A blended learning framework based on collaborative web technologies in Tanzanian Higher Education institutions

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Abstract

The research aimed to design a Blended Learning Framework (BLF) which is supported with Collaborative Web Technologies (CWTs) for Tanzanian Higher Education Institutions (HEIs). The designed and validated BLF serves as guidelines to the Blended Learning practices in higher education in Tanzania. Typically, Blended Learning is a combination of face-to-face and online instructional models. From the extant literature reviewed, there is no evidence of a BLF that is suitable for the Tanzanian HEIs. To achieve the main aim, five research objectives were developed: (a) review the literature to identify appropriate CWTs which can support BL environment for enhanced learning and teaching in Tanzanian HEIs; (b) assess the usage patterns of the CWTs in Tanzanian HEIs; (c) assess the available ICT infrastructure that can support BL with CWTs in Tanzanian HEIs; (d) design a BLF that supports CWTs for HEIs in Tanzania and (e) apply (evaluate) the BLF to three modules in one of the HEIs in Tanzania.

The selected Six HEIs in Tanzania informed the design, validation and testing of the framework. The New Blended Learning Framework was tested using three modules from one of the six institutions. We present results which show that our new Blended Learning Framework promoted increased interactions between students and lecturers. The results also show that the framework enhanced and promoted the active participation of the students in their learning process. Three modules each had a higher average module mark than the previous year when the BLF was not used. One of the modules had a 9% module average increase over that of the previous year. The research has three main contributions: firstly, a New BLF supported with CWTs was designed for Tanzanian HEIs; secondly, the New Blended Learning Framework has shown to enhance interactions between students and lecturers and thirdly, the New Blended Learning Framework has shown to promote active participation of students in their leaning process. Other contributions include the establishment of the current available ICT Infrastructure in Tanzania for supporting BLF based on CWTs and the current usage patterns of the CWTs in Tanzanian HEIs.

Author's Declaration

I declare that this thesis is my own work and all the written work is my own, except where stated and referenced otherwise. This work has not been accepted or submitted for any comparable award elsewhere. I hereby give my consent for my thesis to be available for photocopying and for inter-library loan and for the title and summary to be made available to outside organizations.

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List of Abbreviations and Acronyms

Abbreviation	Meaning
3D	A three-dimensional
BL	Blended Learning
BLF	Blended Learning Framework
CD-ROM	Compact Disc Read-Only Memory
CERN	Conseil Européen pour la Recherche Nucléaire
CWTs	Collaborative Web Technologies
DfES	Department for Education Services
DTPB	Decomposed Theory of Planned Behaviour
DVD	Digital Video Disc
EHEA	European Higher Education Area
E-Learning	Electronic Learning
ELT	Experiential Learning Theory
e-Moderation	Electronic Moderation
FAQs	Frequently Asked Questions
HEIs	Higher Education Institutions
HTML	Hypertext Mark-Up Language
HTTP	Hypertext Transfer Protocol
IAA	Institute of Accountancy Arusha
ICT	Information and Communication Technology
IFM	Institute of Finance Management
IP	Internet Protocol
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
kWh	kilowatt-hour
LAN	Local Area Network
LMS	Learning Management Systems
MM	Mixed Methods
MMR	Mixed Methods Research
NACTE	National Council for Technical Education

Abbreviation	Meaning
NHS	National Health Services
OUT	Open University of Tanzania
PC	Personal Computer
PhD	Philosophiæ Doctor
RDF	Resource Description Framework
RSS	Really Simple Syndication
SAUT	St. Augustine the University of Tanzania
SIM	Subscriber Identity Module
SM	Social Media
SPSS	Statistical Package for the Social Sciences
TAM	Technological Acceptance Model
TCP	Transmission Control Protocol
TCU	Tanzania Commission for Universities
TIA	Tanzania Institute of Accountancy
TTCL	Tanzania Telecommunications Co. Ltd
TV	Television
UDSM	University of Dar es Salaam
UK	United Kingdom
UNISA	University of South Africa
URI	Universal Resource Identifier
URT	United Republic of Tanzania
W3C	The World Wide Web Consortium
WAN	Wide Area Network
Wi-Fi	Wireless Fidelity
WOL	Web Ontology Language
WWW	World Wide Web
WWWW	World Wide Web Worm
XML	Extensible Mark-Up Language

DEDICATION

I dedicate this thesis to my parents – father Marco Bahaye Pima and mother Maria Bugumba Budeba for their unconditional love and prayers.

CHAPTER ONE

1.0 INTRODUCTION

Blended Learning (BL) has become a widespread practice in Higher Education due to the advancement of web technologies (Graham, Woodfield and Harrison 2013). BL means the mix between face-to-face encounters and online instructional models (Chew 2009, Abdelaziz *et al.* 2011, Graham, Woodfield and Harrison 2013, and Pima *et al. 2016*). Given the current trends and use, BL must be guided by models and frameworks which are general and specific to the intended Higher Education contexts (Garrison and Vaughan 2008, Georgouli, Skalkidis and Guerreiro 2008, Bower, Hedberg and Kuswara 2010, and Mirriahi, Alonzo and Fox 2015). In addition, a framework or model for BL must be relevant and suitable to a target context (Samover, Porter and McDaniel 2009). However, the review of the extant literature shows that the existing BL models and frameworks are not suitable for use in Tanzanian Higher Education Institutions (HEIs). Furthermore, the review showed that, little research has been done in the design and validation of Blended Learning Framework (BLF) for use in Tanzanian HEIs. Consequently, this lack of a suitable framework leads to challenges in the teaching and learning process when using BL in Tanzanian HEIs. In response to the challenges, a New BLF, supported with, Collaborative Web Technologies (CWTs) was sought, designed, validated and tested by applying it to three modules in a Tanzanian HEI. On the other hand, CWTs are the web tools which enable collaborative tasks by more than one user synchronously or asynchronously (Rosbotom and Lecarpentier 2010). In view of the current discussion, both students and lecturers use CWTs in HEIs in Tanzania and globally (Ajjan and Hartshorne 2008, Bennett *et al*. 2012, Graham, Woodfield and Harrison 2013, Pima *et al*. 2016).

This chapter is organised into six sections. Section 1.1 provides the problem statement highlighting relevant scientific issues leading to the current study. Section 1.2 discusses the research context, which is the Higher Education in

Tanzania. It also provides a justification why the problem is of interest and discusses the uniqueness of the Tanzanian HEIs context. Section 1.3 provides the research aim, objectives and the research questions of the study. The research contributions are summarised in section 1.4. Section 1.5 discusses the scope and limitations of the research. Section 1.6 states the structure of this thesis.

1.1 Problem Statement

In Higher Education, the use of CWTs has become a frequent practice (Bennett *et al.* 2012, Halverson *et al.* 2014, Pima *et al*. 2018). This is due to the web revolution in 1990s (Berners-Lee *et al.* 1992) which has changed the way people create, process, and share information (Chua 2013, and Balubaid 2013). That is, the use of the CWTs such as social media, the wikis, blogs and podcasts (Doolan 2006, O'Bannon *et al.* 2011, Balubaid 2013, Özdemir and Aydın 2015) has become common amongst students and their lecturers. Consequently, the BL (Bai and Smith 2010) has increasingly become a widespread practice (Graham, Woodfield and Harrison 2013) in HEIs. However, the use of BL in higher education needs a guiding framework. A New BLF could ensure quality consistency, best practice and enhance teaching and learning experiences. Even though both students and lecturers in Tanzanian HEIs use CWTs, there is no evidence, whatsoever, that shows the availability of any framework to guide the use of BL (Lwoga 2012, Mtebe and Raphael 2013, Pima *et al.* 2016, and Pima *et al.* 2018).

The scope and meaning of BL is debatable and scholars such as Chew, Turner and Jones (2009) and Littlejohn and Pegler (2007) believe that the BL is growing too fast. The extant literature reviewed shows the thematic trends presented in table 1.1 (Pima *et al*. 2018). The trend in BL themes include (in the order high-low) BL instructional design (Graham, Woodfield and Harrison 2013), BL disposition (Halverson *et al.* 2014), BL exploration (Iqbal *et al.* 2011), BL learners' outcomes (Krug, Roberts-Pittman and Balch 2011), comparison between face-to-face and

online learning (Francescato *et al.* 2006), BL technologies (Ooms *et al.* 2008), BL interactions (Pianta *et al.* 2012) and BL professional development (Brook and Lock 2012). However, there is little efforts by researchers on the design and validation of BL frameworks for Higher Education (Chew, 2009, Graham, Woodfield and Harrison 2013, Bennett *et al.* 2012, Pima *et al*. 2018).

While the extant reviewed literature shows increased adoption of BL in Tanzanian HEIs (Lwoga 2012, Mtebe 2013, Pima *et al.* 2016 and Pima *et al.* 2018), on the other hand, the use of BL in HEIs in Tanzania is more a personal motivation than institutional or departmental motivation. Consequently, the likelihood to lower the quality of teaching and learning becomes clear, unless the framework is made available to give guidance. In other, words, the use of CWTs is high among students and lecturers in HEIs in Tanzania. For instance, in a recent study by Pima *et al.* (2016) it was revealed that the use of mobile devices by HEIs students and lecturers had increased in Tanzania. In their study, Pima *et al.* (2016) revealed further that there is a strong and fast-growing ICT infrastructure in HEIs in Tanzania to support the use of CWTs in a BL environment. However, there is no evidence of any existing guidelines on how to use CWTs and how to mix face-to-face and online instructional models. Therefore, a BL Framework for using CWTs in HEIs is needed at least in Tanzania (Sharpe *et al.* 2006, Sife, Lwoga and Sanga 2007, Chew 2009, Davidson 2011, Baxter *et al.* 2011, Mirriahi *et al.* 2015 and Pima *et al.* 2018).

1.2 Higher Education in Tanzania

The United Republic of Tanzania (URT) is the largest East African country covering 947,303 km2 of land (see **Appendix I**) with a population of 44.9 million people as per the 2012 national census (NBS 2015). The second largest is Kenya with 581,309 km2 of land, and third is Uganda with 241,038 km2 of land. The other east African countries include Rwanda and Burundi. In the URT, higher education

includes all post-advanced level secondary education leading to the award of an ordinary diploma or a professional level I certificate and above (TCU 2012). The Tanzanian University Qualifications Framework 2012 (UQF) classified non-higher education awards as ranging from certificate of primary education to advanced certificate of secondary education and technical certificate at national technical awards (NTA) level 5 (TCU 2012). Thus, higher education consists of universities, university colleges and non-university institutions such as institutes and colleges (TCU 2012) and (MSTHE 1999).

By June 2015, the URT had 37 full-fledged universities, 15 university colleges (TCU 2015) and 343 colleges and institutions – under the category of non-university higher education institutions (NACTE 2015). All universities and university colleges are under the jurisdiction of the Tanzanian Commission for Universities (TCU) while all non-university higher education institutions are under the jurisdiction of the National Accreditation Council for Technical Education (NACTE). Moreover, recently, the TCU and NACTE became the coordinators of admissions in Higher Education through two separate Central Admissions Systems. For example, TCU deals with admission to various degree programmes while NACTE deals with admissions to technical diploma and certificate programmes (UNESCO 2011). Both NACTE and TCU are responsible for regulatory, quality assurance and advisory functions (NACTE 2015). All higher education students from the bachelor's degree level to postgraduate programmes are eligible to access the Student's Loan facilities (HESLB 2015). Face-to-face instructional model is a common practice among Tanzania HEIs.

The online facilities include the Learning Management Systems, online databases, e-learning systems (Chan 2007 and Abdelaziz *et al.* 2011) and PowerPoint projection devices (Komba 2009, Mwasha and Pima 2011, Lwoga 2012, and Mtebe 2015). However, the use of online facilities depend on the available ICT infrastructure.

The uniqueness of the Tanzanian ICT infrastructure in HEIs could be in the following main areas: the level of ICT advancement in the country, investment projects in ICT, access level of individual students and lecturers to affordable internet, power supply and computer literacy (Lwoga 2012, and Mtebe and Raphael 2013). Equally important, based on experiences in the ICT Infrastructure Management, the five factors mentioned above, give a justifiable possibility to uniquely distinguish the ICT infrastructure in HEIs in Tanzania and those in other countries (Omollo 2011).

For example, the emerging technologies have raised the internet penetration rate from 11.50% in 2011 to 14.50% in 2016 (Internet World Stats 2017) as shown in table 1.1. In the education sector, pupil's enrolment has also increased. In Tanzania, for example, primary school enrolment rose to 69% in 2016. In 2015, the enrolment had risen to 95% after the removal of fees in the primary school education. Understanderbly, this was one of the highest enrolments in Africa (Wainaina *et al*. 2014: 127, Lancaster 2015). In higher education, the enrolment increased from below 150,000 students in 2010/11 to 278,931 in 2011/12 and 279,564 in 2012/13 respectively (MoE 2016).

Table 1.1 Tanzanian Internet usage and population growth

YEAR	Users	Population	% Pen.	Source
2000	50,000	14,712,000	0.30%	ITU
2002	500,000	13,874,610	3.60%	ITU
2005	820,000	12,247,589	6.70%	ITU
2009	520,000	41,048,532	1.30%	ITU
2011	4,932,535	42,746,620	11.50%	ITU
2016	7,590,794	52,482,726	14.50%	ITU

Source: Internet World Stats 2017

Nevertheless, internet in Tanzania is expensive although lecturers can afford to access it more than their students. In HEIs, internet bandwidth is limited to the individual/institutional purchasing power. For example, the researcher's observation at the Institute of Accountancy Arusha, showed that 3,000 internet users (staff and students) used only 8mbps in 2015. Although this was regarded as a significant improvement from 4mbps in 2013, the bandwith was insuffient to support the users' need in the campus. Low bandwidth could limit users to upload and download video and rich multimedia contents. Low bandwidth may also result into negative feeling and attitude.

There is a limited power supply in Tanzania which is characterised by frequent and unplanned power outages (Kamagi 2015). As a result, HEIs use power generators to run their services during the power outages. Consequently, the running cost becomes very high and the class sessions and study times are affected too. Additionally, unplanned power outages damage the ICT devices and equipment as well as the information systems. The e-learning systems (Chan 2007) and other management information systems could be unavailable and unrealiable causing complaints from students and lecturers (Abdelaziz *et al.* 2011). However, there are ongoing projects which aim to strengthen power supply in Tanzania (Kamagi 2015).

Another unique feature of Tanzanian ICT environment in HEIs is the services provided by the IT Services departments. The available systems are outdated such that they are no longer supported by vendors. For example, until 2015, there were a few HEIs that were using Windows XP which was no longer supported by Microsoft. Additionally, the staff and students' portal in most of the HEIs are hardly accessible through smart phones (Pima *et al.* 2016). The audio-visual units are supplied with PowerPointing devices and laptops. Moreover, computer illiteracy among the students is prevalent. This is due to the fact that majority of the students access the computer and smart phones for the first time when they enrol into a university. Consequently, HEIs provide orientation to the new students to use the ICT services.

Despite the increased enrolment, there are challenges which require strategies for tackling them. These challenges are associated with an increase in students' enrolment. In general, the challenges include insuffient teaching and learning resources in higher education, high cost of higher education, low ratio of lecturers to students, increased demand to use emerging technologies and increased demand for enrolment (Wainaina *et al*. 2014).

Markedly, the primary objective of the Tanzanian higher education is to impart and promote high levels of learning, scientific and technological knowledge and develop abilities of research. It is also responsible for professional training and research and consultancy activities (tzonline 2010). In the same manner, HEIs are responsible for preparing graduates to deal with the national development challenges.

In this regard, the use of emerging web technologies is important to meet the above objectives (Rohani and Yazdani 2012, and Cassidy *et al.* 2014). Notably, Tanzania aims at attaining creativity, innovation and high level of quality education to meet developmental challenges and compete regionally and internationally (URT 2010). One of the strategies to address the challenges and attain the national education objectives could be to embrace technologies for enhanced learning and teaching (Rosbottom 2010, and Rohani and Yazdani 2012). The strategy could be to use the emerging collaborative web technologies (Rohani and Yazdani 2012, Cassidy *et al.* 2014) in a BL environment. However, such use requires a contextually designed BL framework (Samover, Porter and McDaniel 2009). Given the importance of a BL framework and ICT infrastructure in learning and teaching process, several studies have investigated and shown enough evidence that there is a strong and fast-growing ICT infrastructure in HEIs in Tanzania to support the use of the CWTs in a BL environment (Lwoga 2012, Mtebe 2013, and Pima *et al.* 2016).

1.3 Research Aim, Questions and Objectives

1.3.1 Research Aim

This study aimed to design a BL Framework based on the use of CWTs in order to enhance learning and teaching in HEIs in Tanzania. The researcher had access to these institutions for the purposes of design, implementation and validation of the proposed new BL Framework for CWTs.

1.3.2 Objectives

In order to meet the main aim in 1.3.1, five research objectives were formulated and met:

a) Review the literature to identify appropriate CWTs which can support BL environment for enhanced learning and teaching in Tanzanian HEIs.
b) Assess the usage patterns of the CWTs in Tanzanian HEIs.
c) Assess the available ICT infrastructure that can support BL with CWTs in Tanzanian HEIs.
d) Design a BLF that supports CWTs for HEIs in Tanzania.
e) Apply the designed BLF to three modules in one of the HEIs in Tanzania.

1.3.3 Research Questions

The following research questions were developed to meet the research objectives in 1.3.2 above.

a) Research Question 1 (RQ1): What are the appropriate CWTs capable of supporting BL environment for enhanced learning and teaching in higher education?
    i. RQ1a: What CWTs can support BL environment for enhanced learning and teaching?

ii. RQ1b: How can the CWTs support the BL environment for enhanced learning and teaching?
iii. RQ1c: What is the adoption rate of BL in Higher Education in developed and developing countries?

b) Research Question 2 (RQ2): What are the common essential usage patterns of the CWTs in Tanzanian HEIs?
   i. RQ2a: Are there any distinct themes emerging from CWTs usage patterns in Tanzanian HEIs?
   ii. Are there any significant differences in dispositions and attitudes on how they use CWTs in learning and teaching in Tanzanian higher education?

c) Research Question 3 (RQ3): Is there an ICT infrastructure that can support BL with CWTs in Tanzanian HEIs?
   i. RQ3a: What is the available ICT infrastructure for CWTs in Blended Learning environment in Tanzania?
   ii. RQ3b: What is the capability of the available ICT infrastructure in HEIs in supporting the use of CWTs in a BL environment?

d) Research Question 4 (RQ4): What is the appropriate BL Framework that can support CWTs to enhance learning and teaching in Tanzania context?

e) Research Question 5 (RQ5): What are the practical implications and views on the proposed BL Framework?
   i. RQ5a: What are the practical implications of the proposed BL Framework in HEIs in Tanzania?
   ii. RQ5b: What are the students' and lecturers' views of the New BL Framework?

1.4 Research Contribution

A summary of the research contributions is provided below, and further discussion is provided in section 8.4 of the thesis.

1.4.1 A New BL Framework based on CWTs

A New BL Framework that uses the CWTs in HEIs was designed, validated and applied to three modules at a Tanzanian Higher Education Institution. The results of the application of the new BL Framework appear to suggest that it enhanced learning and teaching. The BL Framework provides guidelines on what, when, who and how to use the CWTs in a BL environment for enhanced learning and teaching in Tanzanian HEIs.

1.4.2 Other Research Contributions

The current state of the art of the available ICT infrastructure in Tanzanian HEIs was established. And finally, the usage patterns of the CWTs characterising the Tanzanian HEIs was determined as well.

1.5 Research Scope and Limitations

The research used both primary and secondary data as shown in table 3.3. The primary data were collected from four participant groups of lecturers, students, the ICT staff, Administrative and Quality Assurance staff. All the participants were chosen based on their roles in the learning process to give opinions on how the BL framework should be designed, validated and tested. The four groups took part in a survey in which questionnaires and interviews were administered at six HEIs in Tanzania. The four groups also took part in focus group meetings and in the validation process of the BL Framework. To meet the timescale and to ensure

more detailed data are collected, a case study was designed at the Institute of Accountancy Arusha, in Tanzania. A case study enabled the collection of data for the design of the BL Framework and its application. Additionally, the presence of all participants at one place, made it easy to collect data needed within the time limit of the research.

The secondary data were collected from institutional documents such as publications, annual reports, and case studies as shown in table 3.3.

Although the BL Framework is intended for use at HEIs in Tanzania and any HEIs with similar context, it is outside the scope of this research to explicitly test and refine it to suit all the needs at each HEI in Tanzania. Consequently, IAA was chosen as a case study to test the BL Framework since the researcher was an employee and had received sponsorship from IAA. During the data collection, the audio and video data were not collected to allow more freedom of participants to express their opinions. Instead, the key points were noted and recorded accordingly. Moreover, further work would include individual test of each CWTs used in the BL Framework and ascertain its acceptance and ability to enhance learning and teaching.

1.6 Thesis Structure

Chapter one has presented an introduction part of the research in terms of the research problem being investigated and the Tanzanian Higher Education context. It also presented the research aim, the research questions, the research objectives and the research contributions. The scope of the research and limitations are discussed too. In summary, chapter one has given an overview of the research problem domain and research perspective. Chapter two presents the discussion of the literature reviewed to find the research domain. The reviewed literature covers both theories and empirical studies in Blended Learning and Collaborative Web Technologies.

Chapter three is about the research methods which present the research philosophy, methodology, approach, design and tools used in this research.

Chapter four of the thesis presents the results of the survey carried out in phase one to assess the available ICT infrastructure in higher education in Tanzania.
Chapter five of the thesis presents the design and validation of the BL Framework which was designed in phase two through focus group meetings and the literature. Chapter five also presents the validation process of the draft framework by key experts who made important modifications to the draft framework. The validation process aimed to improve the draft BL Framework and to ensure its relevance and effectiveness for enhancing learning and teaching in HEIs in Tanzania.
Chapter six is about the New BL Framework. The New BL Framework was designed based on the validation results in chapter five. The New BL Framework has five processes which are based on the learning process.
Chapter seven presents the application of the new framework to three modules at a Tanzanian HEI – IAA. A questionnaire was administered at the end of the semester in which the students and lecturers expressed their views in terms of usability and acceptance of the New BL Framework. Chapter eight gives the conclusions and possible further work.

CHAPTER TWO

2.0 LITERATURE REVIEW

"….by using web technology…. we need to shift education from a focus on consumption of content provided by the teachers to creation by the students" (O'Reilly, Cator and Blake-Plock 2012).

This chapter reviews the literature on the Collaborative Web Technologies (CWTs) and Blended Learning (BL). The review was carried out firstly, to show the proper CWTs which can support BL environment for enhanced learning and teaching in Higher Education and secondly, to establish the empirical and theoretical pieces of evidence underpinning the BL frameworks.

2.1 Blended Learning Framework Concept

Blended Learning is the combination of face-to-face and online instruction models (Graham, Woodfield and Harrison 2013). The term framework means "*a set of rules, ideas, or beliefs which you use to deal with problems or to decide what to do"* (Collins 2017). Additionally, MacMillan Dictionary (2017) defines the word framework as a "*set of principles, ideas etc. that you use when you are forming your decisions and judgments.*" In this thesis, the term framework stands for a comprehensive guideline towards the use of blended learning in HEIs. The debate about the meaning is provided in section 2.5 and the current frameworks are discussed in section 2.6 below.

2.2 Collaborative Web Technologies and the Web Evolution

Collaborative Web Technologies (CWTs) are "*computing systems that include, as one of their major design goals, features designed to facilitate work that involves*

more than one person" (Rosbottom 2010, and Lomas *et al*. 2008, and Cheung and Hew 2011). The CWTs are what Cassidy *et al.* (2014) calls emerging technologies. The involvement is synchronous or asynchronous in nature allowing the creation, reading, execution and customization of the shared contents (Köse 2010, Lal and Lal 2011, and Yamagata-Lynch 2014). Examples of the CWTs include the Social Networks, wikis, blogs and podcast (Doolan 2006, Boulos, Maramba and Wheeler 2006 and O'Bannon *et al.* 2011). CWTs also include RSS, mash-ups, virtual societies, and folksonomy. In recent years, CWTs have become used in business, education, and social interactions (Sharpe *et al*. 2006, Chew 2009, Davidson 2011, Baxter *et al.* 2011 and Mirriahi *et al.* 2015).

The extant literature shows that the web began as a working tool for the CERN scientists in 1989 (Anderson 2007, Tim 2010, and Mwasha and Pima 2011). The web then expanded to a global space for sharing and exchanging information for all people (Anderson 2007 and Tim 2010). This evolution was enhanced by a series of projects that took place between1980s and 2000s. Such projects included developing a web browser called Nexus or World Wide Web (WWW) and a web server aiming to locate, retrieve, and display web contents (Tim 2010). The World Wide Web Consortium (W3C) was formed in 1994 with its mission being to "lead the World Wide Web to its full potential by developing protocols and guidelines that ensure the long-term growth of the Web" (W3C 2014). Since then, the W3C has concentrated on the open standards principles and design principles of the web and thus becomes a place for web practitioners to set specifications and standards for the web (W3C 2014b). This has enabled the evolution of web from Web 1.0 to Web 2.0 and Web 3.0 (Boriachon and Dagouat 2007, Shen 2012, Fojt 2013, Chua 2013 and World Wide Web Foundation 2014).

2.3 Web Generations and its Application in Education

The first generation of the web is known as Web 1.0 coined by Sir Tim Berners-Lee in 1993 (Evans 2013). The term Web 1.0 refers to the first web; the read-only web (Ebner 2007 Evans 2013). It was characterised by static websites with limited user interactions and less updates (Crook 2008, Lal and Lal 2011, and Evans 2013). In these cases, the web forms were used to fetch visitor's feedback. Web 1.0 websites were slow and needed the user to refresh the page when additional information was added on the website (Boriachon and Dagouat 2007).

Web 2.0 is the second generation of the web and focuses on an online collaborative and socialization environment (Boriachon and Dagouat 2007, Ching and Hsu 2011 and webopedia 2014). Berners-Lee describes web 2.0 as the "read-write" web which empowers users to contribute contents and interact instantly (Naik and Shivalingaiah 2008, and Shen 2012). When referring to a version number of the web evolution, web 2.0 is an enhanced form of web 1.0 technologies. The technologies which make web 2.0 a collaborative and social web include Social Networks, wikis, blogs, podcast, RSS, mash-ups, virtual societies, folksonomy and Bookmarking (Ebner 2007, Naik and Shivalingaiah 2008, Ching and Hsu 2011, O'Bannon *et al.* 2011, and Evans 2013).

In higher education, the web has been used since the web 1.0 era where e-learning systems were developed and used for learning and teaching purposes (Abdelaziz *et al.* 2011, Chen *et al.* 2010, Banday 2008 and Chan 2007). During the Web 1.0 era, the E-learning systems inherited similar challenges of the web 1.0. In web 2.0, however, communication and sharing of information have been improved and the real contribution of web 2.0 technologies in learning and teaching depends on the ability of the learners to use the contents provided (Ching and Hsu 2011 and Shen 2012). Web 2.0 allows interaction between lecturers and students and amongst students (Fernández and Fernández 2015). The technologies allow students to contribute, share and edit web contents created by their lecturers

(Păuleţ-Crăiniceanu 2014). This ability made the web to be open and collaborative in nature. The open, collaborative and socialization features of web 2.0 can enhance learning and teaching (Bower, Hedberg, and Kuswara 2009, Ching and Hsu 2011, Singh, Bebi and Gulati 2011, and Shen 2012).

Web 2.0 paved the way to another step of the web evolution: that is, to the web of data or semantic web called web 3.0 (Fojt 2013). This is regarded as the third phase of the web evolution since its inception in 1989 (Ching and Hsu 2011 and Păuleţ-Crăiniceanu 2014). Web 3.0 is regarded as a sematic web. In web 3.0, the contents can be accessible by both browser-based applications and non-browser applications, called agents. Data is interconnected transversely over a wide spectrum of infrastructures. This makes data accessible, meaningful and understandable to both human and machines (Garrigos-Simon, Alcami and Ribera 2012).

The CWTs brought about new evolution in information capture, analysis, sharing and storage and will enhance learning and teaching (Naik and Shivalingaiah 2008, Verizon 2010, Lal and Lal 2011, Emerald 2013 and Fernández and Fernández 2015). The CWTs are used in learning and teaching (Rahat *et al.* 2012) as well as in university library services (Pacheco, Kuhn, and Grant 2010). Moreover, the CWTs enable students to engage themselves in knowledge creation through sharing (Ziegler, Paulus and Woodside 2006), self and peer review and appraisal, participation and individual tailored needs (Sodt and Summey 2009).

However, in the least technologically developed countries like Tanzania, the use of CWTs is at its early stage (Sife, Lwoga and Sanga 2007, Lwoga 2012, and Pima *et al.* 2016). In these countries, the use is limited to the Content/Learning Management Systems, the open source software (Lwoga 2012 and Mtebe 2013). Evidence in extant literature appears to suggest that the use of CWTs for teaching and learning in the least technologically developed countries is a personal decision (Lwoga 2012, Mtebe 2013, and Pima *et al*. 2016). Additionally, the empirical

evidence in Tanzanian HEIs shows the absence of institutional guidelines on their use for learning and teaching and the lack of awareness of CWTs (Sife, Lwoga and Sanga 2007, and Lwoga 2012). These have contributed to many HEIs not putting in place guiding framework on the adoption and practices of CWTs for enhancing learning and teaching (Lwoga 2012, Mtebe 2013, Pima *et al.* 2016, and Porter *et al.* 2016).

2.4 Collaborative Web Technologies for Blended Learning

"…*blogs, social media, websites, and wikis, provide innovative and fertile learning spaces for students, as they shift the learning processes from linear pathways to more interactive and collaborative dynamics*" (Wheeler, Yeomans and Wheeler 2008).

The CWTs have been in use for more than a decade in higher education and have improved the learning experience among students (Wheeler, Yeomans and Wheeler 2008, Ratneswary and Rasiah 2014 and Fernández and Fernández 2015). Additionally, Carroll *et al.* (2013) argue that the use of these technologies could enhance social learning and interactions, self and peer assessments, formative feedback, personal and group reflections, active engagement and improved overall students' performance (Ziegler, Paulus and Woodside 2006, Baltaci-Goktalay and Ozdilek 2010 and Ratneswary and Rasiah 2014). Researchers such as Kay and Kletskin (2012) give more reasons on why the CWTs have attracted many students. The reasons include the need to engage in group work, online community and social interactions more actively (Doolan 2006 and Ziegler, Paulus and Woodside 2006). Scholars such as Boyd and Ellison (2008), Churchill (2009), Dunlap and Lowenthal (2011), Kay (2012) and Mao (2014) agree that the use of wikis, social networks, blogs and podcasts (Doolan 2006 and Boulos, Maramba and Wheeler 2006) is gaining acceptance in higher education.

Moreover, the constructivist theorists Piaget and Bruner argue that an individual learns because of explorations and experiences. In support of the social constructivism theory, Vygotsky argues that learning occurs through effective exchange of ideas and social interactions. During interactions and sharing of ideas, the earlier knowledge is modified and reconstructed through a defined learning environment. So, the CWTs provide the media for active exchange of knowledge and social interactions (Witts 2006, Young 2008, Chiu, Wen and Sheng 2009 and Özdener and Güngör 2010). Thus, CWTs such as wikis, social media, blogs and podcasts have been created to allow sharing as discussed in sections 2.4.1 through 2.4.4 for student-centred approach (Abraham 2007).

2.4.1 Wikis

A Wiki has been defined as the hypertext web technology designed with both asynchronous and synchronous features to allow direct editing, updating, modifying and deletion of its contents (Vossen and Hagemann 2007, Laughton 2011, Chow 2013, Yamagata-Lynch 2014 and Özdemir and Aydın 2015). It is a Hawaiian word meaning ‘very quick’ that has been in use since its invention by Ward Cunningham in 1995. There are six distinguishing features to explain a wiki. These include the presence of a page or title. Each wiki has a page or title, which covers a specific theme or topic. The second feature is the ability to create a link. A wiki is expected to have links to other sites, recommended projects (Eugenia 2014) or web pages.

Thirdly, a text mark-up for formatting web contents which enables collaborative group writing. In another research, Muscarà and Beercock (2010) insists that the wiki allows for easing formatting of the shared content into a simple syntax that allows posting and reading/displaying more easily into a wide range of devices. The fourth feature is the availability of permission structure which always the “*vary in degree of granularity and control*” for all authors. This idea is supported by

Eugenia (2014) who argues that peer review and editing are vital features of a wiki. Wiki could also be used for summary writing in a group or coursework (Wichadee 2010). Additionally, the “most unique feature of wiki authoring is collaboration, which enables the owner of a wiki site to grant ownership, collaborative and view rights to other people so that team members can edit and view at anytime and anywhere” (Eugenia 2014: 142).

The fifth feature of a wiki is the availability of “*Recent Changes*” where a list of changes is made available to all visitors and contributors of the page. This feature enables a “history function that records all edits, with colour coding, allowing users to trace all revisions being made. The history log enables edits to be traced to the users and helps the teacher to monitor and assess students’ progress” (Wang 2014 and Özdemir and Aydın 2015). The sixth feature is the search function, where key words search facility is embedded for searching the wiki contents. In wikis, advanced search facility is added with Boolean search capabilities (Wang 2014, and Özdemir and Aydın 2015).

The seventh feature allows students to communicate not only with their teachers but also to communicate with their peers (Ramanau and Geng 2009). Muscarà and Beercock (2010) commented on the features of wikis that they are based on collaborative authorship grounded on constructive criticism. This argument is supported by Gokcearslana and Ozcan (2011) who add that the authorship is on multiple contributions, which in turn creates collective ownership, more responsible for their contents, knowledge sharing and community development. A wiki offers more advantages which include the freedom to publish contents online and which can be shared and read by many readers (Wichadee 2010, and Eugenia 2014).

Ramanau and Geng (2009) provide the practical implications of wikis in education that it offers a forum where current information and knowledge free of vandalism is exchanged among members. With a wiki, there is unrestricted workflow of ideas

from different authors who take responsibilities for their contents (Castaneda 2007). With a wiki, the learners who are not comfortable to present their ideas in front of the class have no problem in a wiki since they can equally contribute their ideas online with more confidence (Churchill 2009). This enables the shift from teacher to student role, from teacher-oriented learning to student oriented and self-directed learning (Muscarà and Beercock 2010).

Wiki as a collaborative web technology has been accepted for use in education (Wang 2014). In addition, wiki is designed and configured for group interactions on co-authorship mechanisms (Castaneda 2007 and Wang 2014). A wiki is more relevant for group work and systematic projects at undergraduate and postgraduate levels (Ramanau and Geng 2009 and Laughton 2010). Wiki has proved to be resourceful for project works, improving group collaboration, improving the individual and group quality of work, and knowledge creation and sharing (Dohn 2009, Laughton 2010 and Wang 2014).

From the foregoing, little is shown on how the wiki should be mixed with face-to-face to enhance learning and teaching in BL environment. The review shows only how individual instructors inconsistently used a wiki in their courses. This could result into different approaches and application when two lecturers are allocated the same module at different times.

2.4.2 Social Media

The use of the CWTs, especially, social media has become ubiquitously among students of higher education (Liu and Brown 2014 and Mao 2014). The term Social Networks has been defined by Mao (2014) and Gao and Feng (2016) as online software applications for collaboration, exchange of knowledge, active interaction, and effective communication capable of involving more than one person. For example, Facebook and Twitter could be used to share learning experiences, networking and promoting collaboration amongst a learning community such in higher education (Thompson, Gray and Kim 2014). However, the debate about the

term social media or social networks continues (Gao and Feng 2016). In this thesis, the term social media is adopted from (Thompson, Gray and Kim 2014 and Mao 2014). However, the term social media and social networks are used interchangeably by different researchers (Tess 2013, Thompson, Gray and Kim 2014 and Mao 2014). Similarly, Kaplan and Haenlein (2010) are worried to use specific definition of social networks as this may be elusive and proposed the use of examples to define social media. Kaplan and Haenlein (2010) list examples of networks that include social media, blogs, wikis (Boulos, Maramba and Wheeler 2006), multi-media platforms, virtual game world and virtual social worlds. However, this is challenged by Tess (2013) who reviewed the literature on social networks by defining the term as web-based system designed with features for users to create individual profiles, create contents and exchange messages (Chan 2007). Tess (2013) supports the previous definition given by Boyd and Ellison (2008). While other definitions are centred on the ability and features of social networks to facilitate collaborations and communications between and among connected people, (Dohn 2009, Falahah and Rosmala 2012) emphasis that social media allow people to do three things. Firstly, to create a profile which may be accessible to the public or to selected friends; secondly, to add, remove, invite and select other users to share a connection and thirdly, to view and interact in several ways with all people in the connection (Falahah and Rosmala 2012). Everson, Gundlach, and Miller (2013) argue that social media such as Facebook and twitter are technologies which allow the content created by individuals to be shared to a wide range of recipient choices (Kietzmann *et al.* 2011). Examples of social media include Facebook, Twitter, and Tumblr (Mao 2014).

