ratio at your institution? **OR** Do your teachers have computer access in their offices? Are they connected to the Internet?	
9	What is your general opinion on adoption of e-learning in Tanzanian higher learning institutions?	
10	Is there anything else that I have missed that you would like to contribute?	

Appendix III: Interview guiding questions for e-learning experts

Interview guiding questions for the e-learning experts		
Respondent ID: …………….. (M or F) Venue:……………………. Date:…………………….. Job title:……………………… Years of Experience:………….. Qualification:……………..		
S/N	**Question**	**Remark**
1	What do you understand by the term e-learning?	
2	In your opinion, is it possible for Tanzanian higher learning institutions to adopt e-learning? *If possible: How likely?* *If not: How hard?*	
3	Are there any necessary requirements for an institution to adopt e-learning? *Ask for particular examples.*	
4	In your own opinion, are there any necessary requirements for teachers to be able to implement e-learning? *Ask for particular examples.*	
5	How can e-learning enhance interaction between; Learners Teachers and content? **OR** What strategies can be used to enhance effective interaction between teacher and students, students and content and students and students in an e-learning environment?	
6	What should be the roles of a teacher and a student in an e-learning environment?	
7	In your own experience what are the barriers that face Tanzanian institutions in adoption and implementation of e-learning?	
8	Is there anything else that I have missed that you would like to contribute?	

Appendix IV: Interview consent form

Research Consent Form: *Interview*

Instructions

- Please read and complete this form carefully.
- If you are willing to participate in this study, put a tick (√) in an appropriate box.
- Sign and date the declaration at the end.

My name is Dalton Kisanga, and I am a PhD research student at the Nottingham Trent University in the United Kingdom. I am doing a research titled *"Investigation of attitudinal factors towards transition from face-to-face to e-learning in Tanzanian higher learning institutions: A mixed methods approach."*

The aim of this research is to investigate teachers' beliefs, understanding and attitudes towards e-learning; and factors that influence teachers' attitudes towards it. The identification of attitudes and their factors will help to plan and increase effectiveness of the adoption of e-learning in higher learning institutions by working out those factors which lead to negative attitudes and strengthening those which lead to positive attitudes. In addition, the study needs to identify strategies that can optimise involvement of teachers and students in e-learning and explore the barriers that can hinder the transition from face-to-face to e-learning.

S/N	Item	Yes	No
1	I have had the project explained to me, and I have read the explanatory statement.		
2	I understand that my participation is voluntarily. I may either refuse to answer question(s) and/or withdraw from this study at any time without having to give an explanation.		
3	I understand that the interview will involve audio recording and note taking and that will be used solely for the purpose of this study.		
4	I understand that all responses given by me will be made absolutely confidential, and will be used for the purpose of this study only and that I will not be named in any written work arising from this study.		
5	I understand that I will be given a transcript of data concerning me for my approval before it is included in the write up of the research.		
6	I understand that the researcher will be discussing the progress of this research with his supervisors at the Nottingham Trent University.		
7	The information I provide can be used in further research projects which have ethics approval as long as my name and contact information is removed before it is given to them.		
8	I understand that the interview will take 30 to 45 minutes		

I voluntarily give my consent to participate in this research and confirm to have a copy of this form for my own record.

……………………………… ………………………………

Signature *Date*

Appendix V: Field data

(a) Teachers' responses to questionnaire *(part)*

MAIN STUDY-DALTON 1- (Field Data-2012).sav

	id	ID_No	gender	qualfn	t_exp	comp_exp	comp_in_office	comp_in_offic e_internet	comp_at_home
1	I1.1	1	2	3	1	1	1	1	1
2	I1.2	2	1	2	1	1	1	1	1
3	I1.3	3	1	2	1	1	1	1	1
4	I1.4	4	1	4	4	1	1	1	1
5	I1.5	5	2	3	2	1	1	1	1
6	I1.6	6	1	4	3	1	1	1	1
7	I1.7	7	1	4	2	1	1	1	1
8	I1.8	8	1	3	4	1	1	1	1
9	I1.9	9	1	4	4	1	1	1	1
10	I1.10	10	1	3	1	1	1	1	1
11	I1.11	11	1	4	4	1	1	1	1
12	I1.12	12	1	3	2	1	1	1	2
13	I1.13	13	1	3	1	1	1	1	1
14	I1.14	14	2	2	1	1	1	1	1
15	I1.15	15	1	3	1	1	1	1	1
16	I1.16	16	1	2	1	1	1	1	1
17	I1.17	17	1	3	1	1	1	1	1
18	I1.18	18	2	4	2	1	1	1	1
19	I1.19	19	2	4	2	1	1	1	1
20	I1.20	20	1	4	4	1	1	1	1
21	I1.21	21	1	1	4	1	1	1	1
22	I1.22	22	1	3	1	1	1	2	1
23	I1.23	23	1	1	1	1	1	1	1
24	I1.24	24	1	2	4	1	1	1	1
25	I1.25	25	1	4	3		1	1	1
26	I1.26	26	2	3	4	1	1	1	1
27	I1.27	27	1	4	4	1	1	1	1
28	I1.28	28	1	2	2	1	1	1	1
29	I1.29	29	1	3	3	1	1	1	1
30	I1.30	30	1	3	4	1	1	1	1
31	I1.31	31	1	1	4	2	2	2	2
32	I1.32	32	1	4	3	1	1	1	2
33	I1.33	33	1	3	4	1	1	1	1
34	I1.34	34	1	3	4	1	1	1	1
35	I1.35	35	1	3	2	1	1	1	1
36	I1.36	36	1	1	1	1	1	1	2
37	I1.37	37	1	3	2	1	1	1	1
38	I1.38	38	1	4	2	1	1	1	1

