UNIVERSITY OF KWAZULU-NATAL

ALLEVIATING HIGHER EDUCATION CHALLENGES THROUGH STRATEGIC INTEGRATION OF TECHNOLOGY: A CASE OF SELECTED UNIVERSITIES IN AFRICA

By

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ABSTRACT

The higher education sector in Africa is evolving and information technology continues to play a key role in driving these changes. Information and communications technologies are improving the creation and transmission of knowledge. This is attributed to the way people learn and create ideas as well as disseminate information within the educational environment and in the public sphere. In this study, an exploratory research was conducted to identify and understand the challenges and opportunities associated with information technology integration in higher education. A survey of 592 staff at the University of Lagos, Nigeria, the University of KwaZulu-Natal, South Africa and University of South Africa was undertaken to address the research problem.

The study makes use of a blend of theoretical frameworks to provide the foundation for identifying, proposing, planning and suggesting information technology strategies that can be integrated into higher education to alleviate higher education challenges in order to enhance teaching and learning outcomes. The three models used are: The Change Management Model; Model of Technology Adoption in the Classroom; and the Diffusion of Innovation Theory. The study evaluates the role of ICTs in higher education and also identified issues, challenges and instances of ICT strategic integration in higher education institutions at the selected universities in Africa. In the process of understanding the strategic integration of information technology in higher education institutions at the selected universities, the study identified what was considered successful technology integration strategies, what were not as successful, and why this was the case.

The study further identified the factors that influence information technology integration in higher education. Having identified the limitations to technology integration and the significance of information technology in higher education at the selected universities, the study proffered recommendations and proposed a strategic framework. The framework offers strategies for the integration of information technology into higher education which can be used to alleviate higher education challenges, enhance teaching and learning outcomes, sustain the integrated information technologies and achieve ICTs promised benefits to higher education.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

1G	- First Generation
2G	- Second Generation
3G	- Third Generation
4G	- Fourth Generation
AC	- Open Access
ACE	- African Coast to Europe
AEGEE	- Association des États Généraux des Étudiants de l'Europe
AET	- Adult Education and Training
ATA	- Agricultural Transformation Agenda
AVU	- African Virtual University
B2B	- Business-to-Business
B2C	- Business-to-Citizens
BBM	- BlackBerry Messenger
BECTA	- British Educational Communications and Technology Agency
BRICS	- Brazil, Russia, India, China and South Africa
CAD	- Computer Aided Design
CC	- Creative Commons
CD	- Compact Disc
CDA	- Critical Discourse Analysis
CHE	- Council on Higher Education
CIS	- Commonwealth of Independent States
CMS	- Course Management System
CNI	- Connect Nigeria Initiative
CVE	- Collaborative Virtual Environment
D2L	- Desire2Learn
DGBL	- Digital Game-Based Learning
DHET	- Department of Higher Education and Training
DoI	- Diffusion of Innovation Theory
DVD	- Digital Versatile Disc
EDA	- Exploratory Data Analysis
EDI	- Electronic Data Interchange

EFA	- Education for All
EFA	- Exploratory Factor Analysis
EGDI	- E-government Development Indexes
EI	- e-Readiness Indexes
ESS	- E-Safety Support
EUP1501	- Ethical Information and Communication Technologies for Development Solutions
EVE	- Educational Virtual Environment
FAQ	- Frequently Asked Questions
FET	- Further Education and Training
FRN	- Federal Republic of Nigeria
G2G	- Government-to-Citizen
GBL	- Game-Based Learning
GDP	- Gross Domestic Product
GETFund	- Ghana Education Trust Funds
GIS	- Geographic Information System
GLO	- Globacom
GPRS	- General Packet Radio Service
GPS	- Global Positioning Systems
GSM	- Global System for Mobile Communications
HE	- Higher Education
HEI	- Higher Education Institutions
HEQC	- Higher Education Quality Committee
HEQF	- Higher Education Qualifications Framework
HP	- Hewlett Packard
IaaS	- Infrastructure as a Service
IBM	- International Business Machines
ICT	- Information and Communication Technology
ICT4AD	- Information and Communication Technology for Accelerated Development
ICT4D	- Information and Communication Technology for Development
IDC	- International Development Community
IE	- Internet Explorer
IM	- Instant Messaging
IMAP	- Interactive Mail Access Protocol

IoT	- Internet of Things
ITU	- International Telecommunication Union
JAMB	- Joint Admission and Matriculation Board
JIT	- Just in Time
LAN	- Local Area Network
LASU	- Lagos State University
LCD	- Least Developed Countries
LMS	- Learning Management System
LTE	- Long Term Evolution
M2M	- Machine-to-Machine
MDGs	- Millennium Development Goals
MERR	- Minimum Estimated Response Rate
MIS	- Management Information Systems
MIT	- Massachusetts Institute of Technology
MLS	- Multimedia Learning Systems
MMS	- Multimedia Message Services
MOOC	- Massive open online courses
MP3	- (Moving Picture Expert Group) Layer-3
NNBS	- Nigerian National Bureau of Statistics
NQF	- National Qualification Framework
NRF	- National Research Foundation
OCW	- Open Courseware
ODeL	- Open and Distance e-Learning
ODL	- Open and Distance Learning
OEC	- Open Education Consortium
OECD	- Organisation for Economic Co-operation and Development
OER	- Open Education Resources
OSN	- Online Social Networks
OSS	- Open Source Software
P.A.Y.E	- Pay-As-You-Earn
PaaS	- Platform as a Service
PC	- Personal Computer
PDA	- Personal Digital Assistance

POP	- Post Office Protocol
PSET	- Post-School Education and Training
Q&A	- Questions and Answers
QAS	- Quality Assurance System
QR	- Quick Response
RFID	- Radio-frequency Identification
RS	- Recommender System
SaaS	- Software as a Service
SACS	- South Atlantic Cable System
SAQA	- South African Qualifications Authority
SARS	- South African Revenue Service
SCUP	- Society for College and University Planning
SEIA	- Secondary Education in Africa
SISP	- Strategic Information Systems Planning
SMS	- Short Message Services
SNS	- Social Network Sites
SPSS	- Statistical Package for the Social Science
STEPS	- Strategic Transformation of Educational Programs and Structures
STEP-B	- Science and Technology Integration at the Post-Basic
TALIF	- Teaching and Learning Innovation Fund
TEL	- Technology Enhanced Learning
TPC	- Tablet Personal Computers
UIF	- Unemployment Insurance Fund
UK	- United Kingdom
UKZN	- University of KwaZulu-Natal
UMTS	- Universal Mobile Telecommunication System
UN	- United Nations
UNCSTD	- United Nations for Science and Technology for Development
UNDP	- United Nations Development Programme
UNECA	- United Nations Economic Commission for Africa
UNESCO	- United Nations Educational, Scientific and Cultural Organization
UNISA	- University of South Africa
UNMDG	- United Nations Millennium Development Goals

UNPAN	- United Nations Public Administration Network
UoW	- University of Wollongong
US	- United States
UTAUT	- Unified Theory of Acceptance and Use of Technology
USAID	- United States Agency for International Development
USB	- Universal Serial Board
VAT	- Value-Added Tax
VC	- Virtual Collaboration
VCD	- Video Compact Disc
VCR	- Video Cassette Recording
VCS	- Virtual Collaborative Space
VHS	- Video Home System
VLE	- Virtual Learning Environment
WAN	- Wide Area Network
WiFi	- Wireless Fidelity
WiMAX	- World Interoperability for Microwave Access
WPAN	- Wireless Personal Area Network
WWW	- World Wide Web

CHAPTER ONE

INTRODUCTION

1.1 Introduction

African higher education is evolving and technology is playing a significant role in this evolution. The universal nature of information and communications technology (ICT) enhances the creation and transmission of knowledge in higher education institutions (Schneckenberg, 2009). The integration of new technology is gradually changing and transforming the field in terms of the way we learn and create ideas, especially in the way teachers transmit new knowledge and research findings to students (Coley, Cradler & Engel, 1997; Schrum & Glasset, 2006; Joseph, 2012).

"Information and communication technology creates, disseminates, communicates, stores, manages, and secures electronic learning materials to achieve innovative educational concepts via a diverse set of tools and resources" (Schneckenberg, 2009, p. 412). Both lecturers and students need to learn how to take full advantage of the opportunities that learning technologies provide in order to improve their profiles as institutional players in the global educational market (Euler, 2004). The fact that the globalisation of ICT has escalated the use of information technology for educational activities does not imply that it has been fully exploited (Noor-Ul-Amin, 2013). This study aims to investigate the current state of information technology integration in African higher education, to identify limitations to technology integration, challenges facing higher education and to propose emerging technology strategies to alleviate the challenge in traditional face-to-face learning and open and distance learning (ODL).

This chapter presents the background of the study, problem statement and the relevance of the study to alleviate higher education challenges through strategic integration of technology in selected African Universities. The specific research objectives derived from the primary objective of the study are highlighted and the secondary research questions derived from the problem statement are identified. The research objectives and research questions designed to achieve the aim of the study are listed. The gaps to be filled by the study and the thesis layout is presented in this chapter.

1.2 Background of Study

Information and communication technology plays a significant role in education both in formal and informal settings (Sang & Tsai, 2009). According to Tallent-Runnels et al., (2006 p. 93) "the evolution of information and communication technology has produced numerous tools and resources such as the online instructions or web-based education (electronic learning) as alternative approaches to 'chalk and talk' teaching and learning, and as extensions of traditional teaching across the world." e-Learning, in short, is online instructions delivered through ICT. E-Learning streamlines education delivery and enables teaching and learning to anyone, anywhere at any time. e-Learning provides the necessary facilities for handling modules through reliable web interfaces (Šumak, Polančič, & Heričko, 2010). More broadly, e-Learning includes learning via many electronic resources such as television, computers, mobile technology and web-based technology.

The relevant literature uses terminology such as online instruction, computer-driven interactive communication, web-based learning, computer-mediated communication, borderless education, distributed learning, cyberspace learning**,** interactive communication, i-Campus learning environment, or virtual learning environment (VLE), telematics environments, e-Learning, virtual classrooms and electronic communication (Guri-RosenblitSource, 2005; Šumak et al., 2010; Goyal & Purohit, 2011). The American Society for Training and Development (ASTD) describes e-Learning "as a tool that embraces a wide range of applications and processes, namely virtual classrooms, computer-based learning, digital collaboration and web-based learning" (DeRouin, Fritzsche, & Eduardo, 2004, p. 147). Joseph (2012) mentions a number of learning methodologies through the use of ICT, such as blended learning, ubiquitous learning, mobile learning, online learning, and e-Learning. In this study, all these forms of teaching and learning through the use of ICT will be classified as *e-Learning.* All these learning technologies are on the increase, and compete to produce high calibre students who live up to international standards. "Some of the functions such as technology-enabled learning-management systems empower people and create new potential in technology shifts because it changes people's thinking, reasoning and knowledge in digital communication and information systems" (Brown, 2000, p. 7).

The creation and use of learning technologies in pedagogy is conceivably the most effective approach to technology integration. Garnham and Kaleta (2002, p. 2) claim that "learning technologies focus more on information delivery than on student learning." Garnham and Kaleta (2002 p. 1) define blended/hybrid learning as "learning where a significant part of the activities are carried out online, but does not completely eliminate the time spent in the traditional classroom." Garrison and Kanuka (2004) believe that blended learning has more transformative potential than mere information delivery in higher education. Both Garrison and Kanuka (ibid., p. 104.) conclude that "higher education institutions will find the adoption of hybrid learning strategies unavoidable in order to achieve satisfaction and learning outcomes."

Therefore, information technology can greatly enrich teaching and learning in higher education if it focuses on the basic objectives of education. Information technology, if integrated adequately can also ease higher education challenges (Jaffer, Ng'ambi, & Czerviewicz, 2007). "Higher education institutions are a country's skill-base as they serve as a knowledge source, facilitate the exchange of information and transform the economy through university-industry networks" (Kapur & Crowley, 2008, p. 12). Higher education is a means to improve economic growth and mitigate poverty in any country (Bloom, Canning, & Chan, 2006). However, as stated in a study by Bloom *et al.* (2006, p. 1), some International Development Community (IDC) members such as UNESCO, UN and UNICEF argue that "higher education has little or no impact on reducing poverty in Africa." This perception has led key players such as the World Bank's education sector to neglect higher education and to spend more on primary and secondary education. This reduction in funds has impacted negatively on higher education in Africa.

Many African countries are currently still struggling to match student enrolment levels with institutional capacity. Furthermore, technology integration and academic research output in Africa is among the lowest in the world (Yizengaw, 2008). The challenges facing higher education institutions in Africa can be categorised under technological advancement, social progress, and economic development. "A major means through which higher education in Africa can enhance economic development is through technological catch-up" (Bloom, Canning, & Chan, 2006, p. 15). Other challenges that this study critically investigates are institutional and structural, or systemic challenges. The study also investigates how time, funding, expertise, access (availability), resources and support issues impact upon technology integration in higher education. Additional factors are identified in the Literature Review chapter.

1.3 Problem Statement

Higher education institutions are important sites for knowledge generation and transfer. In the quest to fulfil their mandate to generate and transfer knowledge, higher education institutions utilise an array of tools consistent with the technological know-how and innovation of each historical epoch. In the advent of the revolution in information technology, higher education institutions have maintained their relevance by incorporating technology into their operations. In terms of policy direction regarding the adoption of technology by higher education institutions, the top echelons of the administration in each institution bear responsibility for decision-making regarding the propriety of each tool for teaching and learning purposes. With specific reference to teaching and learning, academics are the custodians of the processes that constitute the actual implementation of the decisions by the management of higher education institutions. In other words, academics are the driving force behind higher education institutions as they help to ensure the transfer of knowledge.

In the context of the technological revolution, information technology has improved knowledge sharing, teaching and learning, and continues to feature prominently in the higher education environment. The centrality of information technology in contemporary higher education environment raises a number of salient questions at the levels of theory and practice. For example, what theoretical considerations underpin the integration and use of information technology in higher education institutions? From the perspective of academics as custodians of teaching and learning processes, what rationale exists for the integration of information technology in higher education? What challenges may higher education institutions grapple with as they integrate information technology in the delivery of their core mandate? What are the potential and actual limitations to the integration of information technology in higher education institutions? What strategies serve to alleviate the challenges associated with the integration of information technology in higher education?

In line with the questions posed above, this study explores and undertakes a prognosis of the challenges and opportunities associated with the integration of information technology and the potential benefits to higher education. In addressing this projection, the study identified that there is much research that focuses on the available ICTs in higher education (Chaka & Govender, 2017; Govender & Chitanana, 2016), but none addressed the promised benefits of information technology in higher education. Due to the prevalence of ICT infrastructure in higher education, it can be considered critical and an assessment needs to be conducted in order to ensure that it achieves its full potential and provides its promised benefits to higher education.

This assessment could serve as a tool to alleviate higher education challenges through strategic integration of information technology by evaluating technology integration instances at selected higher education institutions. The assessment includes an evaluation of what was considered successful, not as successful, why and how the strategic technology integration were dealt with.

1.3.1 First sub-problem

Internationally, institutions are investing substantial resources in an effort to integrate information technology into teaching and learning, but are not seeing the promised benefits (Chaka & Govender, 2017; Govender & Chitanana, 2016; Pennarola & Caporarello, 2013). The problem is worse in developing countries (Khodabandelou, et al., 2016). According to Esterhuizen, Blignaut and Ellis (2013), there are some key factors for the successful integration of technology into universities, some of which are personal interest in the use of technology, management support, adequate ICT infrastructure, accessible resources, government support, and successful appropriation of technology by academic staff. This study investigates the roles that academic staff and management support play in the integration of technology into higher education in order to achieve the promised benefits.

1.3.2 Second sub-problem

According to Kituyi and Tusubira (2013), higher education institutions in most developing countries are lagging behind with regards to the immense benefits and opportunities that information and communication technologies provide in developed countries. Without a clear understanding of the difficulties faced by academics in the use of technology for educational purposes, institutional management will not be able to fully identify the factors that influence the integration of information technologies. This study identifies the important factors that can determine the success of information technology integration in higher education, especially in developing regions.

1.3.3 Third sub-problem

Learning technology and educational technology are useful tools and approaches for skills development in higher education. Harrow and Oblinger (2015, p. 13) stated that “the use of information technologies in higher institutions can serve the purpose of integration and transformation.” As a result, information technology integration enhances teaching and learning outcomes and technology transformation allows learners to acquire knowledge in innovative ways. But these may not be easily achieved due to certain challenges and limitations. These challenges may be institutional and structural/systemic in nature. The study investigates and identifies the challenges and/or, limitations that may hinder the potential opportunities of information technology integration and transformation in higher education.

1.4 Research Objectives

The primary objective of the study is to make recommendations that will help alleviate higher education challenges through strategic integration of technology.

The following are the secondary specific objectives that are required to support the primary objective of the study:

1. To investigate the awareness of the rationale for the integration and use of information technologies at the selected universities in Africa;

2. To examine the historiography and pedagogical underpinnings of the integration of information technology in higher education;

3. To identify the challenges to information technology integration into higher education;

4. To identify the limitations of information technology integration in higher education; and

5. To propose solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education.

1.5 Research Questions

How can the integration of technology alleviate higher education challenges and enhance teaching and learning outcomes?

The primary research question above is broken down into five secondary research questions. The research questions seek to address and provide answers to the primary research questions, and are listed as follows:

1. What is the rationale for the integration and use of information technologies at the selected universities in Africa?

2. What are the historical trends and pedagogical underpinnings of the integration of information technology in higher education;

3. What are the challenges to information technology integration into higher education;

4. What are the limitations of information technology integration in higher education; and

5. What solutions can be proposed to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education?

1.6 Statement of Hypotheses

In order to achieve the study's objectives, the following proposition will be tested empirically:

H0: Alleviating higher education challenges through strategic integration of technology has no direct impact on enhancing teaching and learning outcomes.

H1: Alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes.

1.7 Summary of Research Methodology Applied

The study relies on both primary and secondary sources of data. In what follows, the modalities for gathering the necessary information required for the study is outlined.

Due to the nature and the problems identified in the study, a single vision or mind-set could not fulfil the objectives of the study (Baxter & Jack, 2008); hence, a mixture of methods and research approaches was utilised with some flexibility. This means that the study adopts a mixed method research approach, where higher priority was given to quantitative research methods. Self-administered and well-structured questionnaires were distributed to participants using a simple random sampling technique. The principles of convenience sampling technique were also employed in the sampling procedures. The sample population consisted of academic staff members (i.e. Tutors/Teaching Assistants, Junior Lecturers to Senior Lecturers, and Associate Professors to Professors) at the selected universities in Africa. The collected data was analysed using the Statistical Package for the Social Sciences (SPSS 24), Microsoft Excel and Microsoft Visio. Analysis of findings was used to draw logical conclusions and to offer apposite recommendations. Validity testing was performed to ascertain the integrity of data.

This exploratory study furnishes new insights into the problem identified. The author also considered pragmatism as the most appropriate underpinning research philosophy. This choice suggests the need to adequately investigate the relationship between alleviating higher education challenges through strategic integration of technology and its impact on teaching and learning outcomes at selected Universities in Africa. The justification for choosing this philosophy is that the study employed a mixed method (i.e. quantitative and qualitative) approach to collect and analyse data.

This study adopts integrated (combination of deductive and inductive) research approach to understand, analyse and interpret collected data through the close-ended questions and the open-ended questions that were included in the primary questionnaire distributed to academics at the selected universities in Africa. It was necessary to validate the responses/information obtained from academics at the selected universities; hence, it was mandated by the proposal defence team that the researcher conduct interviews with management/administrator (especially in the IT Department/Unit) at the selected institutions to ensure that the answers given by the academics clearly reflect the existential issues and challenges in the integration of information technology in higher education. The in-depth interview responses obtained from the selected management/administrators from the selected universities were analysed and interpreted using the inductive research approach. Thematic analysis was used as the method of analysis for the qualitative aspects of the study, for transcription and description of the analysed results (Creswell, 2009). Scholars (Creswell, 2009; Saunders et al, 2016) have noted that thematic analysis method is a useful research method any researcher should learn, due to its flexibility and utility to identifying concepts into themes. A detailed description of the adopted methodology for the study is presented in Chapter Five of the thesis.

1.7.1 Research Setting and Sample Population

As mentioned earlier, the study explores the research theme in the context of three higher education institutions in Nigeria and South Africa. Questionnaires were distributed to participants at two prominent direct contact (or on-site) institutions of learning in each country and an open distance learning (ODL) institution in South Africa with the largest students' enrolment in Africa in the ODL category. The selected ODL institution is large enough to provide relevant answers to the research questions due to its services that cut across Africa and the rest of the world. The institutions are identified as follows:

1. Lagos State University (LASU), Lagos, Nigeria;
2. University of KwaZulu-Natal (UKZN), Durban, South Africa; and
3. University of South Africa (UNISA), Pretoria, South Africa.