Facebook, for instance, has attracted many students due to their ease-of use and sharing of information more conveniently and engaging users in informal learning (Pérez, Araiza and Doerfer 2013), creative and expressive forms of behaviour (Sharma, Joshi, and Sharma, 2016). Throughout the communication and interaction process, new knowledge is socially constructed (Boyd and Ellison

2008). Additionally, Facebook could be integrated into the teaching practices to encourage interactions and collaborative activities (Puhl, Tsovaltzi and Weinberger 2015, Gruzd, Staves and Wilk 2012).

Facebook – a well-known social medium - has grown from the medium for college students at Harvard (Boyd and Ellison 2008) to the largest global system with about one billion users (Everson, Gundlach, and Miller 2013). It offers a medium for interactions between the instructor and the students. It can be used as a medium to motivate and give feedback to students in a more convenient way than traditional e-learning systems (Selwyn 2009 and Abdelaziz *et al.* 2011). Of recent, it has been equipped with collaborative tools such as bulletin board, instant messaging, email and file sharing services (Schwartz 2010). With Facebook, students can collaborate for group work, individual work and outside class activities (Pérez, Araiza and Doerfer 2013 and Everson, Gundlach, and Miller 2013).

Although Facebook is widely used by students outside the classroom (Wang *et al.* 2014 and Puhl, Tsovaltzi and Weinberger 2015), little has been done to study its application in learning and teaching. Similarly, little has been reported on a guiding framework for such use (Roblyer *et al.* 2010, Hew 2011, DeAndrea *et al.* 2012 and Vollum 2014). Given its prominence and acceptability among learners, a study to assess how it can enhance learning and teaching in a blended learning environment is essential.

2.4.3 Blogs

A blog is a collaborative web technology used as a publishing system for periodical articles (Churchill 2009 and Ozkan 2015). As a publishing system, it enables its reader to read and comment on the published contents. In Tanzania, one of the popular blogposts is the “Jamii Forum” (Jamii Forum 2017). When used in education a blog is powerful for both learner reflections and social interactions (Richardson 2006, Carroll *et al.* 2013 and Ozkan 2015). In the Bandura’s Social Cognitive Theory (Bandura 1986), self-reflection is attained when a learner can realize his/her gifts and faults, concede and challenge possible suppositions on notions, moods and actions hence leading to greater self-awareness. A blog is a tool with the ability to enhance learning through personal reflection (Shao 2010 and Ozkan 2015). This can be achieved through group work which may involve discussion and practical work (Churchill 2009). Blogs are not only useful for students, but also very useful to facilitators in teaching activities (Churchill 2010).
Churchill (2009) further summarises the results of activities done by teachers and students. Facilitators can use blogs to give important information about the course, share students’ reflections and issues about the course delivery and administration. A blog is also a communication tool for posting announcements, distributing and sharing learning materials to learners (Churchill 2010). In the facilitation role, a blog is useful for monitoring students’ progress, providing feedback, encouraging and motivating students on individual and group basis.

From the foregoing, a student can use a blog to present tasks assigned, share ideas, read and write reflections on contributions and receive facilitator’s comments and guidance. All these make the blog a powerful collaborative web technology for learning and teaching. From a constructivism point of view, a blog enables a learner to be an active participant in the learning process (Carroll *et al.* 2013). It also enables the learner to construct knowledge. In this way, the teacher’s role

becomes facilitation and advisor in the learning process (Chiu, Wen and Sheng 2009).

Blogging has gained acceptance in higher education (Young 2008). Students can write and respond to shared contents and in so doing they refresh their thoughts and construct a learning community (Chiu, Wen, and Sheng 2009). In this situation, the personal reflection and construction of knowledge is realised by students (Witts 2006 and Shao 2010). In this way knowledge is constructed by individuals from their experiences and interactions (Schunk and Zimmerman 2008) as well as joint interaction and engagement based on a wide diversity of social culture (Chiu, Wen and Sheng 2009, Shao 2010 and Yoo and Huang 2011).

A blog (and other Collaborative web technologies such as wikis, social networks, and podcasts) has features designed to enhance learning and teaching (Churchill 2009) based on a constructivism theory (Dillenbourg 1999). It has features which encourage cooperation among participants to achieve certain common objectives in the learning process. It provides an avenue for learners to support each other, exchange, and mirror on each other's experiences, create a learning community with its own learning culture, and thus construct knowledge (Yoo and Huang 2011 Chiu, Wen and Sheng 2009, Dillenbourg 1999 and McGrath 1984).

Glogoff (2005) argues that a blog is a tool for furthering learning and teaching through reflections. It makes participants to be more active and more thoughtful in the learning process (Shao 2010). In this way, learners are skilful in creating their personal knowledge with guidance from their facilitators (Dillenbourg 1999, McGrath 1984, Richardson 2006, Young 2008, Theng and Mai 2013 and Ozkan 2015).

Theng and Mai (2013) argue further that a blog enhances collaboration among group members where peers could work together, encourage and support each other. This followed a result of a survey of 104 year 1 students who enrolled for IT degree at INTI International University in 2012/13. In this study results further show

that blogs increase personal satisfaction and enhancement with better understanding and new skills positively realised. Students reported that the use of blogs in a group work had motivated and made them enjoy learning and the course. Another significant finding in this study is that blogs enhance communication and interactions among students and between them and their facilitators. In this way, a learning community was developed, and success realised in the project work.

From the foregoing, one can argue that a blog, as one of the collaborative web technologies, can enhance learning and teaching. Since blogs are designed with collaborative features, learners can construct knowledge in a constructivist learning classroom. A blog further provides a collaborative learning environment (Dohn 2009) where positive learning experience is cultivated and a more student-centred (Abraham 2007) and self-directed learning is achieved. However, there is no evidence to show that a framework guides such uses. Each facilitator takes a unique way to integrate blogs in the learning process.

2.4.4 Podcasts

Use of podcasts to enable students view and listen to learning materials is prevalent in HEIs (McSwiggan and Campbell 2017). In all cases the use of podcasts in higher education include the capture and dissemination of lectures (Thompson, Gray and Kim 2014), illustration step-by-step of solving a problem (Kay 2012), provision of additional materials to learners (McGarr 2009) and the sharing of administrative information and functions by administrators (Thompson, Gray and Kim 2014). Podcast is still at its infancy stage and little has been reported in terms of research and guiding framework to enhance learning and teaching (Kay 2012).

YouTube was launched in February 2005 for entertainment and later for education (Kay 2012). After one year, that is, in 2006, YouTube received 100 million views a

day and by late 2011, it had reached over 3 billion views per day (Kay 2012). The launch of YouTube was an important motivation to the growth of podcast and its use in education. Another factor was increased availability of high-speed internet bandwidth between 2006 and 2010 (Smith 2010). This changed the way higher education institutions used podcasts in teaching and learning. This gave rise to different types and purposes of podcasts (Kay 2012).

Kay (2012) discussed four types of podcasts. In his review of 53 peer reviewed papers, Kay cites Heilesen (2010) as one of the researchers who discussed lecture-based podcasts. This lecture-based podcast records the entire lecture which students can use instead of physical encounters or after class reviews (Heilesen 2010). It is useful for a review after class hours where students can replay at any time and places.

The second type of podcast is an enhanced video podcast. Holbrook and Dupont (2010) replies to the "why enhanced" question, that it is only used to provide footage mostly of PowerPoint presentation with an audio support. He argues that enhanced podcast helps in revision time (Holbrook and Dupont 2010). This argument is supported by (Kay 2012) who points out that enhanced podcasting improves that quality of face-to-face classes and enables students to prepare well for the class and after class learning.

For the third type of podcast, the supplementary podcast (McGarr 2009) is used to support either face-to-face or online learning. McGarr (2009) compares supplementary podcast with worked examples and states that the two types are the same. In the fourth type, worked examples, McGarr (2009) supports the first idea by Crippen and Earl (2004) that video can be posted to show step-by-step in solving real world problems (Kay and Kletskin 2012). In this way, students can learn by examples (Kay 2012).

From the foregoing, podcasts are important in education in several ways. Kay (2012) points the first reason as being to improve learning. He based his argument from the study results and literature by Bennett and Glover (2008) who found out that podcast was used to prepare for classes. Other scholars supported by Kay

(2012) include Fernandez, Simon and Sallan (2009) pointed out that podcast was used for self-checking on the knowledge constructed and looking for better notes (Traphagan, Kucsera and Kishi 2010).

The second reason for the use of podcast in education is enhanced control over learning and the learning process (Kay 2012). There are two types of students: idealists and pragmatists (Dolnicar 2005); the former ones prefer face-to-face learning and are decreasing in number, while the latter ones, which are increasing in higher education, prefer own-control over where and when they learn (Montgomery 2009, Palfrey and Gasser 2008) and Tapscott 2008). Therefore, podcast has gained support of most pragmatist students in higher education who want to control their learning environment for more flexibility (Griffin, Mitchell and Thompson 2009).

The third reason for students using podcast was to catch up with missed class sessions. Kay (2012) supports this reason with facts from four studies. 60-80% of students in these studies showed the usefulness of podcast to capture missed classes. However, Foertsch *et al.* (2002) and McKinney and Page (2009) qualify the above argument that it is only proper reasons such as busy schedule and travel constraints that can amount to missed classes. One can argue that podcasts if used for lectures can create a room for students to absent themselves from face-to-face sessions (Walls *et al.* 2010 and Kay 2012). Also, when used to supplement or to enhance learning, quality issues and consistency must be maintained for best practice at institutional adoption (Tyagi 2012, and Lin, Zimmer and Lee 2013) and quality assurance, and therefore there is a need for a guiding framework (Kituyi and Tusubira 2013). From the foregoing, the four selected CWTs are useful in education and have the potential to enhance learning and teaching.

2.5 Blended Learning Debate in Higher Education

In conjunction with the discussion in section 2.1 above, BL is still at its infancy stage as an instructional model (Chew 2009, Lwoga 2012, Spanjers *et al.* 2015 and Pima *et al*. 2018). The extant literature shows that there is no consensus on what constitutes BL (Fong and Wang 2007, Chew, Turner and Jones 2009) or what it means by the term blended learning. BL has means a combination of face-to-face instructional model and online teaching and learning activities (Chew 2009 and Cheung and Slavin 2013). Some researchers have challenged this definition. For instance, in 2003, Bielawski and Metcalf (2003) claimed that the BL definition has little input to the existing definition over what electronic learning gives. This means, the definition is the same with minimal distinction between the two terms (Blended Learning and E-Learning). They further argue that even the little new meaning added does not distinguish it from what is currently known about E-Learning (Chan 2007 and Allen, Seaman and Garret 2007).

However, there are BL practitioners and researchers who reject the criticism above. They point out a clear distinction between the two terms. One of these practitioners is the ministry responsible for education for the United Kingdom (DfES 2002 and Drysdale *et al.* 2013). The DfES states the demarcation between E-Learning and BL that the former is concerned with teaching using ICT while the latter is concerned with the blends between traditional face-to-face learning and online learning via e-learning and other technologies (Abdelaziz *et al.* 2011). In other words, BL is an approach or a model to link the use of technology and the learning process activities; in contrast, e-learning is a computer system concerned with the use of technology in learning (Jones 2006: 185).

Graham (2006) in Chew (2009) and Drysdale *et al.* (2013) reviewed the works of different researchers on Blended Learning. Graham (2006 in Chew 2009) agreed that BL is a mixture of physical encounters in a face-to-face instructional model

with online learning instructional model. This definition was proposed by Reay (2001) and modified by Ward and LaBranche (2003) and enriched in the debate made in a review by Chew, Turner and Jones (2009). There were other prominent scholars who supported the definition above. These scholars included Littlejohn and Pegler (2007). Moreover, Littlejohn and Pegler (2007) added that BL could include either e-learning systems with face-to-face instructions or the mixture within the e-learning mix of media (Chew 2009 and Abdelaziz *et al.* 2011).

Given the above discussion, BL should also consider the dimensions proposed by Kim (2007) which are further expanded by Allan (2007) into seven dimensions. Allan draws his dimensions from Sharpe *et al.* (2006). Firstly, technology which includes the mixture of web-based technologies such as the Collaborative Web Technologies; secondly the delivery on a variety of modes; thirdly synchronous and synchronous interactions (Chow 2013); fourthly, practical based and non-practical learning; fifthly, crosscutting programmes and specialities; sixthly, use of different instructional methodologies with diverse targets and seventhly, teacher-centred and self-paced planned learning.

However, Chew (2009) disagrees with Allan (2007) and Sharpe *et al.* (2006) on six dimensions, instead, takes the claim by Littlejohn and Pegler (2007). He simplified the definition and mix of blended learning into four dimensions: firstly, the space: where physical encounters or online interactions take place. Secondly, the time blend which is concerned with the location of participant such as ubiquitous and availability; but also, whether synchronous or asynchronous (Chow 2013 and Yamagata-Lynch 2014). Thirdly, the media blend which is concerned with the tools, technologies and resources. Fourthly, the activity blend which should consider the learning and teaching activities for either individual or groups. Lastly, Chew (2009) claims that the above definitions offer the meaning and scope of BL.

2.6 Current Blended Learning Frameworks

Reviews on BL have been done to reveal the thematic trends and research direction (Vignare 2007). Five Blended Learning Frameworks are reviewed in this thesis.

2.6.1 Inquiry-Based Framework

Garrison and Vaughan (2008) worked on an Inquiry based framework which recognizes blended learning design to guide BL environment. In their work, Garrison and Vaughan proposed a general Blended Learning Framework, Principles and Guidelines based on the Dewey constructivism school of thought. In this approach, education is all about collaborative constructs based on inquiry (Wang 2014) where knowledge is generated through social interactions and collaboration.

In this review, Garrison and Vaughan (2008) claimed that reflections and lectures are key elements in the learning process. These are ingredients of the blended learning which must be thoughtfully integrated to enhance a learner's engagement (Ziegler, Paulus and Woodside 2006 and Chew 2009). In this framework, the basic step of inquiry is "cognitive presence" Chew (2009: 51). The ability constructs this to share information, link ideas and concepts and finally test them contextually. The next element is "Teaching Presence" Chew (2009:51). At this element, a relevant structure and process is constructed, which may include curricula development and delivery methods, knowledge management and evaluation. Finally, the "Social Presence" Chew (2009: 51). This element encourages expression, collaboration, and engagement of learners (Ziegler, Paulus and Woodside 2006). However, this framework heavily depends on educational technologies (Cheung and Slavin 2013) and is only used at faculty level. It is more descriptive and general than A simpler,

structured and practical oriented one (Chew 2009). Moreover, the Inquiry-Based Framework does not explicitly provide the use of technologies such as the CWTs.

2.6.2 A Framework for a Course Web-enhancement

Georgouli, Skalkidis and Guerreiro (2008) proposed a blended learning framework to guide learning activities during class session time and homework time learning and teaching based on web-based tools (Chan 2007), and, the Learning Management Systems. The framework was tested at the Technological Educational Institute of Athens in the Informatics department. The results showed qualities and consistency of teaching were enhanced. The framework is grounded on the Learner-Centred approach. In this approach, five principles are proposed:

a) *Learning is promoted when learners observe a demonstration, the demonstration principle.*
b) *Learning is promoted when learners apply the new knowledge, the application principle.*
c) *Learning is promoted when learners engage in a task-centred instructional strategy, the task-centred principle.*
d) *Learning is promoted when learners activate prior knowledge or experience, the activation principle.*
e) *Learning is promoted when learners integrate their new knowledge into their everyday world, the integration principle."*

The Framework has four main components: administration, content, activities and community. The Administration component is responsible for e-course access policy, registration settings, collecting statistics and data for evaluation. Georgouli, Skalkidis and Guerreiro (2008) argue that "Administration" component is indispensable as it sets the rules and policies necessary for the e-course administration. The second component is Content. This consists of properly

designed lesson notes, tutorials and demonstration accessible by learners through web browsers. The emphasis has been on either downloading or using them online. An exercise tool is part of the content where its content must be derived from a well-detailed lesson plan. The third component is Activities. This consists of assessment and learning activities. The assessment is divided into self-assessment and assignment. This focus is to design measurable assessment with which students can measure their progress. The assignment aims to engage learners at both face-to-face and online sessions. This component makes use of a well-detailed teaching plan.

The fourth component of the framework is community. The component makes use of user group and communication tools. Channels of communications are designed to suit all learners. Messages are sent to all, specific and individual students depending on the purpose. A forum for group work is added and supervised by the teacher with a feedback mechanism.

The framework is faculty-based and has tools proposed for each component. It is a recommendable attempt to address the gap that exists between technology and pedagogy. However, the framework ignores the fact that CWTs are commonly used in the HEIs instead, it heavily depends on the Learning Management system (LMS). Although it aims at learner-centred approach, the framework facilitates more on teacher-centred approach. The framework recognises that Lecturers must use the LMS to upload video or notes first before they can be downloaded or read online by students.

2.6.3 A Framework for Web 2.0 Learning Design

The Framework is about the learning design using web 2.0 technologies (Bower, Hedberg and Kuswara 2010). It is an integrated framework for conceptualizing and performing Web 2.0 tools learning design based on Krathwohl's Taxonomy of learning (Krathwohl 2002). The web technology is viewed as only a mediator in the learning process to meet learner's needs. The framework is grounded on three

elements called technology, pedagogy and content knowledge. The design further integrates assessment and the entire learning process (Bower, Hedberg and Kuswara 2010). The framework uses four aspects to enable negotiation and production for the learning design and delivery in blended learning environment (Bower, Hedberg and Kuswara, 2010):

a) Transmissive-concerned with disseminating information to learners at the right time;
b) Dialogic-based on synchronous communication mechanisms for effective reflections and feedback on the learning tasks (Chow 2013);
c) Constructionist-based on the ability of learners to construct their own knowledge during the time of interactions guided by pre-defined activities; and
d) Co-constructive-based on the ability to produce an output as a group work and interactions.

However, the Framework for Web 2.0 Learning Design focuses on education than technology. It depends heavily on the teacher to initiate the learning process. That is, it concentrates on teacher-centred approach rather than student-centred approach (Abraham 2007). There is a wide range of web 2.0 technologies selected whose application in the learning design could not fit in the entire learning environment. Moreover, pre-service teachers and the results used the Framework could not be indicated exemplarily.

2.6.4 A Framework for Institutional Adoption on Blended Learning

Graham, Woodfield and Harrison (2013) expressed the need for a BL framework in HEI given the partial research focus on institutional strategy and approval matters on BL in higher education. The study was motivated by, among other factors, the need to recognise the BL (Graham, Woodfield, and Harrison 2013: 4) as one of the

greatest unattended trends in HEIs (Young 2002: 2). A Framework for institutional adoption aimed to provide details to administrators to guide institutions on blended learning adoption and implementation. The framework also identifies “some markers” to guide the adoption process (Graham, Woodfield and Harrison 2013: 5).

The framework has three stages and three categories of adoption. Stage one is to create awareness and exploration of blended learning. Lecturers and administrators are involved, and no clear structure and support put in place. All efforts are directed towards awareness creation. This is grounded on the diffusion of innovation theory (Koohang and Plessis 2004) where agenda and awareness are made known to key stakeholders.

Stage 2 is the adoption and early implementation of blended learning. The stage is characterized by formal adoption and structuring the policies and infrastructure necessary for full implementation. The third stage is the mature implementation and growth of blended learning. At these last two stages, the blended learning is formally accepted and used at the institutional level. The framework has demonstrated general issues of adoption and implementation of BL at an individual HEI. The framework is one of the good attempts in the design of the BL frameworks. The proposed framework advances from the adoption stages (Tyagi 2012) by considering the learning process. Moreover, the Framework for Institutional Adoption on Blended Learning does not use the CWTs which the current research proposed.

2.6.5 A Blended Learning Framework for Curriculum Design and Professional Development

This framework sought to establish flexible and affordable learning in higher education (Mirriahi, Alonzo and Fox 2015). The framework was designed to guide course design, act as a self-test instrument, and for professional development program. The authors succeeded in giving a general picture on how the course

could be designed to ensure consistency and quality of academic practices. It focussed on personalized learning experiences in which learners are placed at the centre of learning and teaching.

Although the framework used some criteria to show the ability of lecturers in the design and delivery of a course, it concentrated on the curriculum design and acts as a guide only. The framework does not consider the use of the CWTs and no evidence whatever, of the considerations of the socio-cultural factors that could affect its implementation (Yoo and Huang 2011). Moreover, the framework was not tested and validated. It was designed based on the focus group meetings and the reviewed literature. Thus, Mirriahi, Alonzo and Fox (2015: 11) emphasized that the "framework is meant to be a formative tool, and hence should not be used rigidly to define BL practice." It could only be used by individual lecturers as a self-assessment tool and to encourage debate on BL practices.

2.7 Thematic and Publication Trends of Blended Learning

In a review of 210 publications on blended learning in higher education, the extant literatures have shown ten thematic trends in the last two decades (Pima *et al*. 2018). These include instructional design, disposition, exploration, learner outcomes, comparison, technology, Interactions, Professional Development, Demographic, and Others as shown in table 2.1.

Table 2.1 themes emerged from Blended Learning Publications

Theme	Freq.	%	Sub-Themes
Instructional Design	62	29.52	Blended Learning; Instructional Models; BL Strategies; BL Best Practices; Course Design; BL Implementation; BL Environment; BL Frameworks; BL Adoption; BL Theorem; and, Others.
Disposition	33	15.71	Learning and Teaching Style; Students and Teachers

Theme	Freq.	%	Sub-Themes
			Perception; Preferences; Attitudes; Equality; Learner Autonomous; and BL and Teaching Experiences.
Exploration	31	14.76	Benefits/Importance; Nature & Scope; Trends (Past, Present, Future); Challenges; Advantages and Disadvantages; Quality; and, Transformative Issues.
Learner Outcomes	27	12.86	Performance Outcomes; Students & Teachers Satisfaction; Engagement (Students and Teachers); Students Retention; Motivation and Efforts; Independence; in Learning; and, Learning Autonomy.
Comparison	17	8.10	F2F vs. Online Learning; F2F vs BL; F2F vs Online Discussion; Online vs F2F vs BL; BL vs E-Learning; and, Video vs Text Feedback.
Technology	21	10.00	Technological Acceptance; Ease-of-use; Comfort with; Technological Infusion; Technological Effects; Use of LMS/CWTs for BL; Implementation; and, Use of Video vs Text Feedback.
Interactions	12	5.71	Social Presence in BL environment; Role of a Teacher and Students; Student-Student Interaction; Students-Teacher Interaction; Student-Teacher-Student Interaction; Collaboration; Social Constructivism; and, Effective Communication.
Professional Development	3	1.43	Teachers Professional BL; Learning and Teaching Styles; and, BL professional Best Practices.
Demographic	2	0.95	Student Profile; Number of Publication; Trends and Publication Demographic.
Others	2	0.95	General Discussion of BL; and, International Issues.
TOTAL	**210**	**100**	

***Table 2.1 adopted from Pima *et al*. (2018)**

From table 2.1, blended learning belongs to the Instructional design theme where there were 62 (29.52%) publications. However, out of 62 publications in the instructional design, only 11 publications were on Blended Learning Framework as shown in table 2.2. That means, little has been done on blended learning framework.

Table 2.2 Instructional Design Publications

Sub-Theme	Freq.	%	Examples
BL Models	36	58.06	A generic model for guiding the integration of ICT into teaching and learning (Wang Q. , 2008)
BL Strategies	26	41.94	Using Blended Learning Strategies to Address Teaching Development Needs: How Does Canada Compare? (Kanuka & Rourke, 2013)
BL Best Practices	26	41.94	Good Practice Report: Blended Learning (Partridge, Ponting, & McCay, 2011)
Course Design	16	25.81	Blending Online Asynchronous and Synchronous Learning (Yamagata-Lynch, 2014)
BL Implementation	13	20.97	Implementing and Promoting Blended Learning in Higher Education Institutions: Comparing Different Approaches (Wang L. , 2010)
BL Environment	9	14.52	Lecturer-Student Communication in Blended Learning Environments (Gecer, 2013)
BL Frameworks	11	17.74	A framework for institutional adoption and implementation of blended learning in higher education (Graham, Woodfield, & Harrison, 2013)
BL Adoption	3	4.84	Blended learning in higher education: Institutional adoption and implementation (Porter, Graham, Spring, & Welch, 2014)
BL Theorem	2	3.23	Empirical Research on Learners' Perceptions: Interaction

Sub-Theme	Freq.	%	Examples
			Equivalency Theorem in Blended Learning (Miyazoe & Anderson, 2010)

***Table 2.2 adopted from Pima *et al*. (2018)**

From the review results in table 2.2, the number of publications on blended learning framework, tend to suggest that little has been done in this area. This means that there is a vacuum between the Blended Learning implementation and application in higher education in least technologically countries like Tanzania. The argument draws its premises on the theories which emphasis that framework gives idea, principles, methods, and people in which problem-solving efforts are based (Graham, Woodfield, and Harrison 2013). "A framework must consider the learners' needs, which include students' relevant learning environment, students' interest, students' experience, students' cultural perspectives, spoken languages, discourse patterns and computer skill level" (Haworth 2014 in Pima *et al.* 2018: 8).

2.8 Gaps in the Current Trends and existing Blended Learning Frameworks

The review of both the publications 2.7 and the BL framework 2.6 above show that it has not shown the stages at which the web tools could be used in the learning process. Furthermore, the framework could not consider the best practices for the use of each of the CWTs in learning and teaching. Finally, the framework does not cover the whole learning process.

From the review of the five BL Frameworks, the following were revealed:

a) The existing tools and frameworks reviewed do not consider the use of the CWTs and the learning process.
b) The tools and framework for the BL frameworks are limited either by their design or by the criteria used to design and use them.

c) The tools and frameworks available had only considered course level, departmental level or institutional adoption level.
d) The tools and available frameworks were not tested and validated were designed to aid self-assessment of individual lecturers in the practice of BL.
e) None of the existing frameworks reviewed were validated and feedback collected from real users such as students and lecturers.

Given the discussion of the gaps identified above, the BL must be designed, validated, and tested contextually. In so doing, such designed framework could suit the learners' contexts and needs (Garrison and Vaughan 2008, Drysdale *et al.* 2013, and Tarhini, Hone and Liu (2013). As a result, the significance and importance of BL framework could be realized (Tarhini, Hone and Liu 2013) in five ways. Firstly, great learning flexibility for both self-paced and scheduled learners. Secondly, wider range of sources for learning materials, with wide options of selecting learning materials. Thirdly, a conducive learning environment for both slow and quick learners by reducing stress and increasing satisfaction and motivation to learn. Fourthly, free and open networking environment and interactions between learners and their trainers in a peer-to-peer mode via a variety of CWTs and facilities (Tarhini, Hone and Liu 2013). Finally, effective communication media on accurate, ubiquitous, synchronous, and asynchronous mechanisms. That means, learners can actively take part in the learning process and track their progress (Graham 2006, Chew 2009, Tarhini, Hone and Liu 2013).

2.9 Chapter Summary

The chapter has given a review of the scholarly work on BLF. The review of the literature has shown the theoretical background of the BL and the CWTs and its application in higher education. A discussion has been provided about the four selected CWTs namely: wikis, social media, blogs, and podcasts. Moreover, the

review of the current BLF has been provided in sections 2.6 and 2.7 above as HEIs strive to consider the potential of the BL and CWTs.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

"not only is it perfectly possible to combine deduction and induction within the same piece of research, but also in our experience it is often advantageous to do so" (Saunders, Lewis and Thornhill 2009:127).

3.1 Introduction

This chapter presents the research philosophy, methodology, approach, design and tools adopted in this research work. The layout of the methodologies is set to link the research questions, objectives, data collections tools, the analysis, presentation of the data and conclusion as suggested by Yin (2003:19-21). In the same way, Hartley (2004:326) suggested to logically link the above sections to meet the research aims and objectives. Nevertheless, Saunders, Lewis and Thornhill (2009) uses the term *"union"* to depict five layers of the logical link of the research methodologies towards answering the research questions and its interpretations (see figure 3.1). Chapter three is organised into nine sections presented below.

3.2 Research Philosophy and Approach

This research adopted a pragmatism philosophical point of view (Saunders, Lewis, and Thornhill 2009) and a Mixed Methods Research (MMR) (O'Cathain, Murphy and Nicholl 2008, and Mertens 2011). The pragmatism basis its premises on the primary focus on research questions (Saunders, Lewis and Thornhill 2009). Similarly, in this research, an argument from Creswell and Plano Clark (2011:41) that pragmatism is associated with MMR is adopted. Along similar lines and with the use of the MMR, pragmatism focuses on three things: firstly, on the consequences of a research; secondly, on the primary importance of the questions asked rather than the methods used; and thirdly, on

the use of multiple methods of data collection to inform the problem under study and generalization of the findings about the design and validation of a BL Framework.

Both deductive and inductive research approach were adopted as a MMR. One can ask, why use mixed approach in this research? One of the answers to this question could be based on propositions from the prominent researchers in the field. For example in their work, Saunders, Lewis and Thornhill (2009:127) wrote "*Not only is it perfectly possible to combine deduction and induction within the same piece of research, but also in our experience it is often advantageous to do so*." While deduction is concerned with development of a theory and rigorous testing of a theory (quantitative) induction is concerned with gaining an understanding of the meanings humans attach to events (qualitative). Deductive approach allowed for the collection of quantitative data and the application of controls to ensure validity of data while inductive approach allowed for the collection of qualitative data and flexible structure to allow changes of research emphasis from one phase to another.

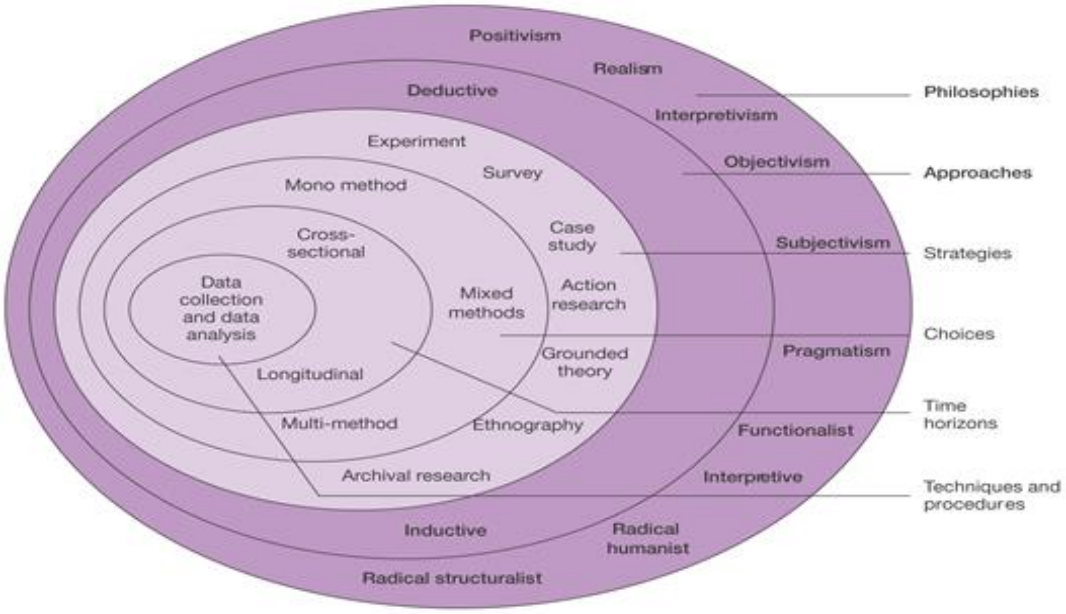


Figure 3.1 Research Process

Source: Saunders, Lewis, and Thornhill (2009)

In so doing, the advantage of adopting both deductive and inductive approach could be to increase reliability. The MMR adopted helped to reduce the participants' error and bias through choosing right time to engage participants and ensuring anonymity of participants. In reducing observer error and observer bias, a high degree of structure to the interview, focus group, and questionnaire were put in place. All these were achieved through the deduction approach.
The second advantage for the mixed approach (deductive and inductive) in this research was to increase the validity of findings. The causal relationship in a deductive approach and the use of questionnaires and the understanding of the meaning in the induction approach were used to reduce risks in the validity. This mixture was important since the research dealt with both qualitative and quantitative data collections.
The combined approach is also useful to reduce the problems that could arise due to generalization of findings and the BL Framework proposed.

Johnson, Onwuegbuzie and Turner (2007) reviewed "what was being mixed (e.g., methods, methodologies, or type of research), the place in the research process in which mixing occurred (e.g. data collection, data analysis), the scope of the mixing (e.g., from data to world views), the purpose or rationale of mixing (e.g., breadth, corroboration) and the elements driving the research (e.g., buttom-up, top-down, a core component)" (Creswell and Plano Clark: 2011:3-4). This review evolved the definition and focus of mixed methods to a methodology that includes the combination of both qualitative and quantitative research. In the same year, Greene (2007) and Creswell and Plano Clark (2007) came up with a supporting view point of mixed methods as methods and philosophy with multiple ways of seeing, hearing, and making sense of the social world.

Moreover, the nature of this research made the use of one source of research data insufficient. The use of documentary review, focus group, and observation in a qualitative research could omit data obtained through survey, experiment/test, questionnaire, and structured interview (Creswell and Plano

Clark 2011:12). It is supposed that the mixed methods took the best of each type such that the research got enough data to answer the research questions comprehensively. And in this regard, designing the framework requires a theoretical review of best practices and standards as well as data collected from questionnaires, focus groups, and initial tests. One method of inquiry cannot guarantee this type of design; thus, deductive and inductive methods have been used.

3.3 Research Design

A research design consists of defined techniques and procedures for data collection, analysis, interpretation and report of a research (Saunders, Lewis and Thornhill 2009). Kumar (2014:122) defines the term research design as *"a procedural-cum-operational plan that details what and how different methods and procedures to be applied during the research process."*

In conjunction with the above discussion on MMR, this research adopted a Multiphase Design (see figure 3.2). In the Multiphase design, the first phase was the collection and analysis of quantitative data; the next phase was the qualitative data collection and analysis and the last phase was the analysis of both qualitative and quantitative data. Multiphase design helped to address the overall research objectives (Creswell and Plano Clark 2011:70,72). In this research, the Multiphase Design supported the development, testing, refining, and evaluating the BL Framework.

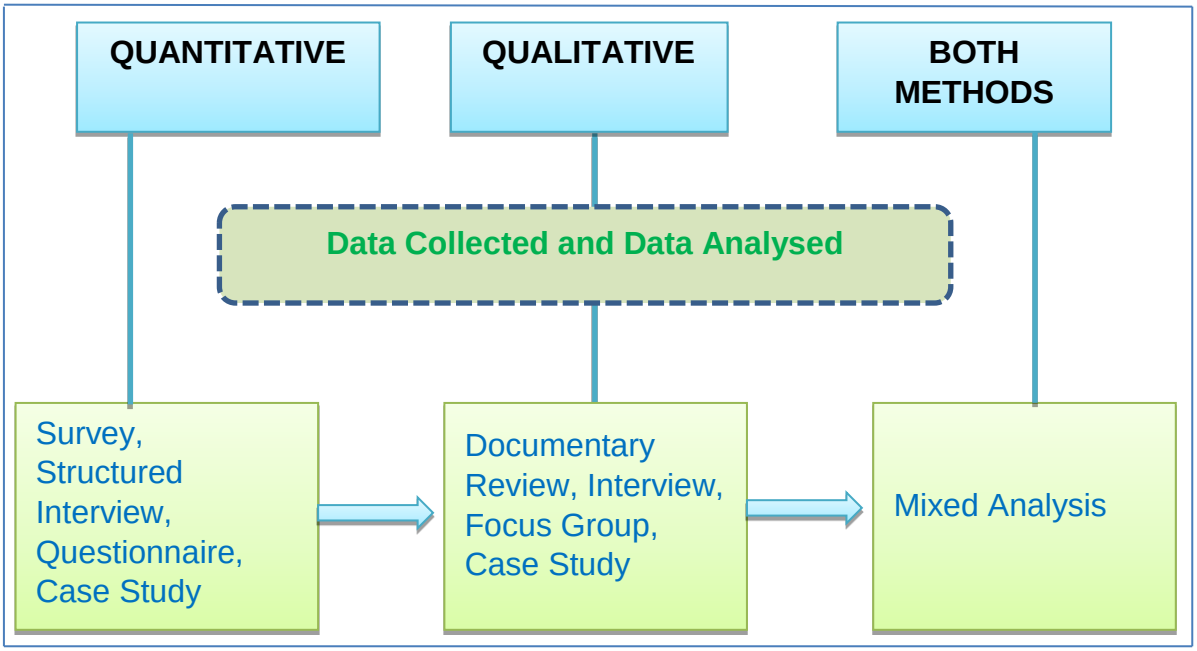


Figure 3.2 Research Design

Modified from Creswell and Plano Clark (2011:70)

3.4 Research Strategy

Research strategy is a systematic plan of actions formulated to achieve the overall research objectives (Saunders, Lewis and Thornhill 2009). In this research three research strategies were used; these are Survey, Experiment, and Case Study. Each of these strategies was used at a specific research phase. MMR was used as explained in section 3.7.

Table 3.1 Research Strategies and Methods selected

Strategy	Type of Inquiry	Methods	Phase
Survey	Qualitative and Quantitative	Documentary Review, Questionnaire, Interview	I
Experiment	Quantitative	Questionnaire, Focus Group	II, III
Case Study	Quantitative and Qualitative	Documentary, Questionnaire, Interview, Focus Group	II, III

Table 3.1 above depicts the adopted research strategies, the methods used and the phase when used.