10/23/13 4:14 PM 1/203

(b) Participants' responses to barriers of e-learning adoption in HLIs *(part)*

Extracts from all participants to the question: ***What are barriers that face Tanzanian higher learning institutions in adoption of e-learning?***

Respondent ID	Representative Quotations
1: Poor infrastructure: *(a) Inconsistent power supply (b) Poor Internet connectivity (c) Insufficient computer laboratories and computers*	
I1.20	"Initial investments to buy computers and establish reliable network connections together with purchase of bandwidth is another big barrier in expansion" *(Male, PhD,YoE: >15)* .
I1.41	"Infrastructure such as laboratories and electric power plus teaching gears such as computers and other supporting equipment" *(Male, HD, YoE:>15)* .
P1	"Example access to computer, challenges of power. Sometime these reasons can be used by those who are not in favour of using e-learning" *(Male,PhD, YoE: 33).*
P2	"We have sufficient computer labs for the students, technicians and staff members….However, we have the electricity problem and the Internet bandwidth is not enough. The existing bandwidth is only 256 kbps" *(Male, MSc, YoE: 10).*
P3	"Yah in terms of infrastructure there is more (pause).Even if today you have a national backbone covering up to village level, still it is not enough because one has to pay for the bandwidth within that national infrastructure, which is (aamm) too high to afford. That is one. But two, once you have that bandwidth then you need to pay for the content provider, that is the service providers (pause) and then there is an issue of electricity. I am not so sure of the exact figure but I am sure it is less than 15 percent of the country, which is on the (aamm) National Grid. So, that means more than 85 percent are not…." *(Male, PhD, YoE:16).*
P4	"We have no enough facilities . We have the problem of power and Insufficient Internet bandwidth. Currently we have 2mbps which is very small… " *(Male, PhD, YoE: 20).*
E1	"Hopefully, you will find that we don't have enough computers or the Internet is slow. So, normally it is one of the bigger ones I think it needs to be addressed. There is a problem of power too, and in most cases this problem helps to create the negative attitudes...because if you go and you get a group of lecturers together and you are positively talking about e-learning they will tell you… we don't know anytime from now electricity might be cut. So why do you want me to put in through that hassle of creating my content and putting it online if electricity is no good to move in anything...Thus, you find such mind-set helps to propel the whole negative" *(Female, MSc, YoE: 7).*
E3	"Talking of Tanzania we have problems on electricity and the Internet bandwidth...With our system which accommodates more than 6000 students you must have a very good infrastructure; in terms of the server, the application itself and the bandwidth" *(Male, BSc, YoE: 3).*
E5	"We don't have enough laboratories, computers, etc. Again electricity can be there but is not reliable [and] the network in other time can be slow *(Male, BSc, YoE: 8).*
E6	"the structures are not supportive for e-learning. Traditionally these institutions were meant to teach face-to-face, so much that people in the organizations are still more comfortable with the face-to-face, but the organizations themselves; infrastructure itself, the structures, the processes, the legal frameworks they are all up to supporting face-to-face application" *(Male, PhD, YoE: 16).*

2: Financial constraints: *(a) High cost of ICT equipment (b) Running cost of Internet services (c) Low budget allocation to public HLIs (d) Low economic status of students*	
I1.16	"Internet cost also is high to have realtime sessions" *(Male, BSc, YoE: 0-5)* .
I1.27	"Operating costs for Internet are on the high side to be afforded." *(Male, PhD, YoE:>15)* .
I4.232	"Cost for educating staff and buying tools for e-learning may hinder institution" *(Male, MSc, YoE: 11-16).*
I4.236	"...the second reason is high initial costs for installation of ICT related facilities and maintenance. The third reason is affordability of individuals to buy and maintain computers..." *(Male, MSc, YoE: >15).*
P3	"But the other one is the financial resources. Having e-learning fully adopted, it needs some preparations including the infrastructure for the example...". *(Male, PhD, YoE:16).*
E2	"Financial contstraints can also be a problem". *(Female, BSc, YoE: 3).*
E5	"There is lack of enough finance to facilitate this technology because all of these issues we have been talking about need financial support to implement". *(Male, BSc, YoE: 8).*
E6	"In my previous research I have never seen that money is a big problem but planning is a big problem. So for most of the time solutions are already there, but the thing is then how to get the solution and customize them in your environment". *(Male, PhD, YoE: 16).*
3: Lack of support: *(a) Lack of technical support (b) Lack of managerial support (c) Lack of government support*	
I1.37	"...but management or political issues might play part in hindering adoption" *(Male, MSc, YoE: 6-10*).
I1.43	"Low budget allocated by the government for that purpose" *(Male, MSc, YoE: 6-10).*
I4.213	"Lack of readiness of the top leadership in my institution to see e-learning is adopted" *(Female, MSc, YoE:>15).*
I4.238	"Lack of government support in providing e-learning materials" *(Male, BSc, YoE: 0-5)* .
P4	"Just my advice, may be it is not on your side, but the government should implement what it has planned (pause). You see...what I can say we are operating the institution with our own efforts...No [substantial] support from the government, just very little. You can imagine for the last two years we were getting one point something billion Tanzanian shillings while our real budget is 3.7 billion shillings... This is not enough because catering services (alone) cost us around 168 million shillings for every month and for 10 months, we need 1.68 billion shillings...and we are getting 1.07 or 1.1 billion shillings a year....This will be a challenge to e-learning, especially if we have no support from the government" *(Male, PhD, YoE: 20).*
E4	"Technical support is also a big problem...our centre supports around 10,000 students across the University. So it is very difficult to support them, while there are very few technical staff in the centre. Roughly, we are about 15. Again, if the management does not push or motivate teachers to use the systems then, it becomes very difficult" *(Male, BSc, YoE: 6).*
E5	"Thereis lack of enough experts to implement these technologies because as you know (pause) these technologies need good experts in animations , network and other technologies, which are embedded in e-learning" *(Male, BSc, YoE: 8).*