Lagos State University (LASU) was established in 1983 and it is located in Ojo, in the commercial city of Lagos, Nigeria in the West African sub-region. LASU has about 1,500 academic staff members and accommodates over 60,000 students who are enrolled for both part-time and full-time programmes. The University of KwaZulu-Natal (UKZN) has five campuses with an estimated 1,457 academic staff members within five colleges across several schools and disciplines. UKZN has over 45,000 students across the five campuses. Lastly, the University of South Africa (UNISA), with its headquarters located in Pretoria, attracts students from 130 countries. Available data indicated that 328,179 students were enrolled across seven colleges with South Africa constituting 91 per cent of the students' population and the remaining 9 per cent representing the rest of Africa and the world (UNISA, 2015a). Academic staff members are categorised as institutional/research professional with a population of 1,849 constituting 33.2 per cent of total staff of 5,575 (UNISA, 2015b).

Table 1.1 Population Distribution across the Three African Universities

Country	Institution	No. Academic Staff
Nigeria	Lagos State University	1,500
South Africa	University of KwaZulu-Natal	1,457
South Africa	UNISA	1,849
Total		**4,806**

Source: Researcher, 2015

1.7.2 Reason for Comparison

The selected higher education institutions were chosen based on shared characteristics between the two countries where the institutions are located. There has been a lot of exchange of trade between the two countries. For instance, Africa's leading telecommunications company, which originated from South Africa migrated to Nigeria in 2001, now has the largest customer base in Nigeria due to the country's enormous population (Isaac, 2018). The institutions are located at their country's cosmopolitan cities: Lagos (Eko), Nigeria; Durban (eThekwini), South Africa; and Pretoria (Tshwane), South Africa. The three cities are cosmopolitan in terms of the cultural diversity and number of foreign nationals residing in and visiting the three cities. The three cities are of great significance to their countries as they are strategic economic hubs. Each of the institutions has well over 1,400 academic staff and over 40,000 students' enrolment at the time of research. Another justification as to why these two countries were adopted for the study was due to the large population of Nigeria and the advanced infrastructural development in South Africa above many other African countries. Access to both countries was convenient for the researcher to collect data for the study due to the fact that the researcher was originally from Lagos, Nigeria and lives in South Africa.

1.8 Motivation for the study

The rationale for the study was the gap identified in the review of literature which led to the need of assessments to address the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa. This was also based on the realisation that certain challenges and limitations may hinder the potential benefits of information technology in higher education. The study emanates from the need to alleviate higher education challenges through strategic integration of technology at selected universities in Africa. These required the study to consider some of the key factors to enhance successful integration of technology in higher education, which are not limited to time, funds, physical space, quality assurance, skills and government support.

1.9 Relevance of the Study

The study is significant to the progress of innovative information technologies and plays a vital role in the field of education. There are lots of opportunities associated with the study in the process of alleviating higher education challenges at the selected universities in Africa. Some of these include identifying the current state of information technology integration in higher education, identifying several factors that can hinder the integration of information technologies in our institutions and providing adequate measures and strategies in the integration of information technologies. In addition, most innovative universities/higher education institutions will be able to make good use of the opportunities derived from technological progression that will be highlighted in this study in order to offer learning to many and can contribute to the fulfilment of the need for the diverse educational consumer base. To this end, the study aims to provide a roadmap that could inform action plans in other higher education institutions that seek to incorporate information technology in their teaching and learning processes, using experiences of their counterparts in Africa. All the insights promised in this study are significant to the outcome of the study and will contribute to the body of knowledge in order to enhance teaching and learning outcomes and enables the realisation of ICT's promised benefits to higher education.

1.10 Scope of the study

The scope of this study is limited to the specific use of information technology to alleviate higher education challenges from the perspectives of academics at the three selected universities in Africa. The change management model, model of technology adoption in the classroom and diffusion of innovation theory were utilised to develop explanations regarding the centrality of the strategic integration of information technology to alleviating higher education challenges. The conceptual tools utilised in this study apply specifically to the links between information technology integration, the alleviation of higher education challenges and enhancement of teaching and learning outcomes from the perspective of the custodians or operators of the technology (i.e. academics and management staff). Therefore, the focal points of analysis in this study are limited to the findings derived from the empirical observations by academics and management staff at the selected universities in Africa. Future studies may explore the same thematic issues from the perspectives of learners.

1.11 Gaps to be filled by the Study

Existing studies and research in the field of information technology delivered through the use of ICT resources have focused more on the attitudes and beliefs of users (Alfahad, 2012; Alhija, 2016; Guha, 2003). Only a few have explored academics' awareness to change management in the integration of technology (Menchaca, Bischoff, & Dara-Abrams, 2003; Walsh, 2014). Another gap to be filled by the study is to identify the roles that academic staff and management support play in the integration of technology into higher education in order to achieve the promised benefits of technology integration which have not been covered in any study. This study promises to fill these gaps by providing information technology strategies that will be used to alleviate higher education technology integration challenges and the sustainability of the technologies so that it will not be discarded after a short period of time. Other gaps to be filled will include proposing a strategic model that can serve as a framework for organisations and institutions in the integration of technology to alleviate educational challenges.

1.12 Research Limitation

The scope of the study is limited to alleviating higher education challenges through strategic information technology integration and make recommendations to enhance teaching and learning outcomes at selected universities in Africa. These outcomes serves as the mediating variables to achieve the objectives of this study. Hence, the discussions offered in this study are limited to these two constructs to play a major role in the realisation of ICTs promised benefits to higher education. Future studies may consider the utilisation of other constructs through these links and focus on other countries in Africa or similar constructs in other part of the world.

The study relies heavily on the experiences and perceptions of academic staff to identify the challenges of integrating information technology into higher education. It is possible that respondents may possibly have been biased and this may have affected the results of the study. However, to overcome such challenges, respondents' views were juxtaposed using statistical methods of reliability and validity tests in order to offer conclusions on the strategic integration of technology in order to alleviate higher education challenges and enhance teaching and learning outcomes at the selected Universities in Africa. Factor analyses were also conducted to test redundancy on the instruments used to ascertain reliability. Given that this study explores thematic issues from the perspective of academics, future studies may explore the same issues from the perspectives of learners to furnish additional insights that may contribute to a holistic understanding of the integration of technology in the higher education context. In addition, the proposed framework will not be measured in order to avoid deviation in the study's scope and this is identified as one of the study's limitations due to time and financial constraints. The study did not intend to measure the framework but intends to publish the framework in an article for other researchers to measure its effectiveness. Measuring the framework/strategy will produce a different research output which will contradict the aim/objectives of this study.

The study surveyed selected universities in specific (2) Anglophone African countries (Western and Southern Africa). The findings may not reflect trends or realities in Francophone and Lusophone countries. No country has been selected in the East, North and Central Africa. This may limit the extent to which generalization can be made. Financial factors such as the cost of printing questionnaires and cost of transportation within the locations where the study was conducted were limiting factors. Therefore, the study was confined to using only two countries in Africa as opposed to all the countries of Africa. In terms of methodological limitations, the use of questionnaire limits the opportunity to clarify responses to questions. To mitigate the effect of this limitation, qualitative interviews were conducted to complement findings from the questionnaire.

1.13 Research Output

During the course of this study, research output has been published elsewhere. Please find the list below:

- Abatan, O. K., & Maharaj, M. S. (2017). Change Management and the Integration of Information Technology: *Research Notes from Selected African Universities*. The 12th International Conference for Internet Technology and Secured Transaction (ICITST-2017). Technically Co-Sponsored by IEEE UK and RI Computer Chapter, University of Cambridge, United Kingdom. 11-14 December 2017, ISBN: 978-1-908320-79-7. Electronic ISBN: 978-1-908320-93-3.
  Print on Demand (PoD) ISBN: 978-1-5386-0598-1

1.14 Layout of the Thesis

The thesis has a total of eleven chapters. This section presents the layout of the thesis and provides a brief overview of each chapter as follows:

1.14.1 Chapter One: Introduction

Chapter One is the introductory chapter. It presents the background of the study, the problem statement, research objectives, research questions and research hypotheses, relevance of the study, gaps to be filled, research limitations and the research output of the study.

1.14.2 Chapter Two: Theoretical Framework Guiding the Study and Contextual Information Technology Integration in Higher Education

Chapter Two begins the literature review chapters by first presenting the adopted theoretical frameworks for this study. It then presents literature review in the context of information and communication technologies. Some aspects presented include but are not limited to the historical background of information technology integration in higher education and pedagogical underpinnings of the integration of technology, which was reviewed to provide answers to the need of integrating technology into higher education. This chapter further reviewed the role and importance of technology integration, impact of integrating technology in higher education, and overview of the history of ICTs in Nigeria and South Africa's higher education sector where the study is conducted. Finally the chapter deals with ICT for development solutions leading to discussions of modern educational ICTs and the top-rated learning tools available for technology integration purposes in higher education.

1.14.3 Chapter Three: A Review of Modern Educational Information and Communications Technology

Chapter Three of the study presents modern educational information and communications technologies. This presentation were followed with discussions on e-Learning concepts, merits, components and facilities within higher education context. Subsequent sections in the chapter described other modern and emerging information and communications technologies in detail. The technologies included Learning Management Systems (LMS), Open and Distance Learning (ODL), Massive Open Online Courses (MOOCs), Mobile Learning, Web 2.0, Internet of Things (IoT) and Cloud Computing that were utilised in the study instrument to measure academics' disposition towards the use of the technologies. The last section of the chapter presented the top-rated learning tools that higher education institutions may find useful and integrate to enhance teaching and learning processes. Argument around the successful integration of the learning tools were presented to close off the chapter.

1.14.4 Chapter Four: Higher Education Landscape and Strategic Technology Integration in Higher Education

Chapter Four presents a literature review on the profile and landscape of higher education as well as the technical background of information technology in higher education and the challenges posed in its integration at the selected Universities, Africa in general and the rest of the world. It also examines the roles that academic and management staff play in technology integration. Instances of various technology integration strategies at the selected countries (Nigeria and South Africa) and other part of the world were also examined in order to identify what may be considered successful and unsuccessful technology integration strategies.

1.14.5 Chapter Five: Research Methodology

Chapter Five presents the research methodology as it provides detailed instruments used in the research. It also describes administrative and implementation processes carried out in the research and relates approaches and techniques to the research objectives in more detail than presented in section 1.7. The chapter features the discussion of the research philosophy adopted, showing the strengths and weaknesses before its adoption. The study adopted pragmatism as the appropriate philosophical basis for this study and further justifies its use. An explanatory research design was adopted. This is necessary in order to adequately describe and explain the relationship between alleviating higher education challenges through strategic technology integration and its impact on enhancing teaching and learning outcomes. This approach is amenable to highlighting a practical spinoff: ensuring the realisation of ICTs promised benefits to higher education. The analysis in this chapter was executed by adopting a simple random sampling technique. A cross-institutional analysis approach was adopted to collect data using the principles of contemporary mixed methods design, where priority was given to quantitative data collection techniques and analysis procedures. Chapter five further presents the administrative procedure of the research design, population of the study, sampling techniques, methods of analysis linking models, and statistical concepts.

1.14.6 Chapter Six: Data Presentation and Analysis – Information Technology at LASU

Chapter Six initiates data presentations and analysis of findings within the construct of change management self-awareness, familiarity and technology integration across the three institutions where the study was conducted. Chapter Six presents findings from Lagos State University, Nigeria. The chapter describes the background information of respondents, change management self-awareness, familiarity and important information technologies for higher education at LASU. In addition, LASU respondents' institutional and personal dispositions towards the use of information technology, predisposing factors and challenges inherent in the adoption of new technologies were presented. The chapter highlights the drawbacks experienced in the use of information technology at LASU. Lastly, presentation of the utility of information technology to higher education at LASU was analysed and interpreted.

1.14.7 Chapter Seven: Data Presentation and Analysis – Information Technology at UKZN

Chapter Seven focuses on findings from the University of KwaZulu-Natal, South Africa. The chapter presents the background information of respondents, change management self-awareness, familiarity and important information technologies for higher education at UKZN. In addition, UKZN respondents' institutional and personal dispositions towards the use of information technology, predisposing factors and challenges inherent in the adoption of new technologies were presented. The drawbacks experienced in the use of information technology at UKZN were presented. Lastly, presentation of the utility of information technology to higher education at UKZN was analysed and interpreted.

1.14.8 Chapter Eight: Data Presentation and Analysis – Information Technology at UNISA

Chapter Eight deals with findings from the University of South Africa, The chapter presents the background information of respondents, change management self-awareness, familiarity and important information technologies for higher education at UNISA. In addition, UNISA respondents' institutional and personal dispositions towards the use of information technology, predisposing factors and challenges inherent in the adoption of new technologies were presented. The chapter describes the drawbacks experienced in the use of information technology at UNISA. Lastly, presentation of the utility of information technology to higher education at UNISA was analysed and interpreted.

1.14.9 Chapter Nine: Evaluation of Research Findings

Chapter Nine evaluates research findings and presents the comparative framings and statistical analysis of findings from LASU, UKZN and UNISA by means of cross-institutional approach. Inferential statistics are presented through Factor Analysis and Validity tests using regression and Anova. Evaluation of findings in terms of data collected from academics regarding drawbacks were discussed. Some of the evaluations include suggested institutional support to address drawback by academics, academic's involvement and experiences with e-Learning technologies for teaching and learning, evaluation of findings from institutional administrators to alleviate technology integration challenges and enhance teaching and learning outcomes, and the quality of administrative support in correlation with technology integration in higher education. Lastly, the chapter evaluates the relationship between early adopter and late adopters of technology in the context of the study's locations (Nigeria and South Africa).

1.14.10 Chapter Ten: Discussion of Research Findings

Chapter Ten discusses the findings of the study based on the empirical evidence presented in Chapters Six Seven and Eight of the thesis. The discussion is presented with regards to the research objectives, research questions and tested hypotheses. The findings of the study are discussed in order to provide contextual understanding of the aim of the study. The chapter makes the point that expanding the boundaries of knowledge with regards to alleviating higher education challenges through strategic integration of technology in order to enhance teaching and learning outcomes potentially contributes to the realisation of the promised benefits of information technology to higher education. The formulated hypotheses are tested using inferential statistics such as correlations, multiple regressions and structural equation modelling.

1.14.11 Chapter Eleven: Summary of Findings, Recommendation and Conclusion

Chapter Eleven draws the concluding remarks, recommendations and suggested strategy for technology integration into higher education in order to alleviate higher education challenges and enhance teaching and learning outcomes at the selected universities in Africa. The chapter concludes the entire study by presenting its scholarly contributions to the body of knowledge in the field of information technology and the higher education sector. The chapter highlights the limitations of the study and suggestions for future research.

1.15 Chapter Summary

This chapter identified the gap in literature in terms of empirical discussions on the relationship between the alleviation of technology integration challenges in higher education and its effect to enhance teaching and learning outcomes at selected Universities in Africa. However, information technology integration into higher education will continue to meet with varying levels of success to enhance teaching and learning as higher education institutions are investing heavily in technology. These two variables are instrumental in providing insight into information technology strategies that will be implemented to alleviate higher education challenges and will offer opportunities to facilitate teaching and learning outcomes at the selected Universities in African by proposing emerging information technologies strategies to enhance technology integration.

The chapter also provided the background information on the role information and communication technologies plays in both formal and informal educational settings. This laid the foundation to identify the challenges facing higher education institutions in Africa which can be categorised under technological advancement, social progress and economic development. It further led to the development of the problem statement, research objectives and questions. The summary of research methodology applied, reason for comparison, motivation for the study, relevance of the study, gaps to be filled and limitations of the study were presented as well as the layout of the thesis. The next chapter presents a review of literature on the theoretical framework guiding the study and the contextual information technology integration in higher education.

CHAPTER TWO

THEORETICAL FRAMEWORK GUIDING THE STUDY AND INFORMATION TECHNOLOGY INTEGRATION IN HIGHER EDUCATION

2.1 Introduction

The previous chapter has outlined the problem to be studied and has presented the objectives and the research questions to achieve the objectives of the study. This chapter presents the theoretical framework guiding the concept of the study and the context for information technology integration in higher education. Review of the historiography and pedagogical underpinnings of the integration of information technology in higher education is presented. This further includes the background and literature review on why the need for technology integration into teaching and learning. Information and communications technology experience and its trend in Africa and the rest of the world. Modern information and communication technologies for development solutions are presented in line with the study's context.

2.2 Review and Justification of the Adopted theoretical Frameworks

According to Hawkridge et al. (1990), there are four major justifications for integrating technology into education. The first is social justification. Social justification of integrating technology into education identifies the role technology currently plays within the society and the need for education to reflect the concerns of the society as well as to clarify technology need for learners. The second is vocational justification, which prepares students for the workforce. This justification is anchored in the reality most jobs require technological skills. The third, pedagogical, justification of integrating information technology into education presupposes that technology enhances the teaching and learning processes. It further suggests that teaching and learning processes will be enhanced through better communication and higher quality tools to improve the teaching of traditional courses in the curriculum. The fourth justification is catalytic which implies that technology integration can produce catalytic effect on both education and society as a whole. Catalytic justification assumes that integrating technology into education improves performance, teaching and learning, management, administration and produces positive impact on educational systems in general. It changes academic and student roles and relationships, and it provides skills to disadvantaged communities which can be used to liberate and transform learners to acquire knowledge in innovative ways.

This study focuses more on the last two types discussed above, namely pedagogical and catalytic justifications. These two justifications have a direct relationship on information technology integration in higher education. The research focus justifies the need to adopt suitable theoretical frameworks that will underpin the study in order to adequately address the problems of the research and to achieve the study's objectives.

It is important to note that there are many theoretical frameworks used in information systems and technology research that may have been deemed pertinent for the construction of the concept of a study of this nature. That said, after a review of theories such as Technology Acceptance Model (TAM), Model of Technology Adoption in the Classroom (MTAC), Unified Theory of Acceptance and Use of Technology (UTUAT), Diffusion of Innovation Theory (DoI), Change Management Model, and Theory of Reasoned Action (TRA), it was determined that three of these theories satisfy the basis of this study. The theories that were not adopted have relative strengths but the researcher did not find the theories suitable to form the basis of this study or adequate to address the research problems or to achieve the study's objectives. Hence, the Change Management Model, Model of technology Adoption in the Classroom and Diffusion of Innovation Theory became the theories of choice for the researcher.

2.2.1 Limitations of unused Theories

After the review of information systems and technology theories such as TAM, UTUAT and TRA which could have been considered to offer some utility to this study, the researcher found some limitations that led to the decision of not adopting such theories. In this instance, a general limitation would be the fact that this study did not focus on people's intention towards technology acceptance or usage which is the focus of the aforementioned theories. Another limitation found in these theories was linked to their capabilities to predict information technology acceptance on attitudes towards behaviour. This study was not conceptualised to predict information technology acceptance on attitudes towards behaviour. Rather, this study sought to find theories that will provide strategies to integrate change especially in the use of technology/innovation. This study notes that some of the information technologies available to higher education have already been adopted by the selected universities. Hence, this study focuses on developing strategies that will improve the use and integration of the technologies in order to fulfil ICTs potential benefits to higher education.

The last limitation observed in the quest of selecting the appropriate research theory was associated with perceived usefulness. This study was not developed to measure a person's view that using a specific system will enhance their job performance. Rather, this study – guided by the research theme – focuses on theories that pertain to strategies to alleviate technology integration challenges in order to enhance teaching and learning outcomes. It is noteworthy that a common strength the researcher found in the aforementioned theories could be associated with their capabilities to lead to information technology acceptance in a social system. However, these attributes were not sufficient for the researcher to adopt the above theories to form the basis of this study. The next sub-section presents the strengths embedded in the adopted theories and how the researcher found the theories suitable to form the basis of this study.

2.2.2 Strength of the Adopted Theories

This section of the study discusses the strengths of the adopted theoretical frameworks that form the basis of this study. It is imperative to reiterate the research objectives of this study as a prelude to explaining the applicability of chosen frameworks to this study. This study's objectives are as follows:

- To investigate the awareness of the rationale for the integration and use of information technologies at the selected universities in Africa;

- To examine the historiography and pedagogical underpinnings of the integration of information technology in higher education;

- To identify the challenges to information technology integration into higher education;

- To identify the limitations of information technology integration in higher education; and

- To propose solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education.