3.4.1 Survey

A Survey was the first research strategy adopted in phase one as discussed in section 3.7. Sekaran and Bougie (2013) points out that a survey is usually used to seek for data about experience, attitudes, or knowledge from participants. A survey was also used in this phase to assess the available ICT infrastructure that could support the use of CWTs in a BL environment. The data collected in phase one was used to assess whether there could be relevant ICT infrastructure in HEIs in Tanzania to support the use of the CWTs in a BL environment.

Sekaran and Bougie (2013:102) argues that a survey allows the use of mixed methods and both qualitative and quantitative data can be collected and analysed. A survey best fits a large population, such as the HEI in Tanzania. The choice is supported by Bryman and Bell (2007:55) who cite the UK Workplace employment relation survey in 2004. The survey results were used as an input in phase two that there is strong and fast growing ICT infrastructure in HEIs in Tanzania capable of supporting the use of the CWTs in a BL environment.

3.4.2 Case Study

The second research strategy employed was a case study. It was selected to focus specifically on the HEIs in Tanzania. Sekaran and Bougie (2013: 103) afirms that a case study focuses on "*specific object, event or activity*", where the case can be an individual, a group, an organisation, an event or situation of interest. In a case study strategy, the researcher collected relevant data and examined the problem more closely and in details (Sekaran and Bougie 2013). The use of a case study enabled the researcher to use multiple methods of data

collection and analysis. This included Documentary Review, Questionnaire, Interview, Observation, and Focus Group in the selected HEIs. These were used during phase two and phase three as discussed in section 3.7.

Additionally, Saunders, Lewis and Thornhill (2009: 145-146) emphasize that a case study is used to investigate a situation in a real life context. The researcher used mixed methods to design, test and avaluate the BL Framework. Additionally, the researcher used cohort and modules in real time during the design and testing of the BL Framework (Saunders, Lewis and Thornhill 2009: 146).

This case study was a multiple case type as advocated by (Yin 2003). More than one case was used in this research in order to synchronise the findings from one case to another for a valid generalisation (Saunders, Lewis and Thornhill 2009: 147). The HEIs selected were six. All the six HEIs were used as case studies in phase one. In phases two and three, only one of the six HEIs was used. The rationale behind this selection was the details needed and an in-depth analysis for each single case in phase one (Teddlie and Tashakkori 2009:25) and representative sample of the first six institutions needed to evaluate the BL Framework(Teddlie and Tashakkori 2009: 174).

The case study allowed the researcher to be one of the observers. As Jarvis (1999: 78) pointed out the importance for a researcher to play an active role in a case study strategy; the researcher was a participant observer, who got very close to the participants.

There were benefits of a case study selection in this study. A case study first provided a thorough details of the situation investigated. Secondly, it provided for the focus group meetings such that ideas and views of participants were collected and evaluated closely to allow the design and the validation of the BL Framework contextually. Thirdly, the case study was applied holistically and realistically in real-life to the six HEIs and the collected data were analysed without loosing its integrity. Fourthly, the case study offered a more in-depth

communication with participants and the phenomenon studied (Jarvis 1999, Yin 2003 and Gerring 2007).

3.4.3 Experiment

An experimental design was used to identify four things from the New BL Framework. Fistly, whether the New BL Framework has improved students' performance. Secondly, whether it has improved interactions and engagement. Thirdly, whether it has improved lecturers' workload allocation; and fourthly, the impacts on the ICT infrastructure in HEIs. Robinson (2011:525) defines an experiment as a *"research strategy characterised by the researcher actively manipulating or changing aspects of what is studied."* Three cohorts were selected from one HEI to experiment with the New BL Framework. The aim was to evaluate the New BL Framework in terms of its usability and acceptability by students and lecturers. The experiment was done during phase three. At the end of the semester, a questionnaire was run (**Appendix IV)** and the data collected were analysed as discussed in section 8.4. Moreover, the selected cohorts were used to assess whether the framework could enhance learning and teaching (Eyyam, Menevi**§** and Dogruer 2011). The evaluation applied the Decomposed Theory of Planned Behaviour (Taylor and Todd 1995) and the Technological Acceptance Model (TAM) (Davis 1989).

From the foregoing, all participants answered questions which were based on the Decomposed Theory of Planned Behaviour (DTPB) (Taylor and Todd 1995) developed from the Theory of Planned Behaviour (Ajzen 1991) and the Technological Acceptance Model (TAM) (Davis 1989), (King and He 2006) and (Park, Nam and Cha 2012). The DTPB understands that the "actual use" is a behaviour which is influenced by the behavioural intention to use CWTs (Mumtaz 2006). The DTBP views the behavioural intention as an output of three factors: attitude, subject norms, and perceived behavioural controls. Both the DTPB and the TAM allow better understanding of the relationship and uncovers specific factors affecting the students' and lecturer's choice of CWTs.

3.5 Research Methods and Procedures

This section provides an account for the research methods and the data collection procedures and techniques which were used in this research. Research methods are key elements in the mixed research design and enable the achievement of the study's objectives. In practice, Dawn (2013: 27) defines research methods as "tools you use to collect your data". Moreover, Saunders, Lewis and Thornhill (2009: 595) define research method as "techniques and procedures used to obtain and analyse research data, including for example questionnaires, observation, interview, and statistical and non-statistical techniques". At the same time, Creswell and Plano Clark (2011: 21) argue that research methods consist of specific strategies and procedures for implementing the research design and include sampling, data collection, data analysis, and interpretation of the findings.

3.5.1 Sampling Procedures

This research adopted a multilevel mixed sampling strategy. In research, sampling is one of the elements of research methods Creswell and Plano Clark (2011:171). Given the research design adopted in 3.3, Creswell and Plano Clark (2011: 197) argue that multilevel sampling strategy is best fit than other sampling strategies since it allows the use of different tecniques to obtain different samples at different phases to answer the research questions. That is, multilevel mixed sampling strategy uses both probability and purposive sampling strategies and further, combines well, the established qualitative and quantitative techniques in a creative way to answer the research questions (Teddlie and Tashakkori 2009: 169). The multilevel mixed sampling strategy allowed a nested flow of sampling procedures where units of analysis were nested within each other. Table 3.2 summaries the procedures of the Multilevel Mixed Sampling Strategy adopted in this study. The table has five columns. The first column provides details about the sampling strategy used. The second column explains the aim of the sampling strategy used and what is expected to

be achieved. This column helps to show the purpose of the strategy and the expected outcome in data collection. The third column indicates the research strategies relevant to the sampling strategy adopted. The fourth column provides the data collection methods used and the last column indicates the phase in which the sampling strategy was used. The Multilevel Mixed Sampling Strategy was designed in this study based on the following criteria: firstly, logically link with the research questions; secondly, adhere to assumptions of sampling techniques; thirdly, generate thorough quantitative and qualitative data; fourthly, allow a clear inference to be drawn; fifthly, meet the research ethical issues as explained in section 3.8; sixthly, must be achievable given time and resources constraints; seventhly, allow for generalization of the findings and conclusion; and eighthly, well described and understandable.

Table 3.2 Multilevel Mixed Methods Sampling Strategy

Sampling Strategy	Aims	Research Strategy	Data Collection	Phase
Purposive: Sampling to achieve representativeness	Sampling to achieve a close representative sample of HEIs in Tanzania. The sample was used to assess the available ICT infrastructure that could support the use of CWT in a BL Framework in Tanzania.	A Survey	Questionnaire, Interview	I
Purposive: Sampling Special and Unique Cases	Sampling to achieve a unique representative of Courses, Facilitators, and Modules at each of the selected HEIs. Uniqueness is based on the need to get only courses which can be facilitated or are relevant to using CWT in a BL environment.	Case Study	Observation	II
	Sampling to achieve a unique representative of Students, Facilitators, ICT experts, and Regulatory Authorities. The sample is used to generate ideas for designing the BL framework.	Experiment / Case Study	Focus Group, Interview, Questionnaire, Observation	II
Probability: Multiple Sampling (Simple Random Sampling and Cluster	Sampling to achieve a representativeness of a population to validate and evaluate the draft BL Framewoek and New BL Framework respectively. Modules, students, and respective facilitators were selected. The sample was used to provide refining insights on the	Case Study, Experiment	Questionnaire, Interview, Observation	II

Sampling Strategy	Aims	Research Strategy	Data Collection	Phase
Sampling)	BL framework. Results were used to improve the framework before final test and validation in phase III.			
Probability: Multiple Sampling (Simple Random Sampling and Cluster Sampling)	Sampling to achieve a representativeness of a population to to test and validate the framework. Modules, students, and respective facilitators are selected. The sample is used to further provide experiences that can improve the BL framework. It is also used to validate the framework. Results are used to do final improvement and to do evaluation of the framework.	Case Study, Experiment	Questionnaire, Interview, Observation	III

Figure 3.3 presents three phases where the framework was designed and validated.

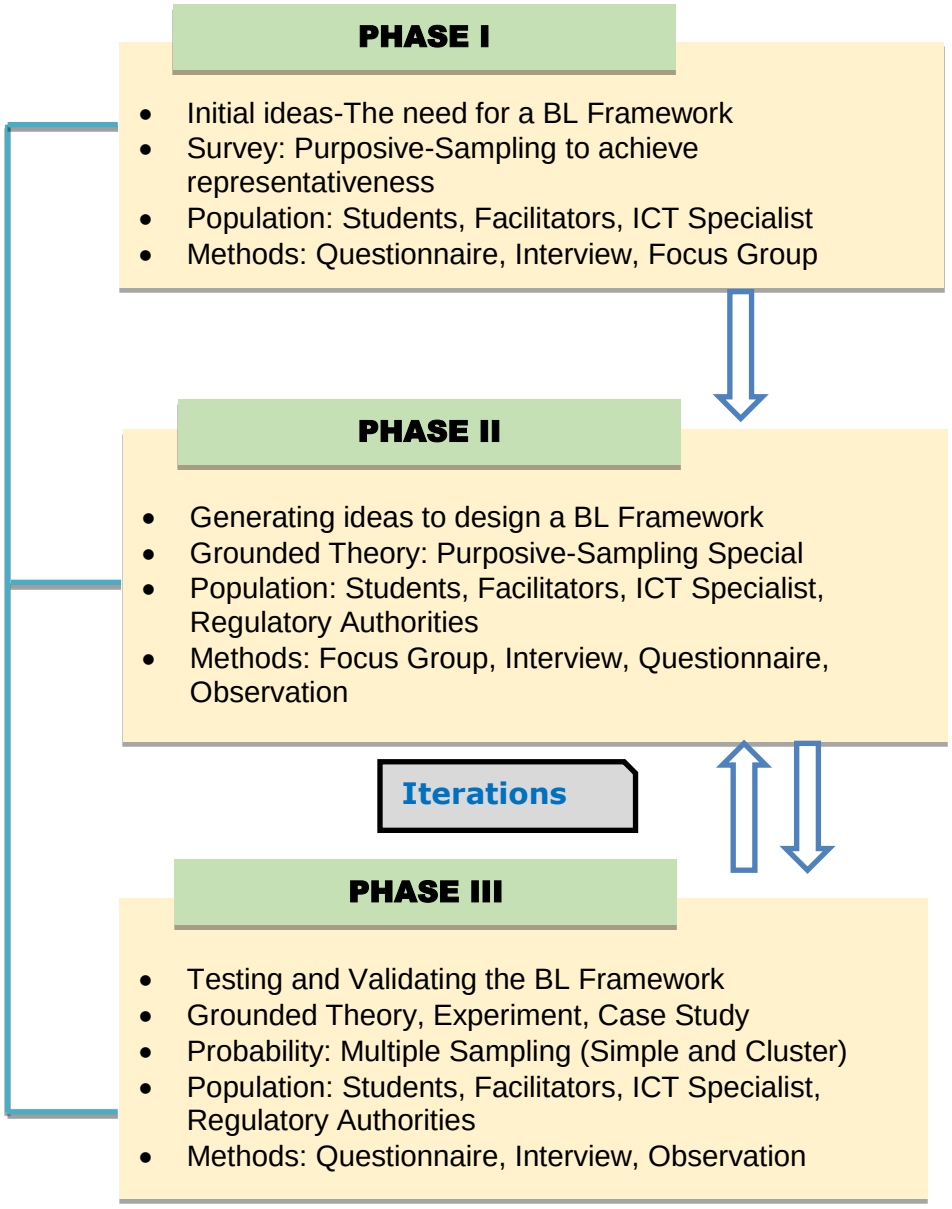


Figure 3.3 Sampling Strategies

3.5.2 Research Population and Sample

As discussed in section 3.7, the research was undertaken in three phases. During phase one of the research, the assessment of the available ICT infrastructure was carried out using the Mixed Methods (MM) approach (Creswell and Plano Clark 2011 and Pima *et al.* 2016). In the current study, a case study of six Higher Education Institutions was designed. The participating HEIs were taken from both Tanzanian Commission for Universities - TCU and the National Accreditation Council for Technical Education – NACTE (Pima *et al.* 2016). That is, three HEIs from TCU and another three HEIs from NACTE. The choice was also based on the geographical locations of these institutions countrywide. Other factors that influenced the choice of the six HEIs were based on logistics regarding the cost of the research and ease of access as well as the need to find data that is representative of HEIs in Tanzania (Saunders, Lewis and Thornhill 2009 and Pima *et al.* 2016).

A purposive sampling method was used to select six HEIs. The selected HEIs were the Institute of Accountancy Arusha (IAA), the Institute of Finance Management (IFM), the Open University of Tanzania (OUT), the University of Dar es Salaam (UDSM), St. August the University of Tanzania (SAUT) and Tanzania Institute of Accountancy (TIA). Then, each HEI had to provide participants. That is, at each of the six HEIs , a stratified sampling strategy was used to group participants into students, lecturers, and ICT staff. The students' group was further divided into postgraduate and undergraduate groups. This was meant to draw a representative sample of participants capable of answering research questions from all students' main groups (Pima *et al.* 2016). Then, a random sampling strategy was used to select survey participants from participating groups as further discussed in section 3.5.3.1 questionnaire.

In order to supplement the questionnaires, interviews were conducted on 178 selected interviewees to clarify their answers or to seek more in-depth information from them. They were made up of 150 students (25 from each of

the six HEIs), 20 academic staff randomly selected from the six HEIs and 8 ICT staff randomly sampled from the six HEIs. Furthermore, a review of institutional documents was used to supplement the questionnaires too. This included a review of the government reports on ICT infrastructure and projects to ascertain the current state of the art in Tanzania. The data collected from these sources were then triangulated (Saunders, Lewis and Thornhill 2009) and analysed together.

During phase two of the research, focus group meetings were held at IAA in order to generate more ideas for the design and validation of the draft BL Framework. The participants in the focus group meetings were purposively selected as shown in section 3.5.3.4.

During phase three, the draft BL Framework was validated by key experts. It was then applied in a real-world setting in which three cohorts were selected as discussed in chapter 7. The modules selected include Database Systems (ITU 07111) a first year degree module studied by all computing students; Database Systems and Implementation (ITU07314) for all second year computing students and Business Computer Applications (ITU07104) studied by all non-computing year one students. The results are presented in section 7.4.

3.5.3 Methods of Data Collection

3.5.3.1 Questionnaire

Questionnaires formed the main data collection method in phase one (**Appendix III**) and phase three (**Appendix IV**). During phase one, the reseracher distributed 1,461 questionnaires and 1,068 were returned (73%). For the returned questionnaires: 900 came from students (out of 1200), 120 (out of 177) were received from Lecturers and 48 (out of 84) ICT staff.

The questionnaire consisted of pre-determined questions distributed to each respondent. Telephone questionnaires and structured interviews were carried out to supplement the distributed questionnaires; the practice which is acceptable in research, in which, Saunders, Lewis and Thornhill (2009:355) provide examples such as TGI Friday's online questionnaire which combined both structured interviews and telephone conversations, was used to complement questionnaires.

In phase three, questionnaires were used too. Questionnaires were admistered to students after they had used the New BL Framework. The questionnaire in **Appendix IV** was used and the results presented in section 7.4. The questionnaires in phase one and phase three collected three types of variables. These included respondents' opinions, behaviours and attitudes (Saunders, Lewis and Thornhill 2009: 362). The variables were incorporated in the questions in order to ensure internal validity. Consistent questions were used for each similar questionnaire set for different groups of respondents in order to yield consistent results on every sampled institution, thus increasing reliability of the findings.

Table 3.3 Research methods, sources, and types of data

Research Method	Data Type	Sources of Data	Purpose
Documentary Review	Secondary	Publications, annual reports, Case Studies	Provide information on the past and current state of the art for understanding the problem domain.
Questionnaire	Primary	Students, Facilitators, ICT Specialists, Regulatory Authority	Obtain first-hand information (opinions, attitudes, interpretation) through open-ended and close-ended questions on the available ICT infrastructure to support CWTs; design of the framework; testing, and validating the framework.
Interview	Primary	Students, Facilitators, ICT Specialists, Regulatory Authority	Obtain first-hand information (opinions, attitudes, interpretation) through unstructured and structured interview on the available ICT infrastructure to support CWTs; design of the framework; testing, and validating the framework.
Observation	Primary	Students, Facilitators	Obtain first-hand information on the actions, behaviour, and events about the use of the available ICT infrastructure in BL environment, design, testing, and validation of the designed BL framework.
Focus Group	Primary	Students, Facilitators, ICT	Obtain first-hand information on impression, interpretation, and

Research Method	Data Type	Sources of Data	Purpose
		Specialists, Regulatory Authority	opinion on the design and validation of the BL Framework

3.5.3.2 Interview

Interview is an essential method for collecting views, attitudes and ideas about the study (see **Appendix V**). In this research, it was used to collect primary data responses from the interviewees (Robson 2013) as indicated in Table 3.4. The interview guide followed the MM strategy by combining “informal conversations” and the “general interview guide approach” as proposed by Teddlie and Tashakkori (2009: 229). The MM strategy allowed the generation of considerable information on the research. At a later stage, the “standardized open-ended interview” was used. In addition, telephone and internet interviews were used for participants who could not be reached easily by the researcher. In-depth information was obtained on participants’ attitudes, ideas, satisfactions and opinions (Teddlie and Tashakkori 2009: 239). The intervew was used from phase one through phase three. During phase one, interview was used to gather data about the available ICT infrastructure to support BL. In phase two, interview was used to generate ideas and knowledge for the design. Finally, in phase three, interview (**Appendix VI**) was combined with focus group meetings to validate and evaluate the New BL Framework.

3.5.3.3 Documentary Review

Documentary review methods comprised of relevant and authentic policy documents, published and unpublished reports, speeches and public records from the HEIs (Saunders, Lewis and Thornhill 2009: 263-265). There were no videos or audios used as part of documentary review (Robson 2013: 348,351). This data collection method was used in phase one and phase two. During

phase one, organisational documents were reviewed in order to establish the suitability of the available ICT infrastructure for supporting the use of CWTs in BL environment. In phase two, the review of documents aimed to establish the best practices and standards adopted in the learning process that affect the BL framework.

3.5.3.4 Focus Group Meetings

Focus group meetings were used in phase two (**Appendix VII**) and phase three (**Appendix VIII**) of the study. The study used two sets of focus group meetings as described in table 3.4 and table 3.5. The first three groups shown in table 3.3 were used to collect data for the design of the Draft BL Framework. The participants shown in table 3.3 were formed with homogenous members. The homogenous membership was meant to facilitate communication, promote active exchange of ideas and experiences, give a sense of safety during discussion and result into a framework (Robson 2013).

During validation of the Draft BL Framework, the three groups were combined to form a heterogeneous group of twelve participants. These were involved in a latter stage that validated the BL Framework together with the Quality Assuarance, Systems Administration, and Heads of Academic Department. The aim was to stimulate and enrich the discussion, inspire each other in order to create new understanding of the topic and enhance idea generation for the validation of a Draft BL Framework (Robson 2013, Saunders, Lewis and Thornhill 2009:341, Teddlie and Tashakkori 2009: 297 and Robson 2013: 228). The two sets formed a total sample size of 40. In tables 3.4 and 3.5, the first column shows the groups that participated and the second column shows the number of participants per each meeting.

Table 3.4 Distribution of Focus Group for the Draft BL Framework.

Group	**Number**
Students (Undergraduate and Postgraduate)	12
ICT Staff (Systems Administrators and User Support)	8
Faculty (Module Leaders and Facilitators)	8
Total	**28**

Additionally, the Draft BL Framework was followed by the validation process which involved a chosen group of experts as shown in table 3.5.

Table 3.5 Distribution of Focus Group for the Validation process.

Group	**Number**
Head of Systems Administration	1
Quality Assurance (NACTE 2; Heads of Academic Department 3)	5
Two representatives from each of the two groups above	6
Total	**12**

3.6 Data Analysis Procedures

3.6.1 Multilevel Mixed Data Analysis Strategy

A multilevel mixed data analysis strategy was adopted to analyse both the qualitative and quantitative data (Bryman and Bell 2007: 630, Teddlie and Tashakkori 2009: 279, and Creswell and Plano Clark 2011: 212). It builds on the Multilevel Mixed Methods Sampling Strategy described in table 3.2. The sampling strategy and phased approach used has an impact on the data collected and subsequently on data analysis. This is because the data collected are qualitative and quantitative. Another reason is the dependence and iterative nature between phases illustrated in figure 3.3. Therefore, the researcher adopted data analysis steps illustrated in figure 3.4 to utilize the benefits of the designated iterations.

The multilevel mixed data analysis began with editing of the raw data collected through the data collection methods. The aim was to remove inconsistencies and incompleteness (Kumar 2014: 296). It also helped to minimize errors, misclassification, and gaps. The second step was coding, where qualitative and quantitative data were coded. For instance, themes grouped qualitative data responses while for quantitative data, coding started with developing a Code Book which was pre-tested before actual coding and verification of coded data. After this step, the qualitative data was analysed using content analysis.

Steps in data analysis modified from Kumar (2009: 295)

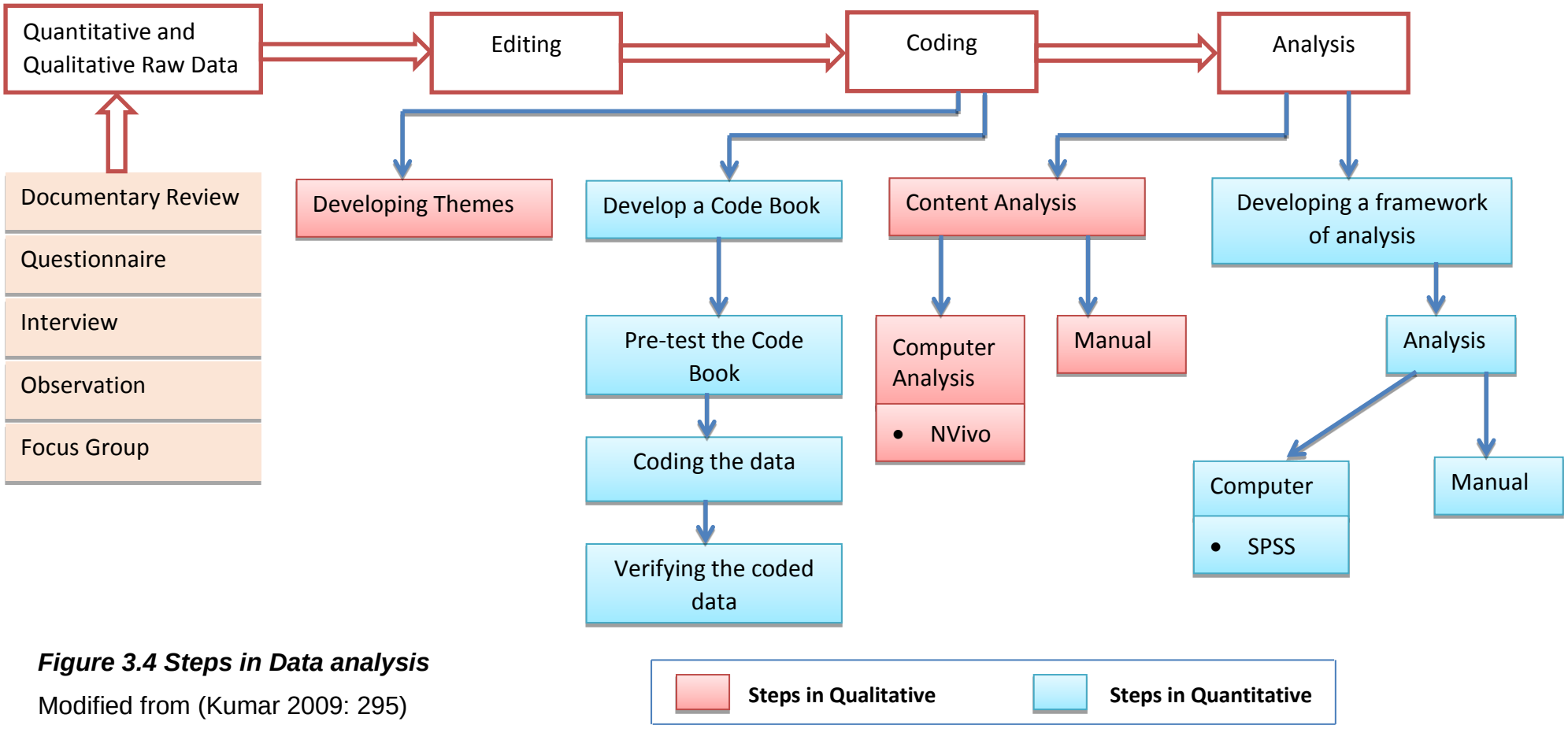


Figure 3.4 Steps in Data analysis

Modified from (Kumar 2009: 295)

3.7 Research Phases

Three research phases were designed as a problem-solving strategy by dividing the research into three manageable components as discussed in section 3.7.1 through 3.7.3 below. The essence of the phases aimed to ensure that the project programme is manageable, and the planned iterations would reduce the project complexity. Additionally, the three phases were meant to ensure ease tracking of the research progress and ensure quality process in the MMR adopted. The phases enabled the researcher to carry out the research and meet all the objectives. Please refer to the Gantt chart in Appendix IX which shows three phases of the research, where tasks for each phase are listed. The arrangement of the tasks in each phase considered the Coventry University PhD Checklists and the research process towards the design, validation and testing of the New BL framework (Selltiz *et al*. 1981: 50). Moreover, the research phases facilitated, logically, the implementation of the research program iteratively, to meet the aims and objectives of the research. For example, the first phase supported the second, and the third phase depended partly on phase one and on the second phase (Creswell and Plano Clark 2011: 72).

3.7.1 Phase One

Phase one was implemented from 2013 to 2014 September as shown in the Gantt chart in appendix IX. The activities done in phase one are reported in chapter one to chapter four of the thesis. During phase one, the first activity was literature review that established the research domain in terms of research gap(s), best practices and evaluation criteria. Secondly, a survey was undertaken to identify the available ICT infrastructure that could support the use of CWTs in a BL Framework. During phase one, the first-three research objectives were implemented. The results in phase one provided inputs on how and what CWTs could be used for the design of the new BL Framework. Firstly, it asserts the available ICT infrastructure in Tanzania that could support the use

of CWTs in BL environment. Secondly, the results in phase one provided inputs on the usage patterns of the CWTs in HEIs in Tanzania. Furthermore, the research methods were designed, and the literature review strengthened. However, the review of the literature was done throughout the research.

3.7.2 Phase Two

The results in phase one were used to inform the activities in phase two. That means, the available ICT infrastructure results and the usage patterns described in chapter four were considered during the design of the BL framework. During phase two, one of the HEIs in Tanzania, the Institute of Accountancy Arusha (IAA) was studied in greater depth using a purposive sampling method. The main data collection method during phase two was the Focus Group. The data collected were used to design the draft BL Framework while taking into considerations the available ICT infrastructure and the usage patterns. Additionally, during phase two the designed draft BL Framework was validated by key experts and refined accordingly as discussed in chapter five and six of the thesis. The feedback comments from the participants (students and lecturers) were collected using two sets of questionnaires and interviews for both students and lecturers. There were iterations between the draft and the refined framework. Moreover, during phase two, the literature review continued to inform and guide the data analysis, evaluation and conclusion.

3.7.3 Phase Three

During phase three, much information was taken from phase two. The BL Framework was refined based on the feedback from phase two. Additionally, during phase three the validation case study was run as further discussed in chapter six and chapter seven. The three phases helped the researcher to meet all the five objectives explained in section 1.3.2. The approach taken is reproducible and could be tested in similar settings. Next is, the research ethical considerations guided the execution of the research project.

3.8 Ethical Considerations

The research adhered to the Coventry University Policy 2009/2010 by getting prior approval to conduct research in Tanzania. Ethical approval was also sought from and granted by Coventry University (see **Appendix X**). Access to sites including students and lecturers at the selected Institutions were sought and granted. All participants received the Research Information Sheet and the Informed Consent Forms in **Appendix II**. Participants were informed that their participation was voluntary, and they were free to withdraw their participation at any time. They were informed about the purpose of data collected. Additionally, data confidentiality and anonymity of respondents were ensured.

3.9 Summary

In summary, the research adopted mixed methods design using both deductive and inductive approaches. Two research strategies were used namely a survey and a case study. The research adopted a multiphase sampling strategy where the sample size depended on the phase and the data needed at each phase. The data collection methods used were questionnaires, interviews, observation, and documentary review and focus group meetings. Ethical considerations were adhered to throughout the study.

CHAPTER FOUR

4.0 ASSESSMENT OF AVAILABLE ICT INFRASTRUCTURE

4.1 Introduction

In this chapter, the results and findings of the survey carried out in phase one are presented. The survey aimed to assess the available ICT infrastructure in HEIs in Tanzania required to support the use of CWTs in a BL environment and to assess the essential usage patterns of CWTs. As discussed in chapter three sections 3.4.1 and 3.7.1, a survey was used to collect information from six HEIs in Tanzania. The survey sought to answer two research questions only.

a) What are the common essential usage patterns of the CWTs in Tanzanian Higher Education Institutions?
b) Is there any ICT infrastructure that can support BL with CWTs in Tanzanian HEIs?

The survey was meant to inform the design of the BL Framework in phase two and its validation in phase three. The chapter is organised into three sections: the overview, the results based on the research questions and summary. For identification of research questions, the *RQ* is used to represent *Research Question* listed in section 1.3.3 while *n* stands for the question number. Additionally, the following abbreviations were used in relation to the quotes:

a) LQ*n*: Lecturer Quote; where *n* represents the number of the quote.
b) STQ*n*: Student Quote; where *n* represents the number of the quote.
c) ITQ*n*: ICT Staff Quote; where *n* represents the number of the quote.
d) ADQ*n*: Administrator Quote; where n represents the number of the quote.

The research questions were answered through questionnaires shown in appendix III (a-c). Thus, the presentation of results in this chapter refers to the questionnaires administered to students (appendix IIIa), lecturers (IIIb) and ICT Staff (IIIc).

4.2 Research Question 2 (RQ2)

What are the common essential usage patterns of the CWTs in Tanzanian Higher Education Institutions? This research question was answered using two sets of questions (RQ2a and RQ2b) as presented below.

RQ2a: Are there any distinct themes emerging from CWTs usage patterns in Tanzanian HEIs?

A usage pattern means how users use the CWTs (Kang, Seo and Hong 2011 and Deniz and Geyik 2015). Given the facts that internet usage patterns have been changing from time to time globally (Madureira *et al.* 2013), this research sought to establish the usage patterns of the CWTs in HEIs in Tanzania. According to Penard *et al.* (2015) internet usage patterns consist of information about how the internet is used, the devices used and the connection options available (Li and Zhu 2011). The current research adopted the definitions given by scholars (Madureira *et al.* 2013, Penard *et al.* 2015 and Deniz and Geyik 2015). A survey was carried out on the internet usage patterns in Tanzanian HEIs to inform the design of the draft BL Framework. The themes under internet usage patterns included firstly, the available devices in HEIs is assessed from the students, lecturers and ICT staff. Secondly, the internet connection options and usage patterns and thirdly, the available and legacy systems in HEIs in Tanzania.

4.2.1 Available Devices

The available devices investigated in this study included devices capable of connecting to the internet and how they were used to access the available web-based systems including the CWTs in HEIs in Tanzania. The questions were designed for students, lecturers and the ICT staff as found in appendices IIIa, IIIb and IIIc respectively. The results are presented group wise, starting with students in 4.2.1.1, then lecturers in 4.2.1.2 and finally, the ICT staff in 4.2.1.3.

4.2.1.1 Students' Results

In the students' category, question 10 in appendix IIIa asked the respondents about the ICT devices in their possession. The result in question 10(a) showed that 408 (45%) respondents possessed desktop computers and 492 (55%) did not possess any desktop computer. In question 10(b) 705 (78%), respondents answered YES that they possessed laptops and 195 (22%) did not possess any laptops. The responses to question 10(c) revealed that 715 (79%) respondents had smart devices while 196 (21%) respondents had no smart devices in their possessions. The responses to question 10(d) showed that there were 704 (78%) students who had tablets and 196 (22%) respondents did not own any tablets. In question 10 (e), there were 860 (96%) respondents who owned feature phone (normal mobile phones) and 40 (4%) respondents who had no feature phones.

With reference to appendix IIIa question 11, students were asked to select the type of the devices they use to connect to the internet. A summary of the results is provided in figure 4.1. The selected devices were being used to connect to the internet except the feature phone (only for voice call and text message) in part 11(e). This indicated that students in HEIs use varieties of devices to connect to the internet. The results also show that most students had more than one device capable of connecting to the internet.

For the qualitative data, a follow up interview with students was conducted. The results showed that students had more than one device due to several factors. The factors included the need to have more than one SIM card to take advantage of different internet and data connection offers and tariff bundles.

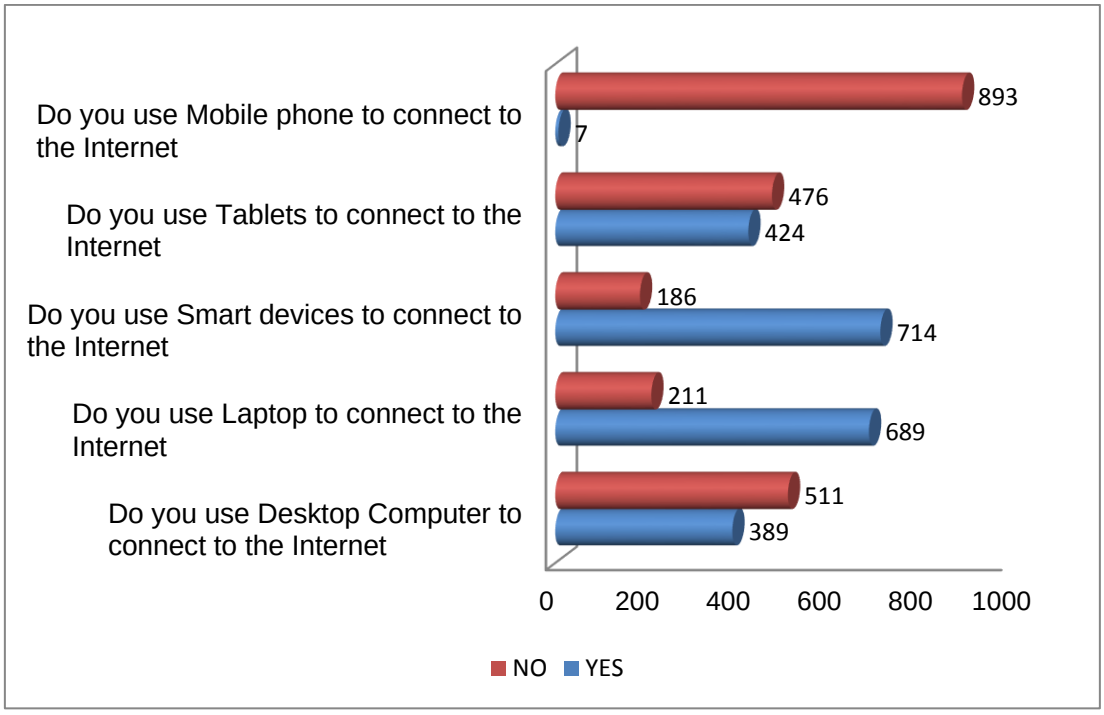


Figure 4.1 Devices used for Internet Connection

Another factor mentioned during the interview was to always ensure availability where students were switching from one device to another due to power supply problems. It was also mentioned that students tended to have one SIM card to communicate with parents and relatives and another SIM card for friends such as boyfriend/girlfriend only or for chatting with peers only. Students further indicated through the interview that their strong presence on social media was enabled by the above devices.