4: Lack of knowledge of e-learning to: *(a) Teachers (b) Students (c) Decision makers eg. Policy makers and Ministry of Education officials*	
I1.36	"Lack of knowledge among various lecturers about the use of e-learning and it's important impact on learning environment" *(Male, HD, YoE: 0-5)* .
I3.159	"Skills gap with some members of staff and hence, students are also a barrier" *(Male, BSc, YoE: 0-5)* .
I3.169	"Lack of computer knowledge to most instructors" *(Male, MSc, YoE: 0-5).*
I4.235	"[Lack of] awareness among stakeholders is a problem" *(Male, MSc, YoE: 0-5).*
P3	"Yes there are quite a lot. One of the challenges that is institutional, is an understanding of the term itself, e-learning." *(Male, PhD, YoE:16).*
P4	"...Most of the lecturers no matter whether they are PhD holders or whatever, but they are not computer literate. I mean (pause) what they know is just opening the lap tops or the computer and reading emails (pause) that is all" *(Male, PhD, YoE: 20).*
E1	"You will find that, some of the lecturers are reserved, probably they don't want to show that they don't know. As a lecturer you are a guru in your own field, and expose your weakness and show that you don't know ICT as much as the rest is a shame, so sometimes the reaction is just to ignore e-learning as if it is not an important aspect" *(Female, MSc, YoE: 7).*
E5	"The other challenge is the point of awareness in the HLIs. Most people are unaware of this mode of learning. So by (aamm) enabling Tanzanians to get awareness on this technology, (aamm) we can succeed in implementing it " *(Male, BSc, YoE: 8).*
5: Resistance to change: *(a) Techno-phobia (b) Poor mind-set (c) Old Age (d) Subject discipline (e) Extra load perception*	
I1.45	"Fear from adopting new technology (technophobia) and mind-set…people are used to traditional ways of learning since baby classes up to universities" *(Male, MSc, YoE: > 15).*
I3.158	"Attitude of some educationists to change from the current system" *(Male, BSc, YoE: 11-15)* .
I3.170	"…we need commited teachers and learners since e-learning needs people with a hardworking and self learning attitude" *(Male, BSc, YoE: 0-5).*
I3.194	"There are so many barriers in e-learning, but in my institution I think economic barrier is very high and willingness, that is acceptance of e-learning" *(Male, BSc, YoE: >15)* .
P1	"There are psychological problems. There are people who always say, well you know this is contrary to what we learnt in school, they were used to be taught in face-to-face mode (pause) Some may fear that they can be exposed when using out-of-date teaching notes.Others may feel well, I am too old for this, so I don't have time to learn new skills". *(Male,PhD, YoE: 33).*
P3	"Mind-set of instructors, students and the general public that you can still deliver the same quality of content by e-learning in absence of instructors. There is a cultural problem too...we are used traditionally to a face-to-face learning but now changing to e-learning is a problem ." *(Male, PhD, YoE:16).*
P4	"We have just installed SIMS in our institution whereby everything now people will be doing online...But people are so resistant and they are not ready for change. People of my age are too resistant to changes. They don't want to change at all." *(Male, PhD, YoE: 20).*
E1	"Some of them might just have a negative mind-set that they find e-learning as extra work. They will argue, *'as I already have enough on my workload, don't add unnecessary things* " *(Female, MSc, YoE: 7).*
E5	"we have experienced here at the University (aamm) teachers who are coming from Arts discipline… do not easily adopt this technology because they rely on conventional pedagogical face-to-face teaching [for example] Professors who have learnt in the previous ages…they say *"it is not necessary for me to know computers, only blackboard and chalk are enough to me to deliver materials."* You see…So this has come to be a challenge to our university community" *(Male, BSc, YoE: 8).*
E6	"… the more age advanced tutors will be more reluctant to go ICT. But again even in some fields…suppose…you'd imagine that somebody who is teaching Mathematics it will be difficult for him to just use MS Word or Excel or PowerPoint to be able to teach that or to be able to teach by Skype, or Videoconferencing,… but for me, for instance, when I want to teach Database, I create databases here. So it is easy for me to explain how database is…because it is already an ICT product. So field and age are quite some important aspects " *(Male, PhD, YoE: 16).*

NB: ***I1.1*** *to* ***I4.258*** *represent 258 teachers from Institutions 1 to 4;* ***P1*** *to* ***P4*** *represent Principals 1 to 4;* ***E1*** *to* ***E7*** *represent e-learning experts 1 to 7.*

(c) Interviewees' responses to strategies of e-learning adoption in HLIs *(part)*

Responses from the interviewees to the question: "*What strategies can be used to overcome barriers, which can hinder adoption of e-learning?"*