In order to find the appropriate theories that underpin the construct of the objectives and to develop relevant survey questions in line with the adopted theories, the study acknowledges that a single theory is insufficient to accomplish the research tasks. Given the thematic concerns that the research encapsulates, it is possible to advance separate frameworks to address specific corresponding aspects of the research. Hence, the study first requires a theory that can underpin the investigation of the awareness of the rationale for the adoption and use of information technologies at the selected universities in Africa. In this quest, Kershaw's (1996) change management model was consulted and the principles guiding the change management model were found appropriate. The principles guiding the change management model sought to address the first research question of the study. Questions 5.1 to 5.5 sought to gain insight on their level of awareness of the rationale for the adoption and use of information technologies for teaching and learning purposes.

The achievement of the first research objective was accomplished by aligning the survey questions to the first adopted theory. The major strength found in the change management model is its applicability to the research endeavour which sought to establish the perceptions of academics regarding change in the use of information technology for educational purposes. University staff generally have to be briefed and trained to properly adapt to the changes and differences created by new information technology/emerging technology introduced to the university teaching and learning environment (Cross, 2018). These findings provided answers to understand the awareness of the rationale for the integration and use of information technologies. Some of the constructs require academics to indicate their perceptions towards their individual understanding that change is actually needed. Having established their personal preferences for or dispositions to change, academics were required to indicate their motivations towards change in order to further understand the nature and the use of adopted information technology at the institutions. An understanding of management's clarification on the need of information technology for different academic purposes was assessed through the principles of change management model. A more detailed application of the theory with regards to specific survey question(s) is further explained in Chapter Five (methodology), Section 5.10.1.2. A literature review was also used to answer a part of the first research question that assesses the landscape and use of adopted information technologies in higher education. These literature findings are presented in Chapter Four of the thesis.

In addressing the second research objective, the researcher consulted Hooper and Reiber's model (Model of Technology Adoption in the Classroom) to examine the historiography and pedagogical underpinnings of the integration of information technology in higher education. The pedagogical underpinnings sought to address the questions – What, How and Why integrate information technology into higher education? The model was used for the construct of the survey questions regarding academics' familiarity with information technology platforms in higher education. This theory has major strengths, as it provides insights into unpacking the background information of academics at the selected universities, their computer/information technology experience, and their disposition towards the use of information technologies available within their reach. This covers question 6 to question 14 of the survey. Some of the principles guiding the construct of the model include five-steps which are *Familiarity*, *Utilisation*, *Integration*, *Reorientation* and *Evolution*. The construct of the model and its applicability to the research instrument are further discussed in Chapter Five, Section 5.10.1.2.

The third, fourth and fifth research questions can be unpacked against the backdrop of Rogers' (2003) diffusion of innovation theory. According to Tornatzky and Klein (1982), the theory has been used since the 1960s to study a variety of innovations which range from agricultural tools to business innovations. Over the years, the theory has been adapted and refined to a set of constructs that could be used to study an organisation and/or an individual information systems implementation success (adoption). To this end, the core constructs of the theory, such as relative advantage, technical compatibility and technical complexity were found useful or applicable to this study. Section D of the questionnaire formed a major part of the core construct of the theory in relation to information technology integration. Diffusion of innovation theory is relevant in the context of Questions 15 to 28 of the questionnaire.

Diffusion of innovation theory also bears relevance to the third research question in relation to challenges that may hinder the realisation of the potential benefits of information technology in higher education. The study takes note of the importance of Diffusion of innovation theory variables such as relative advantage, technical compatibility and technical complexity. These variables were identified as contributing factors to IS implementation or adoption. Therefore, the study made good use of Diffusion of innovation theory variables to develop 14 factors that may determine the success of information technology integration in higher education (Question 16 in the questionnaire). The same variables were used to develop 12 challenges, identified as variables, in this study and how serious these challenges were in the use and integration of information technology for teaching and learning purposes. These challenges are captured in Question 17 of the questionnaire.

With reference to the fourth research question that sought to identify limitations of information technology integration in higher education, the study utilised Diffusion of innovation theory factor 'technical compatibility' to develop Questions 20 to 23 of the questionnaire. These questions sought to identify the limiting factors such as unsatisfactory technical support and experience provided to academics in the use and integration of information technology by the university management. Research question five generally considers the three factors identified in Diffusion of innovation theory by assessing the extent to which information technology integration is critical to enhance teaching and learning. It also evaluates the drawbacks academics experience in the integration process and the sustainability of the integrated information technologies at the selected universities in Africa. Overall, the impact of using and integrating information technology in higher education was evaluated. Based on the findings, objective five proposed solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education. A snapshot and the principles of the three adopted models are further unpacked in the next section for simplicity.

2.3 Theoretical Framework

A single theoretical framework will not provide sufficient basis for identifying, proposing, planning and suggesting information technologies' strategies that can be integrated into higher education to enhance learning outcome. Therefore, a blend of theoretical perceptions is proposed for the study after an extensive review of relevant literature.

The three models proposed are: (1) The Change Management Model (Kershaw, 1996); (2) Model of Technology Adoption in the Classroom (Hooper & Reiber, 1995) and (3) The Diffusion of Innovation Theory (Rogers E. M., 2003). The specific relevance of each theory is described and discussed below:

2.3.1 Change Management Model

Managing changes in higher education does not necessarily impose the introduction of new technology. Rather it is about encouraging the people involved in the delivery of instruction or education to change the way they do things and their view about their respective roles in the institution (Kershaw, 1996). The process of managing changes begins with individual's or people's understanding that change is actually needed in the institution. What follows is, people must understand and accept that they must change and, finally, the people actually do change. This process may take several years to achieve, but it will enhance the integration of technological innovation into higher education.

To better understand the integration of information technology into higher education, as depicted in Figure 2.1, Kershaw (1996) indicated that the strategies for implementing change in any institution should involve clarifying the need for educational technology, creating suitable institutional/organizational structures, providing adequate support, training and promoting technology use for different purposes. The institution must be prepared to reallocate limited resources to support learners and staff members who use the technology, otherwise there will be no change.

2.3.2 Model of Technology Adoption in the Classroom

Hooper and Reiber (1995) presented a model of technology adoption using five step-hierarchical principles in order to better understand both traditional and modern applications of technology in education as depicted in Figure 1.1 below.

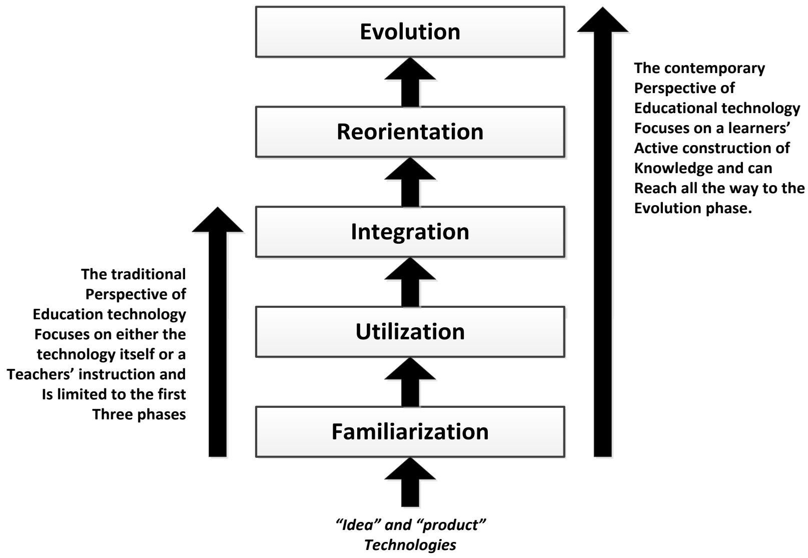


Figure 2.1 Model of Adoption of both "idea" and "product" Technologies in Education, (Hooper & Reiber, 1995, p. 2).

There are five phases in the model and they include: Familiarity, Utilization, Integration, Reorientation and Evolution. Each phase has its own concerns and corresponding support needed to provide an understanding to a Lecturer's location within the construct of technology adoption. However, the full potential of any information technology will only be realised once the educator/teacher progresses through all the five phases, otherwise the technology will probably be misused or quickly discarded from use.

In the model, familiarization is the lowest level and the progress begins in this phase. Familiarization requires a light exposure to technology (for example, instructors' participation in an in-service workshop covering the fundamentals of a particular technology). The second phase is utilization, where instructors use the technology at least once or for minor routine tasks within the lecture period. Integration is what follows in the third phase where instructors select technology based on its relevance to the instructional task and not for the sake of using technology. This is the phase where technology adoption often stops.

The fourth and fifth phases include Re-orientation and Evolution. Both of these phases are categorised as deeper levels where learning is emphasised and technology is a part of the learning framework rather than a distinct application. Changes occur at these levels because instructors are willing to change methods of giving instructions and media to improve learning outcomes.

2.3.3 Diffusion of Innovation Theory

Rogers (2003) was able to describe diffusion as a process in which an innovation is being communicated through certain channels over time and within a particular social system. However, diffusion is said to be a distinct kind of communication that communicates messages about a new knowledge or idea (innovation/emerging technology), (Rogers, 2003, p. 6). Rogers' description of diffusion has four main elements and these elements are defined as follows:

- ❖ Innovation as the idea, thing, object or practice developed as the focus of the adoption or implementation;
- ❖ Communication channel presents the process in which the innovation is introduced and marketed to in individual or the social system;
- ❖ Time that determines the acceptance rate of the innovation (technology) over a period of time; and
- ❖ Social systems referring to the elements (i.e., individual, organisations, groups, people and subsystems) associated with the adoption stages of the invention and their various impacts on one and other.

Each of the four elements stated above have one or more significant roles to play in technology integration stages and it is the foundation that best describes information technologies strategies into higher education in Africa. The theory defines five different categories of adopters in the diffusion process and they include, the *Innovators*, *Early Adopters*, *Early Majority*, *Late Majority* and *Laggards* depicted in Figure 2.2 below.

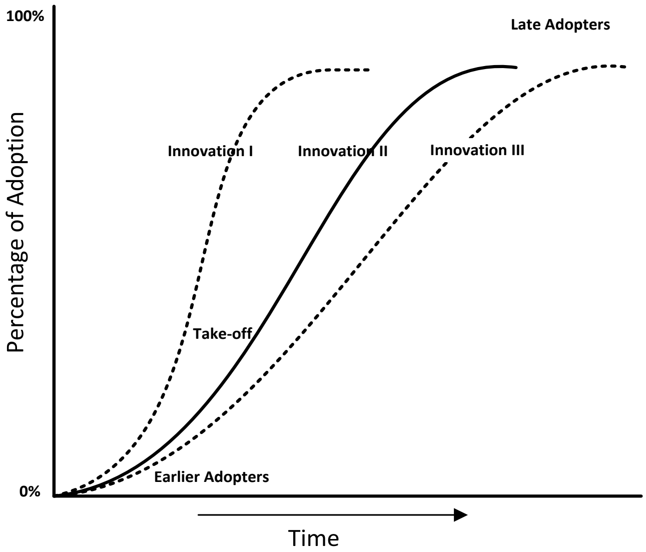


Figure 2.2 Diffusion Process (Rogers, 2003)

The study's findings describe the categories in which academics/respondents belong in the diffusion process with regards to their motivation to the adoption of new technology.

In addition, there are factors identified in the diffusion of innovation theory to influence information technology adoption and these factors vary within the different categories of adopters. These factors constitute variables determining the adoption rate of information technology across different higher education institutions. They are better identified as the perceived attributes of innovations and they are as follows: Relative advantage, Technical *compatibility*, Technical *complexity*, *trialability* and, lastly, *observability*. These factors are shown in figure 2.3 and demonstrate how they eventually lead to information systems implementation success (dependent variable).

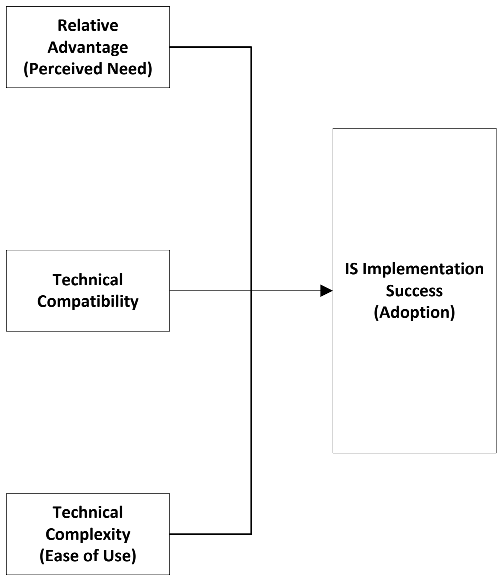


Figure 2.3 Factors contributing to the adoption of Technology (Rogers, 2003).

Rogers (2003) stated that for innovation to be successfully adopted or have a rapid adoption rate, it should have a greater relative advantage over the existing practices, compatibility to user's needs perceiving the innovation as being reliable or dependable, trialability, observability and be less complex in the use of technology. Further explanation into the adoption process indicated that adoption process can be broken down into stages, but not limited to *awareness* of the new technology, *interest* in the use of the technology, *evaluation* of the technology, *trial* by experimenting the new technology which will lead to *adoption*.

The theory is a great tool for the study and research has, however, revealed that relative advantage, technical compatibility and technical complexity are important forerunners to information technology implementation success (Agarwal & Prassad, 2003; Bradford & Florin, 2003, Cooper & Zmud, 1990; Crum et al., 1996). The assumptions of the theories and models highlighted will guide the study towards achieving its objectives. However, there are similarities in the theories and models which include individual perceptions to innovation which play a crucial role in technology adoption. Other important factors include users' degree of familiarity with the technology or some form of initial exposure to technology, change in social systems and support and, finally, time.

2.4 What is Technology Integration?

There have been different definitions of the term 'technology integration'. Some scholars thought that technology integration should be understood and examined based on the purpose of computer use to carry out specific activities by teachers in reliable and productive ways (Bebell, Russell, & O'Dwyer, 2004; Miller, 2007; Redish & Chan, 2007). Dockstader (1999) stated that technology integration is the effective and efficient use of computers in a general content area which allows learners to learn the application of computer skills within the curriculum. This means that "technology integration allows the curriculum to drive technology usage whilst not having technology to drive the curriculum" (Dockstader, 1999, p. 73). Hew and Brush (2007) defined technology integration as the way in which educators utilize technology to develop student's thinking skills. Overall, technology integration provides academics the opportunity to become more constructive in their thinking and teaching approaches while learners are better prepared for the twenty first century workforce. In addition, academics become better guides and facilitators of learning while learners possess planning skills, become critical thinkers and creators. Technology integration will also aid strong communication skills both for interpersonal relationships and presentation needs. Ogle et al., (2002, p. 75) define "technology integration as the combination of technology resources and technology-based practices into the day-to-day management and routine of any institution." However, technology resources may include, but are not limited to computers, customized software (such as LMSs), network communication systems and infrastructures, while technology-based practices may also include, but are not limited to Internet-based research, collaborative work, data retrieval and communication (Ogle, et al., 2002).

2.5 Historiography of Technology Integration into Higher Education

This section of the study evaluates the historiography and pedagogical underpinnings of the integration of information technology in higher education. The proposed objective of the study sought to establish and provide answers to address the questions – What, How and Why integrate information technology into higher education? In doing so, it is noteworthy that the advent of information and communications technology has brought about changes to the way people learn and these changes come with new challenges to learning. The application of ICT to courseware has become an emerging trend in education systems across the world. However, educators will not be able to utilize ICT resources to transmit knowledge acquired (in designing appropriate course materials and courseware) to learners without clearly understanding the constraints, characteristics and values of ICT. This section unpacks previous studies and review the history of technology integration trends associated with change management, user perceptions, challenges and strategies for integration of information technology into educational systems across Africa and the rest of the world.

Considering similar studies conducted in successful technology integration efforts, Fishman *et al*., (2004) found that there are six common features that lead to the success of technology integration in higher education. The features include: strong leaders within the institution; adequate technology access and technical support; high number of lecturers involved in technology activities; institutional vision and rationale that links with the vision of technology use; support for lecturers, time for planning, collaborating and reporting technology use and a high level of collaboration among lecturers. It is concluded in the study that the success of technology integration is attributable to the function of the voluntary nature of participants (educators) who are willing to engage in the use of technology. The six features are beneficial to this research project as they form part of the variables that complement the factors in determining the success of information technology integration in higher education and the challenges academics are faced with in the use of technology for teaching and learning practices.

In the never-easy change management process, Rogers (2002) applied a five-factor hierarchical model of adoption of technology in the classroom (which included, *familiarity*, *utilization*, *integration*, *reorientation* and *evolution*) to examine and understand the barriers to technology adoption on data gathered from two higher education institutions. The study's examination was able to produce interactions, visual representations and the interdependence of elements that contribute to the construction of barriers to technology integration. This five-factor hierarchical model of adoption of technology in the classroom was able to illuminate both the internal and external obstacles impeding technology adoption. "The model assisted curriculum developers to create a pre-service and an in-service educators' curriculum that assisted in the successful infusion of emerging technologies into the existing curriculum" (Rogers, 2002, p. 456).

Zimmerman and Yohon (2004) responded to the low use of information technology for teaching and learning in higher education faculties with the study that proposed the use of systems analysis guided by the diffusion of innovation theory. The systems analysis enables researchers to identify barriers that limit higher education adoption of technologies and to develop strategies to minimize such barriers. The study further identified concepts from which variables were derived that influence higher education adoption/non-adoption of information technologies for teaching and learning activities. The study concluded by indicating that more research is required to identify the many factors that can determine the adoption of information technologies in higher education faculties as well as the barriers that impede the adoption of information technologies.

Sang and Tsai (2009) used diffusion of innovation theory to analyse strategies for integrating information and communications technology into teaching activities in Taiwan. The study involved leaders, committees, teachers, non-teachers and students in six different schools (six groups) using Roger's five categories of adopters, based on their degree of IT acceptance. The study identified administrators as being responsible for the planning, supporting and co-ordinating of teacher's teaching activities. Without the administrators, technology integration is probably impossible. The study further stated that it usually takes an extended evaluation time or period and lots of effort is required for educational institutions to decide whether or not to adopt a new technology, notwithstanding the fact that ICT managers may think and advise that, if adopted, the new technology poses several advantages to teaching and learning outcomes. Identification of time and challenges in the form of constraints are factors in the study of technology integration in higher education.

Another study conducted in Europe (Schneckenberg, 2009) argued that the lack of faculty engagement and interest in e-Learning hinders technology innovation and integration efforts in higher education. The study indicated that faculty members are the gatekeepers and process owners of research and teaching in the university. University leaders need to consider underlying innovation barriers when engaging academic staff who will need to use the latest learning technologies by considering specific goals, motivating the academic staff and tailoring the institutional e-Learning adoption to serve the real learning purpose and the interest of academic staff. In conclusion, the study urges European universities to develop new strategic management models for academic staff in order to enable them to withstand competition and carve niches in emerging international markets. The study shows the degree to which barriers, motivation and strategic management are key variables to consider in the study of technology integration.

Beliefs, feelings, perceptions and attitudes are considered the most common factors that influence an instructor's decision to integrate technology into teaching. In the study conducted at the College of Education, King Saud University, Saudi Arabia on effective use of information technology (Alfahad, 2012) the factors are further broken down into two categories which include the internal and external factors. The internal factors that were considered were: Individual beliefs, preferences, anxiety, feelings, fears, and perceptions. The external factors were: Faculty demography (i.e. age, gender), size and institutional support. The study indicated that despite the availability of more new technologies for instructors to use than ever before, many of the instructors are resistant to integrate technology into their classrooms. The study further analyses and describes shifts in information technology usage and their impact on higher education sector as a whole.

2.6 Why Integrate Technology into Teaching and Learning in Higher Education?

According to Protheroe (2005, p. 47), "an effective technology integration does not necessarily mean the effective use of technologies for teaching the same content in the same manner it was thought out, but, rather, it is the use of technology to provide opportunities to support new models of teaching and learning." These opportunities include student's collaboration and construction of knowledge. Notes from Ogle et al., (2002) indicated that a successful technology integration must be aligned with the institution's routine and must be seamless and it must be efficient enough to support both the purpose and goals of the institution. Despite the different definitions of technology integration by researchers, there are common elements that note that technology integration occurs when educators are extensively trained in the use of technology to determine the appropriate roles and purpose of the technology; when students and educators make use of the technology routinely when required for a deemed purpose; when students and educators have full access to technology and when students and educators are supported and empowered in executing the application of the required technology (Summak, Samancioğlu, & Bağlibel, 2010).

Blair (2012) indicated that technology integration has the capability of engaging students to learn at a high level. It was further noted that technology integration has infused the four C's into teaching and learning practices. "The four C's being: *Critical thinking*, *Creativity*, *Communication* and *Collaboration"* (Blair 2012, p. 9). When students are possessed with the combination of technology skills, communication skills and information skills required to function in a learning environment, they are said to be technologically fluent (Mills & Tincher, 2003). On the other hand, teachers or educators who are technologically fluent are characterized as being able to apply technology in the teaching of the curriculum, able to apply technology to facilitate collaboration and co-operation within the learning environment as well as being able to use technology for problem-solving and decision-making in the learning environment.