> *STQ1: "I'm always online to chat and surf the internet, I don't want to miss out."*
>
> *STQ2: "...I prefer two SIM Cards to avoid quarrels with my friend and my parents as well."*
>
> *STQ3: "At the university I use the university internet, then at home I use my data bundle, so I needed a smart phone and my mummy bought one for me."*
>
> *STQ4: "…. although my friend has no smart phone, but she gets everything from us and the university labs."*

4.2.1.2 Lecturers' Results

Lecturers were asked two questions about the available devices theme explained in section 4.2.1. Question 10 in appendix IIIb asked the respondents about the devices they use to connect to internet. In question 10(a) which asked, "Do you use Desktop Computer to connect to the Internet?" 99.2 (n=119) said YES and 0.8% (n=1) said NO. In question 10(b) which asked, "Do you use Laptop to connect to the Internet?" 81.7% (n=98) said YES and 18.3% (n=22) said NO. In question 10(c) which asked, "Do you use Smart device to connect to the Internet?" 90% (n=108) said YES and 10% (n=12) said NO. In question 10(d) which asked, "Do you use Tablets to connect to the Internet?" 80.8% (n=97) said YES and 19.2% (n=23) said NO. In question 10(e) which asked, "Do you use Mobile phone to connect to the Internet?" 89.2% (n=107) said YES and 10.8% (n=13) said NO. The above results show that these devices can connect with ease to the Internet.

In question 22, respondents were asked whether they can access web-based systems including the CWTs by using the devices they have. The results are summarised in table 4.1. The results in table 4.1 show the most used devices and the web-based systems where smart phone was the most used device.

Table 4.1 ICT Devices for Web-based Systems and CWTs

	Mobile Phone	Smart Phone	Laptop	Desktop	All	Mixed	TOTAL
Search Engine	1	44	0	0	36	39	120
Online Databases	0	44	0	0	36	39	119
Podcasts	1	44	0	0	37	38	120
Face book	1	44	0	0	37	38	120
Blogs	0	2	0	0	2	115	119
Twitter	0	2	0	0	19	98	119
Wikis	0	10	0	0	10	99	119
LinkedIn	0	10	0	0	11	98	119

	Mobile Phone	Smart Phone	Laptop	Desktop	All	Mixed	TOTAL
RSS	0	2	0	0	19	98	119
Instagram	0	21	0	0	19	79	119

The qualitative data were collected from the interviews. In a follow up interview which assessed the number of devices had by lecturers, the results show that lecturers (67%) had more than one device to ensure availability and flexibility in selecting the provider.

> *LCQ1: "… surely, the two devices I use help me to supplement the uni internet and at home I surf as well."*
> *LCQ2: "We have enough to use for online teaching, and I interact well with my students even at home, unless there are power cut-off."*
> *LCQ3: "We have a lot of emerging devices these days, it is just you to choose which, and to learn fast."*

4.2.1.3 ICT Staff Results

Question 17 in appendix IIIc was used to ask ICT staff whether their clients were able to access a list of web-based systems including CWTs by using their devices. Both the detailed questions and the results are summarised in table 4.2 below. From table 4.2, the results show over 50% of the IT staff in higher education institutions in Tanzania use mixed devices and, in some instance, they could use all devices.

In a follow up interview, it was revealed that the systems mentioned in Table 4.2 were accessible through all devices mentioned in column two through five.

For instance, interview results show that the LMS such as Moodle had a mobile app such that it could be accessed through the desktop, laptop and all mobile devices.

Table 4.2 Devices used to connect to the internet at HEIs in Tanzania

	Mobile Phone	Smart Phone	Laptop	Desktop	All	Mixed	TOTAL
With which devices can you access Students Portal?	0	0	0	0	6	42	48
With which devices can you access Staff Portal?	0	0	0	0	7	41	48
With which devices, can you access University Website?	0	0	0	0	40	8	48
With which devices, can you access LMS (Moodle)?	0	0	0	0	25	23	48
With which devices, can you access Students' Academic Records Systems?	0	0	0	0	4	44	48
With which devices, can you access Social Networks?	0	0	0	0	15	33	48
With which devices, can you access Wikis?	0	0	0	0	18	30	48
With which devices, can you access Blogs?	0	0	0	0	21	27	48
With which devices, can you access Podcast?	0	0	0	0	11	37	48
With which devices, can you access Online Databases?	0	0	0	0	20	28	48

ITQ1: "we have launched Moodle App and both students and Lecturers can access it through all devices including smart phones and tablets."
ITQ2: "…to access students and staff portals for instance, only internet connection is needed, and Microsoft SharePoint allows connection from any authenticated devices."

The results from the students, lecturers and the ICT staff presented above show the emerging themes of the devices used to connect to the internet. These include desktop computer, laptop, Smart devices and Tablets used for online activities by students in HEIs in Tanzania. Furthermore, the results above show that the devices are used to connect to the internet for reasons, among others, accessing learning materials or sharing knowledge. These emerging themes suppose that there are varieties of devices amongst the students and lecturers to use for online activities including learning and teaching.

4.2.2 Internet Connection and Usage Patterns

For the students, lecturers and the ICT staff, the theme used a set of five questions grouped to address two key issues: firstly, the internet connection mechanisms and ISPs and secondly, the internet tools and how they were used.

4.2.2.1 Students' Results

Using the questionnaire in appendix IIIa, quantitative data from the questionnaires were collected using firstly, question 12 which asked about the types of connection mechanism used and secondly, question 13 (appendix IIIa) which asked about the Internet Service Provider (ISP) used. The results from question 12 show that majority (n=717) were using Mobile (SIM card) data connection at home or residence followed by Wi-Fi (n=714) at University. The illustration in figure 4.2 show further that many students (n=689) use mobile data connection at home/residence more often than other types of connections.

The qualitative data from the interviews further revealed that mobile broadband was also commonly used. Finally, the qualitative data show the least used type of connection to be wired (cable) data connection due to extra cost for setup and initial cost to establish the connection at home/residence. Note that the names of the *providers* have been withheld for ethical purposes.

> *STQ5: "…. Provides cheap and flexible internet connection data bundles, so I prefer mobile data connection."*
>
> *STQ6: "I only use wired connection in the uni labs with uni computers, not at home."*
>
> *STQ7: "sometimes I use the [provider_name] modem to connect to the internet at home and at school."*

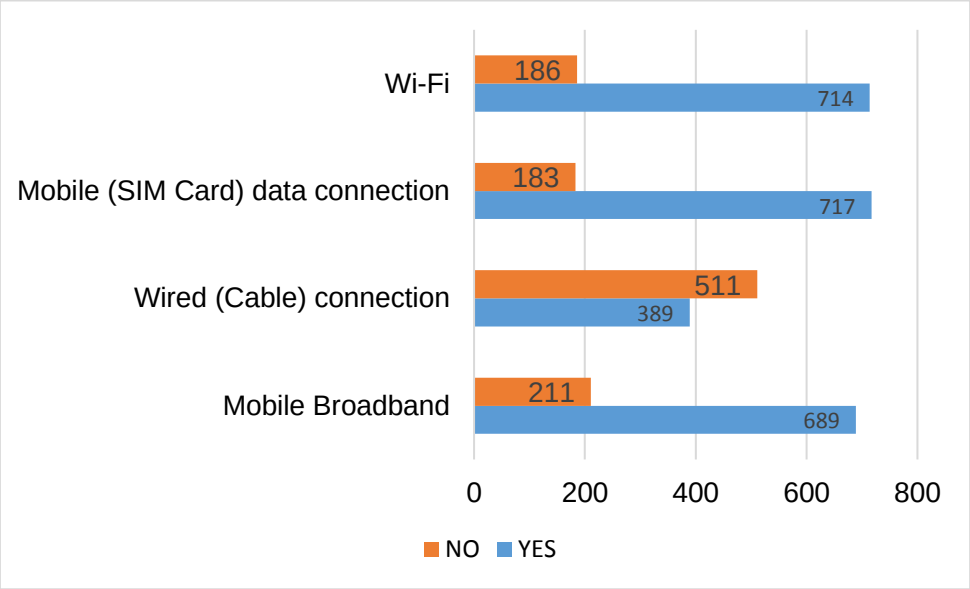


Figure 4.2 Internet Connection Mechanism used by Students of HEIs in Tanzania

The themes emerging from the results above show five types of connections available: Wi-Fi, Mobile (SIM Card) data connection, Wired (cable) connection and Modem/mobile Broadband connection.

Furthermore, in question 13 of the questionnaire (appendix IIIa) students were also asked to tell their ISPs. ISP is a key component of the ICT infrastructure

that ensures reliable and high-speed internet connection. The results show that majority of students (n=680) 76% were TiGo subscribers; followed by Vodacom (n=496); then Airtel (n=377); TTCL (n=360), SMILE (n=181) and Zantel (n=170).

In a follow up interview, qualitative data revealed that at the time of data collection (July 2015) the highly ranked mobile data providers had had affordable tariff bundles compared to other providers. They also had special bundles for HEIs students in which students could purchase only at campuses.

In figure 4.3, the types of bundle tariffs collected using question 14 in appendix IIIa are presented. The results showed that 42% of students (n=900) had been using weekly tariff, 31% monthly tariff, 21% a day tariff, 4% mixed tariffs and 2% hourly tariff.

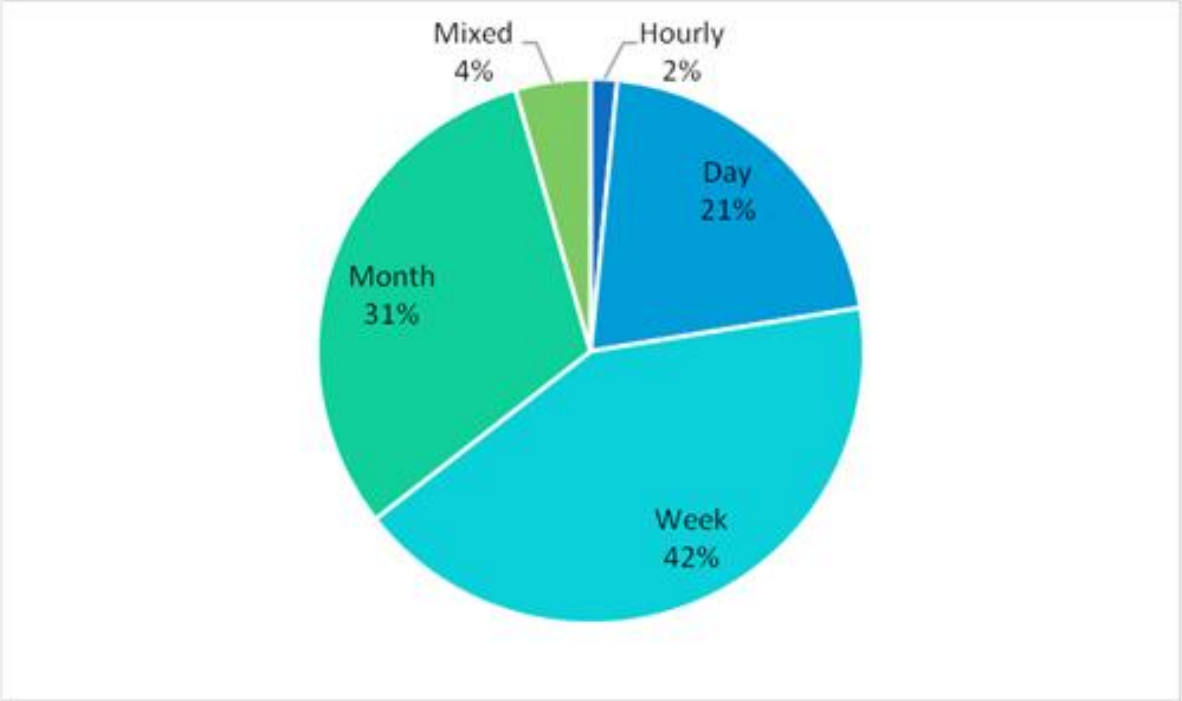


Figure 4.3 Types of Internet Bundle Tariffs used

Finally, quantitative data collected using question 15 in appendix IIIa “Do you have an account in any of the CWTs?” show that 84.3% had accounts and 15.7% did not have any account in any of the CWTs.

Then, qualitative data were collected from an interview which asked the 15.7% of the respondents who had said that they had no account in any of the CWTs system. The question asked them whether they plan or wish to have an account in any of the CWTs. The result shows that all interviewees would be happy to have an account in Facebook, blogs, wikis and YouTube. The themes appearing from the results above include: major ISPs, the Internet tariff bundles and the readiness to create CWTs accounts.

4.2.2.2 Lecturers' Results

Question 11 (appendix IIIb) asked about the internet connection mechanisms. The results are summarised in table 4.4.

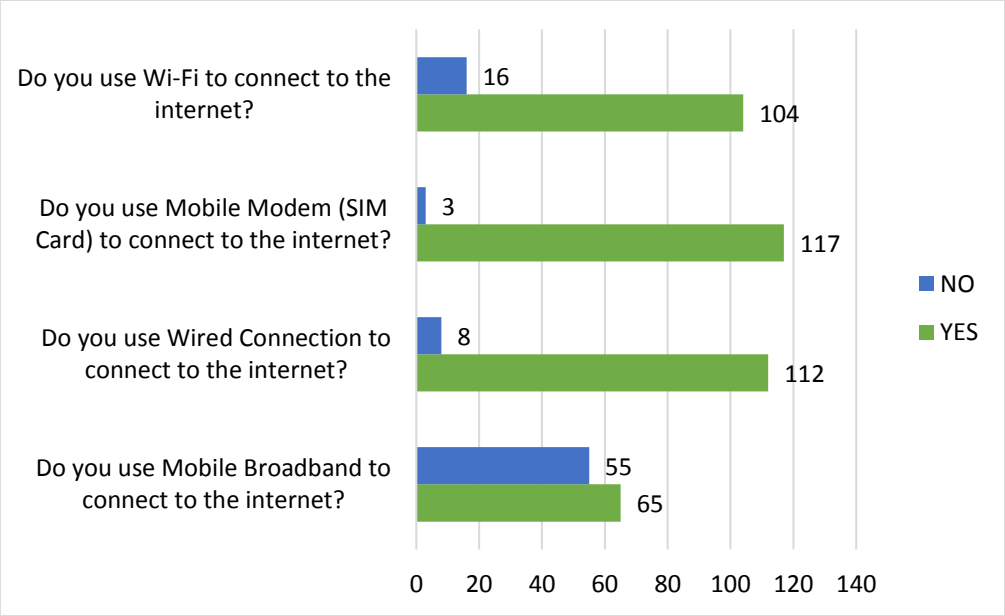


Figure 4.4 Internet Connection Mechanism used by Lecturers

The quantitative results in figure 4.4 were collected using question 11. In question 11(a), the results show 56% (n=65) of the respondents were using Mobile Broadband and in 11(b) 93% (n=112) were using wired connection. The results show further that internet connection mechanisms used by lecturers included SIM Card or Mobile data services (by 97 %,) and Wi-Fi (by 87%).

In follow up interviews, the qualitative data collected using interviews revealed that mobile data from cellular network providers were being used more than all other types of connection. The least used was the mobile broadband. The themes emerging from the results above show five types of connections available: Wi-Fi, Mobile (SIM Card) data connection, Wired (cable) connection and Modem/mobile Broadband connection.

Additionally, question 12 in appendix IIIb, asked the lecturers to rank the ISP used. The quantitative data in figure 4.5 showed Tigo as the leading ISP for mobile data services, followed by Vodacom and then Airtel.

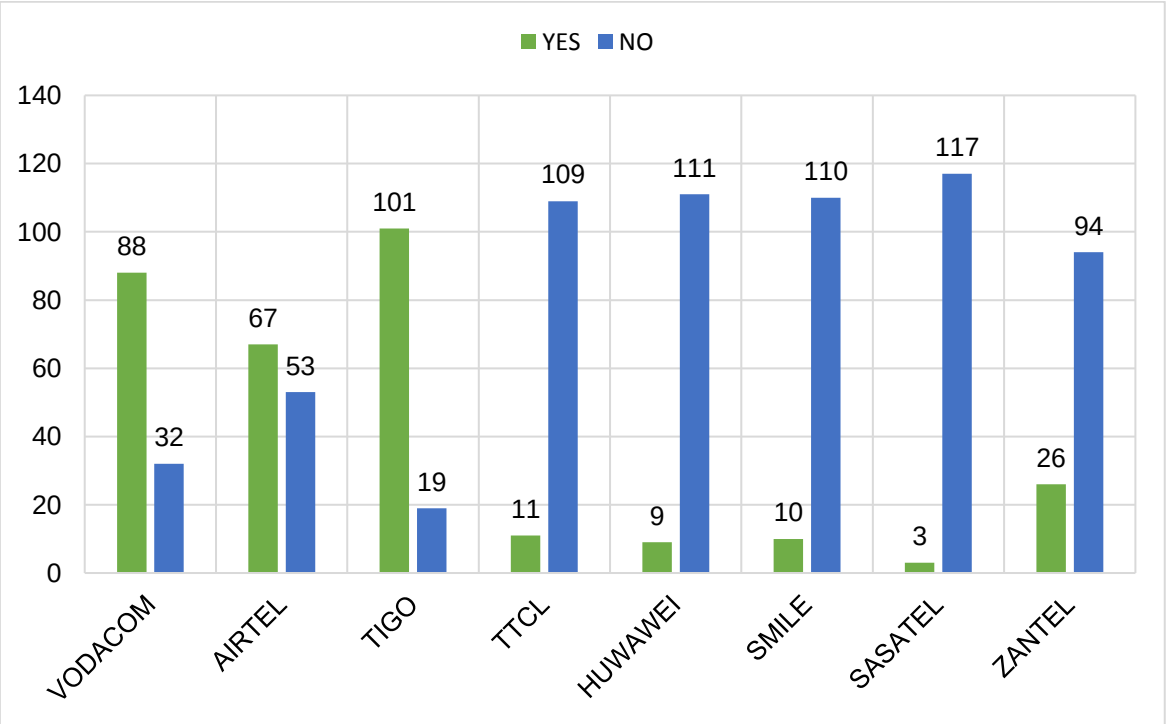


Figure 4.5 Common ISPs used by Lecturers of HEIs in Tanzania

Similarly, qualitative data show related results as said below:

> *LCQ4: "… [provider_name] is more reliable than others when I am at home and I could use it at my office too."*

Moreover, lecturers (n=120) were asked to state the types of tariff preferred most in question 13 (appendix IIIb). The results in figure 4.6 show that 78% of the respondents preferred monthly tariffs. In a follow up interview, lecturers revealed that monthly tariffs were giving them room to plan and budget as well as give enough bandwidth for the whole month at an affordable discount.

> *LCQ5: "…. I have more choices to use mobile data. I can pay through many options including M-Pesa and through my bank account too."*

The results also show that 12% of the respondents were using mixed tariffs. In a follow up interview, respondents revealed that mixed tariffs were being used to meet specific needs such as uploading homework at the end of coursework, downloading YouTube clips to supplement lecture notes, and social media access.

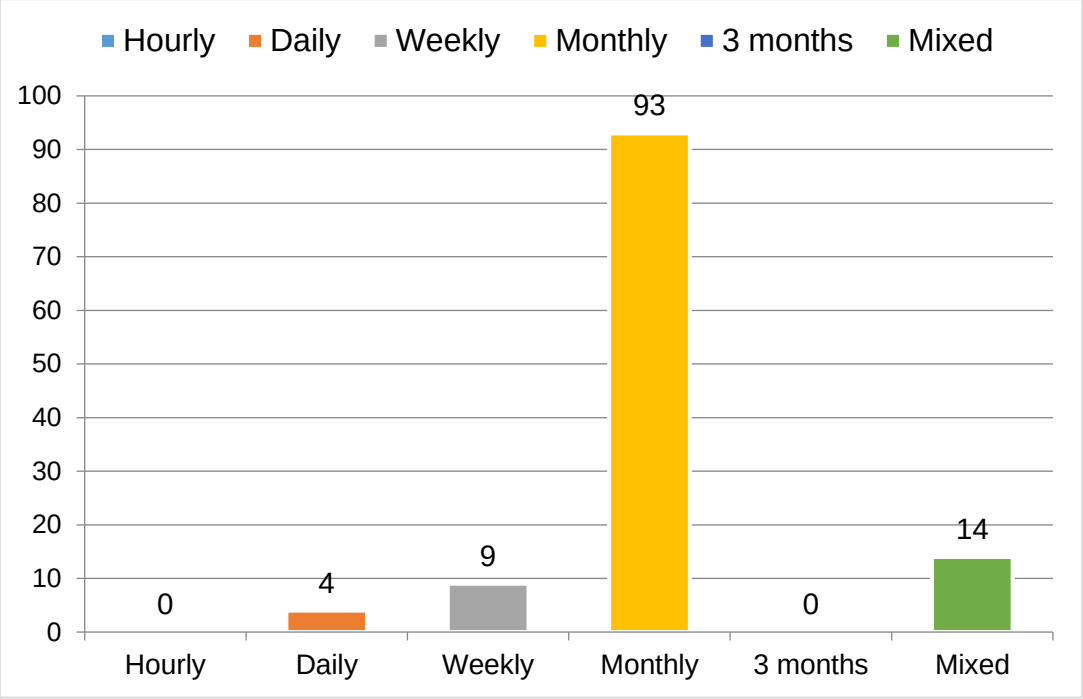


Figure 4.6 Types of Internet Bundle Tariffs used

Finally, in question 14 (appendix IIIb), respondents were asked to state whether they had an account in any CWTs. The results show that 84.2% of respondents (n=120) had accounts and 15.8% did not have any account in any of the CWTs. In the Follow up interview questions on this account, lecturers revealed that they have accounts in social media such as Facebook, Twitter, Instagram, blogs, wikis and YouTube. However, those who had no account in the CWTs were ready to have one in future.

The themes emerging from the results above show the major ISPs, the Internet tariff bundles and the readiness to create CWTs accounts.

4.2.2.3 ICT Staff Results

Question 10 (appendix IIIc) asked ICT staff to mention the ISPs used in their respective HEIs. Question 11 (appendix IIIc) asked ICT staff to choose the type of internet connection used at their institutions. The results show that all HEIs were using ADSL connected through National Fibre Optic Backbone. The reason for the choice of one ISP by all HEIs was that "*it is a government policy*" where all HEIs were needed to use the government bandwidth at an affordable price provided by TTCL. Until December 2017, TTCL was a corporate institution owned 100% by the government of Tanzania. In question 12 (appendix IIIc), ICT staff were asked "How reliable and available is your ISP?" The results show that 90% (n=43) said the ISP was reliable while 11% (n=5) said the ISP was somehow reliable.

Furthermore, the qualitative data also revealed that wireless was being used as a backup and free internet service targeting students other than staff. In addition, interview findings showed that Wi-Fi is provided by private companies and used for backup facilities. Nevertheless, the ICT staff said the ICT Policies in their institutions do not restrict the use of CWTs. On the bandwidth, the quantitative data show 100% of the HEIs started with 512kbps in early 2000 to 15mbps in 2015.

> *ITQ3: "Our policies are not very strict to social media, although we don't allow absolute access over academic use."*

The themes emerging from the results above show the major ISPs, the Internet tariff bundles and the readiness to create CWTs accounts.

4.2.3 Legacy and Base Systems at HEIs

4.2.3.1 Student Results

The legacy and base systems form an essential component to assess the internet usage patterns through internet skills, effective use and access related issues. For the quantitative data, in question 20 (appendix IIIa), student

respondents (n=900) were asked: “In your own opinion, do you need training to use internet?” The results show that 63% of all respondents (n=900) said they did not need training to use internet. This means that over 570 respondents were frequent users of the internet and internet-based systems. However, 30% of the respondents said they needed training to use the internet while 6% said they were not sure if training was essential for them.

The qualitative data show the reasons for each of the three responses:

STQ8: “I have been using the internet for above 2 years now.”

STQ9: “I just joined the university and it is my first time I use internet.”

STQ10: “I will learn the time I am needed to do so!”

Furthermore, in a follow up interview, qualitative results revealed that there were few students who had never used their IT accounts at their universities. However, the same students who never used their university accounts had created accounts in some of the CWTs such as Social media and YouTube. That means, they were online with the CWTs than the university systems. However, the experience gained by the students, from the use of CWTs, could motivate students to use the CWTs in learning and teaching.

The researcher further asked students (question 21 appendix IIIa) “How do you access the named learning systems/media above? The results in figure 4.7 show that the university websites being accessed from anywhere and needs no authentication. The Students’ Portal was accessed more from within the campus than outside the campuses; and Learning Management Systems (Moodle) results show access from anywhere with authentication needed.

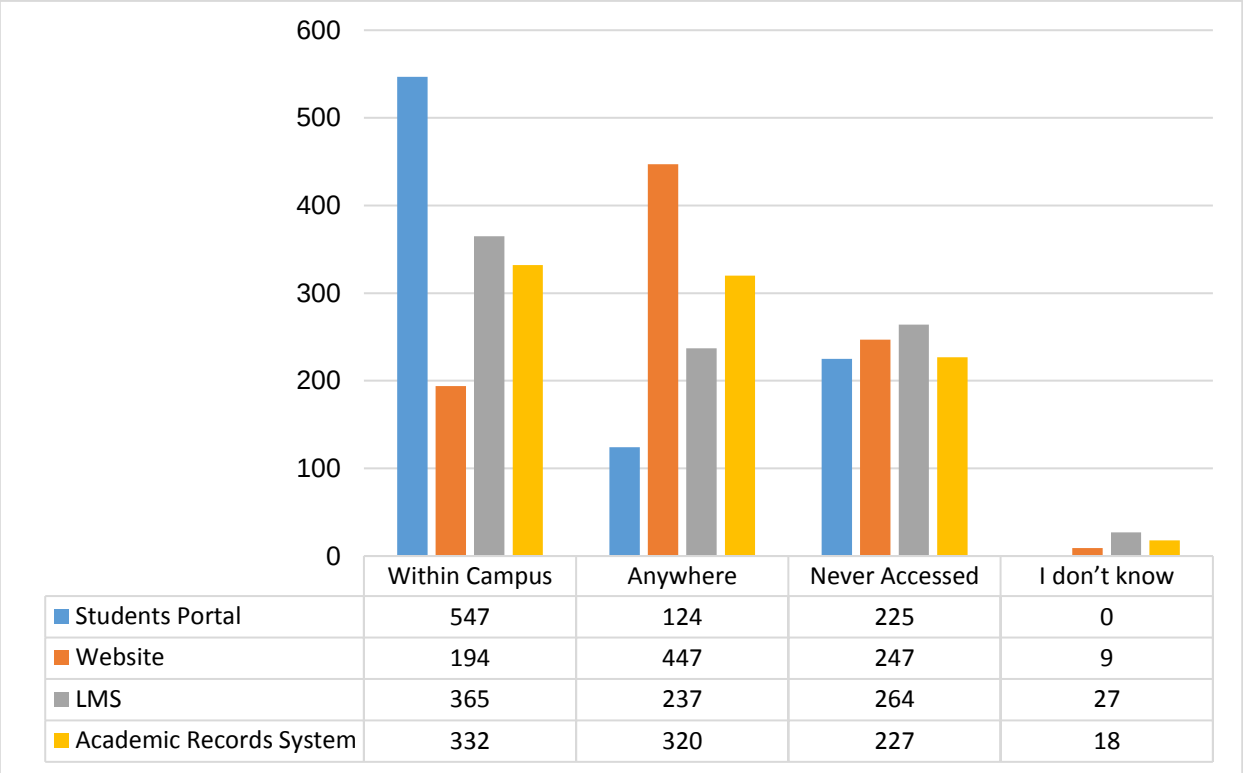


Figure 4.7 Access to Information Systems

The frequency of access to available university information systems was further assessed through question 22 (Appendix IIIa). Respondents were asked "How often do you visit or use the learning systems/media above? The results are summarised in table 4.6.

Table 4.6 Frequency of Access to University Information Systems

System	Daily	1-3 days a week	Once a week	1-3 days a month	very rarely	never accessed
Students Portal	124	125	139	41	308	163
Website	317	243	141	25	138	36
LMS	113	151	203	61	195	177
Academic Records System	193	165	156	73	133	180

System	Daily	1-3 days a week	Once a week	1-3 days a month	very rarely	never accessed
Social Media	351	195	161	30	97	64

The results in Table 4.6 show social media and university website being accessed often (on daily basis) by 334 students on average. The results also show that 159 students on average were accessing academic records systems and Students' Portal daily. The results also show weekly average of 235 students on social media and university website. However, the most rarely visited system is the Students' Portal (n=308, 34%) followed by the LMS (n=195, 22%). 20% of the students (n=180) had never visited the academic records systems and LMS.

Taking into consideration both qualitative and quantitative results, the emerging themes include legacy systems being used to enhance internet surfing skills and experiences. Examples of the legacy system used include the Students Portal, Staff Portal, Websites, Learning Management Systems (LMS) and Academic Records Systems. Moreover, students accessed more social media than the legacy systems at their HEIs.

4.2.3.2 Lecturers' Results

In question 18 (appendix IIIb), lecturers were asked to state whether they needed training to use the CWTs. The results showed that all lecturers did not need training to use CWTs in teaching and learning in their respective modules.
In question 19 (appendix IIIb), respondents were asked "Does your university/institution have the following learning systems/media?" The results are summarised in figure 4.8.

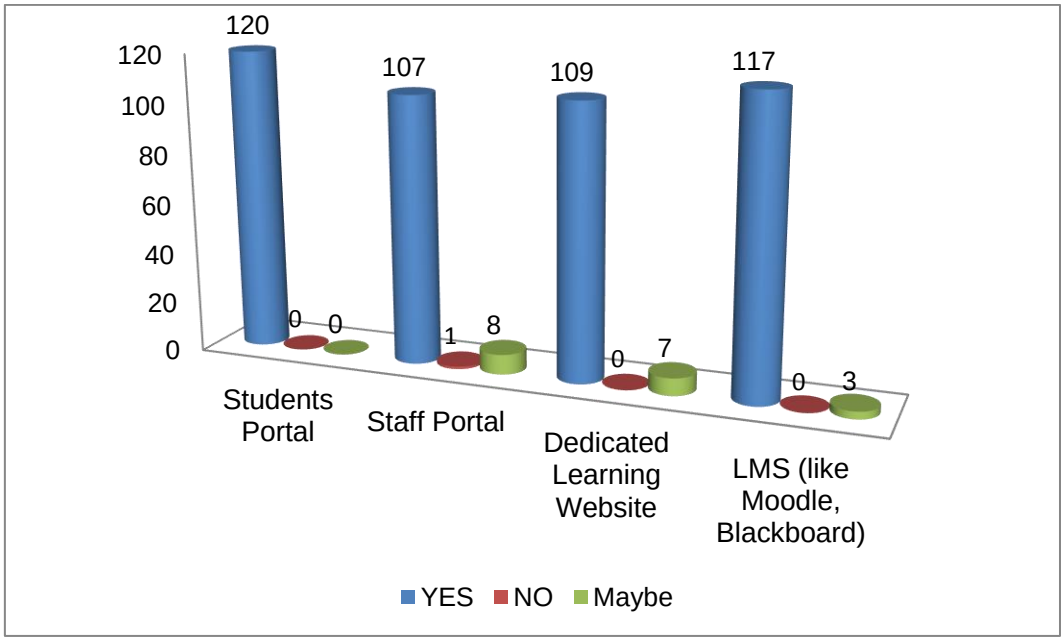


Figure 4.8 Available Information Systems in HEIs

Figure 4.8 shows that 100% (n=120) of the respondents said that their HEIs had Students' Portal. 89% (n=107) of the respondents said HEIs in Tanzania had staff portals and 90% (n=109) said HEIs had working websites. In addition, the results show that 98% (n=117) of the respondents said HEIs had LMS such as Moodle and Blackboard. These systems form a strong base for the legacy system supporting learning and teaching in HEIs in developing countries.

Question 20 (appendix IIIb) asked respondents how and from where they could assess the available information systems by selecting one of the following: "only on campus", "from anywhere", "never accessed" and "I don't know". On the accessibility of students' portal, 39% said it was accessible only on campus, 43% said it was accessible from anywhere, 13% said they had never accessed it and 4% said did not know.

The frequency of visit was also assessed (see question 23, appendix IIIIb) as part of how they used the legacy systems. The question aimed to identify behavioural patterns by lecturers on the existing systems. The results in figure 4.9 show that search engines were being accessed daily by 68% (n=82)

respondents than other systems. The social networks (Facebook and Twitter) were more accessed that is, 1-3 days a week by 44% (n=53) respondents than other systems. Learning Management Systems (LMS e.g. Moodle and Blackboard) were being more accessed at least once a week than all other systems by 53% (n=63) of the respondents.

When supplementing the quantitative data above, interviews were carried out and the results presented below:

> *LCQ6: "The search engine, Google, is a must to use daily for searching its databases."*
>
> *LCQ7: "The tool I use often is the student Portal…for uploading and informing my students. Secondly, the Moodle, although not all students are enrolled into the Moodle."*

From the findings, the current systems in HEIs are often used as indicated. Moreover, taking into consideration both qualitative and quantitative results, the emerging themes include legacy systems being used to enhance internet surfing skills and experiences. Examples of the legacy systems used include the Student Portal, Staff Portal, Websites, Learning Management Systems (LMS) and Academic Records Systems. Moreover, students accessed more social media than the legacy systems at their HEIs.

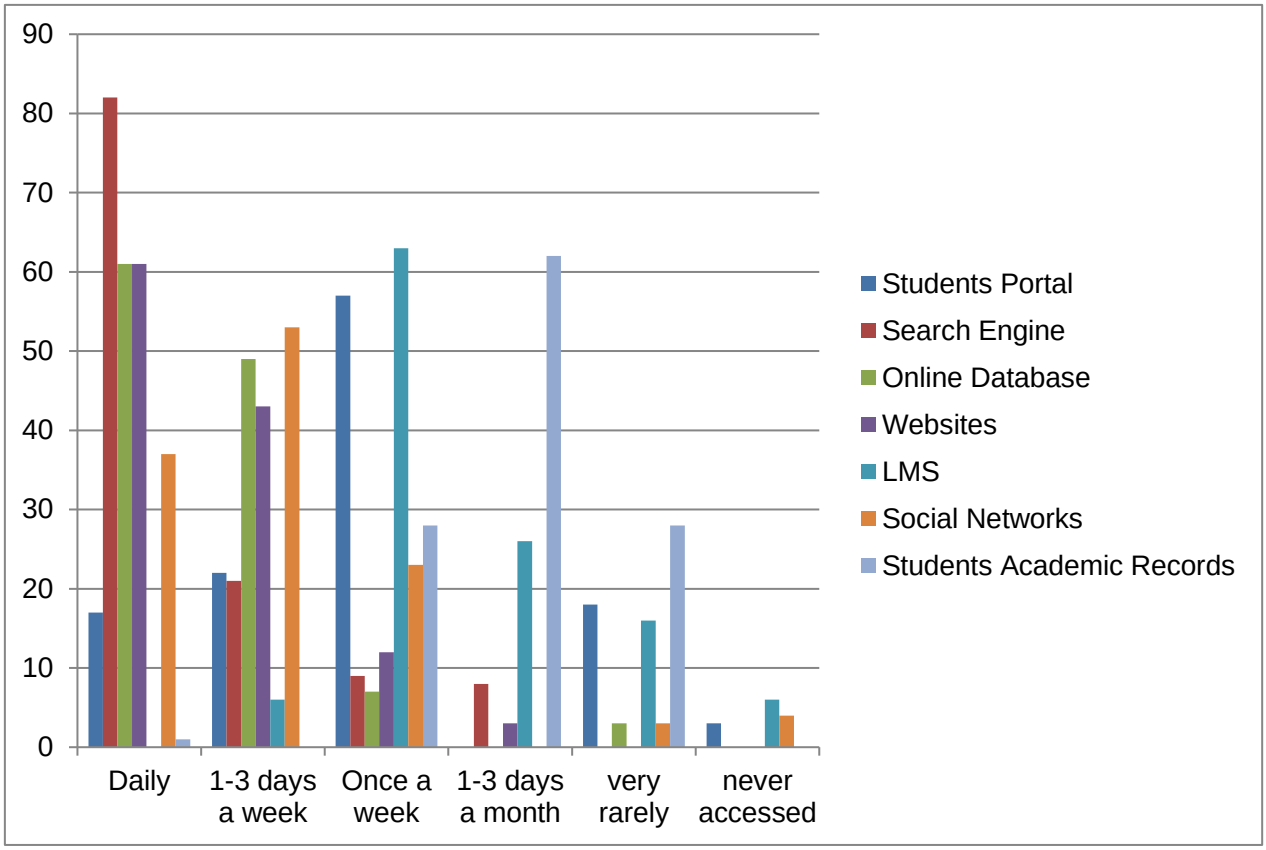


Figure 4.9 Frequency of Access to University Information Systems

4.2.3.3 ICT Staff Results

Quantitative results were collected using question 16 (appendix IIIc) where respondents were asked to state how their clients (students and lecturers) were accessing information systems using variables: only on campus, anywhere, never accessed, I don't know. The summary of results in figure 4.10 shows at least all available information systems are accessible from anywhere.