Respondent ID	Representative Quotations
1. Strategies related to infrastructure: *(a) Use of renewable energy (eg solar power) and electric generators (b) strengthening Internet bandwidth (c) use of intranet (d) extension of computer laboratories and equipment (e) Introduction of regional centres to increase education access*	
P1	"...with our infrastructure and problems of power…people are trying to look for renewable energies (solar) and you will find if you can (aamm) power your phone it should not be an issue to power your lap top. But, also taking into account that people are buying lot of expensive phones, so it is probably that they don't know the value of a laptop. But the fact is that now most of these gadgets …are multi-purpose…If you take Samsung Galaxy, or whatever, I mean, you have just about everything...however, we did put up a scheme, which allowed teachers to buy computers (or lap tops) for their own and pay in phases". *(Male,PhD, YoE: 33).*
P2	" To minimize this problem, we have enough generator service. On these generators we have one generator with capacity of 100kV, another one has 65kV and another two generators have 10kV each. So, we have in total 185kV generators services. Thus, we have uninterrupted electricity and so far we have no difficulties in electricity supply. Also we are trying to strengthen the Internet bandwidth from 256kbps up to 2mbps"*(Male, MSc, YoE: 10).*
P3	"Second, given the geographical set up of the country, the National backbone which has already started should also be extended to the district level, to the ward level and later to the village level. Now I cannot see the government being able to do that on its own, so may be(aamm) the interventional of the private sectors ... Once you have the National backbone then you can have now the feeder from the village, from the wards, from the townships, from institutions that are in those areas to be able to honest the full potential of the National infrastructure." *(Male, PhD, YoE:16).*
P4	"What we did is that, we signed a memorandum of understanding with VETA centres to use their regional centres and of course we were lucky that those four centres ... had the Internet . Second, recently we have started radio services at the university and we want to start a TV, yes, so we will be having this video conferencing and whatever in the very near future. So those are our strategies... Secondly, power is important because we are now looking for a possibility of buying a big generator and we also plan to have solar power systemand and finally, connectivity,currently, we have 2 Mbps which is very small…Actually, very soon we will be getting either 9 or 10 free Mbps from TTCL " *(Male, PhD, YoE: 20).*
E1	"... Students in remote areas do not have electricity and they don't have access to… computers per se. But as an institution we have organised various centres that can help such students and provided some centres with the laboratories. For the example, here instead of sending students materials on hard copies we use the CDs "*(Female, MSc, YoE: 7).*
E2	"...presence of Internet is not very much of a concern because you can develop a system as a local host….and normally we conduct on offline system. As a training person, you are one who has the network. So, you stay in front to tell them how to do it. They do it locally at the end of the day they take a backup on their flash (disks) and then they restore on online courses " *(Female, BSc, YoE: 3).*
E5	"There is an extension of laboratories and other equipment that can enable us eradicate these problems. For example, we have been provided an area for only technological field at Kijitonyama area. So by migrating from here to Kijitonyama we will get an enough area, laboratories and equipment, donated by the World Bank" *(Male, BSc, YoE: 8).*
E7	"About inadequate infrastructure... it depends with the institution some have decided to host outside to Western countries however you will then solve some of the problems that your LMS may be up all the time. But in our case we have tried to have a backup generator instead of relying on the national electrical power supply" *(Male, MSc, YoE: 10).*
2: Strategies to address financial constraints : *(a) Collaboration with private sectors and donor organizations (b) Government financial support*	
P1	"Well, I think…nature has always its own way of doing things. If you look at the costs of computers and lap tops have been going down (pause) ok, so that is one way…" *(Male,PhD, YoE: 33).*
P3	"I can suggest from two perspectives. One, it should be one of the priority at the National level. That means from the government perspective, they should be some budget for that. I know the budget is constrained always and always it will be anyway...But also the private-public partnership sort of. The government can put up policies that could create a conducive environment for private sectors to get involved and enhance e-learning "*(Male, PhD, YoE:16).*
E2	"... we must make sure that first of all there is a financial support. You can have like (pause) a kind of proposal that will assist to set financials. So if you know that you are being funded for certain kind of task, then to be on the safe side is to make sure that thing happened and that will facilitate the e-learning (pause), yes " *(Female, BSc, YoE: 3).*