According to Mills and Tincher (2003, p. 383), "technology integration is characterized as a developmental process that involves the following five interdependent stages*: entry stage*; *adoption stage*; *adaptation stage*; *appropriation stage*; and *invention stage."* In the first stage which is the e*ntry stage*, lecturers utilize text-based materials and guidelines to support instructor co-ordinated activities. In the *adoption stage,* which is the second stage, lecturers make use of technology for typing, processing of words, or to promote the acquisition of knowledge or skills through repetitive practice on software. In the third stage, the lecturer integrates new technologies into the learning environment or classroom and students use word processors (e.g. Microsoft Word), databases (e.g. Microsoft Access, Microsoft SQL

Server), graphic programmes (e.g. Adobe Photoshop), and computer-assisted instruction in the *adaptation stage*. In the *appropriation stage*, lecturers start to comprehend the value and usefulness of technology and students work with computers begins to take place with project-based instructions. In the final stage which is the *invention stage*, learning will be oriented around student-centred learning practices which will include peer tutoring, multi-disciplinary instruction, project-based instruction and individually-paced instruction.

From the literature gathered on technology integration, it can be seen that the concept of technology integration is a significant and important concept that goes beyond the acquisition and utilization of information technology in the learning environment, but, rather, it provides the opportunity, benefits and empowerment to reform educational systems. Technology integration is capable of facilitating the teaching and learning processes therefore making teaching and learning more manageable and meaningful and enhancing learning outcomes.

2.7 The Role and Importance of Technology Integration

ICTs have increasingly been supported as a significant solution for poverty eradication, empowerment of people with disadvantaged backgrounds (women and minorities) and for wide-ranging developments such as educational and business development (Maier & Nair-Reichert, 2007). ICTs were described by the International Telecommunication Union (ITU, 2016) as potentially powerful tools or technologies that enable development: 'Development Enablers'. According to Karake-Shalhoub and Al'Qasimi (2006, p. 8), "ICTs are cost-effective with possible transformative power that allows developing nations to circumvent and advance several development stages by equipping people with self-empowering tools."

Several development agencies such as the Canadian International Development Research, USAID, NRF, and World Bank have contributed extensively by increasing funding for ICT projects that aim to support educational developments, e-commerce, networking projects, e-government and business development (Lafond & Sinha, 2005). It has been noted that many people and various organisations are keen participants of a number of ICT-enabled programmes/projects. These projects have assisted in alleviating poverty, have assisted in solving the challenges facing both business and education as well as assisting in social development. Some of the projects and programmes include computer training, computer repair work, call-centre training, data-entry facilities and billing and information technology integration in educational systems (Hafkin & Huyer, 2006).

Eggleston, Jensen and Zeckhauser (2002) argued, in a study of global information technology, that ICTs are able to enrich the operations of different functioning market areas that are relevant to the livelihoods of the poor. The study indicated that ICTs can support greater market integration in many ways. For example:

- ICTs provide greater access to weather-related information and credit opportunities;

- Increased information about the availability of jobs could result in better and faster matching between labourers and job opportunities;
- ICTs allow firms and individuals in developing countries to participate more competitively and with greater ease in the regional, national and global economies and reduce uncertainty in doing business;
- Information regarding prices enables producers to plan their product-mix and input purchases in an efficient manner;
- Access to ICTs allows producers to sell their products in the most profitable markets and determines the optimum timing of sales;
- Availability of price information shrinks the informational asymmetry between the rural producers and middlemen;
- ICTs reduce the exploitation of rural producers by e-middlemen;
- Increased information facilitates technology diffusion, adoption and innovation at a much faster pace;
- Increased information concerning the availability of jobs and facilitates better and faster matching between landless labourers and available jobs, ultimately leading to increased productivity; and
- ICTs provide greater access to weather-related information and credit opportunities.

By and large, access to ICTs provides many opportunities that are required to improve the operational markets that are relevant for the welfare not only of the poor, but people in general and improved access to ICTs could significantly improve nations' economy over a period of time (Reddi, 2011).

"The rapid advancements in ICTs have contributed immensely to the emergence of the globally-connected world through the Internet network and the Internet has evolved from being not just a network for academics and researchers, but it has provided other ways in which educators and businesses offer their products and services" (Asgarkhani & Sarkar, 2011, p. 1305). Both the Internet and other web-based technologies have had reflective influence on the delivery of educational products and services over the past three decades. This has allowed educators in ICT-enabled countries to be innovative in methods of providing teaching and learning opportunities (Pan, Lau, & Lai, 2010).

In addition, Ghavifekr et al., (2014), outlined three areas of the importance of technology, such that: (1) Technology serves as a powerful tool for assisting individuals to achieve their personal and shared goals; (2) technology mitigates human suffering and improves social justice to help individuals or people make a difference in their domain; and (3) technology helps people to acquire knowledge and skills in order to evaluate and to decide on appropriate approaches when faced with problems.

2.8 Impact of Integrating Technology for Teaching and Learning Processes

This section of the study conducts literature review on the effectiveness of technology integration to enhancing teaching and learning processes in higher education. However, this research focus is on academics' opinions on technology integration in higher education, nevertheless, the literature review will be used to provide some answers to the research objective (the effectiveness of integrating technology in higher education to enhance teaching and learning outcomes). Since the role of academics in higher education is to integrate technology for teaching and learning processes, students will be the determinant as to whether the integrated technology is effective in their learning processes. However, the outcome of this study will be adequate to provide specific solutions to alleviate information technology integration challenges through specific strategies in order to enhance teaching and learning outcomes at the selected universities in Africa. The researcher was not permitted to conduct further research on student's opinions as to whether technology integration enhances their learning processes, but there have been extensive research studies that have been conducted on the perceptions and opinions of students as to whether technology integration has any effect (positive/negative) on their learning processes and outcomes in higher education (Abatan & Maharaj, 2014; Barron et al., 2006; Hussain, Morgan, & Al-Jumeily, 2011; Saba, 2009).

Information technology has been identified to be effective for teaching and learning preparation. Information technology has the possibility to prepare learners for life in the 21st century. Through technology skills, students are capable and ready to face future challenges because of their proper understanding of technology. This is because of the tendencies of ICTs to boost people's motivation and confidence, develop skills and widen human knowledge and information (Hussain, Morgan, & Al-Jumeily, 2011).

Barron, Ivers, Lilavois and Wells (2006, p. 35) argued that "technology provides an excellent opportunity for students' exploration, instruction and motivation in a multi-sensory diverse world." The study further argued that the integration of technology into teaching and learning should not be seen as a luxury, but rather as a necessity for future survival of technology-driven educational systems. Barron et al., (2006) outlined the following benefits of integrating technology into learning processes. It:

- Motivates and stimulates students by making their learning experience more exciting and relevant;
- Provides flexibility and opportunity for special needs students;
- Enhances communication skills;
- Builds cultural bridges and closes the gaps of digital division;
- Supports active learning or student-centred learning;
- Supports co-operative learning and increases student-teacher communication; and
- Provides various learning methods or styles to students.

Saba (2009, p. 2) indicated that “with the great deal of investment that is put in place to suit an institution’s needs in the integration of information technology, it is important to know whether or not the investment is effective or worthwhile.” The study then examined research from around the world to indicate whether or not there is sufficient evidence that supports the role and benefits of using information technology in educational environments. In summary, the following benefits and the role of technology, acting as a catalyst for change in educational systems, was derived:

- Technology improves students’ achievement on tests or assessments;
- Technology improves the quality of students’ work;
- Technology serves as a benefit for at-risk students;
- Technology improves students’ attitudes towards learning; and
- Technology acts as a catalyst for change.

Having identified the roles and benefits of technology in teaching and learning from the study, Saba (2009, p.9) concluded by asking the question: “what can be done to remove barriers in order to further the integration of technology into educational systems?”

2.9 Technology Integration Assessment Tools

Miller (2007) indicated that educational decision-makers are faced with challenges in accurately assessing the level of technology integration in the learning environment. Institutional boards often request evidence from institutional leaders (e.g. Deans, Directors and Vice-principals) concerning the efficiency of the investment made in the integration of technology. While the institutional boards do not argue with the fact that the integration of technology is a smart instructional strategy, they want to identify the level of its effectiveness in teaching and learning practices (Ghavifekr, et al., 2014). Regular evaluation of technology-integration effectiveness is essential as it helps decision-makers to shape their future decisions on professional development plans such as: staff development programmes; prioritizing budgets to meet state and or national grant requirements and instructional strategy (Summak, Samancioğlu, & Bağlibel, 2010).

The need for the evaluation of technology-integration effectiveness has prompted institutions and researchers to study and develop frameworks and models suitable for the assessment and evaluation of the degree of technology integration in educational environments. Some of the well-known technology-integration level assessment tools are discussed as follows:

- The Level of Technology Implementation (LoTi) was developed in 1995 as a conceptual framework to measure the levels of the implementation of technology in the learning environment. It was developed in order to assist educators in the restructuring of their staff’s curricula to include realistic usage of technology. This process was based on instructions and qualitative assessments (Moersch, 2002). Over time, the framework has been associated with 21st century learning (Summak, Samancioğlu, & Bağlibel, 2010). LoTi is a type of technology-integration assessment tool that measures educators' levels of technology integration, ranging from low to high. "The levels include: Level 0 – Non-Use; Level 1 – Awareness; Level 2 – Exploration; Level 3 – Infusion; Level 4a – Integration: Mechanism; Level 4b – Integration: Routine; Level 5 – Expansion and Level 6 – Refinement" (Moersch, 2002, p. 47).

- Observation Protocol for Technology Integration in the Classroom (OPTIC), developed in 2004 by the Northwest Regional Educational Laboratory, was designed to assess or observe the level of technology integration in the classroom and, or, in the technology laboratory (NETC, 2009).OPTIC provides an extensive user-guide as it is designed to address school-wide technological issues. This tool was not designed to measure and evaluate educator's level of technology integration in the learning environments, but was designed to focus exclusively on students' activities with integrated technology in the learning environment (Elmendorf & Song, 2015).

- Profiling Educational Technology Integration (PETI) was designed in 2002 by the Metiri Group which was appointed by the American State Educational Technology Directors Association (SETDA). This tool is a framework that includes three different surveys for the evaluation of teachers, school administrators and district administrators. The three categories of survey are interdependent and are used for site-visitation protocols, reporting structure and, lastly, for sampling methodologies which reduce data collection problems (Miller, 2007).

The appropriate use and application of any of the tools suitable for the institution can be used to produce expected results of assessment. Some of the features of technology-integration assessment tools are presented in Table 2.1 below:

Table 2.1 Features of Technology Integration Assessment Tools (Summak, Samancioğlu, & Bağlibel, 2010)

Tool Name	Assessment Available for:	Method & Instrument	Assessment Framework	Reportation	Availability Option
LOTI	Higher education faculty, school administrators, media specialists, instructional specialists, in-service teachers and pre-service teachers	Survey/Questionnaire	LoTi	N/A	Available as survey (loticonnection.com)
OPTIC	School wide	Observation/Rubric, Continuum or Scale	N/A	N/A	Available online (mcgillivray.org)
PETI	Teachers, school administrator and district administrator	Survey/Questionnaire	SETDA	Includes report format	Available online at no cost (setda.org)

The technology-integration assessment tools, mentioned above, can serve a useful purpose in the evaluation and assessment of the present and future integrated technology in the learning environment. The tools can be used in order to achieve the full potential and benefit of ICT.

2.10 Technology Integration Sustainability in Higher Education

Higher education institutions are not immune to developments in sophisticated information and communication technology (Daniela et al., 2018; Englund, Olofsson & Price, 2017). Technology-enhanced teaching and learning has established itself as one of the most debated topics in higher education. Across the higher education field, the widespread debate on technology integration in higher education for teaching and learning processes has given rise to the question of how to sustain the integrated information technologies. As been discussed in Section 2.8, information technology serves as a highly supportive tool for educational purposes. Its impact on higher education has been of significant benefits to provide sophisticated teaching and learning experience. However, to maintain such benefits, it is important to implement means and approaches to sustain information technology in the higher education field.

In the foregoing statement, this study takes note of the paucity of research on technology integration sustainability in higher education, however, this study made attempts to review the very few studies that has been conducted in this field. On the other hand, the outcome of the primary research findings of this study promises to offer and contribute to the field of knowledge. This will be achieved by providing strategies for integrating information technology into higher education to alleviate higher education challenges in order to enhance teaching and learning outcomes. This study also promises to provide strategies in the form of recommendations for the sustainability of information technologies integrated into higher education in order to realise ICTs promised benefits.

Some researchers argue that the sustainability of information technology in higher education is possible provided there are organisational changes in higher education process and in the curriculum redesign to develop sustainable education (Amador et al., 2015; Palma & Pedrozo, 2015; Visvizi et al., 2018). The implication of the findings shows that organisational change in higher education process, which can be linked to university managements' role in higher education process plays an important role in technology integration sustainability in higher education. Management are the decision-makers when it comes to policy making and policy enforcement within the higher education environment, however, effective change in the integration of information technology and adequate support provided to the need of both academics and students will enhance technology integration sustainability.

Daniela et al. (2018) argued in the study that utilised Sustainability Education Academic Development (SEAD) framework to analyse technology-enhanced learning and sustainability interlinkage in order to determine the role higher education play in the development of sustainability related skills and knowledge. The researchers argued that an emerging need to provide adequate support to academics in the development of their digital competence is a necessity for the sustainability of technology in higher education. This argument was supported by Englund, Olofsson and Price (2017, p. 74) who stated that "supporting conceptual change should, therefore, be a central component of professional development activities if a more effective use of educational technology is to be achieved."

This implies that university management should provide adequate support and take into consideration other problems in order to fully support the incessant usage of information technology in higher education. Some of the factors to take into consideration should include but not limited to academics' workload, educational competence in the use of information technology and pedagogical inertia shown by established academic staff. Most established academic staff consider their teaching approach to be adequate and not requiring change (Englund, Olofsson & Price, 2017). This type of attitude may be referred to as resisting change. Hence, the need to provide support in form of training and retraining programmes or staff development programmes becomes a necessity in order to sustain technology integration in higher education.

2.11 ICT Integration in Higher Education: Experience in Africa

This section focuses on the advent, development and adoption of ICT in Africa. Population of African countries continues to increase over the years and, as the population increases, the need for ICT development and expansion is also increasingly required (Adeola & Othman, 2011). The major ICT project that is impacting on the integration of ICT in Africa is the development and expansion of fibre optics (submarine cable connections) which was introduced in 2009. However, other companies like

Seacom (privately-funded and mostly owned by Africans), South Atlantic Cable system (SACS), which connects Brazil with Angola, ACE cable and GLO are still investing heavily in the project and this expansion has transformed the speed of African internet to date. Figure 2.4 shows the history and development of fibre optics cable network in Africa:

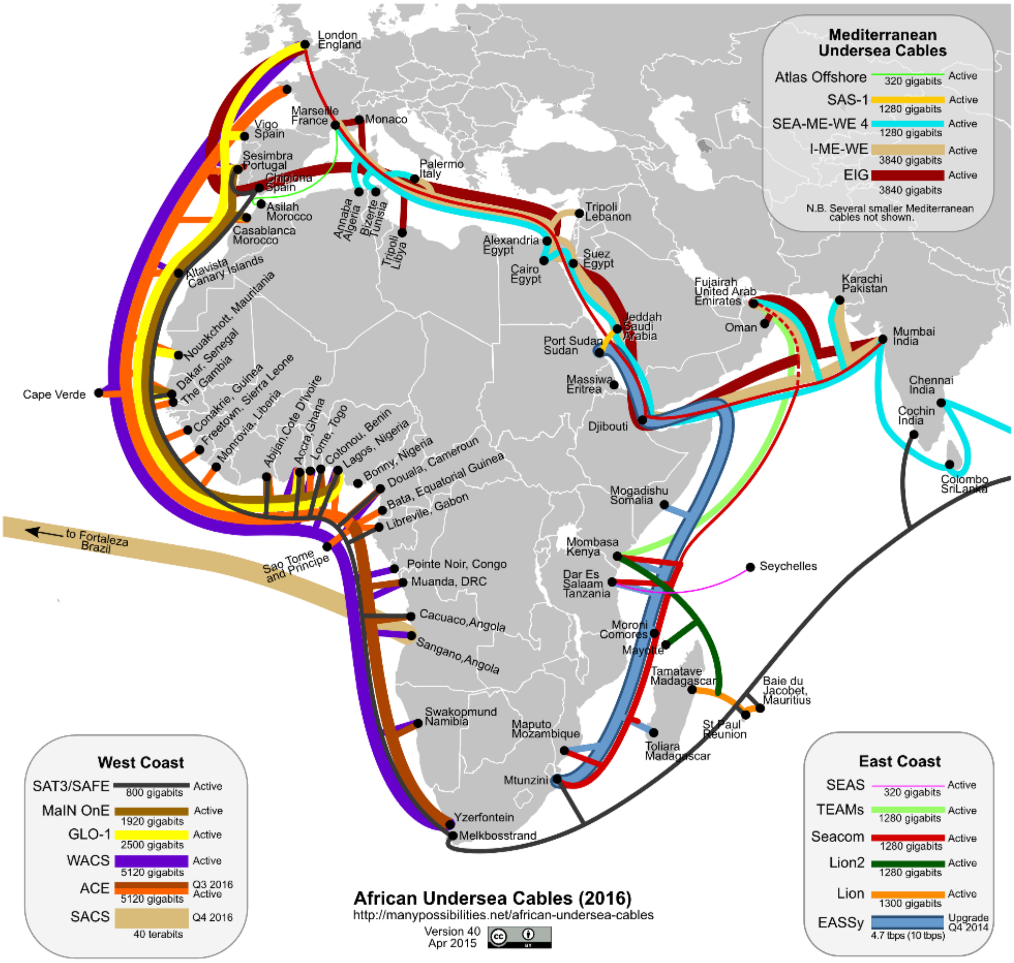


Figure 2.4 African Submarine Cable Network (Song, 2015)

Nigeria, South Africa, Ghana and many other African countries were once connected to the internet through the orbiting satellites that were providing snail-speed internet in the late 90s, but now the African region has multiple submarine cable systems on both sides of the continent, linked to Europe and Asia through 5 undersea fibre cables and allowing more countries to connect every year and providing millions of citizens access to 3G and 4G mobile data (Song, 2015).

Earlier research conducted indicated that there were gender inequalities in the use of ICTs in the world. The study indicated that the rating of ICTs use by women is not proportionate to their numbers in the world population. Research further indicated that 62 per cent of computers and the internet users are men in the urban areas of Latin America. The survey conducted in African countries showed that 86 per cent of Ethiopian computers and internet users are men. Similar results were obtained in Senegal and Zambia with 83 per cent and 64 per cent of users were men (UNCSTD, 1995; Marcelle 2000). According to Opoku-Mensah (2015), whilst many ICT initiatives (e.g. e-Learning) can be found in Africa, it is clear that many countries in Africa are still a long way from e-Learning readiness. e-Learning became possible in Africa when there was ICT integration in the education systems. ICT integrations requires strategies and polices of its own which can be derived by joining National Education goals and National ICT policy with Strategy.

The first African ministerial forum indicated that innovative integration of information and communications technologies into teaching and learning prompts the creation and implementation of plans and policies in: the development of student and student-centred approaches; the guidance and planning for change; the equipment of learners, teachers and schools with appropriate digital devices, but not limited to interactive whiteboards, computers, cell phones and tablets and the promotion of logical curricular reforms for the computer age in terms of skills, knowledge and value (Ndoye, 2014). The implementation of these plans and policies will motivate change by teachers, learners, parents and the entire education system in Africa. However, for these plans and policies to have a long-term effect and success, some African countries may need to be backed up by partnering with international organizations such as the World Bank, United Nation's UNECA or UNESCO and, as seen in Nigeria, where the Connect Nigeria Initiative (CNI) of the Federal Ministry connected over 1.4 million higher institutions students to the internet across 27 federal universities. This initiative includes the equipment of 1,552 secondary schools with internet access. The initiative comes with outside assistance by partnering with the World Bank's STEP-B project (Opoku-Mensah, 2015). A World Bank project in partnership with Kenyatta University in Nairobi aimed at establishing education networks that offer computer studies as a subject in High Schools. The outcome of this initiative has made it much easier for educators to implement ICTs into their education system (Ndege, 2015).