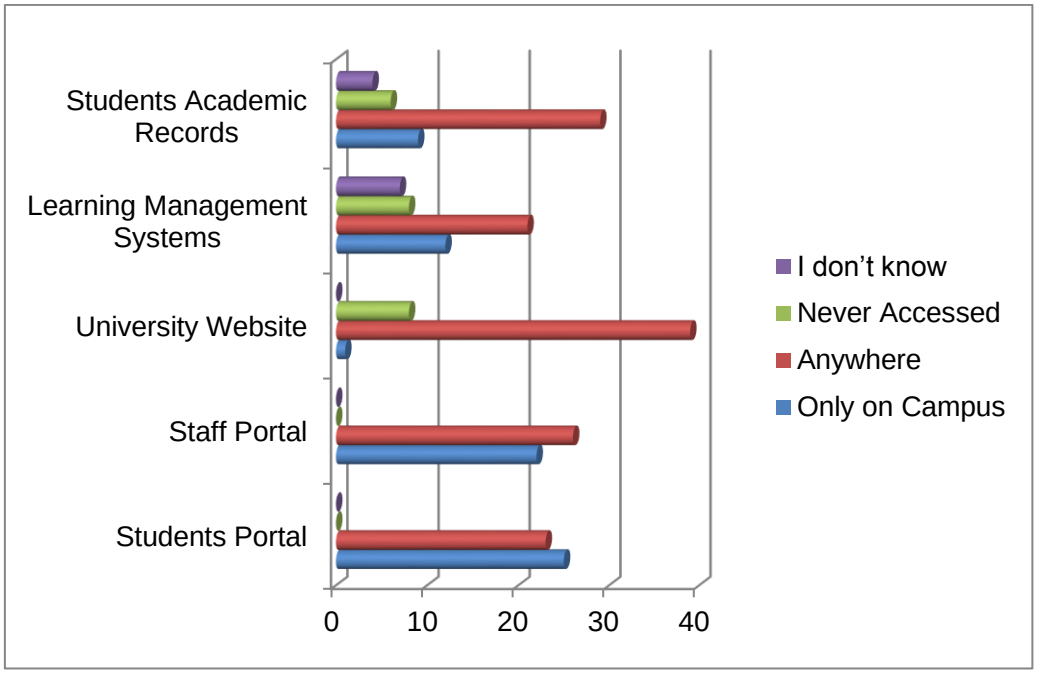
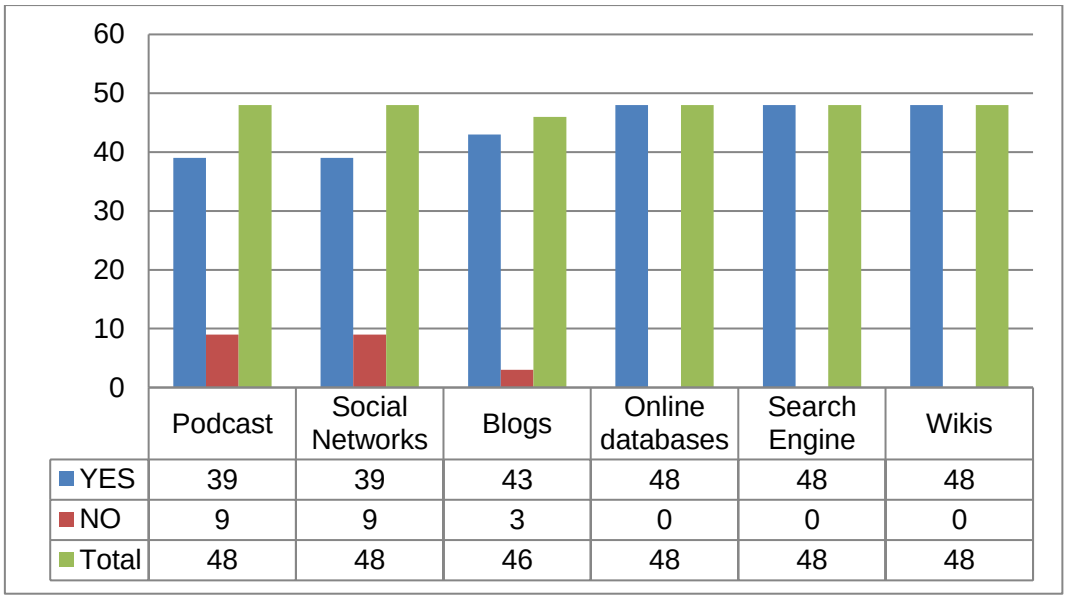


Figure 4.10 ICT Staff access to Information Systems

The results in figure 4.10 show that students and staff can access from home or any other places the available academic resources. Furthermore, in question 18 of the appendix IIIc, ICT staff "are the following web technologies accessible through your LAN/WAN? Figure 4.11 illustrate the results.



	Podcast	Social Networks	Blogs	Online databases	Search Engine	Wikis
YES	39	39	43	48	48	48
NO	9	9	3	0	0	0
Total	48	48	46	48	48	48

Figure 4.11 Accessibility of CWTs through HEIs LAN/WAN

From figure 4.11, the results show that all CWTs were accessible through HEIs' LAN/WAN. For instance, the results show 81% (n=39) said YouTube and Social media could be accessed through LAN/WAN at all HEIs surveyed. The results also show the wikis; search engines; and online databases were accessible through LAN/WAN in all HEIs surveyed.

> *ITQ4: "At some hours, Social media are allowed, and upon request from the Lecturer for class use."*

The findings of questions 16 and 18 of appendix IIIc, give evidence that the present systems in HEIs are often used and the infrastructure allow access to CWTs. Moreover, taking into consideration both qualitative and quantitative results, the emerging themes include legacy systems being used to enhance internet surfing skills and experiences. Examples of the legacy systems used include the Student Portal, Staff Portal, Websites, Learning Management Systems (LMS) and Academic Records Systems. The results have shown that the legacy systems formed a strong base to show that CWTs could easily be used by students, lecturers, and ICT staff of HEIs in Tanzania.

RQ2b: Are there any significant differences in dispositions and attitudes on how they use CWTs in learning and teaching in Tanzanian higher education?

4.2.4 Internet Usage Dispositions

4.2.4.1 Students' Results

The Internet Usage Disposition forms the fourth theme the essential usage patterns of CWTs in the learning process in HEIs. The sub-theme aims to assess the students' satisfaction, accessibility and reflections on teaching activities. Four questions from appendix IIIa were used to get results about the sub-theme. Question 16 asked respondents whether the internet bundle they were using met the expected needs. The results show that majority of students (n=618) had answered "Absolutely Yes" and "Yes", thus were happy that the

internet was meeting their needs, which is 68% of all the respondents. 32% of the respondents (n=618) said “may be”, “No” and “Absolutely No.”

The students were further asked, in a follow up interview, about how the bundle met their needs. The interview results revealed students’ needs such as to download and upload music, video clips, download and upload pictures and chatting. The interview results also revealed that users were facing storage challenges on downloaded and uploaded data.

> *STQ11: “I am not happy with the download speed, you have to wait a while before it is whole downloaded.”*

Question 18 in appendix IIIa asked respondents to rate their level of satisfaction with the internet they were using. The results show 55.5% of respondents (n=120) were satisfied. In addition, 28.6% were neutral. Those who were dissatisfied with the internet they were using were 15.8%.

> *STQ12: “For learning purposes, my needs are met, although I want more speed.”*

The level of satisfaction in terms of meeting users’ internet needs and its availability as a service presents an argument that the ICT infrastructure available can support the use of CWTs in a BL environment in HEIs in Tanzania.

Furthermore, question 17 in appendix IIIa asked students if they were using the available internet bundles of their choice to access online resources. The results show that 74.9% were using internet to access online lecture notes; 45.8% were using internet to access online video tutorials; 66.1% were using internet for chatting and 78% were using internet for email and internet surfing. The qualitative results reveal: personal initiatives, module guidance and library information services as some of the motivations towards the usage of the CWTs.

> *STQ13: “It is my desire to use it and the Lecturer’s requirement.”*
>
> *STQ14: “Sometimes I fail to download materials uploaded by Lecturers.”*

In question 19 in appendix IIIa, respondents were asked: “Does any of your Lecturers use CWTs to disseminate materials?” The results reveal that 89% of all respondents said NO and 11% said YES. This means that lecturers were not using CWTs in class activities as supported by Terrell, Richardson and Hamilton (2011). The available internet bundles from different ISPs can support the use of CWTs in a BL environment.

4.2.4.2 Lecturers’ Results

Using the questionnaire in appendix IIIb, respondents were asked questions related to the internet Usage Dispositions. The theme aims to assess the satisfaction, accessibility and reflections on teaching activities.

In question 15, respondents were asked whether the internet bundle used meets the expected needs. The results show 75% (n=90) respondents said YES, and 12.5% said May be and 9% said Absolutely YES. In summary, majority (84%) of respondents were happy that the internet meets their needs.
In a follow up interview, lecturers said they used the internet for social and academic purposes. Social purposes include access to social media and chatting through WhatsApp and other messengers. Academic purposes revealed include access to LMS, online databases and online academic communities.
Question 16 in appendix IIIb asked lectures if they were using the available internet bundles of their choice to access online resources. The results show that 100% (n=120) were using internet to access online resources such as to upload and download lecture notes, video clips, emails, and Social Media.
In a follow up interview, lecturers said that although they use the internet to access online resources, however, there is a need to increase the bandwidth.

Question 17 in appendix IIIb asked respondents to rate the level of satisfaction with the internet they use. The results in figure 4.12 show that 79% of respondents were satisfied and 6.7% were very satisfied. This is, 85%

satisfaction (very satisfied and satisfied). In addition, 9% were neutral and 5% were dissatisfied. The results in question 19 correlate with the results in question 17 where lecturers showed vividly that the internet meets their needs and hence they are satisfied.

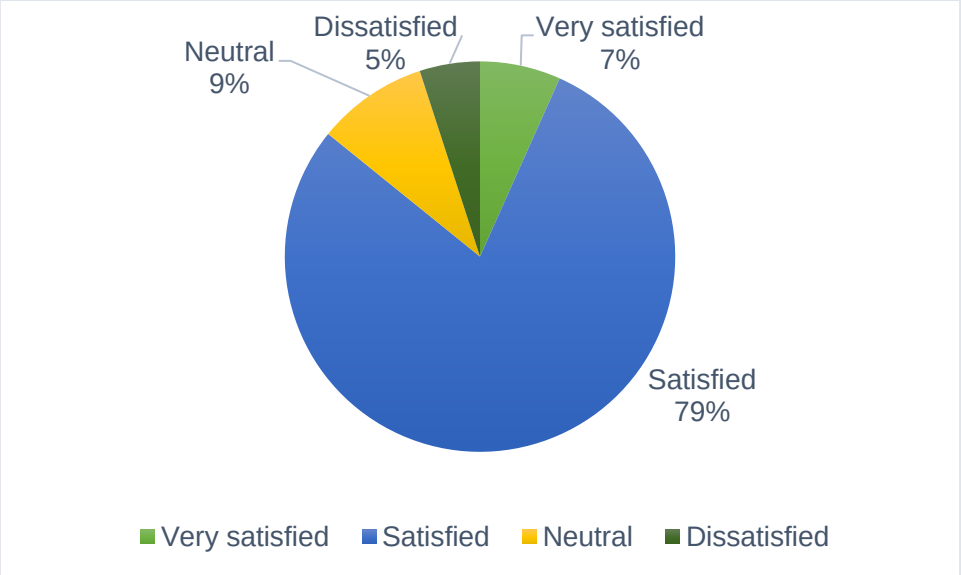


Figure 4.12 Level of Satisfaction with Internet used by Lecturers

The level of satisfaction in terms of meeting users' internet needs and its availability as a service presents an argument that the ICT infrastructure available can support the use of CWTs in a BL environment in HEIs in Tanzania.

In question 21, respondents were asked to rate the usefulness of web-based systems and the CWTs. The results show that majority of lecturers believe that CWTs such as Podcast, Social media (Facebook and Twitter), Wikis and blogs are useful in learning and teaching. For instance, 84% (n=101) respondents believe that podcast is useful in teaching and learning process. 93% (n=112) respondents believe that blogs are useful in teaching and learning and finally, 83% (n=99) respondents believe that wikis are useful in teaching and learning.

The results also show that lecturers support the use of social media. For the Facebook 73% (n=88) respondents support its use and usefulness in teaching and learning, while for Twitter, 88% (n=105) of respondents support the use and its usefulness in teaching and learning process. Search engines and online

databases were highly ranked too. For instance, search engines were ranked useful by 87% (n=104) respondents and 85% (n=103) respondents said online databases were useful in learning and teaching process.

In the follow up interviews, lecturers revealed that the lack of policy and guiding framework on the use of CWTs in learning formed some of the hindering factors. Lecturers further revealed that the use of CWTs in learning could enhance their teaching experience and increase interactions with students.

> *LCQ8: "I prefer using CWTs in teaching, however, we have no clear policy whether to use or not."*
>
> *LCQ9: "My students are always online, and I could be wise to share new knowledge with them right there online."*

4.2.4.3 ICT Staff Results

The Internet Usage and Dispositions theme were assessed through three questions: questions 13, 14 and 19 in the ICT staff questionnaire set in appendix IIIc.

In question 13, respondents were asked "Do the Internet bundle tariffs you use, meet your need to connect to the above web technologies?" 48 respondents answered this question. The results show that 58% of the respondents said YES, 40% said MAYBE and 2% said NO. The results suggest that HEIs had bandwidth which were meeting their needs with suggestions for upgrading. In question 14, respondents were asked "How satisfied are you with the internet services you get through your mobile phone or laptop or desktop?" The results show that 69% of the respondents were satisfied, 29% were neutral and 2% were very satisfied. That shows that, majority of users were satisfied with the services. Furthermore, the interview results revealed that efforts had been made to improve internet connections in many HEIs. For example, until June 2012, IAA used 2mbps for internet connections. This served both students and staff internet connection needs. Efforts were made to upgrade to 4mbp in July

2012 and in July 2014, another upgrade to 8mbps was implemented. These changes made many users to be happy with the current internet service.

Respondents were also asked (in question 19 appendix IIIc) that “In your own opinion, rate the usefulness of the following web technologies in teaching and learning.” The results show that majority of the respondents viewed the existing information systems and the CWTs as useful tools for academic performance. The results also show that about 96% said podcasts were useful, 60% said Social Networks were useful, 71% said blogs were useful, 85% said online databases were useful and 88% said search engines were useful tools for enhancing learning and teaching. The results also show disapproval by 71% of all the respondents on the usefulness of RSS in academic performance.
From the above results, it is evident that students, lecturers and ICT Staff were confident with and could embrace the CWTs in learning and teaching.
The results showed majority of respondents from each of the groups saw CWTs as useful tools for collaborative and interactive learning. The results show that the existing systems were useful and helped to build their internet surfing skills.

4.3 Research Question 3 (RQ3)

Is there an ICT infrastructure that can support BL with CWTs in Tanzanian HEIs?

4.3.1 Network Backbone

The quantitative data collected from questions 10 and 11 in appendix IIIc, as reported in section 4.2.2.3 above, revealed that all six HEIs surveyed had an ISP. All government HEIs were connected to the national fibre optic backbone. The Fibre Optic Backbone gave reliable infrastructure for the internet connection in HEIs in Tanzania.

Furthermore, the data collected from the interviews with ICT Staff revealed that, currently, the National Fibre Optic Backbone is available across the country in all districts.

> *ITQ5: "as far as I am aware, our Institution will soon be linked to the Fibre Optic Network which has reached in all Districts of Tanzania."*

The review of the documents revealed the presence of major projects for the Tanzanian National Fibre Optic (TCR 2015).

The major ISPs in Tanzanian HEIs surveyed were presented in figure 4.5 in section 4.2.2 above. As earlier discussed in section 4.2.2.1 above, the major ISPs for students' cellular network services were TiGo; followed by Vodacom (n=496); then Airtel (n=377); TTCL (n=360), SMILE (n=181) and Zantel (n=170). For the lecturers, refer to section 4.2.2.2, figure 4.5, the major providers include Tigo as the leading ISP for mobile data services, followed by Vodacom and then Airtel. In section 4.2.2.3 above, most of the backbone connections (67%) in HEIs use DSL from TTCL as collected from question 11 in appendix IIIc. In addition, interview findings showed that Wi-Fi is provided by private companies and used for backup facilities. In question 15 (appendix IIIc), respondents were asked to choose the computer network architecture in use at their respective HEIs. The results show that all HEIs were using Client/Server architecture. In a follow up interview, it was revealed that none of the HEIs had a plan to upgrade to Cloud Computing. Additionally, in the interview with the ICT Staff it was revealed that there are strong internal network infrastructure and systems capable of supporting the use of CWTS.

> *ITQ6: "We have a strong LAN in the campus installed with Fibre. Our systems have Active Directory, Mail Server, Print Server, File Server, Gateway and a DELL-Terabyte backup server for all data and systems backups."*
>
> *ITQ7: "We ran windows systems with minimal support of Open Sources systems."*

The present Network Backbone in Tanzania enabled all HEIs to connect to a fast internet connection. The presence of strong LAN and WAN in HEIs coupled

with the proper server systems and software present a strong infrastructure capable of supporting the use of CWTs in learning and teaching.

4.3.2 Bandwidth

4.3.2.1 Students' Results

All the HEIs surveyed had bandwidths ranging from 2mbps to 10mbps. The bandwidths were provided by ISPs discussed in section 4.2.2 and 4.3.1 above. In this section, only reliability issues are presented to supplement the data in section 4.2.2 and 4.3.1 above.

For the student's questionnaire in appendix IIIa, in question 7(a) all respondents were asked to rate (using major problem, minor problem, not a problem, I do not know) whether home or residence internet connection was not reliable. The results show that over 40% of the respondents did not see this as a problem and 41% saw it as a minor problem. The quantitative results as a follow up revealed that students were comfortable with the internet connection at home or residence, despite some minor problems.

> *STQ12: I prefer [provider_name] as it has internet bundle for students, and I afford it."*
>
> *STQ13: "Other cellular operators were offering a wide range of internet connection options via mobile modems and data connectivity."*

In question 7(b), 50% (n=897) of the students said the internet was affordable, 47% said was expensive and 2% said it was very expensive while 1% did not know what to say. In terms of the internet availability, question 7(c), asked students to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence internet connection was not available. Total respondents were 899. The findings revealed that only 120 (13%) respondents rated this as a major problem; 383 (43%) respondents rated it as a minor problem; 383 (43%) respondents rated it as not a problem; and one (1%) respondent did not know. In this question, respondents showed that internet

connection was available most of the time. This is showed by over 43% of respondents who said that the internet was available. This is supported by another 43% of the respondents who saw internet unavailability as a minor problem.

In question 7(d), students were asked to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence wireless internet connection was poor. Although all respondents admitted the lack of wireless internet connection, however, this was not a problem to hinder the use of the CWTs in blended learning and teaching. The results show 100 (11%) of the respondents rated this as a major problem; 401 (45%) respondents rated this as a minor problem; 389 (43%) respondents rated poor wireless connection as not a problem and 10 (1%) respondents rated it as not a problem at all.

In question 7(e) on wireless internet connection, students were asked to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence wireless internet connection was not available. The results show that 108 (12%) respondents rated the unavailability of Wi-Fi internet connection as a major problem; 383 (43%) rated this as minor problem; 399 (44%) respondents rated this as not a problem; and 9 (1%) respondents said they did not know. The results show that students do not depend on wireless internet connection. The presence of mobile modems and data connectivity from cellular operators such as TiGo, Vodacom, Airtel, TTCL, Zantel and Smile surpass the internet connection needs of students at home or residence. From the above results, the reliability, availability and cost of internet connection were rated as either a minor or not a problem by over 80% of all the respondents.

These findings suggest the presence of strong internet connection through different ISPs in Tanzania.

Question 8 in appendix IIIa was also used to assess the bandwidth. Question 8(a) asked students to rate (using major problem, minor problem, not a problem and I do not know) whether at the university the internet was not reliable to support the use of CWTs. The results show that 204 (23%) rated it as major

problem; 438 (49%) rated it as a minor problem; 245 (27%) rated it as not a problem; and 13 (1%) said they did not know. However, in a follow up interview, what was meant by minor problem, it was revealed that the issues are related to accessibility to the university information systems and not the ICT infrastructure.

> *STQ15: "The minor issues such as hourly access to the computer laboratory and restrictions posed by the IT Department."*

The results highlight the reality of the ICT infrastructure in HEIs as being strong with capabilities to support BL with CWTs. The combination of "minor problems" and "not a problem" rates accounted for 76% of all the respondents.

From students' questionnaire in appendix IIIa, in question 8(b) "Internet connection is very expensive at the university" the results indicate that 91 (10%) said "major problem"; 359 (40%) respondents said, "minor problem"; 413 (46%) respondents said, "not a problem" and 36 (4%) respondents did not know while one respondent did not respond to this question. The results further show that 86% (minor problem and not a problem combined) present the strong base of ICT infrastructure in HEIs in Tanzania. The infrastructure can support CWTs in learning and teaching. Students were also interviewed about the cost of internet at universities to supplement questionnaire's responses. 80% of the interviewed students mentioned internet tariffs for their mobile devices as an additional cost and service to university's internet services paid by individual students.

In question 8(c) respondents were asked to rate (using major problem, minor problem, not a problem and I do not know) whether the internet was not available at university/college. The results show that 187 (21%) respondents rated major problem; 415 (46%) respondents rated minor problem; 266 (30%) responded as not a problem; and 32 (3%) said they did not know. This is further illustrated in figure 4.13.

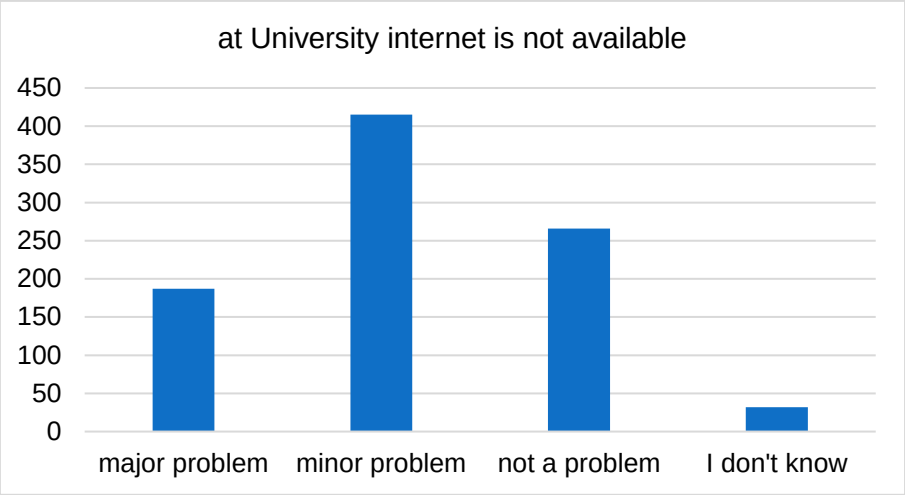


Figure 4.13 Students' Response on ICT Infrastructure

In a follow up interview, it was further revealed that internet unavailability was attributed by power outages and sometimes by the ISP problems. However, all sampled universities had power backup solutions to restore ICT services in case of power problems. In case of ISP related problems, universities had LAN/WAN business continuity plans to ensure all critical services operated/resumed to normal in time. This is another evidence for the presence of capable ICT infrastructure to support BL supported by CWTs.

Question 8(d) asked students Wi-Fi at the University. The question asked students to rate whether unavailability of wireless internet connection at the university was a "major problem", "minor problem", "not a problem" and "I do not know". Results show that 300 (33%) respondents rated poor wireless connection as a major problem; 274 (31%) respondents replied, "minor problem"; 310 (34%) respondents replied, "not a problem" and 16 (2%) respondents replied, "I don't know".

The results for part (e) of question 8 on whether unavailability of wireless internet connection at the university was a "major problem", "minor problem", "not a problem" and "I do not know" show a significant number (n=300) of respondents rated this as a major problem. This contributes to 42% of all respondents. In a follow up interview on this response, the problems related to

unavailability of Wi-Fi at universities were non-technically oriented. These included the presence of strong cable/wired LAN, hence wireless was regarded as additional or something not necessary; availability of strong cellular data connectivity at affordable prices by students and the failure of some IT policies to appreciate CWTs' potentials in learning and teaching.

The results on the unavailability of wireless internet connection at the university further show that 263 (29%) respondents replied, "minor problem"; 236 (26%) respondents replied, "not a problem; and 26 (3%) respondents replied, "I don't know". The above results about internet connectivity in HEIs in Tanzania show that this is a good ICT infrastructure capable of supporting BL using CWTs to enhance learning and teaching.

These results and the results of question 9 (in in appendices IIIa, IIIb and IIIc) show a slow internet connection, a lack of awareness about ICT services and network related problems.

4.3.2.2 Lecturers' Results

As noted in section 4.3.1 above, the availability of internet connection at home/residence and university is one of the core components of the ICT infrastructure needed to support BL with CWTs. 120 lecturers were asked questions on internet connection issues. These questions were divided into two sets, each consisting of four questions. The first set assessed internet connectivity at home/residence domain and the second assessed connectivity at universities. In both sets, the first question asked about internet connection's reliability; the second asked about the costs and the third asked about availability of internet connection. The fourth question asked about stability (poor/strength) of wireless internet connection and the fifth question asked about the availability of wireless internet connection. These form part (a) through part (e) of question 7 and part (a) through part(e) of question 8 respectively.

In question 7(a) in appendix IIIb, all respondents were asked to rate (using major problem, minor problem, not a problem and I do not know) whether home

or residence internet connection was not reliable. Figure 4.10 shows over 64% (n=77) of the respondents (n=120) saw internet connection reliability as a minor problem.

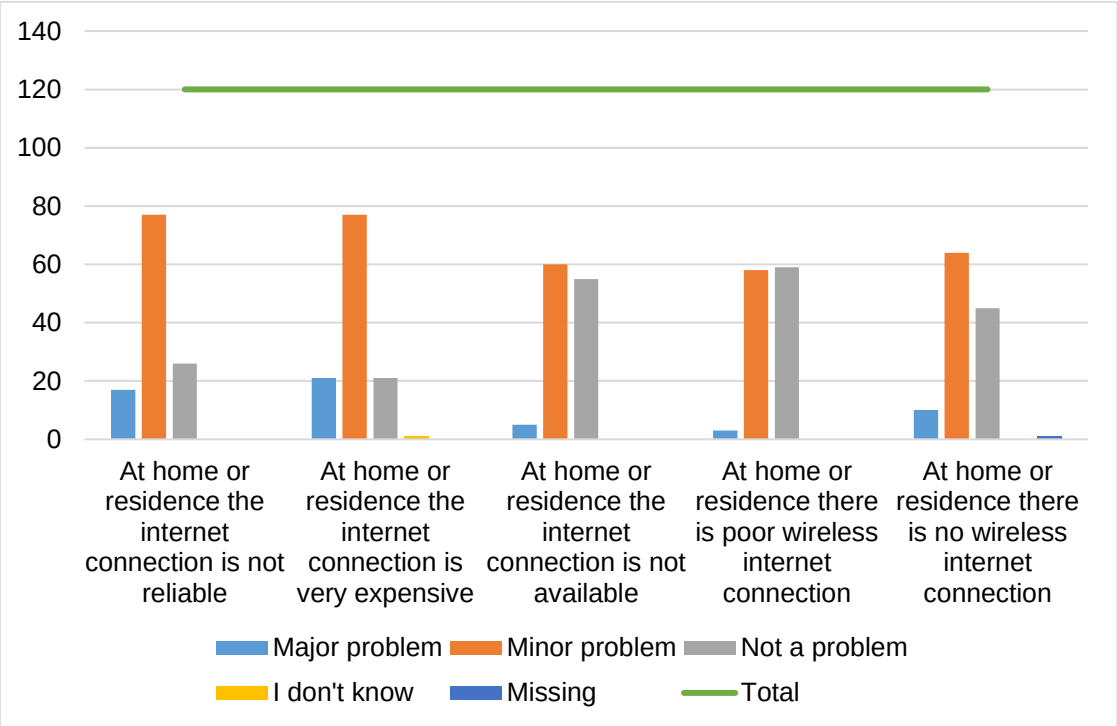


Figure 4.14 Lecturers' Response on Internet Connection Problems at home or Residence in Tanzania

From figure 4.14, the results also show that 22% (n=26) of the respondents did not see internet reliability as a problem at all and 14% (n=17) said internet reliability was a major problem. The results show that lecturers were comfortable with the internet connection at home or residence, despite minor problems. In a follow up interview questions about the reliability of internet connection at home, lecturers claimed that they were happy with the available internet tariffs from cellular operators. This claim was like the reply given by students on the same question. The use of different internet tariff bundles offered them many options to choose from. However, power problem was seen to exist, and it formed part of the problems facing internet reliability. Despite the presence of power backup facilities, majority of the respondents (51%) still

believed that the power problem was hindering most of their activities. Except for power supply issues, there existed a strong base of mobile data connectivity and reliable bandwidth to enable learning and teaching through CWTs in a BL framework.

Results of question 7(b), which asked lecturers to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence internet connection was expensive show that out of 120 lecturers surveyed, 64.2% of respondents (=77) saw the cost of internet as a minor problem. 17.5% of the respondents (n=21) saw the cost of internet connection as not a problem. Only one respondent (0.8%) did not know what to answer.

Part c of question 7, asked lecturers to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence internet connection was not available. In their reply, 50% (n=60) of the respondents said it was a minor problem. 46% (n=55) of the respondents said it was not a problem while 4% (n=5) said it was a major problem. As the students claimed, the lecturers also said in interviews that they were using more than one ISP. This allows them to switch from one provider to another to ensure availability.

The researcher assessed the availability of Wi-Fi at home or residence using question 7(d). The question asked lecturers to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence wireless internet connection was poor. The results show that 49% (n=59) of the respondents said it was not a problem, 48% (n=58) said it was a minor problem and 3% (n=3) said it was a major problem. Although all respondents admitted the lack of wireless internet connection, this was not a problem to hinder the use of Collaborative Web Technologies in a Blended learning and teaching. This is because mobile operators have been giving reliable connection as noted above.

In question 7(e) about wireless internet connection, lecturers were asked to rate (using major problem, minor problem, not a problem and I do not know) whether home or residence wireless internet connection was not available. The total

number of respondents was 119. The results show that 54% (n=64) of the respondents said it was a minor problem, 38% (n=38) said it was not a problem and 8% (n=10) said it was a major problem. As it was noted in 5.3.1 above, the results show that lecturers were not depending on wireless internet connection. The presence of mobile modems and data connectivity from cellular operators such as TiGo, Vodacom, Airtel, TTCL, Zantel and Smile surpassed the internet connection needs of lecturers at home or residence. This shows the presence of ICT infrastructure capable of supporting Blended Learning supported with Collaborative Web Technologies in Tanzania.

The second part that asked about internet connection issues is question 8. In this question, lecturers were asked about internet issues in Higher Education Institutions (HEIs). Four questions were used and the results (in figure 5.11) indicate the presence of capable ICT infrastructure to support Blended Learning with Collaborative Web Technologies. Part (a) of question 8 asked students to rate (using major problem, minor problem, not a problem and I do not know) whether at the university the internet was not reliable. The results show that 51% (n=61) of the respondents replied that it was not a problem, 47% (n=56) respondents said it was a minor problem while 2% (n=2) said it was a major problem. The results highlight the reality of the ICT infrastructure in HEIs as being strong with capabilities to support BL with CWTs. The combination of “minor problems” and “not a problem” rates accounts for 98% of all the respondents. In the follow up interview, respondents who said “minor problem” listed minor problems as those related to the access to university management systems and authentication problems.

The results in question 8(a) correlate with the results in question 8(b). In question 8(b) where lecturers were asked to rate (using major problem, minor problem, not a problem and I do not know) whether the internet is expensive, the results show that none of the respondents said it was a major problem. 79% (n=95) said it was not a problem. Additionally, 18% (n=21) said it was a minor problem and 3% (=4) did not know. The results further show that 97% (minor

problem and not a problem combined) present the strong base of ICT infrastructure in HEIs in Tanzania. Therefore, the infrastructure can support CWTs in learning and teaching. In a follow up interview about the cost, lecturers said costs came from individual connections other than those provided by the University.

In question 8(c), respondents were asked to rate (using major problem, minor problem, not a problem and I do not know) whether the internet was not available or vice versa. The results show that 57% (n=68) said it was a minor problem and 24% (n=29) said it was not a problem. These two categories of (minor and not a problem) responses combined, form 81% of all (n=119) of the respondents. 17% (n=21) said it was a major problem while 1% said I do not know and 1% did not respond to this question as further illustrated in figure 4.14.

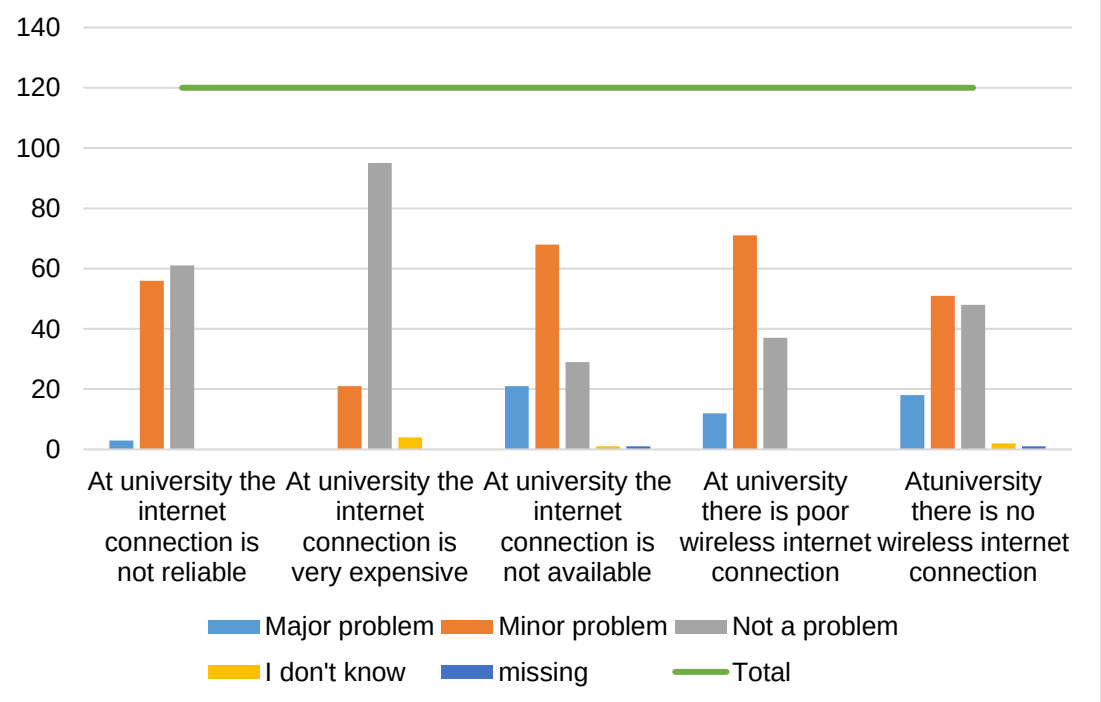


Figure 4.14 Lecturers' Responses on ICT infrastructure

Part (d) of question 8, lecturers were asked to rate the available wireless internet connection at their respective universities. The question asked them to

rate whether poor wireless internet connection at the university was a “major problem”, “minor problem”, “not a problem” and “I do not know”. Results for part (d) of question 8 show that 59% (n=71) said it was a minor problem; 31% (n=37) said it was not a problem and 10% (n=12) said it was a major problem.

The responses to question 8(e) which asked whether unavailability of wireless internet connection at the university was a “major problem”, “minor problem”, “not a problem” and “I do not know” show a significant number (n=82%) of respondents rated this as a minor problem and not a problem with 42% (n=51) and 40% (n=48) respectively. However, 15% (n=18) rated it as a major problem. Furthermore, 2% (n=2) replied “I don’t know” and 1% (n=1) did not answer the question. The results indicate the presence of strong cable/wired LAN hence wireless being regarded as additional or something not necessary; availability of strong cellular data connectivity at affordable prices by students and the failure of IT policies to appreciate CWTs’ potentials in learning and teaching.

4.3.2.3 ICT Staff’s Results

In questions 7 and 8 of the questionnaire in appendix IIIc, ICT staff were asked questions related to the internet connection experiences at home and the university. In this theme, respondents had to answer by using “major problem, minor problem, not a problem and I do not know”. In question 7 in appendix IIIc, ICT staff (54%) said internet connection at home was a major problem. On the other hand, 46% of respondents said the internet connection at home was not a problem. The researcher elicited more data from the respondents through follow up interviews. In a follow up interview, respondents said they enjoyed good speed of “download” at the university than at home.

> *ITQ8 “…at home you have to pay for yourself and the spend is slow than at the University”*
>
> *ITQ9 “at home I continue with my business with Facebook and Blogs”*

The interview results also show that majority of respondents said that despite the minor internet problems, CWTs can be used in a BL environment to enhance learning and teaching.

In question 8 in appendix IIIc, respondents were also asked questions about internet connection problems at the university. The results are summarised in table 4.4.

Table 4.4: Internet connection problems at the university

Problems	**Major problem**	**Minor problem**	**Not a problem**	**I do not know**	**TOTAL**
At University the Internet connection is not reliable	0	19	29	0	48
At University the Internet connection is very expensive	0	5	42	1	48
At University the Internet is not available	0	13	33	2	48
At University there is poor wireless internet connection	0	18	30	0	48
At University there is no wireless internet connection	0	20	28	0	48

In table 4.4, on average, 68% of respondents said internet connection problems listed in the table were “not a problem”. In addition, none of the respondents said these were major problems. The table also shows an average of 31% of respondents said the listed problems in table 4.4 were minor problems.