3: Strategies to address lack of support : *(a) Staff training (short and long term) (b) Establishment of independent support unit*	
P2	"What I can tell you is when we introduce this e-learning it would be better to open a separate department (aamm) so that we can operate through that department successfully and minimize interruptions with the existing departments. So, that would be highly successful I think " *(Male, MSc, YoE: 10).*
E1	"...Without support from top management, you could be just a little section there trying to make a little business and getting nowhere…Another thing is, having a support unit…okay? If you have got a top management having the sight…the full sight of seeing that e-learning is a crucial and part of teaching and learning experience but you don't have support team to give the operational bit then, you end up with (pause), may be a failure again " *(Female, MSc, YoE: 7).*
E2	"Yeah, first of all you must have a good technical team (pause), like software developer or a person who is good to customize.The management should also get involved (pause). They should also be the first to wish having the e-learning system and prepare a strategic plan on which they have to accomplish. The strategic plan should show a need of computers and training how to support them, may be in phases. They need to start by the technical staff to make sure that the system is there and functions properly. After that…they can conduct training to staff and other users " *(Female, BSc, YoE: 3).*
E4	"Before we can establish something, we are trying to face some people whom we think they can assist to implement it. We tell them; just the same as if you want to do your research, you have to write a proposal and present...but for the technical support, first, we are trying to take technical people from other colleges or schools and they will be provided with special training in order to assist their colleagues in colleges or schools they are coming from " *(Male, BSc, YoE: 6).*
E7	"...We are taking people for studies. We are taking the technical staff, for instance, to short courses, multimedia productions, animation and whatever, but also we are taking some of the academic member of staff for instructional design courses and we have people who have done Master degree in Instructional Design so far and Multimedia Production. We are trying to fill the gaps like that " *(Male, MSc, YoE: 10).*
4. Strategies on awareness raising: *(a) Professional development trainings (b) Training through consultations*	
P1	"We had a programme which we called IT 'Fundis'. In the IT 'Fundis', we had elementary class on IT…for staff. We did it I think twice, but then we realised that, some of these aspects people can learn by themselves ".*(Male,PhD, YoE: 33).*
P2	"We give staff faculty different development programmes. Sometimes the programmes covers ICT related issues; example multimedia and internet services.These programmes are provided every month". *(Male, MSc, YoE: 10).*
P3	"We have an e-learning programme (aamm) but is not there yet due to the challenges I have been mentioning. When we talk of e-learning in that sense may be can be understood by some not all, but if you talk of e-learning in some other parts of the country…up country, is a white elephant! They cannot even conceive, because they don't have access to the Internet...therefore awareness should be instituted" .*(Male, PhD, YoE:16).*
P4	"We need to give them awareness and to keep on preaching, I say preaching because that is the only way you can make people believe that this thing is important. Giving them local awareness like what we are used to do does not help and you see the new generation will always look for money and not patriotism. Nevertheless we provide ICT courses conducted after the office hours that is after 3:30 pm...unfortunately very few attended". *(Male, PhD, YoE: 20).*
E1	"We do schedule training for lecturers and students now they have also started. But what we do is that we identify people from regional centres and then we conduct workshops … We give them basic training on how to upload the content to the system and how to navigate the LMS, principles on how to facilitate online activities and then we give them obviously an opportunity to go back home and implement what they have gone through in the workshop. Then we also… hold…another form of training through consultation (pause). So the team is involved with…physically visiting the lecturers and see how they could go through their courses... " *(Female, MSc, YoE: 7)*
E2	"For teachers, it is difficult unless there is some incentive…to support them and get something like a workshop. Like here we also do something like competition, and the winners are awarded. They do it and they like it. But incentives are what matters. So it is possible, we train them and at the same time, they develop their courses. Normally we do such kinds of training and workshops. Thus, when they get back, at least three quarters or 50 percent of their courses are developed " *(Female, BSc, YoE: 3)*
E3	"Most people have ICT skills. However, because we are more interested on the learning platform, what we do is that, we undertake sensitization training to instructors on the e-learning platform. First of all, before the new semester begins, for like two to three days we hold workshops and go through the platform with the instructors. They have to update their materials, dates, assignments and stuff like that... ". *(Male, BSc, YoE: 3)*

5. Strategies to address resistance to change: *(a) Authoritative policy (b) Educating teachers through trainings (c) Financial motivation to use e-learning in classrooms*	
P1	"One way is through policy of course. Policy in the sense that you just push people, you know, to deposit some of the stuff if you have a platform … in the Internet for students to be able to do it (pause). I mean we need at least to push people to be using the Internet. Say we are going to transmit all pieces of information through emails. So that means everybody must have an email address and everybody would be able to communicate through that (pause). So, I mean…putting policies in place, and requiring aspects that you can really monitor and follow-up ." *(Male,PhD, YoE: 33)* .
P3	"The issue of mind-set is easy if it is made a National agenda...we can start these from the grass root, meaning from the primary level of education, it is integrated into the curriculum so people could be trained that the learning is not only face-to-face, but could be via e-learning, so that one grows with that in mind ... if it starts from the primary level, secondary level, then by the time they reach the university level then they know that this is a way forward". *(Male, PhD, YoE:16).*
P4	"Computer literacy skills programmes were conducted, unfortunately very few attended. Then what I told them is that for any person who is going to be resistant I will make sure that he won't get monthly salary if he/she has not uploaded this semester results into the network. Next, I had to formulate a team, which assisted people how to enter data, how to upload and how to retrieve. For others it was a problem. But it was just a week ago when these things were possible. Otherwise, people were very resistant" *(Male, PhD, YoE: 20)* .
E5	"It is just educating them and convincing them through training, we just invite them in the training so that they learn…they learn and gradually they come to associate it with technology" *(Male, BSc, YoE: 8).*
E7	"What we did for our case for our distance courses we entered into agreement with teachers. First of all because the copyright issue says that if you are an employee whatever you produce belongs to your employer in your institution. But we said no, it won't go like that. Thus, we had a short contract and gave them some remunerations that you create your materials, of course it will belong to the university but, at least you shall be paid a token…So that has motivated some of them " *(Male, MSc, YoE: 10).*

Key Note: *P1 to P4 represent Principals 1 to 4 and E1 to E7 represent e-learning experts 1 to 7.*

Appendix VI: Principals' responses on whether or not they accept e-learning

Principals' responses to the question: "*If you were to give your opinion as a principal on whether to accept or reject the adoption of e-learning in your institution, what will be your stand and why?*"