Today, it is difficult to identify many operations and activities in Africa that do not involve the use of ICTs. The Internet and other relative technologies have had an extensive impact on the way we live and work in Africa. According to Alemneh and Hastings, (2006, p.4), "digital technology advancements is shaping the way we create, use, preserve and access information resources that the traditional methods of accessing or organizing information resources are no longer effective." Internet applications and development in digital library initiatives are making information-resources integration easier to access and are providing academics in Africa with access to more diverse information sources and services which will enable ICTs in education to continue to grow (Kossaï & Piget, 2014). ICT infrastructure and penetration has become the measure of the distinction between developed and underdeveloped countries. Many countries across the globe are investing heavily in the infrastructure necessary to pave ways and to widen their routes in ICT integration, yet many countries in Africa still struggle to get onto the information technology highway (Damtew, 2004). According to Alemneh and Hastings (2006), there have been a number of concerns as to whether or not the Internet can help African countries to achieve their development potentials or whether the internet technology is widening the gaps between the privileged and underprivileged. In summary, unless African countries become full players in the global information revolution, the gaps between the privileged and underprivileged will continue to widen, a situation which will continue to increase marginalization in Africa.

According to Gillwald, Milek and Stork (2010), the diffusion of information and communication technology is highly uneven in some urban areas of Africa, while leaving some rural areas of the continent almost untouched. Findings from the Research ICT Africa (RIA) indicated that access to ICT is controlled by household income and is increasingly constrained by education and literacy (Gillward, Milek, & Stork, 2010). Therefore, "digital literacy has become a priority to improve the use of ICT and to enhance the quality of education in Africa, and this requires the need to equip educators with skills they need to use ICT in their teaching and learning practices" (Ndege, 2015, p. 38). Although, ICT has been introduced into many higher education institutions in Africa in the form of infrastructure, new curricula and professional development, it can also be perceived as a catalyst for changing educators' practices. "ICTs can be used for introducing various network-based technologies that can serve as effective tools for helping educators to develop a more student-centred and constructive classroom teaching and learning environment" (Shehu, Bada, & Enemali, 2012, p. 86). ICT integration in Africa now enhances teacher and student accessibility to a wider range of teaching and learning materials that can be used in the classroom environment. It also allows teachers to use supplementary computer tools such as digital cameras and scanners to capture external information to be entered into computers for teaching customization and students' assessments. Learning materials such as art collections, atlases, e-Books, and encyclopaedias can be in digital format for everyday classroom use (Govender & Chitanana, 2016).

Multinational organizations such as the World Bank provide funding support to public universities across Africa in order to support institutions with ICT facilities and infrastructure as well as equip educators with adequate technology to integrate technology into teaching and learning practices. This has been particularly true in Ghana, through the Teaching and Learning Innovation Fund (TALIF) and the Ghana Education Trust Fund (GET Fund). These multinational organizations are also able to provide capacity-building support and infrastructural support to distance learning programmes in the public higher education institutions. This initiative has allowed the Ghanaian government to provide a centrally-synchronized e-Learning implementation to facilitate educational reform with the effective use of technology. Such interventions are able to sustain ICT integration in higher education in Africa.

Despite e-Learning coming into the picture, the introduction of ICT into higher education has brought a simplified learning process to Africa, which allows learners to acquire knowledge and information at their own pace, in places that have access to the Internet (Matshinhe, 2015). The presence of ICT has provided opportunities for education to become more available and affordable in Africa and this has allowed many countries to harness the power of ICT to improve the quality of learners' education. Undoubtedly, one cannot erase the fact that ICT integration in education required some strategies. For instance, the Egyptian government has placed strong emphasis on the ICT sector where ICT Strategy 2012-2017 plays a vital role in integration and innovation within the country (*e-Learning Africa*, 2015). The strategy aimed at providing high speed internet facilities to higher education institutions across the country, providing tablets to over 20 million learners and learning communities with support from local entrepreneurs and innovators that will expand the Egyptian educational curriculum.

The awareness of the significance of ICT in our lives, especially for educational accomplishments, should be “persuasive enough to implement strategies to empower ICTs in the support of teaching and learning processes in higher education” (Nagunwa & Lwoga, 2012, p. 2). The strategy is capable of allowing ICT integration to continue to provide developments and prospects in educational activities. Some of the objectives to consider when integrating ICT into education in Africa are its capability to increase various educational services and approaches; to promote equal opportunity for all to obtain educational information anytime and anywhere there is Internet connection; to improve technology literacy for all citizens involved in one way or another (especially the educators and learners); to develop distance education with nationwide content and to help to implement the principle of a lasting learning experience (Kaka, 2008).

2.12 ICT in Higher Education in Nigeria

This section of the study provides an overview of ICT in Nigeria, a brief profile of Nigeria including information on the land mass, population, religion, language, Gross Domestic Product (GDP) and facts on the level of technology integration into its educational system. Nigeria, situated in the western shore of Africa with a population of about 177.5 million citizens (World Bank, 2015). It occupies a land mass of about 923, 768 sq. km. (356,669 sq. miles). Nigeria is known for its rich culture of over 250 ethnic groups across the nation. With six geopolitical zones and 774 local government areas, the country is made up of 36 States (National-Geographic, 2015).

Despite its richness and diversity in culture, Nigeria has one official language which is English. It gained independence on the 1st of October 1960 from Great Britain. Nigeria is the leading oil producer in Africa, but the main export is not limited to oil and petroleum products however, other exports from the country include cocoa and rubber. The federal government of Nigeria has been striving to boost the economy which experienced a tremendous oil boom in the 70s and is now boosting education and agriculture through the Education for All (EFA), Agricultural Transformation Agenda (ATA), and the Millennium Development Goals (MDGs) with support from the United Nations Development Programme. (UNDP), (Opoku-Mensah, 2015).

The very first formal education in Nigeria began in 1843 in Badagry, Lagos, in a building owned by the Methodist Missionaries. Over the years, the country has transformed the education sector but is still challenged with a number of drawbacks which include a shortage of academic staff (in all areas, especially in the areas of science and technology) and insufficient investment to keep pace with the growing school-age population (NNBS, 2015). Nigeria is faced with other challenges besides those in the education sector. These could be best addressed through its ICT construction policy. One major drawback is the instability of the power supply (energy) by the Power Holding Company of Nigeria (PHCN) that provides electrical energy to the entire nation. Electricity is an essential infrastructure in any economy for effective ICT operations. Without stable electricity, ICT cannot attain its full potential or purpose (Diso, 2005).

According to the Nigerian National Bureau of Statistics (NNBS, 2015), the educational challenges in Nigeria, particularly in the higher education sector, has led to an increasing number of students leaving the country in pursuit of better education abroad. The United States (U.S) Embassy in Nigeria recorded that Nigeria is the largest source of students' enrolment in the United States with a total number of 6,568 enrolled at accredited U.S universities and colleges in 2012. Further reports from NNBS indicated that, in 2010, almost three million children between the ages 6 and 14 had never attended a school in Nigeria. This represents about 8.1 per cent of the entire child population within the aforementioned age bracket. As the country strives to improve educational quality across the board, a lot of effort has already been made to revive this sector, but more needs to be done in order to improve educational standards. This will entail improving access to funds, infrastructure and expertise.

The Nigerian education sector went through a significant enrolment increase between 2010 and 2012. The number of enrolled students increased by 27.49 per cent and 15.46 per cent in 2011 and 2012 respectively. However, there is a big difference between the number of Nigerian males enrolled and the number of females enrolled. The average of male students to female is at 4.5:1. The number of male students constituted 11,806,478 and the female students constituted 464,058 in the same period (NNBS, 2015). This is an indication that Nigerian males are more able to access education than their female counterparts. Undoubtedly, improved integration of ICT will assist in the education of women and, especially, poor, marginalized, children, and those in the rural areas.

In the process of reaching those yet to be reached, industry stakeholders (such as government departments, private organisations and non-governmental organizations) set out to meet new targets in 2015, in collaboration with the federal government, to consolidate past technological achievements. The stakeholders (i.e. telecommunication companies) in the ICT sector are pushing aggressive infrastructure rollout across the country their agenda being not only to help the country to explore new areas of ICT, but also to help in the consolidation of past technological achievements and the integration of ICT to educate its citizens (Okonji, 2015).

2.13 ICT in Higher Education in South Africa

This section also presents a brief profile of South Africa and its ICT integration. The country occupies the largest land mass of the southernmost part of the African continent, with 1, 219, 090 sq. km. (471, 011 sq. miles). South Africa is a nation of 54 million people (World Bank, 2015) and is the twenty-fifth largest country in the world (SSA, 2011) with an annual population growth rate of 1.2%. It is mostly occupied by four major ethnic groups including Blacks (most populous ethnic group), followed by the White population, the Coloured population and, lastly, the Asians, dominated by the Indians, Japanese and Chinese. The country's predominant religions include Christianity, Islam, Hinduism, Traditional African religion and Judaism. Compared to the one official (English) language of Nigeria, South Africa has 11 official languages including English, Afrikaans, Xitsonga, isiZulu, Sesotho, Tshivenda, isiXhosa, Setswana, isiNdebele, Sesotho sa Leboa and siSwati. All within the nine provinces that make up the country where Pretoria (Tshwane), in the Gauteng province, serves as the capital city of the country and it is the administrative base of the government.

The World Bank (2015) ranked South Africa as one of the top two countries in Africa with the largest economy and income level an upper-middle income GDP of $349.8 billion in 2014. South Africa also became one of the group members of the emerging BRICS countries in 2010 in an effort to boost its economy (Gillwald & Simon, 2012).

South African democracy emerged in 1994, just at the time of the development and transformation of ICTs in Africa. After 1994, the South African government, institutions, schools and education experienced great transformation and development in the areas of ICT. The development of ICT and the Internet have assisted South Africans in the way they conduct their work operations, learn and conduct research. Over the years, ICTs have become more significant to the lives of people living in South Africa and have improved young South Africans' preparations for their adult working lives. There is a need to advance education standards by providing access to ICTs such as computers, the Internet and other digital resources. Therefore, South African national education system aims to provide learners with a curriculum-integrated with ICTs that will enhance problem-solving, reasoning and provide learning strategies in an effort to develop its education sector (Assan & Thomas, 2012).

According to the Department of Education (2006), the integration of ICT into the curriculum is projected to improve educational outcomes as well as to improve the quality and the effect of teaching and learning in the South African higher education system. This strategy is set to prepare South Africans for global competition as well as to prepare the country for a highly sophisticated technologically- enhanced economy (Todd & Mason, 2005). However, there remains disproportionate access to information and communication technologies amongst South African schools. This is due to several developmental challenges the country is facing (Assan & Thomas, 2012). The Department of Education (2006) released data on ICT integration that indicated that there was an increase of 12.3% and 26.5% between 1999 and 2002, respectively, on computers available for teaching and learning activities in public schools across the country. Due to the slow pace at which ICT is integrated within teaching and learning, there was a demand for ICTs to be implemented into school curricula based on the *Constitution (Act 108 of 1996*).

The purpose of the *Constitution* is to increase the life quality of every South African citizen and to provide potential liberty.

2.14 Information and Communications Technology for Development (ICT4D) Solutions

Information and Communications Technology for Development (ICT4D) solutions is no longer a new programme to the world since its commencement in year 2000 by the United Nations (UN) and G8 (Leading Industrial Countries), and it has since been developed and adopted by many organizations and institutions across the world (UNDP, 2001). The understanding of ICT4D solutions as a core development priority has evolved rapidly since its introduction. However, related ICT trends to the prediction made by Gordon Moore (co-founder of Intel) in Moore's Law, who argued in 1965 that the pace of technology growth will double every two years. But, because of the invention of telecommunication technology, satellites, computers, the Internet and, mobile phones, it has been affirmed that technology density now doubles every eighteen months (Reddi, 2011).

In order to address core sectors of development such as Education, Agriculture, Health, Governments and many more, ICTs provide access to education, information and knowledge, rural development, access to facilities in agriculture and public services and access to income-producing opportunities. Today, innovations within ICTs are taking place on various improved platforms and services such as the telecommunications, e-Learning/mobile learning, Web 2.0, Internet of Things (IoT) and cloud-computing. For the purpose of this study, the aforementioned innovations play crucial roles in the integration of technology towards alleviating higher education challenges across higher education institutions in the world and are discussed in the sub-sections that follow.

2.14.1 Telecommunications Infrastructure in Higher Education

The telecommunications technology has evolved from the wire-bound transmission to the wireless transmission that offers several advantages over the wire-bound transmission (ITU, 2011). Telecommunications technology and services have improved over the years in connectivity quality as technological evolves. "Telecommunication technology includes, but is not limited to, voice, video and internet communication services while telecommunication services also involves, but is not limited to, voice communications, video streaming, graphics and television services at a very high transmission speed" (Abatan & Maharaj, 2014, p. 64). The development of technology in the provision of telecommunication services has aided telecommunication users the capability to share information using telecommunication devices such as smartphones, notebooks, wireless modems and/or wireless routers at affordable amounts. Some telecommunication services include, but is not limited to: Wi-Fi, Video on Demand (VoD), mobile telephony, paging, computer communications, conference television, facsimile/fax, surveillance, video telephone, view-data, cable television, remote metering and alarm services for security companies (Yang & Olfman, 2006).

The motivation for universal telecommunications is mostly based on the fast technology growth and increasingly more liberal governmental policies amongst countries. “It is understood that in the past decade, a number of developing economies have engaged in reform paths and have experienced a significant expansion in their telecommunications networks and have experienced outstanding improvement in productivity” (Fink, Mattoo, & Rathindran, 2003, p. 444). In addition, the number of fixed-line telecommunication subscribers and mobile telecommunication subscribers has grown from just less than 1 billion to almost 4 billion worldwide between 1996 and 2006 (Djiofack- Zebaze & Keck, 2009). This is an indication that the telecommunication industry has experienced tremendous growth and rapid structural changes. Also, the mobile telecommunications industry has made the world a global village which has “resulted in profound changes within the social and educational structures that rivals those of the Industrial Revolution” (Yang & Olfman, 2006, p. 278).

“Telecommunications has remained a productive innovation and has boosted penetration rates that have never been reached by any other technology” (Fuentelsaz, Maicas, & Polo, 2008, p. 437). Especially in education, the acceptance of telecommunications has been influenced by many factors. According to Abatan and Maharaj (2014), cost, billing, user-satisfaction, security, network availability and stability, to mention a few factors, were directly influenced by the adoption of telecommunications technology for academic endeavours by users (such as academics, management and students). The study maintained that telecommunications technology has rendered itself a useful educational tool and its significant usage in the educational environment produces the opportunities to explore the many ways in which it could be integrated into teaching and learning practices in higher educational institutions.

2.15 Summary of Chapter

This chapter presented theoretical framework guiding the concept of the study and the context for information technology integration in higher education. First, the review and justification for the adopted theoretical frameworks underpinning the concept of this study was discussed. The limitations of theories consulted that were not chosen were also discussed. It then discussed how and why the adopted theories were chosen and their strengths to support the construct of the research objectives to address the research problems of the study. The second aspect of the study focused on the context of information technology integration in higher education to address some of the research problems of this study in order to achieve the objectives of the study. Some of the literature reviewed included the background of technology integration, the need of technology integration, the role, importance and the impact of technology integration in higher education.

CHAPTER THREE

A REVIEW OF MODERN EDUCATIONAL INFORMATION AND COMMUNICATIONS TECHNOLOGY

3.1 Introduction

Chapter two presented literature concerning the theoretical framework guiding the concept of the study, the background of ICTs and the role, benefits and impact of integrating technology into higher education. This chapter of the study discusses the modern educational information and communications technologies. e-Learning concepts, merits, components and facilities are discussed. Subsequent sections described other modern and emerging information and communications technologies in detail and this includes Learning Management Systems (LMS), Open and Distance Learning (ODL), Massive Open Online Courses (MOOCs), Mobile Learning, Web 2.0, Internet of Things (IoT) and Cloud Computing. The last section of the chapter presents the top-rated learning tools that higher education institutions may integrate to enhance teaching and learning processes. Argument around the successful integration of the learning tools were presented to close off the chapter.

3.2 Digital Learning and Virtual Collaboration

The European Union (2000) sets out a policy for an improved knowledge-based and information society, emphasizing the need to integrate emerging technologies as well as to implement change that will assist in the exchange of knowledge which would affect all institutions and various aspects of society. The policy currently serves as a strategic goal for the European Union to become potentially the most competitive and dynamic knowledge-based economy in the world. Within this context, Konstantinidis, Bamidis and Kaldoudi (2009, p. 8) debated that "higher education systems are increasingly deploying modern information and communication technologies to support teaching and learning in order to develop alternative forms of education delivery" such as digital learning and that they differ from the traditional way of teaching in order to provide emerging trends in education which tend to shift attention from just teaching to learning. A typical example of the emerging information and communications technology enabling digital learning includes the Distance Learning programmes, Learning Management Systems and integrated contents.

Virtual Collaboration (VC) means "the collaboration of groups or a team of people across boundaries of space and time supported through the use information and communications technology" (Biuk-Aghai, 2003, p. 129). In virtual collaboration, team members are geographically dispersed which many organizations are today. They rely on technology because of its capability to bring people to work together in a virtual space and time that exists within computers making it unnecessary to bring people together in a fact-to-face collaboration. According to Bouras, Giannaka and Tsiatso (2003, p. 725), "virtual collaboration in an educational setting is referred to as an Educational Virtual Environment (EVE) which is an instance of a Collaborative Virtual Environment (CVE) that aims at providing collaborative educational services such as synchronous and asynchronous e-Learning services."

A collaborative virtual environment, as described by Buik-Aghai (2001), may vary between different systems but must have a minimum functionality and capability to support the following concepts:

- *Action* – which combines all the operations that can be carried out within a collaborative virtual environment by the user (e.g. the process of opening an artefact);
- *Artefact* – this includes any document or other type of object that lies within the collaborative virtual environment or is linked to the collaborative virtual environment (e.g. a text file);
- *Communication Channel* – This is the medium that allows the users of the collaborative virtual environment to communicate with each other such as in an asynchronous discussion forum used in e-Learning or in a synchronous text-based chat (e.g. Instant Messaging);
- *Collaborative Virtual Environment*– this is the actual virtual environment itself within which users communicate and collaborate; and
- *User* – the user in collaborative virtual environment is referred to as the representation of the human user who makes use of the virtual environment for collaboration.

As much as there are many benefits to be gained from virtual collaboration, there are also some challenges highlighted in the use of the technology. Among these challenges, Biuk-Aghai (2003) identified the difficulty in virtual collaboration where team members, who joined in an on-going virtual collaboration, tend to be confused about 'What is', 'What has been' and 'What is going on?' Buig-Aghai concluded that, unlike traditional face-to-face communication, virtual collaboration lacks the physical clues which could inform the traditional members involved concerning the contents and progress of on-going work by overhearing or overseeing what other team members are working on. This could provide vital information to assist their own actions in order to keep pace with the work. The systems that support virtual collaboration are known as Virtual Collaboration Systems (VCS), which usually involve software that provides collaborative spaces. Virtual Collaborative Space (VCS) in virtual collaboration is the virtual space that offers the opportunity of bringing the people, artefacts and communication networks together for collaborative activity (Biuk-Aghai, Simoff, & Debenham, 2005). VCS also provide environments that integrate collaborative tools and functions for the users to have a sense of realism (Dillenbourg, 2000).

According to Dillenbourg (2000), virtual learning environments are not restricted to distance education, in the same way that web-based education is often associated with distance education, but it is equally widely used to support face-to-face learning in higher education. Web-based education combines distance and face-to-face learning which makes the higher education learning environment more robust. In actual fact, many distance education students do not live far away from the physical institution, but use the cyber links due to their tight time constraints (as they are often employed). Educational virtual environments such as asynchronous e-Learning services provide them with time flexibility (fully explained in Section 3.3.2).

3.3 e-Learning

e-Learning has been categorized as a form of education that is based on modern methods of delivery or communication which include the use of computers, a network system, numerous forms of audio/visual resources, the Internet, websites and e-Libraries accessed in the classroom or from a distance (Goyal & Purohit, 2011). According to Allison and Allison (2014), due to the flexibility in the e-Learning method of delivery, the type of learning is accessible to any person irrespective of their location or age as long as there is Internet connection. Ironically, some of the challenges experienced in e-Learning and which obstruct its full integration have been attributed to the lack of qualified e-Learning instructors and modern e-Learning facilities.

Typically, e-Learning is the type of education that is delivered through the World Wide Web (WWW) medium, where, in most cases, the educational institutions provide the programmes and learning resources on a website available for learners to interact with either on a closed or shared network or the Internet through the use of Blogs, discussion forums, e-mail, chat rooms, instant messaging, Frequently Asked Questions (FAQs), Questions and Answers (Q&A), Audio/Visual facilities (Podcast) and many more, which have the advantage of being able to provide *Real-time* Feedback (Šumak at al., 2010).