In question 9 in appendix IIIc, respondents were asked “What are the other main problems that you face in using the internet?” The results were collected and summarised as follows: bandwidth limitation (66.7%); ISPs’ infrastructural challenges (19%); computer networking problems (8%); restricted access (4%) and hardware problems (2%).

Furthermore, qualitative data collected from follow up interviews, about the internet connection stability showed that universities have strong and reliable internet connections provided free of charge to both students and staff at specified time. Additionally, the interview results revealed that respondents were confident with the available ICT infrastructure at the university and the cell tower sites owned by the cellular network providers in the country.

4.3.3 ICT Policy

All surveyed HEIs had ICT policies. The ICT policies govern the use and management of the ICT Infrastructure. The documentary review carried out revealed that all HEIs surveyed had developed their ICT policies from between 2004 to 2007. It was further revealed that in 2003, the Tanzanian Government published the first National ICT Policy. The second version of the Tanzania National ICT Policy was published in May 2016. The minister responsible for works, transport and communication directed all institutions to adhere to the national ICT policy by creating their own institutional policies. However, as from 2016, all HEIs in Tanzania were required to design and implement ICT policies based on the National ICT Policy 2016.

ITQ10: "ICT Policy is both a regulatory and professional requirement."

The ICT policies in the six surveyed HEIs provided limited access to the Social Media. For example, students had specific hours to access social media in computer laboratories and unlimited time via the Wireless Network. Lecturers could use social media anytime while in the office but would need to seek approval to use social media in a computer laboratory during class hours.

4.3.4 People

"People" consist of ICT support staff and users, form a major component of the ICT Infrastructure. All six HEIs surveyed had ICT staff working in the department. At each of the surveyed HEIs, there was the ICT Director/Manager. There were Systems Administrators, Systems Analysts, Computer Technicians

and User Help staff. From the researcher's personal experience and his observations in the six HEIs, the level of ICT staff was not a problem. All the HEIs had enough staff to support the ICT Services. It is also important to note that the HEIs used intern students always to improve their services. It was seen that the students were working at the HEIs all year around as part of the field placement and volunteering opportunities. The ICT Staff employed in the HEIs had all the required skills and competencies to support the ICT Services.

The ICT services offered in the surveyed HEIs include the Mail, Portal, File, LMS, Library System, Computer repair and maintenance, Printing, Video Conferencing, internet and Audio-Visual. The services offered by the ICT Departments were tailored to the institutional objectives.

From both the quantitative and qualitative results presented above, there is strong ICT infrastructure in HEIs in Tanzania. That is, the results presented above show that the HEIs in Tanzania have the proper ICT Infrastructure for online learning through CWTs. The students, lecturers and ICT Staff have a wide range of devices capable of connecting to the Internet. The available network backbone, LAN/WAN in all HEIs can support both the legacy systems and the CWTs in a BL environment. In addition, the students, lecturers, and ICT staff use mobile data modems from major cellular network providers. For example, they use five types of connection such as Wi-Fi, Mobile (SIM Card) data connection, Wired (cable) connection and Modem/mobile Broadband connection.

The results have also shown the presence of affordable internet tariff bundles such as university package, monthly, weekly, day, nightly and weekend bundles. These tariffs were considered very useful by all students, lecturers and the ICT people. Most respondents had created an account in at least one of the CWTs.

The legacy systems which were currently being used in HEIs helped to enhance internet surfing skills and experiences. Examples of the legacy system used include the Student Portal, Staff Portal, Websites, Learning Management

Systems (LMS) and Academic Records Systems. Moreover, students accessed more social media than the legacy systems at their HEIs.

Moreover, the results have shown that the legacy systems formed a strong base to show that CWTs could easily be used by students, lecturers and ICT staff of HEIs in Tanzania. It is evident that students, lecturers and ICT staff were confident with and could embrace the CWTs in learning and teaching. The results showed that most respondents from each of the groups saw CWTs as useful tools for collaborative and interactive learning. The results show that the existing systems were useful and helped to build their internet surfing skills.

4.3.5 Readiness to use CWTs in BL environment

A general question was put to all groups: “can we use CWTs in a BL environment in HEIs in Tanzania?”

The results collected from students in question 23 in appendix IIIa, show that 85% (n=749) said YES and 15% (n=134) said NO. Similarly, lecturers were asked the same question in question 23 in appendix IIIc. The results show that 80.6% (n=) said YES while 19.2% said NO. Finally, the ICT staff replied to question 20 in appendix IIIc, in which 79% (n=38) said YES, and 11% (n=10) said NO. Apart from quantitative data, the researcher collected qualitative data from the follow up interviews. The results show that students, lecturers and ICT staff were ready to use the CWTs in a BL environment. Furthermore, one of the students said:

STQ16 “we are ready to use, but our Lecturers…”

In line with the above results, majority of students in HEIs preferred the adoption and use of CWTs for learning and teaching in BL environment. This is due to the presence of good and reliable ICT infrastructure at both their universities and at home or residence.

4.4 Chapter Summary

This chapter gives a discussion of the results and findings for phase one in which two objectives were met. The results show the presence of strong existing ICT infrastructure capable of supporting BL with CWTs for enhanced learning and teaching. The analysis was organised into three groups of students, lecturers and ICT staff. The findings show six main themes including internet connectivity at home/residence and university, availability of ICT Devices for CWTs, internet connectivity and usage patterns and, the legacy and base systems.

CHAPTER FIVE

5.0 DESIGN AND VALIDATION OF DRAFT BLENDED LEARNING FRAMEWORK

5.1 Overview of the Draft BL Framework

The results in chapter four revealed that there is a strong and fast-growing ICT infrastructure that can support the use of CWTs in a Blended Learning environment. The available components of the ICT infrastructure include devices (smart phones, laptops, desktops) owned by individual students and lecturers, ISPs with reliable internet connections and optional tariff bundles, legacy systems already in use, network backbone both LAN and WAN, bandwidth, ICT policy, supporting staff and the readiness to use BL Framework in HEIs in Tanzania. In this chapter, the research entered its second phase, whereby, ideas to design the BL framework are collected and triangulated based on the results of chapter four and from the extant literature in chapter 2-3. Chapter five provides a discussion of the results collected from primary and secondary information to design the draft BL Framework. The constituent elements of the BL Framework were combined to form a draft BL Framework. The four elements of the draft BL Framework include module delivery, assessment, feedback and review.

The draft BL Framework was designed based on the qualitative data collected from the focus group as discussed in 3.5.3.4 and the participants in the focus group meetings in table 3.4 and 3.5. At this stage, the meetings sought to collect views on the constructs and how, when, and where the mix between the face-to-face and the CWTs should occur in the learning process. Additionally, the literature reviewed in chapter two and the results of a survey in chapter four were used to inform the design through best practices and standards of the design of the BL Framework. There is the evidence that a similar approach was

used by Mirrihi, Alonzo and Fox (2009) to develop a BLF for the curriculum design and professional development.

5.2 Focus Group Results

The results from the focus group meetings were collected, transcribed and incrementally used to build the Draft BL Framework. The results were based on each element of the Draft BL Framework. The levels of mix in terms of the face-to-face and online modes are discussed in 5.2.1. Each activity of the proposed learning process was matched with the appropriate CWTs as shown in A**ppendix XI**. Additionally, the results show the selected CWTs that were appropriate for the Tanzanian HEIs.

5.2.1 Levels of the “Blend” in the Learning Process

The BL Framework was designed to cater for the learning and teaching of students enrolled while studying using selected CWTs. The BL Framework blends the face-to-face and online instructional models that occur at the four stages of the learning process. For this research, the word “level” and “process” are used synonymously. The four learning processes in the CBET include the Course Registration, Module Delivery, Module Assessment, and Module Feedback and Review. Equally important, the four processes consider the major components of the CBET curriculum framework used in HEIs offering technical education in Tanzania (NACTE 2015). According to the NACTE CBET curriculum development guidelines 2010, each of the four learning processes is essential towards the fulfilment of a National Technical Award (NTA) level. However, since the BL Framework is limited to the teaching and learning process, the programme/course registration process was not considered. That is, NACTE recognises “a registered student” as a person who has met the minimum entry requirements at that NTA Level. Then, a registered student must enrol into modules of his/her choices by selecting the core and elective modules. The module enrolment is considered part of the BL Framework. Then

the student enters the second stage of the learning process called delivery. The third stage is an assessment and finally feedback and reviews stage. Along similar lines, the blend between face-to-face and the CWTs occurs at the four stages to enhance learning and teaching experiences as further discussed below. The use of a BLF aims to offset the disadvantages of each when used alone.

As shown in **Appendix XI**, first, during Course Registration, the CWTs could be used to disseminate information about the elective and core modules, module requirements, important dates, checklists, professional requirements and regulations. The use of CWTs at this level is important for students. For example, "*at the beginning of a course, it may be advantageous to have a face-to-face class to meet and build community. In contrast, discussing a complex issue that requires reflection* [about the module] *may be better accomplished through an asynchronous Internet discussion forum*" (Garrison and Kanuka 2004:97).

The areas of CWTs application at this stage are listed in table 5.1. New students enrolled into a module ought to access the CWTs to keep them updated with their module leader and programme director. At this level, the CWTs could be embedded with the university websites, the Learning Management Systems (LMS) such as Moodle and the student/staff portal (Rohani and Yazdani 2012). At this level, the use of the CWTs could enhance access to information and provide quick and personalised feedback comments to the queries raised.

On the other hand, the university staff, including the lecturers, could use the CWTs to provide essential information and feedback in a personalised manner. Thus, the BLF at this level could improve the quality of services delivery and enhance students' experiences through the CWTs. The percentage of the blend could be 60% online through CWTs and 40% face-to-face interactions. The basic requirements at this level include the management's commitment to the programme, the presence of broadband and reliable internet connection,

website, learning management system, a blended learning policy and HEI accounts on the CWTs.

From the foregoing, a registered student enters the second stage, that is, the Module Delivery. The CBET curriculum framework needs a registered student to attain specified credit hours through module delivery. Along similar lines, during the module delivery, the CWTs are used in a proper mix where 40% is face-to-face and 60% is online instructional models. The CWTs should enhance learning and teaching through increased interactions and active engagement. The module is delivered through lectures, seminars, tutorials and practices in a real-life. At this level of the learning process, the CWTs are useful media for the module delivery methods. Additionally, the available evidence from the literature (Balubaid 2013, Păuleţ-Crăiniceanu 2014, Iqbal *et al.* 2011, and Lwoga 2012) agreed with the results from the focus group meetings. The evidences suggest that the CWTs could be used for module delivery methods such as lectures, seminars, tutorials, field work and practical work. The CWTs could also be used to access learning materials, announcements, news and alerts. A statement made by one participant says:

> "*Not all my lectures will be face-to-face, almost 60% to 70% are online and my students enjoy the module through shared experiences.*"

However, through discussions in the focus group meetings, this BLF submits that the use of CWTs could enhance learning and teaching where 60% of the module components could be delivered entirely online and 40% through face-to-face methods. This enhances students' and lecturers' flexibility in terms of time, place and content formats, and thus, offsets the disadvantages of face-to-face and the CWTs when used alone. Moreover, the requirements of the blend at this stage are like those at stage one.

The third stage of the learning process considered in the BLF is an assessment. In the CBET, the term assessment is defined as the "process of collecting evidence of learners' efforts to measure and make judgments about the achievement or non-achievement of specified standards or qualifications"

(NACTE 2010 and Xiufang and Qingchao 2008). The competence-based assessment (CBA) uses four methods, namely Observation of workplace performance, Competence test, Role-play, and the Project/Assignment (NACTE 2009) and (NACTE 2010). These assessment methods could be attempted and submitted for grading through oral, demonstrations, and/or written formats. That means the use of CWTs for oral and written assessment formats could take up to 80% online and 20% face-to-face. The main activities at this stage for students include actual attempt of the assessment, group discussion, online and offline assessment submission, assessment inquiries and responding to the assessment feedback. On the other hand, a lecturer is responsible for coursework assessment design, pre-and post-assessment moderation, assessment issuance, marking, and giving formative and summative feedback to students and the administration (Northern Illinois University 2010).

In this research, summative assessment was used to collect information and feedback at the end of the module learning process. The focus of the summative assessment was to assess the final product of the entire learning process at the completion stage. On the other hand, formative assessment included the collection of information and feedback about teaching and learning during the learning and teaching process.

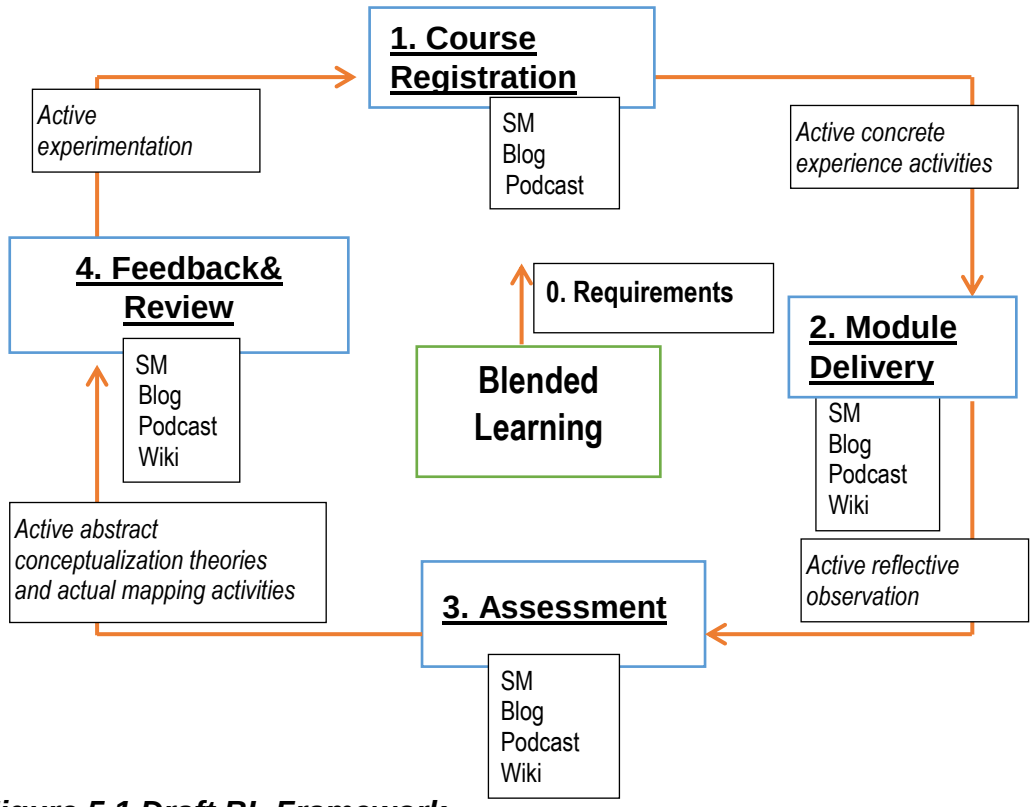


Figure 5.1 Draft BL Framework

The primary focus of the formative assessment was to identify areas that needed improvement. At this stage, the appropriately selected CWTs could be used to do all the activities for the students and the lecturers as explained above. Moreover, the CWTs could be accessed through the LMS and the records management systems. The basic requirements of the CWTs at this stage include the presence of a reliable internet connection and the LMS or records management system. The other requirements may include the presence of a BL policy and commitment from the top management.

Finally, the fourth stage of the learning process is the Course Feedback and Review. This stage is divided into two folds. The first fold is the formative and summative feedback on individual and group assessment (Xiufang and Qingchao 2008). For example, in the CBET, each assessment issued to students receives both formative and summative feedback from a lecturer. The feedback could be provided about the areas of improvement, strengths and

extra sources to knowledge and practices. On the second fold, the feedback and review consist of continuous course module improvement activities. That is, students and the lecturer continuously review the module contents in the view of providing new areas to improve which are finally reflected in the curriculum review. In some cases, students may as well provide feedback about the facilitators on the quality and quantity of the module delivery and administration and the level of satisfaction to the course. The two folds of the course feedback and review could be enhanced using CWTs for 90% online and 10% on face-to-face. Additionally, the CWTs could be embedded with the student portal, the LMS, and other university information systems such as the Library Management System (Rohani and Yazdani 2012). These systems form the basic requirements in addition to the reliable internet connection, BL policy, good ICT infrastructure and support.

5.2.2 Selected CWTs and the percentage of the Mix

Four CWTs were selected and their use discussed by all members as shown in table 3.3. The selected CWTs included the Wiki, Blog, Podcast, and Social media (Facebook).

Table 5.1 The BLF mixture ratio.

Process	**face-to-face (%)**	**Online (CWTs %)**
Course Registration	40	60
Module Delivery	40	60
Module Assessment	20	80
Module Feedback and Review	10	90

The selection and use of the four CWTs is provided in appendix XI, whereby, a lecturer could choose from a range of technologies for a learning activity. Nevertheless, the BL framework mixture ratio is a guide which could be used as a minimum level.

5.3 Validation

The newly designed BL Framework (draft) was validated by experts. The scope of the validation was limited to the learning process and application of the new BL Framework. The aim was to improve it and ensure its relevance and rigor for enhancing learning and teaching in HEIs in Tanzania. The process used for validation and the feedback received are discussed in this chapter. The final BL Framework construction and interpretation, with an in-depth explanation of its requirements, applicability is provided in chapter six.

5.4.1 Domain Experts

Twelve domain experts were contacted to evaluate and validate the individual elements and completeness of the entire draft BL Framework. The experts were drawn from the Curriculum Development, ICT and Learning Technology, Teaching Methodology, students as CWTs users and the Quality Assurance. The expert domain chosen created a multidimensional knowledge and experience capable of highlighting the shortfalls in the draft BL Framework. A similar approach to the selection of domain experts to validate the draft Framework was used by Richards (2016). The groups of experts are shown in table 3.5. As stated in section 3.5.3.4, the aim was to stimulate and enrich the discussion, inspire each other in order to create new understanding of the topic and the generation of ideas for the validation of a Draft BL Framework (Robson 2013, Saunders, Lewis and Thornhill 2009: 341, Teddlie and Tashakkori 2009: 297 and Robson 2013: 228).

5.5 Validation Methods

Two methods were used: the focus group and documentary review. During focus group meeting, a focus group protocol was designed and used to guide the discussion as shown in **Appendix VIII**. Each participant had an equal chance to contribute and discuss other participant's ideas. A consensus was

reached for each of the constituents of the draft BL Framework. The documentary review guided and enriched the discussion and analysis by using known best practices and standards in blended learning. All validators were given the focus group protocol before the meeting day and had time to read and understand it before the meeting day. That was why each validator was asked to present her/his findings. Finally, the qualitative data collected were analysed together with secondary data and then used to revise the draft BL Framework and produce the final/new BL Framework.

5.6 Results

The validation was carried out by independent experts in this domain as discussed above. The aim was to refine and seek endorsement from the experts on the draft BL Framework. Thus, the results are based on individual components of the Draft BL Framework. The primary result of the validation process was the complexity reduction of the draft BL Framework. The reduction took place after the deletion, modifications, and merging of some elements of the draft BL Framework. The outcomes are presented using eight focus group validation questions in Appendix VIII. The validation results, summarised in table 5.1 to table 5.8, confirmed the BL Framework's validity and helped to identify the further work discussed in chapter Eight.

Table 5.1 Focus Group Validation Answer One

Q&A	FGVQ1. What is your overall impression of the Blended Learning Framework and its usability?
Participants	ALL
Answer	Complexity of the mixture ratio, overlapping of the CWTs at each process, and beyond learning and teaching.
Solution	Each process given its mix actual ratio in percentage; CWTs at each process defined and explanations on how to use was added; Course Registration process considered out of the learning and teaching process and was replaced with module enrolment.

Table 5.2 Focus Group Validation Answer Two

Q&A Participants	FGVQ2. What impact can a Blended Learning Framework have on enhancing learning and teaching in HEIs in Tanzania?
	ALL
Answer	Testing in real settings is required; and Resources requirements vital
Solution	A Case study for testing acceptance and s was added in chapter PPP; Resource requirement element and discussion introduced within the BL Framework.

Table 5.3 Focus Group Validation Answer Three

Q&A	FGVQ3. Are there any parts of the Blended Learning Framework that appear disjointed or lack cohesion?
Participants	ALL
Answer	Separate Feedback from Review; More details on how to apply the CWTs at each process; Disjoint the Registration from the Framework.
Solution	Feedback was made to stand alone from the Review part of the module as illustrated in the New BL Framework; Details added on how to use the CWTs at each stage; A Case study added to explain the real application; and Registration process to be removed.

Table 5.4 Focus Group Validation Answer Four

Q&A	FGVQ4. Which elements would you add to make the Blended Learning Framework enhance learning and teaching in HEIs?
Participants	ALL
Answer	The mixture ratio indicating face-to-face and online modes; Add Feedback process and Review Process separately; Add Requirement as the initial element to be fulfilled before the actual use of the Framework.
Solution	The face-to-face ratio and online ratio shown with explanation; added two new process: Feedback and Review to replace Feedback and Review process.

Table 5.5 Focus Group Validation Answer 5

Q&A	FGVQ5. Which elements would you remove or alter and why?
Participants	ALL
Answer	Course Registration Process
Solution	The course registration process was removed since it was considered not part of the learning and teaching process. Instead, this should be replaced with module enrolment in which students are enrolled into a module.

Table 5.6 Focus Group Validation Answer Six

Q&A	FGVQ6. How would you describe the complexity of the framework within a Blended Learning environment?
Participants	ALL
Answer	Repetition of the CWTs at each stage; the need to go through all four processes; unclear explanation on the use of CWTs.
Solution	The CWTs repeats since they could be used differently at some processes; explanations added for the rationale behind going through all four stages; more details and examples provided on how to use one CWTs at different processes of the learning and teaching.

Table 5.7 Focus Group Validation Answer Seven

Q&A Participants	FGVQ7. What do you consider the key CWTs appropriate for blending with face-to-face instructional model in the Blended Learning environment?
	ALL
Answer	Wikis; Blogs; Podcasts; Facebook; Twitter; WhatsApp.
Solution	Only four CWTs were considered as they could easily be used through mobile devices and desktop computers for learning in HEIs in Tanzania as revealed by the survey in chapter four.

Table 5.8 Focus Group Validation Answer Eight

Q&A Participants	FGVQ8. How would you describe the validity of the Blended Learning Framework within the higher education environment in Tanzania?
	ALL
Answer	Apply and collect performance results and acceptance to a module in one of the HEIs; Remove and add the elements suggested in FGVQ3-4-5-6 above.
Solution	Students' performance measured after the use of the BL Framework in three modules; Acceptance level using TAM and TPDA measured using three modules; All recommendations in FGVQ3-4-5-6 above implemented.

5.7 Summary

The chapter presented the draft BL Framework in which the first focus group meetings were used. The participants included students, ICT staff, and lecturers. The qualitative data collected from the focus group meetings were analysed in relation to the reviewed literature on blended learning and the CWTs in chapter two. The output of the analysis was the Draft BL Framework. The Draft BL Framework has considered all inputs made by the participants, the best practices and standards in blended learning and CWTs. The draft BL Framework was validated by domain experts from the quality assurance team, the Heads of Academic Department, Head of the ICT Department; and users – representing the students, lecturers and ICT staff. These validators were independent and had not took part in the design of the initial framework, except the group of users named above. The group of users was included in the validation process to safeguard the contextual value that could be overlooked by the other participating validators. However, the validation process was guided by documentary review and policies governing the HEIs and the CBET. The results were to refine the draft BL and then to produce the new BL Framework presented in chapter six.

CHAPTER SIX

6.0 THE NEW BLENDED LEARNING FRAMEWORK

6.1 Overview

The New BL Framework in figure 6.1 is an output of the validation process of the draft framework discussed in chapter five. The New BL Framework is further elaborated in table 6.2. This chapter presents the New BL Framework, a novelty contribution of this research. The new framework incorporated all the inputs collected and analysed in table 5.1 through table 5.8 in chapter five. This chapter is organised into four sections: New BL Framework construction; Levels of the Blend in the learning process; the New BL Framework and Chapter summary.

6.2 New BL Framework Construction

All answers and solutions presented in tables 5.1 through 5.8 consist of input used for the construction of the BL Framework illustrated in figure 6.1. The discussion is based on individual component of the BL Framework.

6.2.1 Module Enrolment

The answers in FGVQ1, FGVQ3, and FGVQ5 suggested the removal of the course registration process in the BL Framework. The removal follows the debate that registration at a HEI is not part of the learning and teaching process. However, further review by experts shows that module enrolment could replace students' registration. That is, students could use BL Framework to get information about module enrolment and all other early module enrolment information from the lecturers or/and the University. Thus, the first process of the New BL Framework becomes *Module Enrolment*.

6.2.2 Delivery

The validators did not mention anything regarding the delivery process. However, overlapping issues of the CWTs in FGVQ1, the ratio used in the mixture between face-to-face and online modes, the need for more explanation on how to use each CWT are discussed in section 6.2.5. Therefore, there was no suggestion to change *Delivery* which forms the second process of the New BL Framework.

6.2.3 Assessment

Validators accepted *Assessment* as the third process of the New BL Framework. Additionally, the design and the logical link of the assessment process were found to be in line with the validators' expectations.

6.2.4 Feedback and Review

Feedback and Review were regarded as a single process in the draft framework. However, the answers and solutions to FGVQ3 and FGVQ4 needed them to be separated. Feedback would consist of all summative and formative feedback provided through the CWTs by lecturers. This constitutes a separate and independent process. On the other hand, module review could constitute all reviews about the module through CWTs such as overall module satisfactions and future improvements. The review could be run at the end of the semester by a lecturer or an independent person. This was seen to be in line with the NACTE quality assurance guidelines and best practices.

In summary, the resultant New BL Framework in figure 6.1 consists of five processes namely, module enrolment, delivery, assessment, feedback and review.

6.2.5 Cross-Cutting Issues

Four cross-cutting issues were raised during the validation process. These issues include the ratio used in the mix between face-to-face and online learning modes; the overlapping of the CWTs in each process; the need to prepare and identify the requirements for the framework; and more explanation about how to use each of the CWTs at each stage and finally, the need to go through all stages of the BL Framework.

Firstly, the ratio of the mix at each stage of the BL Framework is provided in table 6.2. Additionally, the discussion on how the mixture is done is provided in section 6.3. Secondly, the overlapping of the CWTs is caused by the multiple features that could be applicable in different processes during the learning process. For example, a blog (delivery) could be used by a lecturer to demonstrate a database normalization. At the same time, students could use a blog to present a practical assignment about a designed website as prototype (Xiufang and Qingchao 2008). Finally, a lecturer could use a blog to give feedback to students. The explanation on each of the CWTs and how to use them is provided in table 6.2. Thirdly, the need for the teaching and learning resources was considered auxiliary (**given 0. Order**) to the framework. However, it was added in the New BL Framework to remind users of the framework of its vital importance.

6.2.6 CWTs for BL Framework

As discussed in sections 4.2 and 4.3, the key CWTs for the BL Framework selected include Wiki, Blog, Podcast, Social Media such as Facebook and Twitter. The selected CWTs are familiar and proven to be used in HEIs in Tanzania. Furthermore, the discussion about Wikis, Social Media, Blogs, and Podcasts are provided in sections 2.4.1, 2.4.2, 2.4.3 and 2.4.4 respectively. The survey results in section 4.3.5 clearly indicated the readiness of both students and lecturers to use the CWTs in learning and teaching. As discussed in this

chapter, the application of the CWTs in a BL Framework is provided in table 6.2 at each stage of the learning process. One of the CWTs could be used in more than one process of the BL Framework as explained in 6.2.5 above.

6.3 Levels of the "Blend" in the Learning Process

6.3.1 New BL Framework Process and Overview

The New BL Framework constructed in section 6.2 above is illustrated in figure 6.1. It has five processes namely module enrolment, delivery, assessment, feedback and review. Additionally, the mixture between face-to-face and online learning occurs at each of the processes. The five learning processes selected constitute part of the recognised processes of the CBET curriculum framework. Equally important, the five processes consider the major components of the CBET curriculum framework used in HEIs offering technical education in Tanzania (NACTE 2015). According to the NACTE CBET curriculum development guidelines 2010, each of the five learning processes is essential towards the fulfilment of a National Technical Award (NTA) level.

The difference between the draft and new BL Framework is summarised in table 6.1. These include the increase in the number of processes from four to five, exclusion of prospect students, and separation of course registration from the learning and teaching process.

Table 6.1 Differences between Draft and New Blended Learning Framework

Draft BL Framework	**New BL Framework**
Four Processes	Five Processes
Course Registration	Module Registration
To be used by both prospective and current students	To be used by current students only
Did not include Resource requirements	Introduced Resource requirements

Draft BL Framework	New BL Framework
element	element

The first process of the New BL Framework is *Module Enrolment* whereby 90% could be online and 10% face-to-face. All registered students must be enrolled (registered) into a module. After the enrolment of the students and a module allocated to a lecturer, the framework goes into the delivery process. The BL Framework shall provide information to students about registration on how and when they should do it. Additionally, information related to reminders and notices could be given too through the CWTs selected in the Framework. The second process is *Module Delivery* which means actual teaching and learning involving physical or virtual contact about the learning outcomes. The CBET curriculum framework needs a registered student to attain a specified number of credit hours through module delivery. During the module delivery, the CWTs are used in an appropriate mix where 40% is face-to-face and 60% is online.

The CWTs are used to increase interactions and active engagement between a student and a lecturer, and amongst students. The interactions are enhanced using both face-to-face and CWTs for all methods of delivery such as lectures, seminars, tutorials and practical work.

Additionally, the available evidence from the literature (Balubaid 2013, Păuleţ-Crăiniceanu 2014, Iqbal *et al.* 2011 and Lwoga 2012) agreed with the results from the focus group meetings. The results suggest that CWTs could be used for module delivery methods mentioned above. The CWTs could also be used to access links to learning materials, announcements, news and alerts about the module.

A statement made by one participants says:

> "*Not all my lectures will be face-to-face, almost 60% to 70% are online and my students enjoy the module through shared experiences.*"

Through interactions and engagement between students and lecturers, and amongst students learning is achieved. Additionally, the New BL Framework enhances students' and lecturers' flexibility in terms of time, place and content

formats, and thus, offsets the disadvantages of face-to-face and the CWTs when used alone. Both lecturers and students must have the basic requirements to use CWTs. These include the computer laboratories, management commitment, broadband and reliable internet connection, learning management system and blended learning policy.

The third process of the New BL Framework is *Assessment*. The assessment has been designed based on the work by Xiufang and Qingchao (2008). In the CBET, the term assessment is defined as the "process of collecting evidence of learners' efforts to measure and make judgments about the achievement or non-achievement of specified standards or qualifications" (NACTE 2010). The competence-based assessment (CBA) uses four methods, namely Observation of workplace performance, Competence Test, Role-play and the Project/Assignment (NACTE 2009 and (NACTE 2010). These assessment methods include the written, audio-visual and oral formats. That is, the use of CWTs for written, audio-visual and oral assessment formats could take up to 20% face-to-face and 80% online via CWTs. The main activities at this stage for students include actual attempt of the assessment, group discussion, online and offline assessment submission, assessment inquiries and responding to the assessment feedback. A lecturer is responsible for coursework assessment design, pre-and post-assessment moderation, assessment issuance, marking, and providing formative and summative feedback to students (Northern Illinois University 2010).

Both summative and formative assessments could use CWTs. The summative assessment is used to collect information and feedback at the end of the module's learning process. Summative assessment aims to assess the final product of the entire learning process at the completion stage. On the other hand, formative assessment included the collection of information and feedback about teaching and learning during the learning and teaching process.

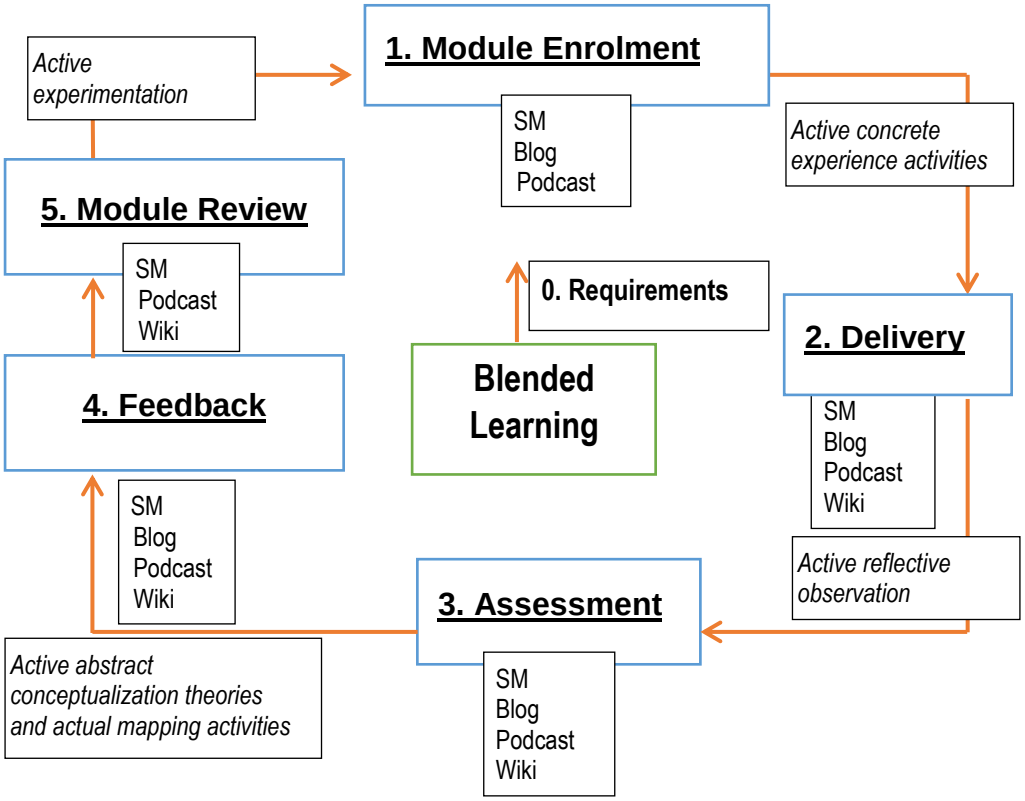


Figure 6.1 New BL Framework

The primary focus of the formative assessment is to identify areas that needed improvement. At this stage, the appropriately selected CWTs could be used to do all the activities for the students and the lecturer(s) as explained above. Moreover, the CWTs could be accessed through the students' portal and Learning Management Systems (e.g. Moodle). The basic requirements of the CWTs at this stage include the presence of a reliable internet connection, the students' portal, and Learning Management System (e.g. Moodle). Other requirements may include the presence of a BL policy and commitment from the top management.

The fourth process of the New BL Framework is *Feedback*. In the framework, Feedback stands for formative and summative feedback on individual and group assessments. For example, in the CBET, every assessment issued to student must receive feedback (either formative summative or summative or both). The feedback could include continuous assessment results or progress

test results and semester examination results. Other feedback could be on the areas of improvement, strengths and extra sources of knowledge and practices. CWTs could be used for providing 90% of the feedback while the remaining 10% of the feedback could be face-to-face. The students could use the CWTs to give peer feedback on individual or group assignments through active sharing and interactions. The lecturers could also use the CWTs to give prompt and informed feedback about students' discussion or chat on a topic. They could also use them for assessment purposes.

The fifth process of the New BL Framework is *Review*. The review in this framework consists of continuous course module improvement activities. That is, students use the selected CWTs to give reviews about the lecturers on the quality and quantity of the module delivery and administration and the level of satisfaction. The use of CWTs could be 100% in the review process. The CWTs could be embedded into the students' portal, the LMS and other university information systems such as the Library Management System (Rohani and Yazdani 2012). These systems form the basic requirements in addition to the reliable internet connection, BL policy, good ICT infrastructure and support as discussed in chapter four.

6.3.2 CWTs application in a New BL Framework

One of the distinguishing features of any CWT is the ability to facilitate interactions between two people asynchronously or synchronously (Chow 2013). This section elaborates on how and when each of the CWTs could be used in the New BL Framework.

The application of the CWTs suggested below was based on the selected technologies from the survey and their use was influenced by the results of the survey in sections 4.2 and 4.3.