Respondent ID	Representative Quotations
P1	"That is just as good as asking, is electronic media necessary? I mean that has become part of life. So, I don't know really if there is a question whether it is necessary or not. E-learning is inevitable. I mean, you may dislike it but that does not make it unnecessary. You see, just as much as smart phone has become normal way of life, just as much as a computer has become a necessity in life, there is no way you can run away from whatever modality of e-learning." *(Male, PhD, YoE: 33)*
P2	"Will accept and we have initiated it through guest lecture programmes to our students through video conferencing…our students can attend and listen through virtual classrooms and the same technology we can move to the next level of introducing e-learning. So actually we have a plan to introduce it though it will take time to implement with proper training, planning and infrastructure." *(Male, MSc, YoE: 10)* .
P3	"I will fully go for adopting e-learning in our environment (aaam) given the rate of admission of students into our institution but also to other learning institutions. Only that, there should be some infrastructure to support e-learning and the preparations in terms of skills and knowledge as well as cultural change have to be in place first before the adoption of e-learning. Else you will have e-learning without proper preparations and then its adoption might be at stake.. ". *(Male, PhD, YoE:16).*
P4	"Of course I will accept right away, yah because of the factors which I have just said. You see, we have the target in our institution which is to reach 15,000 students by the year 2025, yah. The first target was to reach 3000 students by the year 2015 and currently I am happy that to-date we have already enrol 3,149 students. The point is that we are increasing students' enrolment without increasing the infrastructure, yah. So, our strategy now is to go e-learning." *(Male, PhD, YoE: 20).*

Key Note: *P1 to P4 represent Principals 1 to 4.*

Appendix VII: Ethical clearance letter

NOTTINGHAM
TRENT UNIVERSITY

Dalton Kisanga
58 Foxearth Avenue
Clifton
Nottingham
NG11 8JQ

Melanie Bentham-Hill
Research Office Team Leader/JICEC Committee Officer
Nottingham Trent University
Art & Design and Built Environment/Arts and Science
Burton Street
Nottingham NG1 4BU
Tel: +44 (0)115 848 2177
Fax: +44 (0)115 848 2096
Email: melanie.bentham-hill@ntu.ac.uk

16 May 2012

Dear Dalton

I am writing to confirm that your ethical clearance checklist was seen by Professor Michael White, chair for the Joint Inter-College Ethics Committee (JICEC) in Art & Design and Built Environment/Arts and Science on 16 April 2012, and was signed off clear on that same day.

If you have any further queries regarding the JICEC, it's methods and procedures, then please do not hesitate to contact me.

Yours sincerely

M Bentham

Melanie Bentham-Hill
Research Office Team Leader

Nottingham Trent University
Burton Street, Nottingham NG1 4BU
Tel. +44 (0)115 941 8418 www.ntu.ac.uk

Appendix VIII: Research approval letter from NTU

NOTTINGHAM
TRENT UNIVERSITY

To whom it may concern.

Rebecca Palfrey
Nottingham Trent University Graduate School
CELS Building
Clifton Lane
Nottingham
NG11 8NS

Tel: +44 (0)115 848 6321
Fax: +44 (0)115 848 6339
Email: rebecca.palfrey@ntu.ac.uk

29 June 2012

Dear Sir or Madam

<u>Re: Mr Dalton Kisanga (DOB 31.07.1965)</u>

This letter is to confirm that Mr Dalton Kisanga is registered as a full-time PhD Research Student in the School of Education at Nottingham Trent University. His supervisory team consists of Professor Gren Ireson, Mrs Stevie Vanhegan and Dr Ruth Richards from the School of Education. Mr Kisanga started his studies on 3 October 2011 and is expected to submit a completed thesis no later than 2 October 2015, which is the maximum time of 4 years allowed for full-time study as stipulated in the University Research Degree Regulations.

As part of his research into E-Learning in Tanzanian Higher Learning Institutions, Mr Kisanga requires to carry out some fieldwork in Tanzania between the dates of 27 August 2012 and 27 February 2013. Nottingham Trent University would like to express their gratitude and appreciation to you for accommodating his research.

If you have any further queries please do not hesitate to contact me.

Yours faithfully

R Palfrey

Rebecca Palfrey

Nottingham Trent University Graduate School
Nottingham Trent University
Clifton Lane
Nottingham
NG11 8NS

Appendix IX: Research approval letter from NACTE

Tel: 255-22-2780077 / 2780312
Fax: 255-22-2780060
E-Mail: info@nacte.go.tz
Website: www.nacte.go.tz

Plot No. 719/1/4,
Mikocheni Light Industrial Area,
P. O. Box 7109,
Dar-es-Salaam,
Tanzania.

NACTE

The National Council for Technical Education

Our Ref: NACTE/AA/310/714/Vol. I/41

Date: 22nd August 2012

Your Ref:

The Principal,
Dar Es Salaam Institute of Technology (DIT),
P. O. Box 2958,
DAR ES SALAAM.

Dear Sir,

RE: MR. DALTON KISANGA

Please refer the above subject matter.

This letter is to confirm that Mr. Dalton Kisanga is an assistant lecturer at Dar Es Salaam Institute of Technology (DIT) and currently registered as a full-time PhD Research Student in the School of Education at Nottingham Trent University. As part of his research into E-Learning in Tanzania Higher Learning Institutions he requires to carry out some field work in Tanzania.

Your Institution is among the identified institutions for this purpose and Mr. Kisanga will visit your institution between 27th August 2012 and 27th February 2013. Your cooperation in accomplishing his objective will be highly appreciated.