The popular study by Zemsky and Messy (2004) described the three-broad e-Learning domains that describe the concept as:

- e-Learning as distance education;
- e-Learning as facilitated transactions software; and
- e-Learning as electronically-mediated learning.

In fact, "any form of teaching and learning activities that involves the use of ICT is referred to as e-Learning" (Allison & Allison, 2014, p. 360). It is also confusing in some cases that e-Learning and distance education/learning do overlap, but by no means are they identical (Zemsky & Massy, 2004; Uys, 2007). The subsequent subsections unpack the similarities and differences in the characteristics of both learning methodologies.

3.3.1 e-Learning Components and Variations

e-Learning is accessible in different forms for the purpose of delivering teaching and learning practices through the usage of various ICT facilities. This section further describes significant technological methodologies and tools used to deliver education. The e-Learning Africa (2015) forum surveyed a number of individuals across Africa from various walks of life. This included students, educators, and women in technology environments, health practitioners, farmers, entrepreneurs and ICT professionals with regard to the commonly used e-Learning components. Some of the components identified in the study were presented in Figure 3.1 and include laptops, smart phones, personal computers, screen projectors, tablets, television sets, basic mobile phones, radios, MP3 players and game consoles. 95 percent of the participants indicated that ICTs are the key to improving educational systems. They all agreed and indicated that ICTs are improving efficiency and creating more opportunities across different sectors. Figure 3.1 below, depicts the percentage at which different e-Learning components are used in Africa, where laptops (19%) and smartphones (14%) are seen to be the most frequently used components. Personal Computers (PCs) and projectors have the same rate of use as television sets and tablets. (10%).

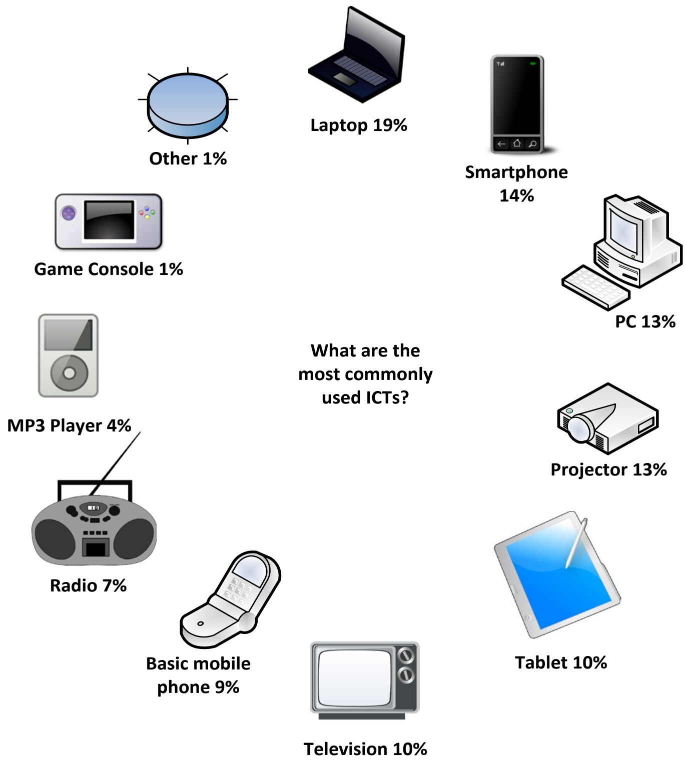


Figure 3.1 Most Commonly-Used e-Learning Components in Africa (*eLearning Africa*, 2015)

Some other e-Learning components available in the market today (that were not presented in the study) may also include, but are not limited to the White board, the electronic smart board, recommended tutor software, virtual classrooms, digital cameras and flash drives.

Wills' (2006) study, conducted in Australia at the University of Wollongong (UoW), argued that there was confusion in the minds of many people as to e-Learning being the same as wholly online. The study further clarified and agreed on the terminology to articulate why there is a need for e-Learning, the important uses of e-Learning, management and support for e-Learning and changes needed to make the use of e-Learning more effective. Wills indicated that the decision of the University's e-Teaching Committee was to describe the term e-Learning as 'blended learning' which best describes the University's approach to e-Learning integration by implementing a range of technologies including the Learning Management System (LMS), electronic portfolio, video conferencing, and streaming of lectures. In the end, a slogan was adopted by the University to define e-Learning at UoW as "Blending teaching and technology to create global learning communities" (Wills, 2006, p. 3).

e-Learning is a learning approach that can cut across different (rural and urban) areas of the globe if properly integrated and the basic idea behind the technology is interactivity for teaching and learning activities. According to Rabbi and Arefin, (2006) e-Learning technology is considered one of the best options to use when teaching in the rural areas, even though most rural areas in developed nations are considered to have poor or inadequate ICT infrastructures. However, the penetration of mobile computing devices and mobile wireless technologies (such as laptops, tablet phones and falling costs of telecommunication services and devices) has driven a revolutionary change by making it possible to incorporate technology into teaching and learning practices.

By and large, wireless systems (such as the wireless ad hoc networks, grid computing and wireless sensor network) could significantly enhance the development of rural areas, especially in Africa, that are lagging behind technologically. In addition, the emerging wireless technologies and mobile computing technologies could be used successfully in the provision of e-Learning practices to people in underdeveloped areas at numerous developing nations (Pathan & Islam, 2005). The following sub-sections further unpack the different emerging e-Learning methodologies, models and technologies that are valuable to the construct of this study.

3.3.2 Asynchronous and Synchronous e-Learning

Virtual collaboration within the collaborative virtual environments has facilitated human-to-human collaboration and this is attainable by supporting communication amongst team members, enabling document or object sharing and by making various specific task tools accessible through information awareness (Buik-Aghai, 2001). The capability of this type of technology is achievable through the two basic types of e-Learning techniques and methodologies (Asynchronous and Synchronous) which are commonly compared. For these e-Learning techniques to succeed, educational institutions and organizations must understand their benefits and limitations. Asynchronous was the first e-Learning initiative and means for teaching and learning, then the synchronous e-Learning initiative gained popularity due to improvement in technology and bandwidth proficiencies (Kinshuk & Nian-Shing, 2006).

Asynchronous e-Learning is the type of technique that is commonly facilitated by media, such as discussion forums, email, blogs, work relationship amongst teachers and learners, most especially when participants are not able to be online at the same time (Hrastinski, 2008). Due to its flexibility, many people take online courses because of their asynchronous nature as it allows them to include education, family, work and other obligations. Its flexibility also enables learners to log on to the e-Learning environments (such as Learning Management System) to download and share documents or to send messages to their teachers and/or, peers. However, synchronous type of e-Learning technique is generally facilitated by media such as Chat, Instant Messaging and Video conferencing to facilitate interactions. In this instance, lecturers/instructors and students experience synchronous e-Learning in a social environment and avoid the frustration of needing to ask questions and answer questions in real time (Olaniran, 2006).

3.4 E-Learning Facilities and Tools

This section describes some of the tools and facilities available on most higher education institution's e-Learning platforms for teaching and learning activities. These facilities provide different teaching and learning objectives and serve as important tools in e-Learning to support both instructors and learners.

3.4.1 Announcement Tool

The announcement tool provides instructors with the means to publish or post announcements to all learners registered on the institutions' e-Learning system for specific modules. The announcement tool enables instructors or lecturers to send attachments to learners and in most cases, an electronic mail is automatically sent to learners whenever the instructor posts or publishes an announcement.

3.4.2 Audio Learning

Audio learning in a web-based environment that does not only conform to the new trend of educational technology but also improves students' usage of online teaching and learning resources autonomously as is self-directed. The contents of an audio learning site is made up of audio files as a type of podcast. Audio learning is designed to accommodate and provide students with a supplementary learning opportunity which allows students to listen to short discourses in order to re-enforce the contents they had learnt in the classroom or to support learning material in an open and distance learning environment (Ghee, Heng, & Shuang, 2012).

3.4.3 Blogs

The term *'Blog'* came from the word weblog or Web log and it is generally known to be a form of online journal that is used for a lot of different purposes (Saddington, 2010). In addition, it is a collection of organized contents in the form of basic words or text that is enriched with video contents, audio contents and embedded objects such as images and files. According to VanFossen (2005), a Blog is part of a website that features contents like editorial commentary. It tells stories, provides links to external sites for recommendation or referral, allows comments and interaction with a participating audience and usually records personal opinions. Blogs generally have become tools for people to release personal information. Blogs have existed since 1997 and their inception has changed the way people express their interests and opinions (Jiang, Pang, & Gu, 2012). Bloggers who are basically the owners of blogs maintain their blog contents in order to provide high-level information contents and resources. Some of the popular blog builders or blogging sites include Weebly, WordPress, Blog.com, WIX and Blogger to mention but a few. Blogging in an education environment is also increasing as many learning management systems integrate 'blogging' functionality that allows learners to reflect on their learning experience. In most cases, learners are assessed based on their opinions or thoughts as well as creativity in the use of the blogging tool, and the tool may be useful for peer assessment too.

3.4.4 Bulletin Boards

The idea of the traditional bulletin boards through the use of pin board and notice board with a surface projected for posting public messages has been shifted and transformed to online bulletin boards where the same types of public messages are posted on a community website for school, government, neighbourhood and organizational use. Most higher education institutions' websites feature online bulletin boards where everyone (including lecturers, learners and support staff members) is able to quickly and easily find interesting articles, glossary definitions, event announcements, jobs, and associated material.

3.4.5 Calendar and Scheduling Tool

The function of the calendar tool on most learning management systems or higher education institution websites is to allow site members to have administrative control and to create and display events in a calendar format. A new task that became vital in the more automated e-Learning environment allows other site members access to view events, open files that may be attached to the calendar and they are also able to print the calendar for the group they belong to. Calendars are usually displayed in dynamic views including day, week, month and year depending on the type of view the user chooses. In addition, events attached to a calendar may have multiple attachments (i.e. an eTutor may find the tool useful by attaching notes or readings that are associated with a tutorial).

Groups, Departments and Research projects may post deadlines which alert members ahead of the submission due dates. The scheduling tool is used to display examination and assignment dates. The dates on the scheduling tool usually correspond to the dates on the Tutorial letter or Study guides. Additional dates for tutorial sessions are usually published on the scheduling tool by the instructor or lecturer.

3.4.6 Chatrooms and Instant Messaging (IM)

The online chat room is very similar to an Instant Messaging (IM) system that usually involves one-on-one communication. The chat room users involve several people with access using their screen names/username to log on to a virtual room and this enables them to communicate with each other by exchanging ideas, information and knowledge. This kind of technology has been integrated into higher education systems to encourage learner-instructor interaction in order to increase learning experience and to enhance learning outcome.

3.4.7 Discussion Forums

The discussion Forum tool is a useful tool for communication between students as well as between students and instructor or lecturer. It usually provides different categories where learners can communicate or discuss aspects of the modules and their study in general. Learners usually have the privilege of creating their own forum topics and instructors may choose to add more topics within the forum created by learners for additional information or resources to assist the students' learning experience.

The discussion forum tool could be an excellent tool to use in the assisting and supporting fellow students and it provides an opportunity to form a learning community that is predominantly lacking or not available in a distance-education instance.

3.4.8 Dropbox

The Dropbox tool is an electronic post box. It allows learners and instructors to post documents to each other. The drop box used on most e-Learning sites at several institutions is limited to each student, which gives access to only the learner and the instructor without allowing other learners access or permission to view each other's drop boxes. There is a world-renowned technology called Dropbox with over 500 million users around the world who rely on the Dropbox technology to help them in the design of buildings, composition of music, running of businesses and co-ordinating disaster relief (Dropbox, 2015). It is a useful tool irrespective of whether one is a lecturer, student and/or management staff.

In addition, Dropbox is a home for all types of documents or files including, but not limited to, photos, music, videos and files. It is an online file-hosting service operated by the company called Dropbox, Inc. which offers cloud storage, personal cloud computing and file synchronization. Dropbox permits its users to create a free account or profile by allowing them to create folders on the Dropbox website or even on their numerous devices such as their smartphones, tablets and computers. Users are able to access their files anywhere and at any time. With its official launch in 2008, Dropbox, over the years, has developed the technology by accommodating its users with more storage space and the capability to upload photographs and videos from cameras, smart phones and tablets as a movement in competition with its counterparts, *Google Drive* and Microsoft's *One Drive*.

3.4.9 Electronic Mail (e-mail)

The *Oxford Dictionary's* (2016) definition of electronic mail or e-mail is "messages distributed by electronic means from one computer user to one or more recipients via a network." *Tech Terms* (2016) also described e-mail as one of the most widely used features of the Internet which allows users to send and receive messages to and from any person(s) with a valid e-mail address wherever they may be in the world, except from places without Internet connectivity. Today, e-mails have become permanently embedded into our society and, due to many research efforts, development has made the technology more convenient, easy to use and to cost virtually nothing (Khan, Khan, Aalsalem, Muhaya, & Chao, 2015). E-mailing systems have become an essential and significant form of communication for millions of people since its capability allows convenient transfer of electronic messages and file attachments to anyone instantly.

To utilize e-mail to its full potential, users must use a mail client to gain access to a mail server. The mail client and the mail server utilize a variety of protocols in the process of exchanging information (Loshin, 1999). E-mail users can access e-mails in several forms, but the most common usages are Post Office Protocol (POP) with POP version 3 (POP3) as current standard, Interactive Mail Access Protocol (IMAP) and Webmail (Myers & Rose, 1996).

The Post Office Protocol (POP) is created to provide support for offline mail processing (e.g. desktop e-mail client programmes such as Outlook and Eudora) where the Post Office Protocol messages are delivered to the mailboxes and users are able to access these and download their messages from the mail server to their single computers. An advantage of the Post Office Protocol is that once the mails are downloaded, the Internet connection can be disconnected and the mails are accessible when it is convenient for the user to read at their own convenience. Additionally, Post Office Protocol frees the server disk because once emails are down-loaded, they are deleted from the server, therefore reducing the server-disk-usage.

Interactive Mail Access Protocol (IMAP) is the most complex of the protocols and a more recent development (i.e. IMAP4), is designed for users to remain connected to a minimum of one or more email servers in the process of creating or reading or organizing messages (Khan et al., 2015). The IMAP protocol does not store e-mail on the computer. Rather, email is delivered to the server and e-mail messages are read by connecting to the server. Another difference in IMAP, when compared to POP, is that email is not usually available when the user is offline. The major advantage of the IMAP is that email is accessible from any machine or device without needing to install a mail client as long as the machine or device is connected to a server. The server also filters e-mail without needing to set it manually.

The third development is the Web-mail and this is preferred to the previous two protocols as it offers some advantages over the IMAP, as it is seen to be easier to use with its capabilities to offer complete access to user's email without needing to download any e-mail or messages to the computer (Dacosta, Put, & DeDecker, 2014). In this case, e-mail is accessible through the means of web browsers. In actual fact, "Webmail depends totally on web browsers such as the Microsoft Internet Explorer (IE), Firefox, Google, Chrome, Opera and Safari to mention a few" (Dacosta, Put, & DeDecker, 2014, p. 249). Academics or students using Webmail often rely on free e-mail providers such as Microsoft Outlook (formerly known as Hotmail), Google, G-mail and Yahoo.

3.4.10 Frequently-Asked Questions (FAQs) Tool

The Frequently-Asked Questions tool is an efficient tool used to answer or respond to typical questions frequently or often asked by students. The Frequently-Asked Questions tool is enabled and available on most module sites or toolbars to answer students' questions and this tool reduces the number of telephone calls or e-mail communication the lecturer receives.

3.4.11 News Tool

The News tool is similar to the Bulletin boards, but uses Rich Site Summary (RSS) feeds to retrieve the latest contents from a remote site that appears in the learner's or instructor's news site. The News tool updates information regularly and saves time as users are not required to visit each site individually. The News tools user gets RSS feeds from news-related sites, online publishers and weblogs that deliver their content as RSS feeds. The RSS feeds can also be recent changes made to a Wiki page site related to the user's field of study or even the revision history of a book. It has many other uses.

3.4.12 Online Assessment

"Online assessment is the process used to measure certain aspects of information for a set of activities where the assessment is delivered through the use of a computer connected to the internet or a network" (Ramanathan, Banerjee, & Rao, 2016, p. 296). It is used quite often in an educational testing environment (e.g. online tests and quizzes). In addition, most higher education institutions are moving components of their assessment systems to the online mode of delivery (Bennette, 2002). A self-assessment tool also provides self-assessment activities for learners to test their knowledge on a specific module and, in most cases, learners receive immediate feedback.

3.4.13 Podcast and VOD cast

Podcast is described as a series of media files that are uploaded onto the Internet or website from time to time that can be downloaded for use through most of the information and communications technology devices such as the cellphones, computers, iPods and many other portable devices. Podcast media files are made up of the combination of audio and video files. This then explains why podcasts can be categorised into two types including audio podcasts mostly called podcasts and video podcasts mostly referred to as VOD casts (Ghee et al., 2012). According Cebeci and Tekdal (2006), a podcast that can be used for educational activities should have words, voice effects and music to enhance the efficiency of the learning process. The characteristics of a good educational podcast should include and not be limited to appropriate play time or a series of reliable contents and it must be portable.

3.4.14 Prescribed Books Tool

The Prescribed Books Tool enables the instructors or lecturers to provide information with regard to the prescribed textbooks to learners. Learners are able to view which book is prescribed for a specific module.

3.4.15 Question and Answers (Q&A) Tool

The Question and Answers tool is similar to the Frequently Asked Questions tool as it is used to answer typical questions asked by students.

3.4.16 Statistics Tool

The Statistics Tool enables instructors to monitor all forms of events that take place in the e-Learning environment such as the active tools used on the e-Learning system, as well as the monitoring of active users of the e-Learning facilities and resources for specific module(s). The events are downloadable in predefined reports and often presented in descriptive statistical format (i.e. Bar chart and Pie chart) or in spreadsheets/Pdf/Rich Text format by dates, user (instructor, teaching assistant, tutors and students) and tools (Announcements, Wiki, FAQs etc.)

3.4.17 Wiki Tool

e-Learning Wiki tools involves a website where all students and instructors with access can add, edit or even change the pages and its contents. The Wiki tool is ideal for collaborative work where two or more learners can work together on a page as well as in activities for the purpose of sharing knowledge, learning and building consensus while typing or writing the document together. Some Wiki assignments enable flexibility by writing and re-writing the assignment multiple times by any one at any time and place.

3.5 Gamified e-Learning (Gamification)

Most learning conferences these days include sessions that incorporate research areas in gamification as it is becoming a more common trend that scholars are asked to add gamification to a learning experience (Whybrow, 2015). "Digital games are quickly becoming significant tools in training, education and healthcare. Although, many people use digital games for entertainment activities, a number of people also use them to escape the difficulties of social life" (Sherry, 2004, p. 330). According to Pivec (2007, p. 387), "the model of the Digital Game-Based Learning (DGBL) provides complex learning opportunities that serve as motivations for learner's because they provide different modes of communication and interactions for learners." Ferguson (2012) indicated that Digital Game-Based Learning has been shown to be effective in the facilitation of healthy behaviour amongst learners (i.e. improved physical activities, healthy lifestyle habits and self-management of illness).

In addition, Game-Based Learning (GBL), which is usually the use of video games as learning tools has gained great interest since the beginning of the new century with the help of the Internet and the World Wide Web and more especially, through the paradigm of Social Networks and Web 2.0 (Simões, Redondo, & Vilas, 2013). This information and communications technology phenomenon are continually influencing the way people learn, relate, communicate and work. The video game technology has gained popularity among younger generations. According to Johnson et al., (2011) video game technology has its shortcoming, which has been tagged as addictive and distractive to learners, due to its ability to affect learning outcomes negatively.

In 2010, a new development of technology emerged called Gamification, this phenomenon applies some components or elements associated with video games in non-game applications, aimed to increase people's interaction and engagement and to support certain behaviour (Simões, Redondo, & Vilas, 2013). According to Dixon, Khaled and Nacke (2011, p. 2) "Gamification technology is the use of game design elements such as the characteristics of games in a non-game environment or context." The concept of gamification over the years has been recognised in marketing and its prospect has been explored in other areas including Education, Environment (social networks), Government, and Health.

Information technology research projects have shown some guidelines in the application of social gamification in education by testing and validating the results of the application. Some of these results include the impact of game play on cognitive development and the identification of features that make for good social gamification (Johnson et al., 2011; Lee & Hammer, 2011). Gamification possesses an impressive possibilities that can motivate students and make higher education institutions attractive by introducing important materials from the video games world, which will increase learner's engagement level without actually using any specific game (Lee & Hammer, 2011). According to Lee and Hammer, to understand the role of gamification in education means to understand what game elements will drive learning behaviour given the circumstances. Gamification projects in education will offer the opportunity to experiment with rules, social roles and emotions of the learners by giving them tasks such as to lead a detective role in a class, working hard to ask the best questions during lecture sessions and many more. When learners play by the rules, they tend to develop new frameworks for understanding their learning activities and this can easily motivate learners to participate more in their learning activities and even change their self-concept (LeBlanc, 2006).