Table 6.2 The Blended Learning Mixture Ratio

Learning Process	CWT	Application
MODULE ENROLMENT *CWTs = 90%* *Face to Face = 10%*	Blog	• Useful for providing free access to programme information such as objectives, structure, duration, fees, and post-course expectations. • Useful for general inquiry and FAQs. • Useful for providing module specific information (almanac, bursaries, news, and events, etc.) • Useful for continued and after class learning during vacation and study breaks.
	Podcast	• Useful as a marketing tool about the programme/module • Useful for publication of students' work in the form of audio or video clips • Useful for publishing career development and trends on the specialty
	SM	• Useful as a marketing tool about the programme. • Useful for live chat with admission support staff • Useful for providing FAQ, news and events broadcasts. • Useful as an information dissemination media and after school chatting about any topic of interest for the programme and module.
	Blog	• Useful for giving free access to programme information such as objectives, structure,

Learning Process	CWT	Application
		duration, fees, and post-course expectations. • Useful for general inquiry and FAQs. • Useful for providing module specific information (almanac, bursaries, news, and events, etc.) • Useful for continued and after class learning during vacation and study breaks.
	Podcast	• Useful as a marketing tool about the programme/module • Useful for publication of students' work in the form of audio or video clips • Useful for publishing career development and trends on the specialty.
DELIVERY Actual teaching and learning using different teaching methods *CWTs = 60%* *f2f =40%*	Blog	• Excellent for uploading lectures, video, audio, texts, images. • Useful for writing skills, peer learning, discussion, news, notice. • Useful for publishing lectures, presentations and university learning environment. • Useful for collaborative tasks for geographically dispersed members hence create a learning community. • Useful for encouraging critical thinking and creativity • Useful for giving links to external resources and sharing of resources. • Useful as a learning journal about a module.
	Wiki	• Useful for posting assignments (individual

Learning Process	CWT	Application
		and group), projects, and reflective assessment results. • Useful for collaborative for geographically dispersed members • Useful for encouraging critical thinking and creativity • Useful for co-authorship and team work building
	Podcast	• Useful for publishing class work and getting feedback • Useful for external links to expertise and industrial sources • Useful for disseminating tutorials, lectures, and other materials to wider learning community • Useful for reflections and peer-reviews • Useful for giving step-by-step practical experiences
	SM	• Portable and active chat possible • Useful for frequent updates and threads on the module • Useful for active student-student and student-teacher interactions • Useful for useful for collaborative work • Useful for class management and enhanced class participation • Useful for creating team work via sharing and celebrating birthdays
ASSESSMENT Carrying out Module	Blog	• Useful for encouraging critical thinking and creativity

Learning Process	CWT	Application
assessment individually and in groups both formative and summative *CWTs = 80%* *f2f =20%*		• Useful for co-authored students' assignment • Useful for posting individual and group work in forms of video, audio, text and images • Useful for peer-review assessments • Useful for students' portfolios
	Wiki	• Useful for encouraging critical thinking and creativity • Useful for co-authored students' assignment • Useful for written individual and group work • Useful for peer-review assessments • Useful for students' portfolios
	Podcast	• Useful for individual and group presentations • Useful for peer-review and reflectional learning • Useful for class project progress review and inspections
	SM	• Useful for creating groups and project pages • Useful for sharing individual and groups assessment for peer review • Using for asking help and getting support • Useful for getting expertise resources through "Like" and "Following" professional pages • Using for archiving past projects for future use
FEEDBACK	Blog	• Useful for conducting survey from students

Learning Process	CWT	Application
Providing both formative and summative feedback to students *CWTs = 90%* *f2f =10%*		• Useful for peer assessment and evaluation • Useful for critical analysis and feedback
	Wiki	• Useful for giving reflections on the programme • Useful for critical analysis and feedback
	SM	• Useful for peer assessment and evaluation • Useful for parents to get and provide feedback • Useful for conducting survey and module review for future improvement
REVIEW Providing review about the module delivery, satisfactions, and areas of improvement *CWTs = 100%* *f2f =0%*	Wiki	• Useful for providing reflections on the programme • Useful for critical analysis and feedback
	SM	• Useful for peer assessment and evaluation • Useful for parents to get and provide feedback • Useful for conducting survey and module review for future improvement.

6.4 Summary

This chapter presented the New BL Framework. The framework has five processes namely: module registration, delivery, assessment, feedback, and review. The New BL Framework is an output of the validation process discussed in chapter five. The framework considered the best practices in BL. In the learning cycle, both students and lecturers could choose from the four CWTs proposed at each stage. At each stage, there are at least two CWTs, each with a guide on how to use it. The levels of the blend (the ratio of online to face-to-face) based on the best practices and views from focus group meetings were discussed.

CHAPTER SEVEN

7.0 APPLICATION OF THE NEW BL FRAMEWORK

7.1 Overview

The New BL Framework presented in chapter six forms the novelty contribution of this thesis. The Framework was tested by applying it to three modules at the Institute of Accountancy Arusha (IAA) as one of the HEIs in Tanzania. The framework was applied to each module in the order of delivery, assessment, feedback and review. This is an application of the framework in an actual classroom setting. Section 7.2 discusses how the New BL Framework was applied. Section 7.3 describes the CWTs used and how they were used. Section 7.4 presents the results of using these CWTs in terms of students' performances, engagement and experience gained. Section 7.5 gives a discussion on the challenges faced by lecturers and students and finally a summary is presented in section 7.6.

7.2 The application Approach

This section provides a discussion on how the New BL Framework was applied. The new BL Framework was applied to three modules taught at the Institute of Accountancy Arusha, Tanzania. The modules selected were the Database Systems (ITU 07111) a first year degree module studied by all computing students, Database Systems and Implementation (ITU07314) studied by all second year computing students and the Business Computer Applications (ITU07104) studied by all none computing year one students.

The module leaders were given orientation for two hours on how to apply the framework to their modules. The basic key issues included:

7.2.1 BL Requirements and Material preparations

Lecturers were guided on how to prepare the module sites in Moodle and how to create a module account for the CWTs used. For the preparation of materials, lecturers were guided on how to create portable lecture notes from the save as function, how to record and upload a video clip to all CWTs and how to copy links to and from Moodle. The exercise was simple, and all lecturers were well prepared for the application of the New BL Framework. Finally, it was important to ensure that a lecturer has a device capable of connecting to the internet. All lecturers had both smart phones and laptops. Additionally, every lecturer had a desktop computer installed in her/his office.

7.2.2 Mapping the BL Framework into Module Outline

Lecturers were guided on how to map the New BL Framework to the module outline. This included creating a Module outline that allowed them to enter the CWT at each of the framework process. Although it was not a standard template, all the lecturers created a sample Module outline showing all the processes of the New BL Framework shown in **Appendix XII**.

The outline in Appendix XII guides the entire teaching and learning process for the whole semester. Students were required to create user accounts in the selected CWTs. For example, the delivery process used a blog, wiki, YouTube for podcasting, and Facebook. Students were required to familiarize with the selected CWTs and create accounts ready for use on the specified dates. The results of the BLF application into teaching and learning is discussed in section 7.4 below.

7.2.3 Using the CWTs for interaction with Students

The three modules mentioned in 7.2 were delivered using blog, wiki, YouTube for podcasting and Facebook. For the formative assessment, only wikis, blog and Facebook were used. On the other hand, the summative assessment utilised Facebook, YouTube and Blog. The CWTs facilitated active learning and

created a common arena for communication and collaborative activities. As suggested by Augustsson (2010), the CWTs were used to communicate new knowledge in the form of texts, images, audios or videos. To do this, every lecturer was needed to create a protocol that guides the interactions. Some marks were assigned to a student who adhered by the interaction protocol. For example, one of the assignments required every student to upload an individual work and then choose someone's assignment to comment on. Additionally, every comment or answer was required to be accompanied by a link or a credible source as citation.

7.3 The CWTs used and how they were used

The Module Outline in Appendix XII was designed and used. It shows the CWTs used and how they were used. The choice of the CWTs was based on the guidelines provided in table 6.2. It was found to be a simple process selecting a CWT for an activity in the learning process. Each lecturer had to prepare a course outline indicating the objective(s) to be achieved, the chapter or topic, the CWT activity for the topic and the selected CWTs to be used. For example:

Objective:	*Describe client/server database architecture concepts and principles.*
CWT Activity:	*In a group of three, discuss the different levels of security that should be established in a client/server database system. [4% Marks]* *Marks Contribution:2% quality work (examples and cite)* *1% comment on other's work (cite)* *1% for a quality reply (cite)*
CWT Selected:	***Wiki**: Students to submit work and Lecturer to offer feedback.* ***Facebook**: for notification (timeline and availability).*

Students were encouraged to participate in the wiki activity (formative assessment) in which 1 mark was awarded only for any reply that a student made. This required every student to participate and comment on someone's work. Unlike in the face-to-face modes, the BL provided an avenue for every student to comment and reply on the work of others within a given period.
For the delivery, Podcast was used to describe the client/server database architecture through YouTube. The lecturer allowed students to ask questions on the topic and replies were provided and remained on the YouTube page for future revision by all students. That is, the responses (Feedback) given by the teacher and fellow students, were open to all students to refer to in future.

Furthermore, all students were given a customized Google form through the Facebook page to provide their anonymous review of the module delivery, quality of teaching and overall satisfaction. In so doing, every student had a chance at her/his own time (but within a given time frame) to provide her/his comments about the module. Moreover, a wiki was created with a single question: What areas of the module must be improved in terms of topics, facilities and time; and any other comment? The replies were open, and criticisms were allowed. This was possible with the BL Framework as the face-to-face alone could have done little and could have omitted good ideas due to time constraints.

7.4 The Results

This section presents the results of applying the New BL Framework.

7.4.1 Students' Performance

The students' performance was divided into two parts: Continuous Assessment (CA) 40% and Semester Examination (SE) 60%. Table 7.1 summarises the scores for the different years for the three modules. The scores for CA and SE are out of 100. The results for Final Results (FR) are out of 100 for the whole semester combining CA and SE.

Table 7.1 Students Performance Comparison

Module		2014/15			2015/16		
		CA	SE	FR	CA	SE	FR
ITU07111	Lowest	42.5	18.0	31.0	60.0	40.0	49.0
	Highest	75.0	80.0	77.0	92.5	82.0	84.0
	Average	65.75	49.7	56.1	71.5	60.9	65.1
ITU07314	Lowest	53.5	31.0	40.0	52.5	24.0	40.0
	Highest	77.5	79.0	78.0	80.0	80.0	79.0
	Average	63.5	51.5	56.4	68.0	56.9	61.3
ITU07104	Lowest	55.0	46.0	52.0	50.0	40.0	49.0
	Highest	80.0	76.0	74.0	85.0	83.0	82.0
	Average	65.0	58.4	61.0	70.0	66.9	68.1

The results in table 7.1 appear to suggest that applying the new BL Framework improved the results of the students. The module average mark of ITU07111 increased from 56.1% in 2014/15 to 65.1% in 2015/2016 (a 9% improvement). The average mark of ITU07104 increased from 61.0% to 68.1% (an increase of 7.1%) and the average mark of ITU07314 increased from 56.4% to 61.3% (an increase of 4.9%). It should be noted that 47 students were enrolled on each of the modules in 2014/15 while 62 students were enrolled on each of the modules

in 2015/16. This research has not investigated the impact, if any, that the different number of students enrolled in each year had on these results.

7.4.2 Engagement and Interactions

In learning and teaching, interaction is associated with communication and socialisation (Herrera Pavo and Rodrigo 2015). The use of CWTs in the BL Framework increased interaction firstly, between lecturers and students, secondly amongst students themselves, and thirdly interactions with learning and teaching contents. **Appendix XIII** and **Appendix XIV** show the Facebook interactions and students' engagement in ITU07111 and ITU07314 respectively. The interaction is both synchronous and asynchronous (Chow 2013). For the synchronous, the interaction is lively and takes place while the sender and the receiver are present. This allowed for quick and accurate feedback. On the other hand, asynchronous interaction allows the sender and receiver to interact at different times. Appendix XIV shows active interactions between students and their lecturer. The use of BL Framework enabled students and lecturers to collaborate by sharing new information that receives reactions and a greater possibility of looking back at the posts for revision. Similarly, appendix XIV shows how students were highly motivated to share their views in confidence on a topic. The interactions were flexibly given at a given time, an opportunity that could not be given by face-to-face or online learning alone. The use of CWTs in a BL Framework enabled students' reflections regarding their own and others' views and excitements. The use of CWTs also supported an individual student to feel that they belong to a class or a group and helped develop their identity within the learning process (Augustsson 2010).

7.4.3 Dispositions and Acceptance Level

At the end of the semester, every participant was requested to respond to a questionnaire; the findings are analysed and presented in this section. Tselios used a similar approach, Daskalakis and Papadopoulou (2011). In the current

study, a questionnaire used the term CWTs as an online learning or BL as combined with face-to-face. There were four (4) lecturers and seventy-eight (78) students. The Technological Acceptance Model (TAM) was used to examine the perceived usefulness and ease of use of the New BL Framework. Davis (1989: 320) provided a definition of perceived usefulness as '*the degree to which a person believes that using a particular system would enhance his/her job performance'*. On the other hand, perceived ease of use means *'the degree to which a person believes that using a particular system would be free of physical and mental effort'* (Davis 1989: 320). The views on usability, acceptance, attitude and dispositions were assessed and presented in sections 7.4.3.1 and 7.4.3.2.

7.4.3.1 Views on Usability and Acceptance Level

Both students and lecturers were asked to give their views on the usability and acceptance level of the New BL Framework (Sadaf, Newby and Ertmer 2012). Four constructs were used based on the TAM. These include Actual Usage, Facilitating Condition, Perceived Behavioural Control and Ease of Use.

a) Actual Use

i. 100% of the lecturers agree that the use of CWTs in their module helped them interact with their students and fellow lecturers more easily. On the other hand, 89% of the students agree that they managed to interact with fellow students and lecturers more easily through CWTs; 8% were neutral and 3% disagreed.

ii. 100% of the lecturers agree that the use of CWTs helped them to enhance their teaching efficacy. In addition, 92% of the students believe that the use of CWTs enhanced their interests in the module and the course of study; 6% were neutral and 2% disagreed.

iii. 100% of the lecturers agree that they actively engaged with their students using the CWTs. For the students, 77% of them agreed that

they were able to participate in the assignment more because of using the CWTs; 18% were neutral and 7% disagreed.

iv. 83% of the lecturers agreed and 17% were neutral that using CWTs helped them teach their modules well. For the students, 87% of them felt that using CWTs helped them to learn more about the subject; 11% were neutral and 2% disagreed.

b) Facilitating Condition

i. 100% of the lecturers agreed that they can use CWTs using their devices connected to the Internet. 90% of students agreed; 8% were neutral and 1% disagreed that they can use CWTs using their devices connected to the Internet.

ii. Students were further asked if they would be glad to ask for financial support, such as a loan, to cover the costs of using CWTs in learning and teaching. The results showed that 68% of students agreed; 21% were neutral and 11% disagreed.

c) Perceived Behavioural Control

i. 100% of the lecturers agreed that using the CWTs is entirely within their control. On their part, 82% of students agreed; 13% were neutral and 4% disagreed that using the CWTs is entirely within their control.

ii. 100% of the lecturers agreed that they have the knowledge, experience and ability to use CWTs. 80% of students agreed; 15% were neutral and 5% disagreed that they have the knowledge, experience and ability to use CWTs.

d) Ease of Use

i. 50% of the lecturers agreed, 17% were neutral and 16% disagreed that they feel that the CWTs interface and features were easy to use and understand. 81% of the students agreed; 14% were neutral and

5% disagreed that they felt that the CWTs interface and features were easy to use and understand.

ii. 67% of the lecturers agreed, 17% were neutral and 16% disagreed that they felt that browsing/editing information on the CWTs was easy. 81% of students agreed; 15% were neutral and 3% disagreed that they felt that browsing/editing information on the CWTs was easy.

iii. 67% of the lecturers agreed and 33% were neutral that they felt that compared to Learning Management Systems (Moodle) the CWTs were easier to use. 88% of students agreed and 12% were neutral that they felt that compared to Learning Management Systems (Moodle) the CWTs were easier to use.

iv. 100% of the lecturers agreed that using CWTs helped them deliver and provide feedback to their students at a more convenient time. 81% of the students agreed; 18% were neutral and 1% disagreed that using CWTs helped them better to learn the materials at a more convenient time.

7.4.3.2 Views on Dispositional and Attitudes

Both students and lecturers were asked their views about the New BL Framework in terms of their attitude, behaviours, perceptions and self-efficacy towards the use of the New BL Framework (Eyyam, Menevi§ and Dogruer 2011, and Baltaci-Goktalay and Ozdilek 2010). Four constructs were used including Attitude, Behavioural Intention, Perceived Usefulness, and Self-Efficacy.

a) Attitude

i. All the lecturers (100%) agreed that the use of CWTs helped them to achieve the module objectives. 87% of the students agreed that the use of the CWTs helped them in achieving course objectives; 11% were neutral and 2% disagreed.

ii. 100% of the lecturers agreed that the CWTs used by their students in their modules were useful for their students and modules. 89% of the students believed that CWTs were useful in their studies; 8% were neutral and 2% disagreed.

iii. 100% of the lecturers agreed and believed that the advantage of using CWTs outweighed the disadvantages of not using it. In the students' survey, 73% of them agreed and believed that the advantage of using CWTs outweighed the disadvantages of not using it; 23% were neutral and 4% disagreed.

iv. 100% of the lecturers agreed that the benefit of using the CWTs was worth the extra effort and time required to learn how to use them. 78% of Students believed that the benefit of using the CWTs was worth the extra effort and time required to learn how to use them; 17% were neutral and 5% disagreed.

v. Finally, 90% of students believed that using CWTs is a good idea; 7% were neutral and 3% disagreed.

b) Behavioural Intention

i. 100% of the lecturers agreed that the use of CWTs motivated them to use it in other modules. 82% of the students agreed that they would like to see CWTs used in other courses; 12% were neutral and 6% disagree.

ii. 100% of the lecturers agreed that the use of CWTs helped them to provide and deliver more materials to their students. 91% of Students agreed, 6% were neutral and 3% disagreed that they obtained more materials because of using the CWTs.

iii. 100% of the lecturers agreed that they would recommend courses that use CWTs over courses that do not use CWTs. 68% of students agreed; 23% were neutral and 9% disagreed that they would recommend courses that use CWTs over those that do not use CWTs. In addition to this, 92% of students agreed; 6% were neutral

and 2% disagreed that they are ready to use CWTs in their future studies.

iv. Finally, 82% of students agreed, 15% were neutral and 3% disagreed that they are happy to use CWTs in the next semester.

c) Perceived Usefulness

i. 67% of the lecturers agreed that technical features of the CWTs helped enhance their teaching experiences and 33% were neutral. 86% of the students agreed; 10% were neutral and 4% disagreed that the technical features of the CWTs enhanced their learning experiences.

ii. 100% of the lecturers agreed that using CWTs improved students' academic performance. 80% of the students agreed; 17% were neutral and 4% disagreed that using CWTs improved their performance.

iii. 100 % of the lecturers agreed that the use of CWTs for assignment helped them to interact more with their students and fellow staff. 79% of the students agreed; 17% were neutral and 4% disagreed that the use of the CWTs for assignment helped them to interact more with their lecturers and fellow students.

iv. 100% of the lecturers agreed that by using CWTs, students' coursework was easily communicated, and feedback provided in time. 74% of the students agreed; 20% were neutral and 6% disagreed that by using CWTs their groups could come to agreements faster about group assignments.

v. 100% of the lecturers agreed that the use of CWTs promoted collaborative learning for their students. 85% of the students agreed; 11% were neutral and 4% disagreed that the use of the CWTs promoted collaborative learning.

d) Self-Efficacy

i. 100% of the lecturers agreed that using CWTs improved students' satisfaction with the course. 83% of the students agreed; 15% were neutral and 2% disagreed that using CWTs improved their satisfaction with the course.

ii. 100% of the lecturers agreed that they felt comfortable using CWTs. 83% of the students agreed; 15% were neutral and 2% disagreed that they felt comfortable using CWTs.

iii. 100% of the lecturers agreed that they used CWTs on their own. 87% of the students agreed; 10% were neutral and 3% disagreed that they used CWTs on their own.

iv. 100% of the lecturers agreed that they can easily use CWTs without technical support from ICT staff. 80% of the students agreed; 17% were neutral and 4% disagreed that they know enough to use CWTs.

7.5 Challenges

The use of the New BL Framework revealed challenges (Kenney and Newcombe 2011 and Draffan and Rainger 2006) which need to be resolved in future work. First, 1% to 6% of the students did not have devices capable of connecting to the internet. These students depended on either their fellow students or on the University IT Facilities. This posed a challenge when activities are given on a time constraint basis. The second challenge was the lack of a BL policy in Tanzanian HEIs. There is a need to put in place a BL Policy that enforces the use of BLF.

7.6 Summary

The results suggest that the BL framework is relevant to the HEIs in Tanzania. All constructs tested revealed high level of acceptance and participants saw the value of the CWTs in learning and teaching.

The New BL Framework was further put into actual use, whereby at the end of the semester a questionnaire was run to capture the actual intention to use and the acceptance of the CWTs in the learning and teaching. The results have revealed that both students and the lecturers would use the CWTs and that they accept the New BL Framework for enhancing learning and teaching in HEIs in Tanzania.

CHAPTER EIGHT

8.0 CONCLUSION AND FURTHER WORK

8.1 Introduction

The research aimed to design and validate a BL Framework that is supported with CWTs for HEIs in Tanzania. The research was carried out using five research questions. In this chapter, a discussion is provided on the answered research questions, the research implications, the research contributions, further work and conclusion.

8.2 Research Questions Answered

The research aimed to answer the following research questions:

What are the appropriate CWTs capable of supporting BL environment for enhanced learning and teaching in higher education in Tanzania?

This research question was answered in all the three phases of the research. The research began by a review of the extant literature, discussed in chapter two, to identify the appropriate CWTs for the new BL Framework. The review informed the process of designing the new BL framework. This step was necessary during phase two when qualitative data from focus group meetings were used to design the framework. During the survey in phase one, respondents were asked whether they have an account in the CWTs. During phase two, participants in the focus group meetings were asked about what CWTs suit which process during learning and teaching; and finally, in phase three, key experts validated the appropriateness of the CWTs at each stage of the draft BL Framework. Responses were also collected from the application case study in chapter 7, where the results indicate high rate of acceptance and

the capability of the CWTs used to enhance learning and teaching through increased interactions and engagement.

What are the common essential usage patterns of the CWTs in Tanzanian HEIs?

Internet usage patterns have been defined as how users use the internet (Kang, Seo and Hong 2011, Deniz and Geyik 2015 and Penard *et al.* 2015). This research question was answered during phase two of the research for the purposes of informing the draft BL Framework. The internet usage patterns identified included devices used in HEIs to access the internet and CWTs, the available internet connection choices and how the CWTs were currently being used by students and lecturers. The information about the internet usage patterns was an essential input to the design of the BL Framework. The presentation and discussion of the findings are provided in section 4.2.4. The findings helped to inform the design and validation process of the BL Framework. The results were provided by students, lecturers and ICT staff who were considered important stakeholders of the BL Framework. Thus, the CWTs usage patterns for the key stakeholders were important to inform the framework that would be used by them.

Is there an ICT infrastructure that can support BL with CWTs in Tanzanian HEIs?

The third research question was answered in a survey as discussed in chapter four. The ICT infrastructure consists of all components which form the backbone that run the ICT services such as Broadband Networks, ISP, Learning Management Information Systems, Internet Connection, Mobile and Desktop Devices and power supply. It was important to know the available ICT infrastructure and to determine whether it could support the use of CWTs in a BL environment. One publication (Pima *et.* 2016) entitled “Assessing the available ICT infrastructure for collaborative web technologies in a blended

learning environment in Tanzania: A mixed methods research" was produced as shown in **Appendix XV**. In this publication, the results revealed the availability of good and growing ICT infrastructure capable of supporting the use of Collaborative Web Technologies (CWTs) BL in HEIs in Tanzania.

What appropriate BL Framework that can support CWTs to enhance learning and teaching in Tanzania context?

The fourth research question was answered through the process of designing and validating the BL Framework. First, through focus group meetings, a draft BL Framework was designed and presented in chapter five. The draft BL Framework consisted of four learning processes. The draft BL Framework was then validated using key experts as discussed in chapter six. The key experts used their skills and experience to refine the draft BL Framework. The results of the validation were used to design the New BL Framework illustrated in figure 6.1. Finally, the New BL Framework was applied to three modules in IAA. The results of the application showed that the New BL Framework can enhance learning and teaching in HEIs in Tanzania. The framework received high rate of acceptance from both the students and the lecturers. The whole process was meant to design and validate an appropriate BL Framework that supports the use of CWTs for enhanced learning and teaching. As discussed in chapter 7, the new BL framework enhanced interactions between students and lecturers. It also helped the students to engage better with their courses. Therefore, the new BL framework can enhance learning and teaching in HEIs in Tanzania.

What are the practical implications and views on the proposed BL Framework?

The results of the application of the new BL framework, as discussed above, showed that the framework increased interactions between lecturers and students. They also showed more interactions between students as well. The students engaged better with their courses. However, there are some practical

implications which include the need to ensure that the application of the new BL framework does not increase the workload of lecturers excessively, the ICT infrastructure is reviewed constantly to ensure it is capable of support the BL framework and a well-defined policy for using the framework is put in place.

8.3 Research Implications

The key stakeholders validated the BL Framework designed initially (referred to in this thesis as the draft BL Framework). The feedback comments from the validation process were used to produce the final BL Framework (referred to in this thesis as the New Framework). The number of processes in the final version increased from 4 to 5. Another difference between the initial version and the final version of the BL Framework is the inclusion of a resource requirements element in the final version. The new BL Framework was also applied to three modules at the Institute of Accountancy Arusha (IAA), Tanzania. The Framework was also evaluated in terms of its usability and technological acceptance. The results presented and discussed in chapter 7 above appear to suggest that the New BL Framework can enhance learning and teaching in HEIs in Tanzania. The application of the Framework resulted in a module average increase between 4.9% and 9% over those of the same modules in the previous year. In addition, the New BL Framework increased the interactions and engagement between the students and lecturers, and amongst students. For example, students could create new knowledge which were shared across the group through the CWTs. Students had flexible forums where to share and acquire knowledge at flexible times. Students were also able to engage in group activities with their peers more flexibly at different times using the CWTs. On the other hand, the lecturers could provide formative feedback prompt to students. It is the view of this research that the interactive and engaging environment created by the CWTs in a new BL Framework enhanced learning and teaching.

The ICT infrastructure present in HEIs proved to be able to support the use of CWTs in a new BL Framework. The results of the application of the framework indicate that students used the new BL Framework from home, computer laboratories and other public places. Moreover, in all the areas, such as residence, university or home, the students and lecturers could connect to the internet. The results further show that student's work was submitted from all places including residence, home and university computer laboratories. This research submits that the available ICT infrastructure could support the use of CWTs in a new BL Framework. The ICT infrastructure is supported by ISPs that offer varieties of internet tariff bundles for students. The internet tariff bundles available in Tanzania were said to be reliable and satisfactory. Both the students and lecturers surveyed said the bundles could support the use of CWTs in a BL Framework. They also claimed that they could connect to the internet from either home/residence or the university. Another component that forms part of the ICT infrastructure is a strong LAN within the HEIs. The LAN installed in HEIs could provide internet connection services to both students and lecturers throughout the day. Although the bandwidth is limited, the use of CWTs in a BL Framework was made possible from the computer laboratories. The availability of legacy systems such as student portal, Moodle, websites, library management systems, and students' records management systems formed another component for the strong ICT infrastructure. Students and lecturers had at least used one of the legacy systems. The legacy systems acted as a gateway to information access within and outside the HEIs. The legacy system shaped a user's navigational skills which could be used in the new BL Framework. Therefore, the people component of the ICT infrastructure had the basic navigational skills necessary to use the CWTs. The survey results had shown that both students and lecturers had used other systems and that they may not require training to use the CWTs in a BL Framework.

Another ICT infrastructure component, the internet enabled devices (such as smart phones, laptops, desktops and other devices) were available for use in a BL Framework. Lecturers and most of the students had devices capable of

connecting to the internet. In addition, the HEIs had devices and resources (such as computer laboratories, computers and Wi-Fi points) that enabled students and lecturers to access online resources from within and outside the HEIs (Ertmer *et al.* 2012). As shown in section 7.4.3.1 (b), about facilitating conditions, the results showed that 90% of students agreed; 8% were neutral and 1% disagreed that they can use CWTs using their devices connected to the Internet. That means, 9% of students surveyed did not have personal devices that would enable them to connect to the internet. They would, therefore, depend on the university's facilities to connect to the internet. The university's internet was made available throughout the week and for the nearby hostels, students could log onto the Wi-Fi internet. The deadlines for the submission of assignments by students took into consideration the fact that some students might depend on the facilities in the university to connect to the internet.

Finally, power supply in the ICT component is vital to support the BL activities. Although many HEIs are in urban areas, they are not exempted from unplanned power outages. The unplanned and prolonged power outages could negatively impact on the use of the CWTs in a New BL Framework. A power outage affects the internet availability and the ability of the devices to operate. Consequently, the unavailability of power could also result into delayed coursework hand-in and submission. Additionally, a power problem could result in poor quality of work by students and make them work under pressure. However, the power problem had been resolved through automatic power generators installed in HEIs and at all mobile cellular network cells. The power generators supply power to all university equipment where students could recharge their mobile devices and store power for home use. Additionally, there are varieties of mobile power banks for different devices which are affordable and available across the country. Most importantly, many students' residences and hostels are installed with Solar Power systems capable of supplementing hydroelectricity solutions. Thus, the power problem is minimised to the level whereby CWTs can be used in a BL Framework.

The New BL Framework is supported with CWTs, which, in this research, form part of the ICT infrastructure required to support the framework. These CWTs include Wiki, Blog, Social Media and Podcast. The results of the application of the Framework in section 7.4 show that the CWTs selected are appropriate for the BL Framework. The CWTs used proved to be effective in the BL Framework. Furthermore, the CWTs are easy to use and require minimum time and skills to learn how to use them. To use any CWT, a student for instance, would only need an internet connection and a subscription.

From the foregoing, the New BL Framework could impact the lecturer and resource's workload allocation and save space for better resources management in several ways. Firstly, with the aid of CWTs one lecturer could be allocated more students than in traditional teaching mode. This could happen due to the options available with the framework. For instance, the use of a new BL Framework reduces face-to-face and lecturer's contact hours with the students and in turn increases online interaction time. In the delivery and assessment processes, a lecturer could require only 40% or 20% of the learning time face-to-face. The new BL Framework in figure 6.1 and mixture ratio in table 6.2 show the percentage of the mixture between face-to-face and online learning instructional modes. As shown in Appendix XII, the Module outline could guide the lecturer on which topic or activity to use CWTs and how to actively engage students through the whole module administration.

Secondly, using the new BL Framework, workload allocation could be improved by allocating the saved time to other activities. The lecturer could use the rest of her/his time in research, consultancy or other modules. The feeling by the lecturers that the BL Framework reduces work was among the factors for their decision to accept it (Ajjan and Hartshorne 2008). In their study entitled "Investigating faculty decisions to adopt Web 2.0 technologies: Theory and emprical tests", Ajjan and Hartshorne argued that there must be motivating factors with impacts on lecturer's work. In the current study, workload reduction was seen as a direct benefit anticipated by lecturers (Ertmer *et al.* 2012).

Thirdly, the workload allocation could be improved by saving spaces and improving resources management such as classrooms and library services. This could be achieved through workload allocation in which classrooms are allocated to face-to-face sessions only. On the other hand, online learning takes place at different places. For example, the online learning could be done at computer laboratories, home, or other places.

Further to the above discussion, the quantitative data shown in section 7.4 had internal reliability above (α>= 0.7) the minimum score. For example, the Validation Case Study had an acceptable alpha score (i.e. α = 0.843). Moreover, the validation process, as one of the means for assessing the suitability of the BLF, was largely informed by literature and the focus groups.

Finally, since learning is achieved through interaction, the New BL Framework creates an avenue for active interactions and engagement between the student and the lecturer. The discussion above has shown that the new BL Framework enhanced learning and teaching. The interactions between students and lecturer, students with contents, and amongst students were enhanced. The new BL Framework received high rate scores in terms of its usability and acceptance by both students and lecturers.

8.4 Research Contribution

8.4.1 A New BL Framework based on CWTs

A New BL Framework that uses CWTs was designed, validated and applied to three modules at a Tanzanian Higher Education Institution. The results of the application of the new BL Framework appear to suggest that it enhanced learning and teaching. The BL Framework provides guidelines on what, when, who and how to use the CWTs in a BL environment for enhanced learning and teaching in Tanzanian HEIs.

8.4.2 Other Research Contributions

The current state of the art of the available ICT infrastructure in Tanzanian HEIs was established. It was used to inform the research on whether it is possible or not to use the CWTs in a BL environment in HEIs in Tanzania.
Finally, the essential usage patterns of CWTs in Tanzanian HEIs was determined. This contribution was achieved through a survey which sought to establish the usage patterns of the CWTs as a step towards the design and validation of the BL Framework.

8.5 Further Work

The results of applying the new BL Framework to three modules showed that the average module marks of these modules increased by about 4.9% to 9% over the average module marks of these modules in the previous year. Further research work is needed to determine further the reason or reasons for this increase. It would also be very useful to investigate how significant these increases are and whether some modules are better suited to the framework than others.

Other areas for further research work include:

a) the need to assess and create a cross-institutional quality assurance and adoption strategies of BL in higher education in Tanzania. These variables could be investigated through collecting first-hand information (interview and focus group) from key stakeholders such as students, lecturers and administrators of Tanzanian HEIs;
b) a study of the BL Requirement model that could further guide lecturers on how to prepare teaching and learning resources needed for BL framework;

c) a study of the trends and usefulness of emerging web technologies such as Udacity and Coursera in the BL Framework in Tanzanian and less technologically developed Higher Education Institutions and
d) the need to merge the technologists and educationalists point of views in a further attempt to establish an integration of technology and pedagogy for the blended learning in higher education.

8.6 Conclusion

The research aimed to design and apply a blended learning framework based on Collaborative Web Technologies (CWTs) for the Higher Education Institutions in Tanzania. To achieve this main aim, the following five research objectives were developed: review the extant literature so as to identify the appropriate CWTs; assess the current usage patterns of CWTs in Tanzanian HEIs; assess the available ICT infrastructure that can support BL with CWTs in Tanzanian HEIs; design a BLF that supports CWTs for HEIs in Tanzania and evaluate the BLF by applying it to three modules in a Tanzanian HEI .

Five research questions were developed later to achieve the aim of the research. All the research objectives were met, and all the research questions were answered. The literature review showed that there was no BL Framework at both the organisational and cross-institutional levels which addresses the use of CWTs in the application of a Bended Learning approach in HEIs in Tanzania. Hence, there is the need to develop a blended learning framework based on collaborative Web Technologies for Tanzanian HEIs.

Our investigation revealed that the ICT infrastructure available in Tanzanian HEIs can support a BL framework based on CWTs. The investigation also showed that lecturers and students are happy and ready to use the BL approach supported by CWTs.

The first version of the BL Framework supported by CWTs designed for a Tanzanian HEI (called draft in this thesis) was validated by key experts and stakeholders. The feedback comments from the validation were used to refine the version and to produce the final version of the BLF (referred to as the New BLF in this thesis). The new BLF was tested or validated by applying it to three modules in a Tanzanian HEI. The results from the application showed that the students were more engaged with their studies. They interacted better with their peers and with their lecturers. All the three modules recorded higher average module marks than they had in the previous year when BLF was not applied. One module had a 9% average module mark increase over that of the previous year. These results appear to suggest that the BLF enhanced the learning and teaching in the three modules. However, one of the challenges to the application of this framework in Tanzanian HEIs is the inability of some students (about 1% to 6% of those surveyed) to acquire their own smart devices or laptops. These students depend on the University's computing facilities which are not portable. Another challenge is the lack of a BL policy in Tanzanian HEIs. There is a need to put in place a BL Policy that guides the use of a BL Framework.

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APPENDICES

Appendix I: The Map of Tanzania

Source: Tanzania National Website

Appendix II: Consent Form and Research Information Sheet

FACULTY OF ENGINEERING AND COMPUTING

INFORMED CONSENT FORM

Dear Respondent,

Kindly fill in this Informed Consent Form

1. Title of the Research: A Blended Learning Framework based on Collaborative Web Technologies for enhanced learning and Teaching: A Case of Tanzania Higher Education Institutions
2. Name of Researcher: John Marco Pima
3. Name of the Participant:

   _____
4. I confirm that I have read and understood the Research Information Sheet provided for the above research.
5. I understand that my participation is voluntary, and I will do my best to provide the required information freely.
6. I agree/disagree to take part in this study at the convenience time and place agreed between the researcher and me.
7. I agree/disagree to the interview being audio recorded
8. I agree/disagree to the use anonymised quotes in publications.

Name of Participant: _____

Signature: _____

Name and Signature of Researcher

John Marco Pima

Sign_____Date_____

THE RESEARCH INFORMATION SHEET

1.0 Nature of the Research

This research information sheet aims to provide summarized information to every participant selected to participate in data collection.

The research aims to design a Blended Learning Framework which is based on the use of Collaborative Web Technologies for Higher Education Institutions in Tanzania. It is carried out by John Marco Pima, a PhD student at Coventry University, UK and Lecturer at the Institute of Accountancy Arusha.

This research involves a sample from among students, Lecturers and ICT staff from Higher Education Institutions in Tanzania. You are requested to participate and contribute to the above aim, which will enhance learning and teaching in Tanzania.

2.0 Research Participation Requirement

The data required is primary and based on the experiences, new ideas and creativity, and proposal on how to use collaborative web technologies in a blended learning environment in Tanzania.

The data is collected using questionnaire, interview, focus group, observation, and documentary review. Time for each is not more than fifteen minutes and commences in October 2014.