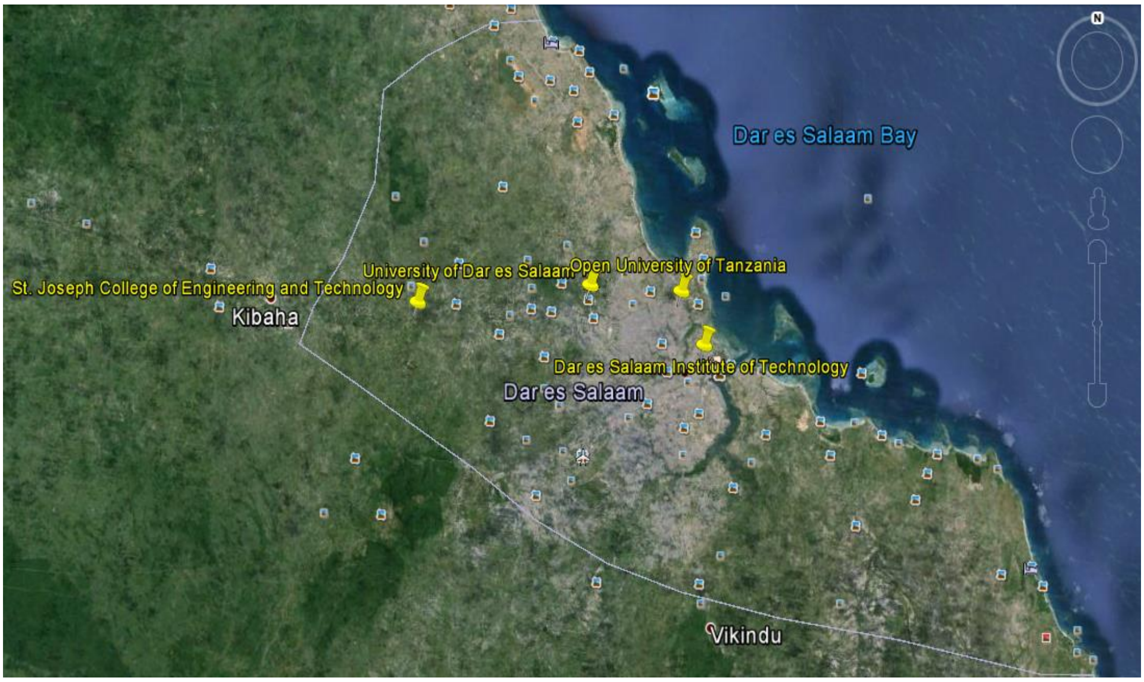
If you have any further queries please do not hesitate to contact the undersigned.

Thank you for your cooperation.

Yours faithfully,

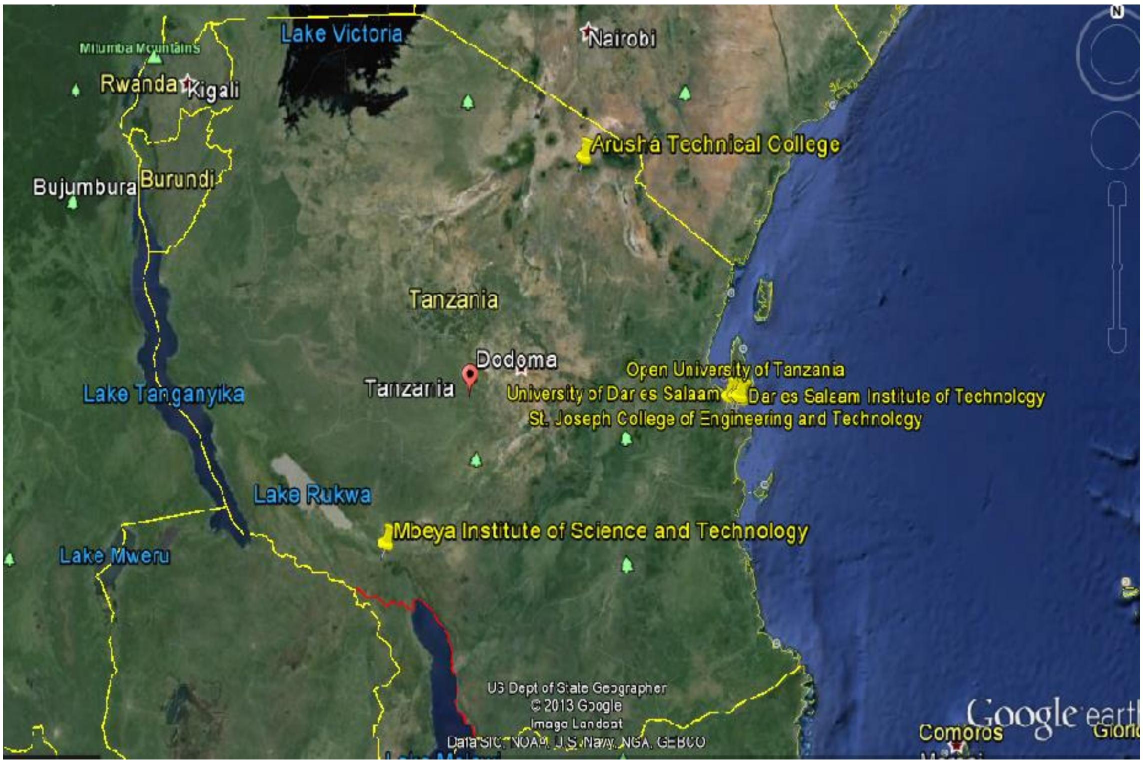
G. Modu
FOR: EXECUTIVE SECRETARY

Appendix Xa: Research sites in Dar es Salaam region



(Source: Google Earth-06/08/2012)

Appendix Xb: Research sites country wise



(Source: Google Earth-06/08/2012)

Appendix XI: Fraser's (1981) Test of Science Related Attitudes (TOSRA) scale

Test of Science Related Attitudes (TOSRA)

(Fraser, 1981)

Directions:

1. This test contains a number of statements about science. You will be asked what you think about these statements. There are no "right" or "wrong" answers. Your opinion is what is wanted.