3.6 Open and Distance Learning (ODL)

The evolution of distance education with regard to its development of ICT was described and classified in the *'Encyclopaedia of Developing Regional Communities with Information and Communications Technology'* (Marshall, Taylor, & Yu, 2005) in three generations. The first generation of distance education integrates attendance and a mailing system by posting written communications and hardcopy textbooks for correspondence between the lecturers and learner from 1840 to 1920. The second generation of distance education was from 1920 to 1980 which also integrates attendance, mailing system and more technologies such as television and radio broadcasting as well as telephone and audio-video tapes i.e. Video Home System (VHS) tapes for correspondence between lecturers and learners. The third-generation distance education is the application of new technologies from 1980 to the present. This involves the use of personal computers and connection to the Internet fused with rich multimedia contents stored in CD-ROMs/DVD-ROMs that have gradually substituted the VHS tapes and the traditional textbooks with eTextbooks. The third generation of distance education provides unlimited access to a repository of contents through the World Wide Web and correspondence between the lecturers and learners is facilitated through email, Chats or Instant Messaging (IM), Discussion forums and some educational software applications known as the Learning Management Systems (LMS).

Distance education has become a well-known educational system in the last decade where the lecturers or instructors involved are separated in space from their students (Agostic, 2005). According to the United States Department of Education (1989), distance education involves the application of electronic devices and telecommunications technology that enables learners to receive instruction from their instructor that originates from a distant location. This is an indication that distance education is developed and provided by means of modern ICTs and the basic or entry requirements of most distance education institutions for course delivery comprises a few information and communication technologies (i.e. learning technologies) to teach and support students. The basic technologies include short message services (SMS), CD-ROM and interactive whiteboards (Esterhuizen, Blignaut, & Ellis, 2013). The understanding of the basic information and communications technology required to deliver distance education is attributed to its evolution discussed below.

The use of ICTs in university instructor training have enabled "students' participation in the information society and the proper use and implementation of ICTs in ODL institutions can be a vehicle to customized learning, provide flexibility with regards to place, time and pace of learning as well as allowing collaboration and continued study even while students are working full time" (Ally, 2009, p. 49). ICTs have boosted both residential education and online and/or distance education across the globe, most especially distance education has become increasingly popular among young adults and has attracted students from several African countries (Van Jaarsveldt, 2007). Currently, South Africa is considered the leader in distance education amongst other African countries with over 300,000 students enrolled yearly at UNISA alone. UNISA offers blended learning and some fully online courses that are called Signature Courses e.g. Ethical ICTs for Development Solutions (EUP1501). According to Bates, (2015) UNISA has been said to be reluctant to invest heavily in online technologies due to the high cost and difficulties with access to the internet. UNISA will have to move swiftly with its technology trends if it is to remain the leading Open and Distance Learning (ODL) institution as compared to its counterpart, the African Virtual University (AVU) in Kenya that is considering providing lectures on mobile phones and hopes to tap into the estimated 112 million smartphones users across Africa.

Jensen (2005) investigated the experience, basic models and trends of ODL in many countries including Australia, Czech Republic, Great Britain and the United States of America. Jensen's study indicated that the videoconferencing system is a common technology for the delivery of learning in most of the aforementioned countries. According to Akhmetova, Vorontsova and Morozova, (2013) eTextbooks and videos can be recorded on a CD-ROM and can be made available through an electronic library or LMSs for learners. Akhmetova *et al*. stated in their study conducted in Russia that institutions and organizations that offers distance learning were regulated by Russian laws to implement blended learning models of education in their use of distance learning technologies. This implies that face-to-face classroom lessons are mandatory for programmes.

The expansion and success of open and distance education has been driven by the need to increase people's access to learning and the availability of technology for delivery. Yet, a number of ODL amenities at face-to-face and/or contact institutions have not been considered successful due to poor planning and inability to ensure that all the required systems to support ODL are fully available and operational (Esterhuizen, Blignaut, & Ellis, 2013). In addition, there are several other challenges that are affecting the planning of ODL which include globalization, material sharing, joint course development, computers and information technology. However, distance education has faced distinct changes, mostly with the migration from correspondence/mailing type of learning delivery methods to technology enhanced learning and the open-access methods (Deimann & Farrow, 2013). According to Akhmetova, Vorontsova and Morozova (2013, p. 508), a successful distance education implementation is "based on major principles, agreements, integrity and dynamics in systemic strategy that supports optimal efficiency together with excellent quality of teaching and learning."

Lastly, it was noted that the arrival of distance learning initially attracted working class people that already have obtained their first degree or some type of vocational certificates and are motivated or inspired to build a career, for personal development and/or to change their profession. However, distance learning has now attracted the group of students who have only matriculation certificates or secondary education and it is required for teachers to offer systemic support to this category, especially helping them to organize their self-study which can be integrated into the learning management system.

3.7 Learning Management Systems (LMS)

The rapid growths in ICTs are creating new and innovative approaches to educate people and the increasing trend is to create and implement friendlier Virtual Learning Environment (VLE) often called Learning Management Systems (LMS), Moodle or web-based Course Management System (CMS), (Šumak et. al., 2010). Clearly, VLE is now commonly used to support many activities associated with teaching and learning in universities and organizations and it increases instructional productivity (Goyal & Purohit, 2011). Although, change is difficult, the rapid development and deployment of new technologies such as the LMS as well as social changes will make the provision of education practicable (Inelmen, 2009). The LMS solution does not only provide educational institutions with the ability to manage online teaching and learning process but it also provides businesses with the ability to manage online training and learning programmes for their employees (O'Loughlin, 2015).

Traditionally, LMS have been designed for the delivery, management, tracking and assessment of learning activities in both formal and informal learning environments. With new techniques of communication and content sharing not forgetting the social networking services, a new generation of technology is emerging to facilitate teaching and learning processes (Stone & Zheng, 2014). These new technologies allow students at numerous universities to learn more in less time as well as allowing higher education institutions to pay attention to the global learning environments if these technologies are used and implemented adequately (Cavus, 2011). In addition, the use of learning management system will allow lecturers, traditional tutors and eTutors to develop, organize and deliver learning contents with capabilities to track learner's activities and performances as well as to evaluate learning outcomes (Bandung, Langi, & Hutabarat, 2013).

"LMS being one of the modern technologies, is an application software that is useful to integrate pedagogical and technological features into a well-developed VLE" (Turan, 2010, p. 95). The functionality of LMSs enables instructors (educators) to create and provide flexible, active and dynamic learning environment that allows students to share resources, upload assignments, participate in online assessments, gain access to grades as well as collaborate and/or engage with their instructors and other class mates (Baskan & Erduran, 2009). This means that LMS is a web-based information system and is customisable in real-time. According to Watson and Watson, (2007) LMSs represent a technology framework with support of various aspects of learning processes such as course management, content management and learning management, and can be implemented in primary, secondary and higher education, firms and in military organisations.

In 2011, some of the LMSs market leaders included Moodle, Pearson, Desire2Learna and Blackboard, but today, there are numerous providers of the technology (Hill, 2012). Figure 3.2 below depicts the global LMS market share at the end of 2015. In all, Moodle and Blackboard have consistently dominated LMS usage for universities across the US, Canada, UK and Australia. However, Desire2Learn (D2L) appears in second place after Moodle in Canada, depicted in Figure 3.2 (EdTech, 2015).

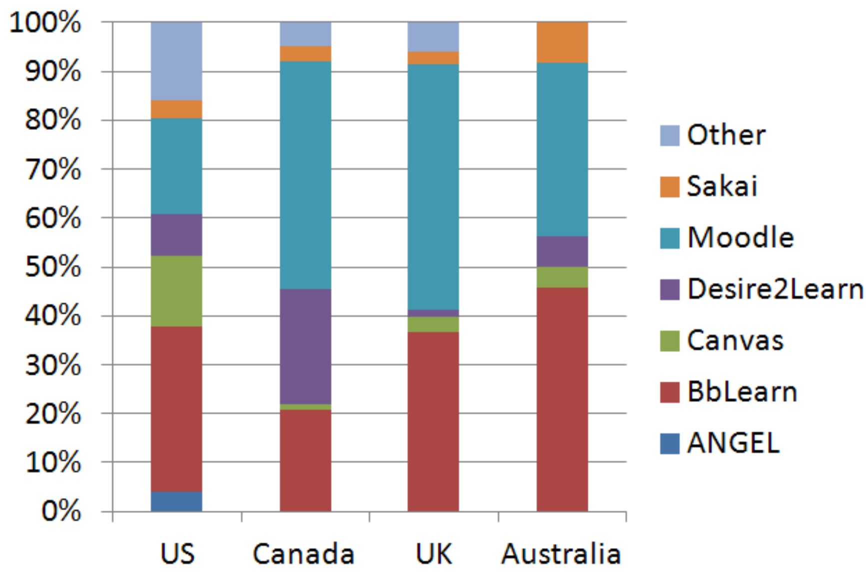


Figure 3.2 Global LMS Usage for Higher Education Institutions (EdTech, 2015)

More importantly, modern LMSs were developed with the rapid growth of the Web and have contributed to the ability (such as, volume of student enrolment) of educational institutions that offer both online and blended learning (Stone & Zheng, 2014). Regardless of the many aspects of learning processes and the goals of the institutions and organisations implementing the LMSs, there is some sort of cohesion with regards to the needs associated the management of learning activities (Ellis, 2009). According to Ellis, an effective LMS should have the following characteristics:

- Centralized and automated administration;
- User self-guided services and self-service;
- Assessment facilities and the capacity to deliver learning content rapidly;
- Consolidated training initiatives on a scalable web-based platform;
- It should support portable devices and standards; and
- It should allow the user to personalize content and enable knowledge reuse.

Valuables features (i.e. student tracking, student capabilities of using pre-test and post-test techniques and generating reports) were envisioned as part of the leaning solution in the design of LMSs. Other functional requirements that LMSs product should feature and are highly recommended are “integration or synchronization with Human Resources systems, Administration tools, content access, content development, content integration, skills management, assessment capabilities, adherence to standards, configurability and security" (Ellis, 2009, p. 1).

3.8 Massive Open Online Courses (MOOCs)

The hype about MOOCs is because élite American Universities and top universities across the globe have adopted them as providers. MOOCs are now seen to represent the first real opportunity for democratizing higher education as they offer several courses in different fields from the best institutions to everyone around the world for the cost of an internet connection. To mention a few, these institutions include Harvard, Stanford University, University of British Columbia, University of Toronto and University of Alberta (Coursera, 2013). However, a typical MOOC allows learners to watch an instructor's short video online and to complete assignments that are graded by their peers, instructors or machines. This kind of teaching allows a professional instructor (i.e. professor) to teach a class of several thousand students in a personalised way. Learners involved in this kind of learning are able to demonstrate their knowledge through interactive and live or online assignments (Bull, 2010).

Butler (2012) described MOOCs as online courses that are open, free to anyone who desires to register and they are said to be the educational buzzword of the year 2012. So, "*The New York Times* called the year 2012 as the year of the MOOC" (Pappano, 2012). According to Daniel (2012, p. 1), "MOOC is an online course that aims at large-scale participation and open access via the web; MOOCs are a unique phenomenon in the development of Open and Distance Learning." The design and participation in MOOC could be similar to that of a higher institution but do not offer credits awarded to students that are paying school fees at a higher institution. However, assessments of learning are done where certification is involved (Daniel, 2012).

The fastest facilitator of distance and flexible education, the 'web' has created new modes of delivery for online instructions and instructional materials via Massive Open Online Courses. It should be stated that simply placing instructional materials online does not provide effective solutions for teaching and learning problems. Specifically, without applying appropriate instructional strategies and theories with the features of the web, the expectation of higher learning outcomes may not be attained (Wang & Reeves, 2007). However, the advent of MOOC has attracted millions of participants across the world. *Coursera*, (2013) a company founded in April 2012 by two Stanford University computer scientists announced that they hit the 4 million registered students mark and they have grown to offer over 400 courses from 86 educational institutions across the world. For these reasons, many interests, discussions and activities have centred on the dynamics of MOOC as the whole idea originated from Open Education Resources (OER) movement (Littlejohn, 2013), which is discussed in the next sub-section. MOOCs are a recent online phenomenon, although they were first developed in 2008 but now they are generating media attention and significant interest from higher education institutions and venture entrepreneurs (such as eDX, Coursera, uDacity, Udemy, P2Pu and Khan Academy) that saw potential business opportunity to be exploited. With the tremendous growth and popularity that MOOCs are drawing, Downes (2008, p. 2) stated that "academic papers on MOOCs began to appear in peer-reviewed papers (i.e. conference proceedings, journals and professional magazines) with an increasing number of publications featuring MOOCs each year." In addition, this fact has been proven as many scholars have written many scholarly articles on MOOCs since 2008 (Ardis & Henderson, 2012; Bull, 2012; Cabiria, 2012; Daniel, 2012).

The design of MOOC was based on an approach that knowledge is distributed across a network of connections (i.e. networked learning) termed 'Connectivism' (Siemens, 2005). The term and first MOOC were created in 2008 during a course on Connectivism and Connective Knowledge (CCK08) conducted through the learning technology centre at the University of Manitoba by Stephen Downes, and George Siemens (Downes, 2012). The CCK08 course was designed for 25 fee-paying learners and roughly 2200 other learners joined in the course without paying, participating using various form of social media tools of choice, which include blog posts, synchronous online meetings, virtual world and RSS feeds. Due to the size of enrolled learners, the CCK courses were called *massive* open online courses.

MOOCs have been branched into two broad categories, which are known as the *x*MOOCs and *c*MOOCs (Daniel, 2012). They are distinct in pedagogy and definitely require categorization and most MOOCs are designed to be instructive and followed the '*Connectivist'* pedagogical approach (Hill, 2012). Most recent types of MOOCs that are getting media and organizational attention fall under the *x*MOOCs category. The new generation of contemporary educational technology institutions, such as Udacity and Cousera MOOCs style are referred to as *x*MOOCs (Liyanagunawardena, Adams, & Williams, 2013). According to Caulfied, (2013) the community of the *x*MOOC should learn from the *c*MOOCs community (early courses) because members of the *c*MOOCs community never end their relationships even after completing or finishing the *c*MOOC. The relationship persists and people often cite valuable relationships they developed in the *c*MOOC as one exponential value and the focus is rather more on community and connections (Rodriguez, 2012). On the other hand, Caulfied's perception is that the *x*MOOCs have a community problem when compared to the *c*MOOCs. *x*MOOCs community are less robust because they are not persistent and it only connects students as students and not as colleagues, the persistent relationship will be discontinued once students complete or finish the course.

For *x*MOOCs to be persistent and have effective communities, Caulfied (2013) suggests that the *x*MOOCs will have to become the core centre of the *c*MOOCs, depicted in Figure 3.3.

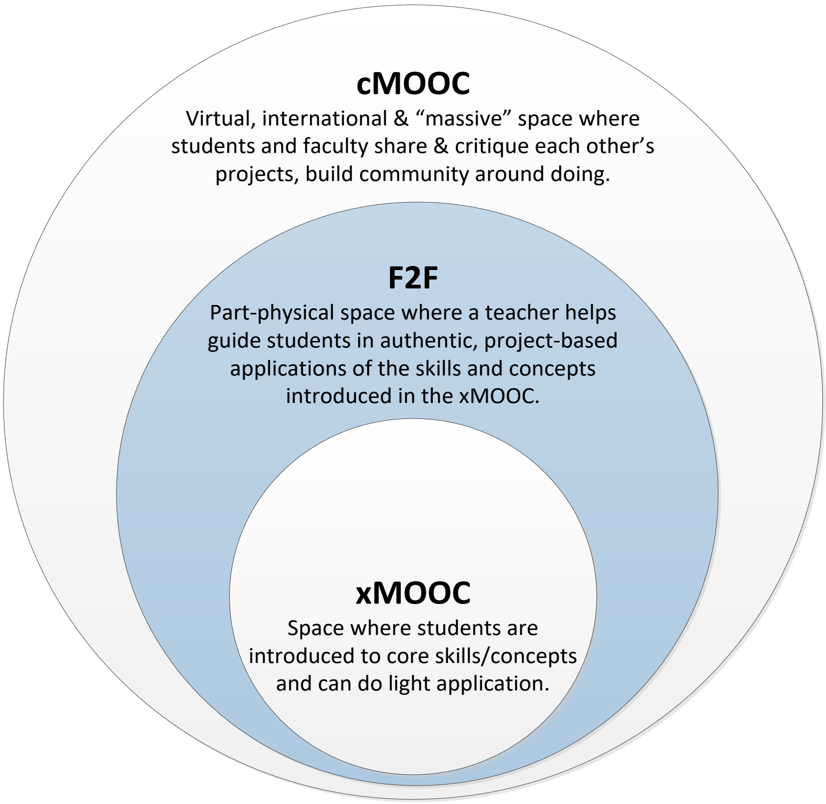


Figure 3.3 Classification of MOOC (Caulfield, 2013)

In conclusion, the primary focus of the social interaction should not only be based around the course alone but should consider and encourage interactions around individual work and interest. By so doing, the xMOOCs communities will thrive and survive even after the completion of the course.

3.8.1 Current Status of MOOCs

The evolution of MOOCs since its inceptions in 2008 has seen an increasing visibility of institutions across Europe and U.S in recent times. According to Aydin (2017), the current status of the MOOC movement is receiving a positive reaction as the demand for MOOCs is growing faster than the supply side of the movement. The study indicated that there are more numbers of institutions providing MOOCs in the U.S and Europe but less providers in Turkey as the country shares over 95% of its landmass with Asia. Aydin (2017) further identified that language barriers, recognition of prior learning, reputation, legislation, absence of awareness, knowhow and infrastructure were among the shortcomings and challenges that affect the provision of MOOCs by institutions in Asia. According to Iqbal, Naeem and Nayyar (2016), the future of MOOCs is still evolving and the prospect of MOOCs will soon become clearer with time. In addition, MOOCs have stimulated educational research, it has invigorated the organisation of standard teaching practices and despite this significant influence, a small number of people from developing countries (such as in Africa and Asia) take advantage of MOOCs.

3.9 Open Education Resources (OER)

The term Open Education Resources was first recommended and adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) which was described as "open provision of ICT-enabled educational resources for use, consultation and for adaption by a community of people for non-profit purposes" (UNESCO, 2002a, p. 24). There are 3 other alternative labels for Open Education Resources which include Open Teaching/Learning Resources, Open Learning Resources and Open Courseware. It was made clear and recommended by UNESCO that the community of users should make Open Educational Resources materials available through the Web or post them on the Web as soon as they are available for global usage and since it for non-commercial purposes, they should seek international assistance to make the materials widespread.

It is important to provide more definitions of the term Open Education Resources for better positioning. According to Conole and McAndrew (2010, p. 1), Open Education Resources are "teaching and learning materials that are freely made available for use and repurposing by teachers and learners." Emphasis made on the 'Open' is momentous as this involves open licenses that allow the usage and reusage of the resources available. Another definition describes Open Education Resources as learning activities that consist of several tasks a student or learner undertakes, individually or in groups with the use of particular resources to achieve a set of projected learning outcomes. The resources may include tools "Software, content and learning management systems and online learning communities", learning contents "courseware, journals, content modules and full courses" and implementation resources "intellectual property license, content localization and principles of best practice" (Conole & McAndrew, 2010, p. 6).

Also in 2002, when the term Open Education Resources was adopted, the Hewlett Foundation initiated a world-wide OER program to catalyse its global access and usage to high-quality academic materials. Then, the most cited definition by Hewlett Foundation, describes Open Education Resources as "High quality teaching, learning and research resources that exist in the public domain which have been released under intellectual property licenses that allows their free use or re-purposing by others" (Ehlers, 2013, p. 84). Organisation for Economic Co-operation and Development (OECD) defines Open Education Resources as "Digitised materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research purposes" (Hylén, 2006, p. 1). The most important initiative is that of the Creative Commons (CC) which also 'allows' (permits) the specific rights for the usage, modification, encouraging, copying, and the sharing of digital materials by creating open licenses (Evans & Haughey, 2014). All these events contributed to the development of Open Educational Resources which has enriched access to digital materials available to distance educators, students and self-learners. Today, many institutions have created their various versions of Open Courseware. The main providers of Open Education Resources include Universities, Education communities, governments and research institutions (Tovar & Piedra, 2014).