3.0 Rights and Obligations of Participants

This research recognises that participation is voluntary. Any participant can decline to answer a question or request to be treated differently. Additionally, every participant is free to take note of his/her responses where voice/video is used. At any stage of the data collection, participants are free to withdraw. Every participant's response is confidential and will be anonymously treated, and data used for the intended purposes only. Each participant is requested to fill in the Informed Consent Form attached.

4.0 Use of Data Collected

The access to the collected data is strictly to only the researcher and the supervisory team in accordance with Coventry University Research Ethical Policies.

5.0 Contact Information

The Researcher Contact information:

Appendix IIIa: Questionnaire Survey Phase I – Students

FACULTY OF ENGINEERING AND COMPUTING

QUESTIONNAIRE TO ASSESS THE ICT INFRASTRUCTURE FOR THE USE OF COLLABORATIVE WEB TECHNOLOGIES IN BLENDED LEARNING ENVIRONMENT

Dear Respondent,

This is a questionnaire to assess the ICT infrastructure in Tanzania which can support the use of collaborative web technologies in teaching and learning.
I humbly take this opportunity to request for your time to go through this questionnaire with the aim of providing information on questions asked. The data provided in the questionnaire will STRICTLY be treated confidential and shall be used for learning purposes only. This is in accordance with the Coventry University and the UK Policy and Code of Conduct on the Governance of Good Research Conduct 2009 as revised in September 2010.

Thank you in advance,
John Marco Pima
Principal Researcher

1. Please state your gender: Female ☐ Male ☐

2. Kindly select your age group (ONLY one)

15-24	25-34	35-44	45-54	55 above
a	b	c	d	e

3. Kindly name your Faculty/Department you work for.
   a. Department/Faculty
      :_____
   b. Position (Option):_____

4. Please select the highest qualification that describes you (Select only one)

PhD	Masters	Degree/Equivalent	Ordinary Diploma	Certificate	Others
a	b	c	d	e	f

5. What do you consider to be your computer literacy? Kindly select one.

Beginner	Intermediate	Advanced	I don't know
a	b	c	d

6. For how long have you been using the internet in Tanzania? Please select.

0-1 years	2-5 years	Above 5years but less than 10 years	Above 10 years Never used	I don't know
a	b	c	d	e

7. Rate the following internet connection problems in <u>your home area/resident</u> using 1=major problem; 2=minor problem; 3=not a problem; 4=I don't know.

Problem	**1**	**2**	**3**	**4**
a. Internet connection is not reliable				
b. Internet connection is very expensive				
c. Internet is not available in my house/home				

Problem	1	2	3	4
area				
d. There is poor wireless internet connection				
e. There is no wireless Internet connection at our home area				

8. Rate the following internet connection problems at <u>your University/College</u> using 1=major problem; 2=minor problem; 3=not a problem; 4=I don't know.

Problem	1	2	3	4
a. Internet connection is not reliable				
b. Internet connection is very expensive				
c. Internet is not available at my university				
d. There is poor wireless internet connection				
e. There is no wireless Internet connection at University				

9. What are other main problems that you face in using the internet? Please list on the space provided below.

   a. _____

10. Which of these computing devices do you possess or have? Please select.

Desktop Computer	Laptop	Smart Devices	Tablets	Mobile Phone	All	None
a	b	c	d	e	f	g

11. Select the types of device that you **<u>MAY</u>** use to connect to the internet. (Tick all that apply)

Desktop Computer	Laptop	Smart Devices	Tablets	Mobile Phone	All	None
a	b	c	d	e	f	g

12. When using the selected device above, how do you connect to the internet? (Tick all that apply): I connect through:

Mobile Broadband	Wired Connection	Mobile Modem *(SIM Card)*	Wi-Fi	Other Devices
a	b	c	d	e

13. Who gives you the internet connection at the moment? Please select:

Vodacom	Airtel	TiGo	TTCL	Huwawei	Smile	SasaTel	Zantel
a	b	c	d	e	f	g	h

14. Kindly select the internet bundle tariffs you use from the provider mentioned above. Please select the bundle tariff you prefer.

Hourly tariffs	Day tariffs	Weekly tariffs	Monthly tariffs	3 Months	Above 3 Months
a	b	c	d	e	f

15. Do you have an account in any of the CWTs?

YES ☐ NO ☐

16. Do the Internet bundle tariffs you use, meet your needs to connect to the above web technologies?

Absolutely Yes	Yes	Maybe	No	Absolutely No	I don't know
a	b	c	d	e	f

17. Can the internet bundle you purchase be used to access online materials below? Please select.

Lecture notes	Video tutorials	Chat	Emails	others
a	b	c	d	e

18. How satisfied are you with the internet services you get through your mobile phone or laptop or desktop or? Please select one.

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	I don't use
a	b	c	d	e	f

19. Does any of your Lecturer use CWTs in the delivery of the module?

YES ☐ NO ☐ NOT SURE ☐

20. In your own opinion, do you think you need training to use the CWTs?

YES ☐ NO ☐ NOT SURE ☐

21. How do you access the named learning systems/media above? Please select.

Media	**Only from within campus**	**From anywhere**	**I have never access it**	**I don't know**
a. Student Portal				
b. Dedicated Learning website				
c. Learning Management System (Moodle/Blackboard)				
d. Students' Academic Record System				
e. Other systems? Please mention:				

22. How often do you visit or use the learning systems/media below?

Media	**Daily**	**1-3 days a week**	**Once weekly**	**1-3 days a month**	**Very rarely**	**Never used**
a. Portal						
b. Website						
c. Dedicated Website						

Media	Daily	1-3 days a week	Once weekly	1-3 days a month	Very rarely	Never used
d. Moodle						
e. Blackboard						
f. Main Website						
g. Students Record System						

23. In your own view, can we use CWTs in a BL environment in HEIs in Tanzania?

YES ☐ NO ☐

Thank You

Appendix IIIb: Questionnaire Survey Phase I – Lecturers

FACULTY OF ENGINEERING AND COMPUTING

QUESTIONNAIRE TO ASSESS THE ICT INFRASTRUCTURE FOR THE USE OF COLLABORATIVE WEB TECHNOLOGIES IN BLENDED LEARNING ENVIRONMENT

Dear Respondent,

This is a questionnaire to assess the ICT infrastructure in Tanzania which can support the use of collaborative web technologies in teaching and learning.
I humbly take this opportunity to request for your time to go through this questionnaire with the aim of providing information on questions asked. The data provided in the questionnaire will STRICTLY be treated confidential and shall be used for learning purposes only. This is in accordance with the Coventry University and the UK Policy and Code of Conduct on the Governance of Good Research Conduct 2009 as revised in September 2010.

Thank you in advance,

John Marco Pima
Principal Researcher

1. Please state your gender: Female ☐ Male ☐

2. Kindly select your age group (ONLY one)

15-24	25-34	35-44	45-54	55 above
a	b	c	d	e

3. Kindly name your Faculty/Department you work for.
   a. Department/Faculty
      :_____
   b. Position (Option):_____

4. Please select the highest qualification that describes you (Select only one)

PhD	Masters	Degree/Equivalent	Ordinary Diploma	Certificate	Others
a	b	c	d	e	f

5. What do you consider to be your computer literacy? Kindly select one.

Beginner	Intermediate	Advanced	I don't know
a	b	c	d

6. For how long have you been using the internet in Tanzania? Please select.

0-1 years	2-5 years	Above 5years	Never used	I don't know
a	b	c	d	e

7. Rate the following internet connection problems in <u>your home area/resident</u> using 1=major problem; 2=minor problem; 3=not a problem; 4=I don't know.

Problem	**1**	**2**	**3**	**4**
f. Internet connection is not reliable				
g. Internet connection is very expensive				
h. Internet is not available in my house/home				

Problem	1	2	3	4
area				
i. There is poor wireless internet connection				
j. There is no wireless Internet connection at our home area				

8. Rate the following internet connection problems at <u>your University/College</u> using 1=major problem; 2=minor problem; 3=not a problem; 4=I don't know.

Problem	1	2	3	4
f. Internet connection is not reliable				
g. Internet connection is very expensive				
h. Internet is not available in my house/home area				
i. There is poor wireless internet connection				
j. There is no wireless Internet connection at our home area				

9. What are other main problems that you face in using the internet? Please list on the space provided below.

   a. _____

10. Select the types of device that you **<u>MAY</u>** use to connect to the internet. (Tick all that apply)

Desktop Computer	Laptop	Smart Devices	Tablets	Mobile Phone	All	None
a	b	c	d	e	f	g

11. When using the selected device above, how do you connect to the internet? (Tick all that apply): I connect through:

Mobile Broadband	Wired Connection	Mobile Modem *(SIM Card)*	Wi-Fi	Other Devices
a	b	c	d	e

12. Who gives you the internet connection at the moment? Please select:

Vodacom	Airtel	TiGo	TTCL	Huwawei	Smile	SasaTel	Zantel
a	b	c	d	e	f	g	h

13. Kindly select the internet bundle tariffs you use from the provider mentioned above. Please select the bundle tariff you prefer.

Hourly tariffs	Day tariffs	Weekly tariffs	Monthly tariffs	3 Months	Above 3 Months
a	b	c	d	e	f

14. Do you have an account in any of the CWTs?

YES ☐ NO ☐

15. Do the Internet bundle tariffs you use, meet your needs to connect to the above web technologies?

Absolutely Yes	Yes	Maybe	No	Absolutely No	I don't know
a	b	c	d	e	f

16. Can the internet bundle you purchase be used to upload or access online materials below? Please select.

Lecture notes	Video tutorials	Chat	Emails	others
a	b	c	d	e

17. How satisfied are you with the internet services you get through your mobile phone or laptop or desktop or? Please select one.

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	I don't use
a	b	c	d	e	f

18. In your own opinion, do you think you need training to use the internet?

YES, ☐ NO ☐ NOT SURE ☐

19. Does your university/institution have the following learning systems/media? Please select.

Media	**Yes**	**No**	**Maybe**	**I don't know**
a. Student Portal				
b. Dedicated Learning website				
c. Learning Management System (Moodle/Blackboard)				
d. Students' Academic Record System				

20. How do you access the learning systems/media above? Please select.

Media	Only from within campus	From anywhere	I have never access it	I don't know
a. Student Portal				
b. Dedicated Learning website				
c. Learning Management System (Moodle/Blackboard)				
d. Students' Academic Record System				
e. Other systems? Please mention:				

21. Rate the usefulness of the following web technologies in your preparations, delivery and assessment in your modules mentioned above found in your institution.

Facility	**Very useful**	**Useful**	**May be**	**Not very useful**	**Not useful**	**I don't know**
a. Search Engines						
b. Online						

Facility	Very useful	Useful	May be	Not very useful	Not useful	I don't know
Databases						
c. Youtube						
d. Facebook						
e. Blogs						
f. Twitter						
g. Wikis						
h. LinkedIn						
i. RSS						
j. Instant gram						
k. MySpace						

22. Can you access the above-named learning systems/media and technologies above (in 20 and 21 above) via the following devices? Select by a tick (✔)

Media	Yes	No
Mobile Phone		
Smart Phone		
Laptop		
Desktop		
All the above		
Mixed devices		

23. How often do you visit or use the learning systems/media?

Media	Daily	1-3 days a week	Once weekly	1-3 days a month	Very rarely	Never used
Portal						
Website						
Dedicated Website						
Moodle						

Media	**Daily**	**1-3 days a week**	**Once weekly**	**1-3 days a month**	**Very rarely**	**Never used**
Blackboard						
Main Website						
Students Record System						

24. In your own view, can we use CWTs in a BL environment in HEIs in Tanzania?

YES ☐ NO ☐

****

Thank You

Appendix IIIc: Questionnaire Survey Phase I – ICT Staff

FACULTY OF ENGINEERING AND COMPUTING

QUESTIONNAIRE TO ASSESS THE ICT INFRASTRUCTURE FOR THE USE OF COLLABORATIVE WEB TECHNOLOGIES IN BLENDED LEARNING ENVIRONMENT

Dear Respondent,

This is a questionnaire to assess the ICT infrastructure in Tanzania which can support the use of collaborative web technologies in teaching and learning.
I humbly take this opportunity to request for your time to go through this questionnaire with the aim of providing information on questions asked. The data provided in the questionnaire will STRICTLY be treated confidential and shall be used for learning purposes only. This is in accordance with the Coventry University and the UK Policy and Code of Conduct on the Governance of Good Research Conduct 2009 as revised in September 2010.

Thank you in advance,

John Marco Pima
Principal Researcher

PART I: PERSONAL PARTICULARS

1. Please state your gender: Female ☐ Male ☐

2. Kindly select your age group (ONLY one)

15-24	25-34	35-44	45-54	55 above
a	b	c	d	e

3. Kindly name your Faculty/Department you work for.
   a. Department/Faculty
      :_____
   b. Position (Option):_____

4. Please select the highest qualification that describes you (Select only one)

PhD	Masters	Degree/Equivalent	Ordinary Diploma	Certificate	Others
a	b	c	d	e	f

5. What do you consider to be your computer literacy? Kindly select one.

Beginner	Intermediate	Advanced	I don't know
a	b	c	d

PART II: INTERNET EXPERIENCE

6. For how long have you been using the internet in Tanzania? Please select.

0-1 years	2-5 years	Above 5years	Never used	I don't know
a	b	c	d	e

7. Rate the following internet connection problems in <u>your home area/resident</u> using 1=major problem; 2=minor problem; 3=not a problem; 4=I don't know.

Problem	**1**	**2**	**3**	**4**
k. Internet connection is not reliable				

Problem	1	2	3	4
l. Internet connection is very expensive				
m. Internet is not available in my house/home area				
n. There is poor wireless internet connection				
o. There is no wireless Internet connection at our home area				

8. Rate the following internet connection problems at <u>your University/College</u> using 1=major problem; 2=minor problem; 3=not a problem; 4=I don't know.

Problem	1	2	3	4
k. Internet connection is not reliable				
l. Internet connection is very expensive				
m. Internet is not available in my house/home area				
n. There is poor wireless internet connection				
o. There is no wireless Internet connection at our home area				

9. What are other main problems that you face in using the internet? Please list on the space provided below.
   a. _____
   b. _____

10. Choose the ISP for your Institution

Vodacom	Airtel	TiGo	TTCL	Huwawei	Smile	SasaTel	Zantel
a	b	c	d	e	f	g	h

11. What type of Internet connection do you use?
    i. WiMAX
    ii. ADSL
    iii. Fibre

iv. VSAT

12. How reliable and available is your internet provider? Please select one.

Reliable	Somehow Reliable	Not Reliable	I don't know
a	b	c	d

13. Do the Internet bundle tariffs you use, meet your need to connect to the above web technologies?

Absolutely Yes	Yes	Maybe	No	Absolutely No	I don't know
a	b	c	d	e	f

14. How satisfied are you with the internet services you get through your mobile phone or laptop or desktop or? Please select one.

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	I don't use
a	b	c	d	e	f

15. What is the University/Institutional Computer Network Architecture in use? Please select:

Peer to peer	Client/Server	SOA	Others
a	b	c	d

16. How do your clients access the named learning systems/media above? Please select.

Media	Only from within campus	From anywhere	Not accessible	N/A*(if not available)*
Student Portal				
Staff Portal				
Dedicated Learning website				
Blackboard				
Moodle				

Students' Academic Record System				
Other systems? Please mention:				

17. Can your clients access the above-named learning systems/media via the following devices? Select by a tick (✔)

	Mobile Phone	Smart Phone	Laptop	Desktop	All	Mixed	TOTAL
With which devices can you access Students Portal?							
With which devices can you access Staff Portal?							
With which devices, can you access University Website?							
With which devices, can you access LMS (Moodle)?							
With which devices, can you access Students' Academic Records Systems?							
With which devices, can you access Social Networks?							
With which devices, can you access Wikis?							
With which devices, can you access Blogs?							
With which devices, can							

	Mobile Phone	Smart Phone	Laptop	Desktop	All	Mixed	TOTAL
you access Podcast?							
With which devices, can you access Online Databases?							

18. Are the following web technologies accessible through your LAN/WAN?

Facility	**YES**	**NO**
Podcast		
Social Media		
Blog		
Online Database		
Search Engine		
Wikis		

19. In your own opinion, rate the usefulness of the following web technologies in teaching and learning:

Technology	**Very useful**	**Useful**	**May be**	**Not very useful**	**Not useful**	**I don't know**
Search Engines						
Online Databases						
Youtube						
Facebook						
Blogs						
Twitter						
Wikis						

20. In your own view, can we use CWTs in a BL environment in HEIs in Tanzania?

YES ☐ NO ☐

Your participation is highly appreciated

John Marco Pima

Principal Researcher

Appendix IV

Appendix IVa: Questionnaire Validation Case Study Phase II - Students

A Survey for Students [End of Semester]

The purpose of this questionnaire is to investigate the usability and acceptance of the used BL Framework via Collaborative Web Technologies (CWTs). Examples of CWTs are the Facebook, YouTube, Wiki, and Blog. Using five-Likert scale, kindly select only one point for each statement.

(Use 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; and 5=Strongly Disagree)

Question Title	**1**	**2**	**3**	**4**	**5**
1. I managed to interact with my fellow students and Lecturers more easily through CWTs in BL environment					
2. I believe that the use of CWTs in BL enhanced my interest in the course					
3. I would like to see BL via CWTs used in other courses					
4. I obtained more material as a result of using the CWTs					
5. I believe that I participated in the assignment more because of using the CWTs in a BL environment					
6. I am ready to use CWTs in BL for my future studies					
7. I am happy to use CWTs in a BL environment within the next semester					
8. I would be glad to ask for financial support to cover the costs of using CWTs in BL environment.					
9. I believe that the use of the CWTs in a BL environment helped in achieving course objectives					
10. I believe that the selected CWTs for the BL Framework are useful in my studies					
11. I believe that the advantage of using CWTs in a BL environment outweighs the disadvantages of not using it					
12. I believe that using CWTs in a BL environment is a good idea					
13. I believe that the benefit of using the CWTs in a BL					

Question Title	1	2	3	4	5
environment is worth the extra effort & time required to learn					
14. I would recommend classes that use CWTs over other classes that do not use CWTs in a BL environment.					
15. I feel that the CWTs interface and features would overall be easy to use and understand					
16. I feel that browsing/editing information on the CWTs would be easy					
17. I feel that compared to Learning Management Systems (Moodle) the CWTs would be easier to use					
18. I feel that technical features in the CWTs enhanced my learning experiences					
19. I feel that I can use CWTs using my device connected to the Internet					
20. I feel that using CWTs helped me learn more about the subject					
21. I feel that using CWTs improved my satisfaction with the course					
22. I feel that using CWTs improved my performance					
23. I feel that using CWTs helped me better learn the material at a more convenient time					
24. Using the CWTs is entirely within my control					
25. I have the knowledge, experience, and ability to use CWTs in a BL Framework.					
26. I believe that the use of the CWTs for assignment helped me interact more with fellow students through the BL Framework used.					
27. I believe that by using CWTs, my group could come to an agreement faster about group assignment					
28. I believe that the use of the CWTs promoted collaborative learning					
29. I would feel comfortable using CWTs					
30. I would easily use CWTs on my own					

Question Title	1	2	3	4	5
31. I know enough to use CWTs					

Thank You

Appendix IVb: Questionnaire Validation Case Study Phase II - Lecturers

A Survey for Lecturers [Post-Use]

The purpose of this questionnaire is to investigate the usability and acceptance of the used BL Framework via Collaborative Web Technologies (CWTs). Examples of CWTs are the Facebook, YouTube, Wiki, and Blog.

Using five-Likert scale, kindly select only one point for each statement.

(Use 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; and 5=Strongly Disagree)

Question Title	**1**	**2**	**3**	**4**	**5**
1. The use of CWTs in my Module helped me to interact with my students and fellow Lecturers more easily					
2. The use of CWTs helped to enhance my teaching efficacy through BL Framework					
3. The use of CWTs in BL Framework motivated me to use it in other modules					
4. The use of CWTs in BL Framework helped me to provide and deliver more material to my students					
5. I managed to actively engage my students using the CWTs in BL Framework					
6. I can easily use CWTs in BL Framework without technical support from ICT staff					
7. The use of CWTs helped me to achieve the module objectives					
8. The CWTs used in BL Framework were useful for my students and modules					
9. I believe that the advantage of using CWTs in BL Framework outweighs the disadvantages of not using it					
10. I believe that the benefit of using the CWTs in BL Framework is worth the extra effort & time required to learn					
11. I would recommend course that use CWTs in BL Framework over other classes that do not use CWTs					
12. I feel that the CWTs interface and features would overall be easy to use and understand					
13. I feel that browsing/editing information on the CWTs would be easy					
14. I feel that compared to Learning Management Systems (Moodle) the CWTs would be easier to use					
15. I feel that technical features in the CWTs would help enhance teaching					

Question Title	1	2	3	4	5
experiences					
16. I feel that I can use CWTs using my device connected to the Internet					
17. I feel that using CWTs helped me teach well my module in in BL Framework.					
18. I feel that using CWTs improved students' satisfaction with the course					
19. I feel that using CWTs in in BL Framework improved students' academic performance					
20. I feel that using CWTs in in BL Framework helped me deliver and provide feedback to my students at a more convenient time					
21. Using the CWTs in in BL Framework is entirely within my control					
22. I have the knowledge, experience, and ability to use CWTs in in BL Framework					
23. I believe that the use of the CWTs for assignment helped me interact more with my students and fellow staff in in BL Framework					
24. I believe that by using CWTs, student's coursework was easily communicated, and feedback provided in time					
25. I believe that the use of the CWTs promoted collaborative learning for my students in in BL Framework					
26. I would feel comfortable using CWTs in in BL Framework					
27. I would easily use CWTs on my own					

Thank You

Appendix V: Interview Protocol Phase One

[Most of the questions were asked to supplement the Questionnaire]

A: STUDENTS

1. What devices do you most use and why to connect to the internet?
2. Clarify what “minor problem” refers to.
3. if you can’t get internet at home, would the internet at university surpass your learning need?
4. Have you been using any of the CWTs (Wiki, Blog, Podcast, and Social Media)?
5. What internet bundle tariff do you use most and why?
6. Who provides you internet and is it reliable?
7. In your opinion, will it be possible to use CWTs in teaching and learning in your university?
8. Are you satisfied with the internet at home or university, why?

B: LECTURERS

1. What devices do you most use and why to connect to the internet?
2. if you can’t get internet at home, would the internet at university surpass your learning need?
3. Have you been using any of the CWTs (Wiki, Blog, Podcast, and Social Media)?
4. What internet bundle tariff do you use most and why?
5. Who provides you internet and is it reliable?
6. In your opinion, will it be possible to use CWTs in teaching and learning in your university?
7. Are you satisfied with the internet at home or university, why?

C: ICT STAFF

1. Can the available software at your university/Institution support online learning delivery?
2. What type of Internet connection do you use?
3. Who provides you internet and is it reliable?
4. What are your general comments on the readiness of the ICT and Telecommunications Infrastructures available in Tanzania to support the online learning which is supported by collaborative web technologies?

Appendix VI: Interview Protocol Phase Two

INTERVIEW GUIDE

1.0 Introduction

a) The purpose of the Interview explained.
b) Consent form and information sheet given.
c) Assurance of confidentiality given to participants.
d) Time expected to be spent provided.
e) Recording and anonymity of the quotes explained.

2.0 Questions addressed

a) What should be the actual use of the framework in learning and teaching?
b) What are the main components of the framework?
c) What are the feedback on attitude and perceptions on the Blended Learning Framework?
d) What are the ingredients to put in the framework?
e) What should be the best Collaborative Web Technologies relevant for the Tanzania Higher Education Institutions Contexts

3.0 Participants

Participants come from samples selected at distinct phases of the research from among Students, Lecturers, ICT Staff, NACTE, and Quality Assurance departments at respective HEIs.

4.0 Role of the Researcher/ Interviewer

a) Identify participants using the sampling strategy
b) Develop an interview schedule
c) Prepare recording equipment and stationeries
d) Training interviewers

e) Moderating the interviews
f) Recording the interview
g) Analyzing results

5.0 Ethical Consideration

The researcher adheres to the Research Ethics approved by Coventry University. Participants were informed of their roles and rights prior the interview.

Appendix VII: Focus Group Protocol Phase Two

RESEARCH FOCUS GROUP PROTOCOL

Question	
1	How can we use the CWTs tools in the learning process to enhance learning and teaching in your module in a BL Framework?
	(a) Registration
	(b) Delivery
	(c) Assessment
	(d) Feedback and Review
2	Example of how should each of the CWT be used at each process or others above
	(a) Wiki
	(b) Blog
	(c) Social Networks (Facebook, Twitter, Instagram)
	(d) Podcast
3	What should be the percentage of mix (face-to-face and CWTs) and structure of the BL Framework?
4	What are your comments of the design, validation and usage of the BL Framework?

==========

Appendix VIII: Focus Group Protocol Phase Three

Focus Group Validation Protocol

1. FGVQ1. What is your overall impression of the Blended Learning Framework and its usability?
2. FGVQ2. What impact can a Blended Learning Framework have on enhancing learning and teaching in HEIs in Tanzania?
3. FGVQ3. Are there any parts of the Blended Learning Framework that appear disjointed or lack cohesion?
4. FGVQ4. Which elements would you add to make the Blended Learning Framework enhance learning and teaching in HEIs?
5. FGVQ5. Which elements would you remove or alter and why?
6. FGVQ6. How would you describe the complexity of the framework within a Blended Learning environment?
7. FGVQ7. What do you consider the key CWTs appropriate for blending with face-to-face instructional model in the Blended Learning environment?
8. FGVQ8. How would you describe the validity of the Blended Learning Framework within the higher education environment in Tanzania?

Appendix IX: Gantt Chart

Activity /Academic Year	**2013/14**				**2014/15**				**2015/16**			
Months *(1=Sept – Nov; 2=Dec - Feb; 3=March – May; 4=Jun – Aug)*	1	2	3	4	1	2	3	4	1	2	3	4
YEAR ONE												
PhD Induction and Registration												
Literature Review												
Generating and refining research ideas												
Defining Research aim and Objectives												
Generating the Research Programme												
Review and Choose Research Methodology												
Conduct Pilot Test												
Review Results of the Pilot Test												
Update Research Methodology												
M001RDC-Induction and Research Methods												
M002RDC-Project Registration PHD01 Milestone												
M002RDC-Project Registration												

KK

Activity /Academic Year	**2013/14**				**2014/15**				**2015/16**			
Months *(1=Sept – Nov; 2=Dec - Feb; 3=March – May; 4=Jun – Aug)*	1	2	3	4	1	2	3	4	1	2	3	4
PHD02 Milestone												
M002RDC-Project Registration PHD03 Milestone												
Progress Review Panel												
YEAR TWO												
Data Collection												
Data Analysis												
Design a Blended Learning Framework												
Validate the Framework												
Update the Framework												
D005RDC-Research Milestone 2 PHD04-Data Collection												
D005RDC-Research Milestone 3 PHD05-Data Analysis												
YEAR THREE												
Run Validation Case Study for the New BL Framework												
Collect Feedback from Students on the New BL Framework												

Activity /Academic Year	**2013/14**				**2014/15**				**2015/16**			
Months *(1=Sept – Nov; 2=Dec - Feb; 3=March – May; 4=Jun – Aug)*	1	2	3	4	1	2	3	4	1	2	3	4
Analyse and Evaluate the Framework												
DR007RDC Research Milestone 4 PHD06-Evaluation												
DR007RDC Research Milestone 5 PHD07-Conclusion												
PRP III												
Write Up Year	**2016/2017**											
	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Thesis Editing												
Proof reading												
Thesis Submission												
D008PRDC-Viva and Thesis												
M008PRDC-Viva Voce												

Appendix X: Ethical Approval Form

Appendix XI: BL Process and CWTs applications

Learning Process	CWT	Application
Course Registration: Perceiving Programme information made accessible to prospect and current students. *CWTs = 60%* *f2f =40%*	Blog	<u>For prospect students, parents, guardians, and the public:</u> • Useful for providing free access to programme information such as objectives, structure, duration, fees, and post-course expectations. • Useful for general inquiry and FAQs. <u>For continuing students:</u> • Useful for providing module specific information (almanac, bursaries, news, and events, etc.) • Useful for continued and after class learning during vacation and study breaks.
	Podcast	• Useful as a marketing tool about the programme/module • Useful for publication of students' work in the form of audio or video clips • Useful for publishing career development and trends on the specialty
	SM	<u>For Prospect Students:</u> • Useful as a marketing tool about the programme. • Useful for live chat with admission support staff • Useful for providing FAQ, news and events broadcasts. <u>For Current Students:</u>

Learning Process	CWT	Application
		• Useful as an information dissemination media and after school chatting regarding any topic of interest for the programme and module.
Delivery: Deciding Actual teaching and learning using different teaching methods *CWTs = 60%* *f2f =40%*	Blog	• Excellent for uploading lectures, video, audio, texts, images. • Useful for writing skills, peer learning, discussion, news, notice. • Useful for posting assignments (individual and group), projects, and reflective assessment results. • Useful for publishing lectures, presentations and university learning environment. • Useful for collaborative tasks for geographically dispersed members hence create a learning community. • Useful for encouraging critical thinking and creativity • Useful for providing links to external resources and sharing of resources. • Useful as a learning journal about a module.
	Wiki	• Useful for posting assignments (individual and group), projects, and reflective assessment results. • Useful for collaborative for geographically dispersed members • Useful for encouraging critical thinking and

Learning Process	CWT	Application
		creativity • Useful for co-authorship and team work building
	Podcast	• Useful for sharing professional experiences • Useful for publishing class work and getting feedback • Useful for external links to expertise and industrial sources • Useful for disseminating tutorials, lectures, and other materials to wider learning community • Useful for reflections and peer-reviews • Useful for providing step-by-step practical experiences
	SM	• Useful for frequent updates and threads on the module • Useful for active student-student and student-teacher interactions • Useful for useful for collaborative work • Useful for class management and enhanced class participation • Using for sharing and celebrating birthdays
Assessment: Acting Carrying out course assessment individually and in groups	Blog	• Useful for encouraging critical thinking and creativity • Useful for co-authored students' assignment • Useful for posting individual and group

Learning Process	CWT	Application
CWTs = 80% *f2f =20%*		work in forms of video, audio, text and images • Useful for peer-review assessments • Useful for students' portfolios
	Wiki	• Useful for encouraging critical thinking and creativity • Useful for co-authored students' assignment • Useful for written individual and group work • Useful for peer-review assessments • Useful for students' portfolios
	Podcast	• Useful for individual and group presentations • Useful for peer-review and reflectional learning • Useful for class project progress review and inspections
	SM	• Useful for creating groups and project pages • Useful for sharing individual and groups assessment for peer review • Using for asking help and getting support • Useful for getting expertise resources through "Like" and "Following" professional pages • Using for archiving past projects for future use
Feedback and Review	Blog	• Useful for conducting survey from parents,

Learning Process	CWT	Application
Providing both formative and summative feedback to students and for programme and module improvement *CWTs = 90%* *f2f =10%*		students, employers, professional bodies. • Useful for peer assessment and evaluation • Useful for critical analysis and feedback
	Wiki	• Useful for providing reflections on the programme • Useful for conducting survey from parents, students, employers, professional bodies. • Useful for peer assessment and evaluation • Useful for critical analysis and feedback
	SM	• Useful for peer assessment and evaluation • Useful for parents to get and provide feedback • Useful for conducting survey and programme evaluation

Appendix XII: Sample Module Outline

INSTITUTE OF ACCOUNTANCY ARUSHA

DEPARTMENT OF INFORMATICS

MODULE OUTLINE 2015/16

Module Code	:	ITU07314
Module Name	:	Database Management and Implementation
Credit Hours	:	12
Pre-requisite Modules	:	Database Systems (ITU07314)
Facilitator Name (s)	:	Module Leader and Instructor
Teaching Schedule	:	[Refer to the Timetable]

MODULE DESCRIPTION

This module is intended to enable students to understand basics of database implementation and optimization.

MODULE OBJECTIVES

The Continuous Assessment contributes 20% of the 40% Coursework.

Written Test contributes 20% of 40% CA Coursework

SN	Objective	Chapter	CWT Activity	CWT
1.	Describe client/server database architecture concepts and principles.	9	In a group of three, discuss the different levels of security that should be established in a client/server database system. [**4% Marks**] • 2% quality work • 1% comment on other's work • 1% for a quality reply	**Wiki**: Students to submit work and Lecturer to offer feedback **Facebook**: for notification (timeline and availability). Podcast: Video Clip on Client/Server database architecture uploaded on YouTube.
2.	Evaluates client/server process architecture.	2,3,4	Group Assignment: Design a database solution in a group and present it online. As a group-design a database solution, (see details in a coursework sheet). [**10% Marks**] • Requirements Documentation: 2.5%	**Facebook**: for discussion, and notification (timeline and availability). **YouTube**: for presentation **Blog**: for e-portfolio purposes (used as logbook)
3.	Use logical and physical database structures in client/server environment.	5, 6		

SN	Objective	Chapter	CWT Activity	CWT
4.	Use DBMS to handle recovery and integrity in client/server system.	12	quality work • Design Documentation: 2.5% acceptable notations • Running System: 2.5% functional and non-functional features • Present (on YouTube): Compare your work with any one work: 2.5% best argument with justifications. • You can book for face-to-face consultation	**Wiki**: Moodle Wiki shall be used requirements and design processes.
5.	Manage client/server database system using computer-based controls.	12		
6.	Use concurrency control techniques to solve transaction-processing problems in database system.	12	Class Lecture session (face-to-face)	Discussion on Facebook about different scenarios on concurrency control techniques.
7.	Maintain indexes in a client/server database	6, 8, 12	Individually, listen the uploaded video and summarize the steps taken to maintain indexes in a	**Facebook**: for discussion and notification (timeline and

SN	Objective	Chapter	CWT Activity	CWT
	system.		client/server database system [**4% Marks**] • Summary in a Blog: 2% quality work • Contribution on others work: 1% critical thinking • Comparison with similar video on the same theme: 1% search skills	availability) **YouTube**: For presentation and comments on other's work **Blog**: for e-portfolio purposes
8.	Apply heuristic transformation rules to improve the efficiency of queries	6, 9	Individual work equivalent to [**2% Marks**]	**Facebook**: for discussion and notification (timeline and availability) **YouTube**: for assignment **Blog**: for e-portfolio purposes **Wiki**: for discussion on comparison
9.	Evaluate approaches for finding query optimization strategies for storage structures.	6, 9		

MODULE CONTENTS

1. Database architecture design and Modelling-*Why a database, Types of database Management systems, Database Development life cycle, Conceptual, physical a model, Apply SQL (DDL and DML) in solving business problems*
2. Client/Server database architecture– *Describe client/server database architecture concepts and principles, Implement and evaluate client/server process architecture, Use logical and physical database structures in client/server environment*
3. Database Implementation Issues (integrity, security, recovery, and concurrency) – *Use DBMS to handle recovery and integrity in client/server system, manage client/server database system using computer-based controls, use concurrency control techniques to solve transaction processing problems in database system.*
4. Optimize server-side queries, storage structure, system catalog and metadata – *Maintain indexes in a client/server database system, apply heuristic transformation rules to improve the efficiency of queries, evaluate approaches for finding query optimization strategies for storage structures.*

MODE OF DELIVERY

This module will be delivered by use of lectures, seminars, and laboratory work in a Blended Learning Instructional Model

MODULE ASSESSMENT

Continuous assessment		**40%**
Assignments	20%	
Test	20%	
End of semester examination		**60%**
Total		**100%**

REQUIRED READING LIST

1. Hoffer, J. and Prescott, M. (2002) Modern Database Management 6th ed. New Jersey: Prentice Hall

RECOMMENDED READING LIST

1. Connolly, T. (2009) Database systems: A practical approach to design, Implementation and Management. 5th Ed. Addison-Wesley
2. Coronel, C. & Rob, P. (2006) Database systems: Design, implementation, and management 7th ed. Thomson Course Technology
3. Date, C. (2003) Introduction to database systems 8th ed. Pearson Education
4. Everest, G. (2003) Database Management: objectives, system functions, and administration McGraw-Hill
5. Kroenke, D (2004) Database processing: fundamentals, Design, and implementation 9th ed. Prentice Hall

Appendix XIII: Facebook Interactions for ITU07314

Appendix XIV: Facebook Interactions for ITU07111

Appendix XV: Research Publications

1. A Thematic Review of Blended Learning in Higher Education. Pima, J. M., Odetayo, M., Iqbal, R. & Sedoyeka, E., 2018. International Journal of Mobile and Blended Learning, 10(1).
2. Assessing the available ICT infrastructure for collaborative web technologies in a blended learning environment in Tanzania: A mixed methods research. Pima, J. M., Odetayo, M., Iqbal, R. & Sedoyeka, E., 2016. International Journal of Education and Development using Information and Communication Technology, 12(1), pp. 37-52.
3. Investigating the lecturers' challenges to embrace Collaborative Web Technologies in Higher Education Institutions. Pima, J. M. & Mtui, J., 2017. International Journal of Education and Development using Information and Communication Technology, 13(3), pp. 80-97.
4. The Collaborative Web Technologies for enhanced Learning and Teaching in Higher Education Institutions in Developing Countries. Pima, J. M. & Mwalumbwe, I., 2016. The Accountancy and Business Review Journal, 11(1&2), pp. 117-138.