2. For each statement, draw a circle around the specific numeric value corresponding to how you feel about each statement. **Please circle only ONE value per statement.**

5 = Strongly Agree (SA)
4 = Agree (A)
3 = Uncertain (U)
2 = Disagree (D)
1 = Strongly Disagree (SD)

Statement	SA	A	U	D	SD
1. Money spent on science is well worth spending.	5	4	3	2	1
2. Scientists usually like to go to their laboratories when they have a day off.	5	4	3	2	1
3. I would prefer to find out why something happens by doing an experiment than be being told.	5	4	3	2	1
4. I enjoy reading about things that disagree with my previous ideas.	5	4	3	2	1
5. Science lessons are fun.	5	4	3	2	1
6. I would like to belong to a science club.	5	4	3	2	1
7. I would dislike being a scientist after I leave school.	5	4	3	2	1
8. Science is man's worst enemy.	5	4	3	2	1
9. Scientists are about as fit and healthy as other people.	5	4	3	2	1
10. Doing experiments is not as good as finding out information from teachers.	5	4	3	2	1
11. I dislike repeating experiments to check that I get the same results.	5	4	3	2	1
12. I dislike science lessons.	5	4	3	2	1
13. I get bored when watching science programs on TV at home.	5	4	3	2	1
14. When I leave school, I would like to work with people who make discoveries in science.	5	4	3	2	1
15. Public money spent on science in the last few years has been used widely.	5	4	3	2	1
16. Scientists do not have enough time to spend with their families.	5	4	3	2	1
17. I would prefer to do experiments rather than to read about them.	5	4	3	2	1
18. I am curious about the world in which we live.	5	4	3	2	1
19. School should have more science lessons each week.	5	4	3	2	1
20. I would like to be given a science book or a piece of science equipment as a present.	5	4	3	2	1
21. I would dislike a job in a science laboratory after I leave school.	5	4	3	2	1
22. Scientific discoveries are doing more harm than good.	5	4	3	2	1
23. Scientists like sports as much as other people do.	5	4	3	2	1
24. I would rather agree with other people than do an experiment to find out for myself.	5	4	3	2	1
25. Finding out about new things is unimportant.	5	4	3	2	1
26. Science lessons bore me.	5	4	3	2	1
27. I dislike reading books about science during my holidays.	5	4	3	2	1
28. Working in a science laboratory would be an interesting way to earn a living.	5	4	3	2	1
29. The government should spend more money on scientific research.	5	4	3	2	1
30. Scientists are less friendly than other people.	5	4	3	2	1

Statement	SA	A	U	D	SD
31. I would prefer to do my own experiments than to find out information from a teacher.	5	4	3	2	1
32. I like to listen to people whose opinions are different from mine.	5	4	3	2	1
33. Science is one of the most interesting school subjects.	5	4	3	2	1
34. I would like to do science experiments at home.	5	4	3	2	1
35. A career in science would be dull and boring.	5	4	3	2	1
36. Too many laboratories are being built at the expense of the rest of education.	5	4	3	2	1
37. Scientists can have a normal family life.	5	4	3	2	1
38. I would rather find out things by asking an expert than by doing an experiment.	5	4	3	2	1
39. I find it boring to hear about new ideas.	5	4	3	2	1
40. Science lessons are a waste of time.	5	4	3	2	1
41. Talking to my friends about science after school would be boring.	5	4	3	2	1
42. I would like to teach science when I leave school.	5	4	3	2	1
43. Science helps to make life better.	5	4	3	2	1
44. Scientists do not care about their working conditions.	5	4	3	2	1
45. I would rather solve a problem by doing an experiment than be told the answer.	5	4	3	2	1
46. In science experiments, I like to use new methods which I have not used before.	5	4	3	2	1
47. I really enjoy going to science lessons.	5	4	3	2	1
48. I would enjoy having a job in a science laboratory during my school holidays.	5	4	3	2	1
49. A job as a scientist would be boring.	5	4	3	2	1
50. This country is spending too much money on science.	5	4	3	2	1
51. Scientists are just as interested in art and music as other people are.	5	4	3	2	1
52. It is better to ask a teacher the answer than to find it out by doing experiments.	5	4	3	2	1
53. I am unwilling to change my ideas when evidence shows that the ideas are poor.	5	4	3	2	1
54. The material covered in science lessons is uninteresting.	5	4	3	2	1
55. Listening to talk about science on the radio would be boring.	5	4	3	2	1
56. A job as a scientist would be interesting.	5	4	3	2	1
57. Science can help to make the world a better place in the future.	5	4	3	2	1
58. Few scientists are happily married.	5	4	3	2	1
59. I would prefer to do an experiment on a topic than to read about it in science magazines.	5	4	3	2	1
60. In science experiments, I report unexpected results as well as expected ones.	5	4	3	2	1
61. I look forward to science lessons.	5	4	3	2	1
62. I would enjoy visiting a science museum on the weekend.	5	4	3	2	1
63. I would dislike becoming a scientist because it needs too much education.	5	4	3	2	1
64. Money used on scientific projects is wasted.	5	4	3	2	1
65. If you met a scientist, he/she would probably look like anyone else you might meet.	5	4	3	2	1
66. It is better to be told scientific facts than to find them out from experiments.	5	4	3	2	1
67. I dislike other peoples' opinions.	5	4	3	2	1
68. I would enjoy school more if there were no science lessons.	5	4	3	2	1
69. I dislike reading newspaper articles about science.	5	4	3	2	1
70. I would like to be a scientist when I leave school.	5	4	3	2	1