The Open Educational Resources emergence is part of a larger trend towards 'Openness' in higher education environments which also include the well-known movement of Open Access (AC) and Open Source Software (OSS), (Downes, 2006). A number of centres as well as a number of online repository hosts have arisen to provide Open Educational Resources. To mention a few, the Globe Repository, the Reusable Learning Object Centres, and Open University in United Kingdom have developed a global research support for Open Education Resources users (Conole, 2010). The largest international OER organization is the Open Courseware (OCW) Consortium which was renamed to Open Education Consortium (OEC), (Tovar & Piedra, 2014). Simultaneously, online and web-based course tools were explored which resulted in the development of Learning Management Systems which were first introduced in the late 90's and the focus on Learning Management Systems paved the way for the focus on information access (Evans & Haughey, 2014). Simultaneously, online and web-based course tools were explored which resulted in the development of Learning Management Systems which were first introduced in the late 90's and the focus on Learning Management Systems paved the way for the focus on information access (Evans & Haughey, 2014).

Google and Yahoo initiated the accessibility of indexed web information in order to provide online access to scholarly materials in a common place across numerous fields, which prompted the likes of the Massachusetts University of Technology (MIT) in 2001 to launch its Open Access (Open Courseware) to online components of courses offered (Zawacki-Richter & Anderson, 2014).The use of Open Education Resources (OER) provides several opportunities for both distance learning education and in the classroom. According to Radu and Andone (2014), many OER projects and initiatives have been produced from over 1000 academics that were involved in the Romanian OER implementation and adaptation for the DidaTec lifelong learning and training in higher education between 2010 and 2013. The project aimed at creating modern education instruments and blended learning technologies that will enrich teaching and learning in the higher education institution environment by providing training in the use of ICTs and modern technologies. OER has become one of the disruptive technologies, amongst which can be included the Internet, Cloud computing and Web 2.0 technologies to mention a few, these technologies are introduced into the educational environment and they have drastically affected methods of delivering learning and educational paradigms as a whole (Tuomi, 2013). More especially, the Web 2.0 technologies have enabled its users to create ubiquitous knowledge which has taken different forms which have had a great influence on distance education, face-to-face learning, online education and open education. It can be seen that the Open Education Resources framework emerged from these concepts and innovations (Radu & Andone, 2014).

The amount of OERs available across the world is increasing (Navarrete & Luján-Mora, 2015), which has prompted companies to invest in the provision of OER services. Michigan State University and Global Food Safety Initiative collaborated to create low-cost training and high-quality education on food safety for developing countries with the use of Open Education Resources (Geith, Vignare, Bourquin, &

Thiagarajan, 2010). Unfortunately, Navarrete and Luján-Mora (2015) reported that only a few directories can be consulted about OER (Discover an Open Source World; OER Quality Projects and the Commonwealth of Learning) as there is lack of unique references or a directory about them (Fox, 2013; Atenas, 2014; COL, 2015).

3.10 Mobile Digital Literacy and Mobile Learning

It is important to unpack the literal meaning of digital literacy before proceeding to defining mobile digital literacy and mobile learning. "The term 'digital literacy' is described as the ability to access information and communications technology and digital media, to critically evaluate and understand the different aspects of digital media and other media contents as well as to be able to communicate in a number of ways" (Ala-Mutka, Punie, & Redecker, 2008). Digital literacy is way more than acquiring the knowledge to send text and watch videos online. Digital literacy means possessing the knowledge and ability required to use a wide range of technological tools such as laptops/notebooks, tablets, smart phones and desktop computers (Nagpal & Sangeeta, 2013).

Shah (2015) described the unique difference between digital literacy, digital skills and computer literacy. As depicted in Figure 3.4, Computer literacy precedes digital literacy and it is referred to as the knowledge and skills required to use traditional computers because it requires practical skills in the use of software application packages.

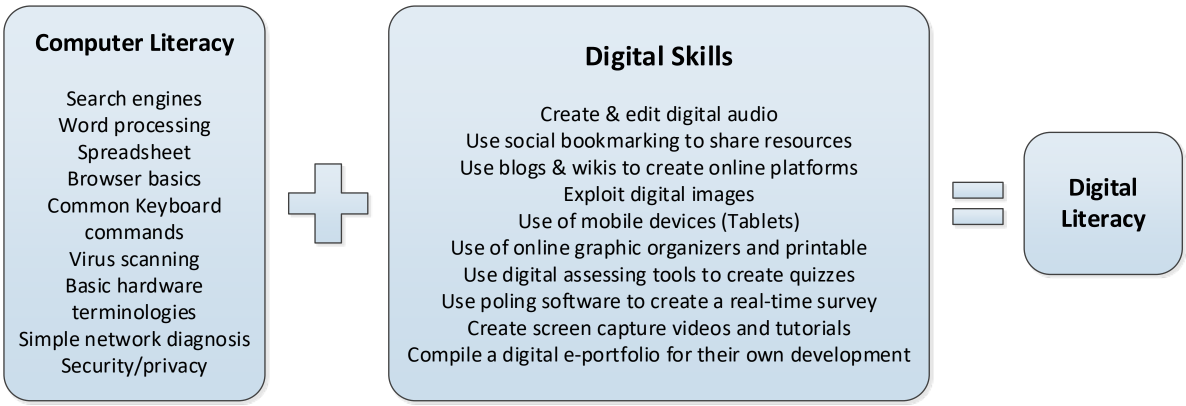


Figure 3.4 Digital Literacy (Shah, 2015, p. 254)

According to Eshet-Alkalai (2004, p. 93), "mobile digital literacy involves the ability of an individual to use mobile digital devices anywhere, anytime and the ability to understand the use of digital technologies efficiently for day-to-day tasks." The resulting advantage of becoming digitally literate plays a vital role and may provide solutions to problems and challenges in the present education system (ESS, 2014). Digitally literate learners tend to be more critical, creative and collaborative in the ways they approach learning and solving problems (Cobcroft et al., 2006). It was argued that institutions must teach and integrate concepts and techniques to allow learners to work with digital devices and to adapt to new technology using the concepts they have been taught (Lin, Widdall, & Ward, 2014). This is because digital literacy involves the use of emerging technologies to communicate meaningfully across technological, cultural, social, language and intellectual barriers.

Knowing that the transformation of manual processes into automated processes is gaining momentum each day as technology evolves, digital literacy has become essential in our day-to-day existence that it is inevitable and almost impossible to ignore (Ala-Mutka, Punie, & Redecker, 2008). In addition, "the growing accessibility of low-cost mobile devices and wireless devices and related infrastructure offers both opportunities and challenges for educational institutions, including their learners and teachers" (Cobcroft, Towers, Smith, & Bruns, 2006, p. 21). It is however, for this purpose that learners and teachers equally should be prepared in advance and should be knowledgeable in mobile digital literacy.

The growth of ICTs and the development of mobile internet initiated mobile learning system. However, mobile learning, just not a blend of mobile technology and learning practices but implicitly means mobile e-Learning, which is developed for the continuation of the conventional e-Learning system (Traxler, 2009). "m-Learning is seen as e-Learning using mobile device and wireless transmission" (Pieri & Diamantini, 2009, p. 184). Mobile learning is construed as a branch of e-learning. It shares similar attributes with e-Learning, which embraces the usage of mobile telecommunication technology and devices to provide pedagogical solutions. Some of the mobile technologies include wireless mobile telecommunication services: Data services, Voice services, Short Message Services (SMS), and Multimedia Message Services (MMS). Mobile technology devices such as the Personal Digital Assistance (PDAs) including Tablet Personal Computers (TPCs), Smart phones, Laptop PCs and Mobile phones are used to provide various educational solutions (Traxler, 2005). The learning phase of m-learning is not bound to a location or region with specific characteristics but through the use of mobile telecommunication technology it allows anyone at any given time to access or transfer information and learning materials anywhere subject to Internet availability across the world (Hartnell-Young, 2007).

Currently, mobile learning exploits the use of handheld computers, mobile telephones as well as other mobile devices that draw on the same set of functionalities (Scott, 2008). More so, mobile telecommunication technology and devices represents new range of mobile technology innovations that offer friendly and faster access to information sharing between educators, instructors, learners, stakeholders, managers or anyone motivated to use the technology at any given time (Selwyn, 2003).

The results of these mobile technological innovations have led to the significance and the need for mobile learning in the society and there is substantial evidence that suggests that mobile learning is a growing educational platform. Numerous and frequent conferences, workshops and seminars have been set up nationally and internationally towards the development and of mobile learning. These conferences and seminars have visibly and significantly suggested the innovation of mobile learning as 'the next big thing' (Cavus & Ibrahim, 2009; Wang, Wu & Wang, 2009 cited in Lominé & Buckhingham, 2009). The field of mobile learning is developing fast as research subject and various groups of researchers have categorized it into four divisions with different definitions to describe its concepts (Winters, 2006) as depicted in Figure 3.5.

"Mobile learning is defined by its relationship to e-Learning, where mobile learning is seen to lean-to e-learning".

"Mobile learning as technocentric, where learning makes use of mobile technology and devices including the PDAs, mobile phones and other mobile devices".

"Mobile learning as enhancement to formal education".

"Mobile learning as people-centred learning, enabling the likelihood of lifelong learning".

Figure 3.5 Four Definitions and Categories of Mobile Learning (Winters, 2006, p. 4)

However, much interest, discussion and activity has been generated around the capacity of mobile telecommunication technology and devices to deliver, enhance and support learning for the disadvantaged, marginalised, under-developed as well as developed communities and regions across the world especially in Africa (Traxler, 2011). The acceptance and ownership of mobile phones and other mobile technology devices has cut across the world (Howard & Mazaheri, 2009). In general, mobile telecommunication technology coverage and expansion has taken learning to many regions of the world and for this reason, mobile learning over the years will allow every citizens of the world to access learning materials, communicate and share information from anywhere, at any time through the usage of these mobile technologies (Scott, 2008). Without doubt, the use of ICTs may improve teaching and learning outcomes when integrated optimally with learner-centred instructions. Wireless phones, notebook computers and the rapid improvement in the Internet proficiencies have transformed the landscape of higher education; where mobile learning is seen as the follow up to the e-Learning technology that originated from distance education (Wang, Wu, & Wang, 2009).

3.11 Web 2.0

Background to the technology phenomenon of Web 2.0 is presented in this section as collection of technologies, social trends and business strategies that are more dynamic and interactive than their predecessor, the Web 1.0 which allows its users to access Web site contents and contributes to it (Murugesan, 2007). Also referred to as the 'social Web', 'wisdom Web', 'read/write Web', 'participative Web', 'people-centric Web', Web 2.0 expanded with Web 2.0-based social applications such as *Wikis, Social Networking Sites* (e.g. Flickr, MySpace, Facebook and YouTube), and *Blogs* (Maamar, Buregio, Faci, Benslimane, & Sheng, 2015). According to the London School of Economics (2016), Web 2.0 is much about uploading and downloading contents, allowing its users to share their images and video files easily together with their thoughts and knowledge online.

Williams, Rice and Rogers (1988, p. 120) categorized "Web 2.0 as new media and the new media are described as the integration of new information and communication technologies into traditional media." O'Reilly (2005) indicated that Web 2.0 is different from traditional media in the sense that its focus is mostly on user-generated contents, collective intelligence principles and collaboration. By its very nature, as described in Figure 3.6, the collaboration in Web 2.0 can be described as many-to-many type of communication, where its predecessor (Web 1.0) is described to be one-to-many type of communications.

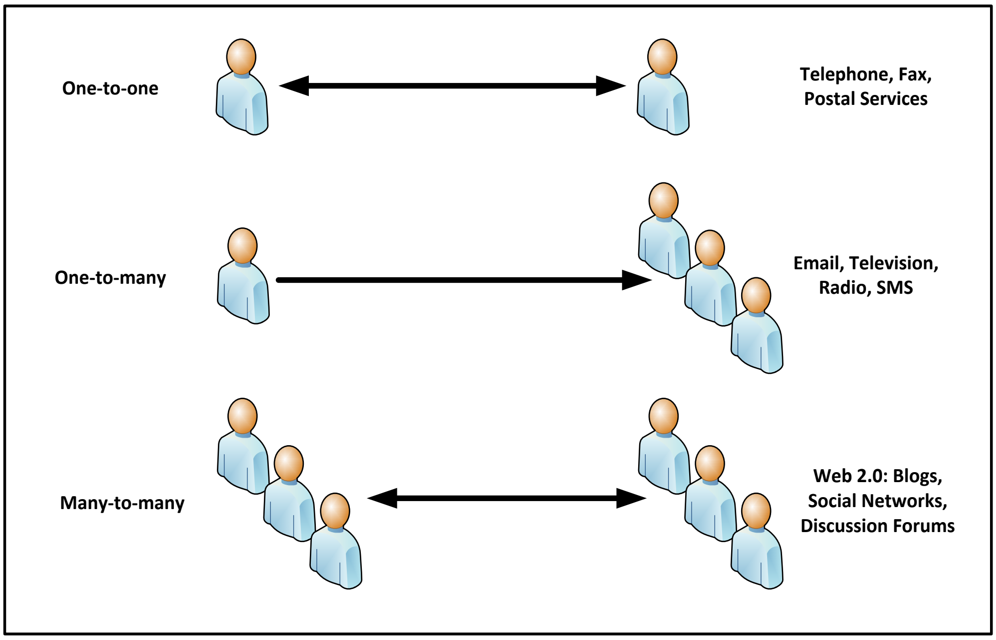


Figure 3.6 Communication Modes, (Pillay, van Niekerk, & Maharaj, 2010)

It is understood that Web 1.0 provided content on demand where an audience could go online and access their desired content at any time while the audiences in the traditional media were restricted. In the second category, interaction was provided to an audience, where the audience was able to provide some sort of feedback to the broadcasters through hot-lines, SMSs and e-mail. In the Web 2.0 category, a more interactive means was provided where users are now able to generate their own content and also comment or leave feedback on the content others have created and shared online.

There is continuous growing interest in integrating Web 2.0 technologies into various areas such as business, education and healthcare. It was predicted by *Forrester Research* (2008) that the value of enterprise Web 2.0 will increase (Perez, 2008). In the context of education, the provision of an effective interactive learning environment is an important issue (Wan, 2010), where it is important to provide different types of interaction, some of it being teacher-to-student, student-to-content and student-to-student. Today, most e-Learning contents are created, authored and delivered through centralized learning management systems which focus more on people-driven models than technology-driven models (Usluela & Mazmana, 2009). The types of interactions to be provided within any e-Learning platform should not be limited to video and audio, but they also require that students should have the presence of the distance lecturer and peers through interaction or connectivity. Interaction provides a sense of belonging because, without it, learners may feel isolated, autonomous, or eventually become discouraged and drop out (Chatti, Klamma, Jarke, & Naeve, 2007). Collaborative culture can foster knowledge networking as well as build community. This learning model should be characterized by the combination of both informal and formal learning within a social context as newly acquired social skills become increasingly important for better performance and continuous improved learning (Wan, 2010).

3.12 Social Networking

Web 2.0 innovation has led to the increasing attraction of Social Network Sites (SNSs) to everyone including learners, academics and industry researchers due to their affordability, accessibility and reach (boyd & Ellison, 2007). According to Ellison, Steinfield, & Lampe (2007), social network sites, which are also referred to as Online Social Networks (OSNs), allow person(s) to present and express themselves through their feelings and emotions by participating in the social networking site. The creation of social networking sites such as Instagram, LinkedIn, Facebook, Pinterest, Google Plus+, Twitter, MySpace, ClassMates and Vine, have attracted billions of users across the world and many of the users have integrated these sites into their daily practices and routine. There are hundreds of social networking sites that cater for a wide range of interests and practices.

Involvement and participation in online social networks have become the way people communicate and interact in the 21st century as people now use social networks to connect with other people almost anywhere in the world (Tobi, Ma'on, & Ghazali, 2013). Studies have shown that participation in online social networks has contributed towards the improvement of people’s confidence and has increased their levels of satisfaction with regard to their needs and sense of belonging by sharing similar feelings and interests with their online contacts. They have contributed to peoples’ happiness and have influenced a positive health status (Ellison, Steinfield, & Lampe, 2007; Cohen & Janicki-Deverts, 2009; Boontarig, Chutimasakul & Papasratorn, 2013; Tobi, Ma'on, & Ghazali, 2013).

Similar to the description of Web 2.0 in the previous sub-section, “Online social networking is described as web-based services that allows a person/user/individual to create profiles and to upload images, texts and videos by interacting with other people in various ways” (Boontarig, Chutimasakul, & Papasratorn, 2013, p. 25). The integration of online social networking into education, especially into e-Learning systems, enriches and enables sharing of knowledge, capturing of knowledge and collaboration (Kadry & El Fadl, 2012). Social networking technology attracts new generations of students and makes them feel comfortable and fit into the culture of higher institutions. New generations of students are known to be demanding and tech savvy when it comes to their use of new technologies for virtually everything they do. It supports and encourages their loyalty to development and technologies. They should be provided with similar technologies that they use in their social lives to support their learning activities (Crook & Harrison, 2008).

As many institutions use traditional technologies such as e-mails, bulletin boards and many more to administer their courses, social networking sites have found their way into the classrooms (Lampe, Ellison, & Steinfield, 2006). According to Kadry and El Fadl (2012), there are mixed feeling towards the use of social networking sites for educational activities. Their study shows that there are concerns associated with an instructor's or teacher's privacy and some faculties are of the opinion that the technology does not contribute to academic endeavour. On the other hand, the study highlighted that there are many others who have supported the idea of using social networking sites for educational purposes (Fischman, 2008; Forte, 2006; Hewitt & Selwyn 2007). When social networking sites are used appropriately in the learning context and the accessibility of the technology is carefully evaluated in terms of pedagogical requirements, the tool offers significant advantages for both distance learning and traditional learning institutions (Greenhow, 2011). Some of the positive features of the tool are its impact on learners' motivation to learn, learners' engagement, collaboration and personal interaction within the learning environment (Kadry & El Fadl, 2012). Due to these positive impacts, learners are able to share knowledge, interact socially and learn because the construction of collective intelligence is significant in improving their various skills and abilities. According to Ahmed, Khan and Ahmed (2014), the impact of social networks has changed the approach of storing, accessing and sharing information within and outside the education institutions.

3.13 Internet of Things (IoT) in Higher Education

The massive growth of information available on the Internet and the increasing number of people accessing this information have created the need for new technologies that can assist in finding resources of choice and interest (Salman, Abu-Issa, Tumar, & Hassouneh, 2015). One new concept or technology associated to future Internet is known as the "Internet of Things" (IoT). In the IoT, people are not the only ones connected to the Internet through their computers, laptops and smartphones, but the Internet of Things allows many other objects such as houses, medical instruments, cars, elevators and many other objects to be connected to the Internet (Ashton, 2009). The future of such connectivity, or 'always connected' is already here and has been partially applied in some countries and in different sectors, including education. The objective of the Internet of Things is to connect anything at any time from any place or anywhere and for anyone, and education is also on the list (Gavras, Karila, Fdida, May, & Potts, 2007).

This means that the Internet of Things describes a world where different types of objects become part of the Internet. Every object (thing) will be uniquely identified and accessible on the network by knowing its location, position and status (Coetzee & Eksteen, 2011). The Internet of Things is based on the Internet and supported by a selection of information-processing equipment and sensing identification devices including Global Positioning Systems (GPS), Just in Time (JIT), Geographic Information System (GIS), Radio-frequency Identification (RFID), Electronic Data Interchange (EDI) and many other modern electronic technologies (Fan & Zhou, 2011).

As of 2016, it was noted that students in higher education institutions are increasingly moving and shifting away from paper-based books towards laptops and tablets (eBooks) with all the information they require at their fingertips. As much as this trend provides convenience for students, it also facilitates teaching processes and makes it more efficient for lecturers to focus on the most important instructions valuable to the learners (Meola, 2016). The IoT allows devices/objects to be connected to the cloud which enable lecturers to gather information or data on the students by determining which of their students require the most individual attention and academic support. Data gathered by the lectures will also allow lecturers to properly modify their lesson plans for future classes. In addition, IoT will enable universities to use connected devices to the cloud to monitor their students, resources and staff at reduced operational cost. Another advantage of such tracking capability will lead to safer learning environment and/or campuses. Students will also be able to monitor and keep track of connected objects such as buses, library seats and devices in laboratory (Meola, 2016).

In addition to the concept of the Internet of Things, another successful concept of the technology is the *Recommender System* (RS) described in the next subsection.

3.13.1 Recommender System

According to Adomavicius and Tuzhilin (2005), the Recommender System is a type of system that makes recommendations to users depending on their background and personalization in order to provide personal, most affordable and high-quality recommendations using data-mining techniques and prediction algorithms to predict people's or user's interest in products, services and information available amongst the vast number of items available on the Internet. Some of the Recommender systems available include, but are not limited to Amazon, MovieLens, WhatshouldIReadNext, Last.fm, StumbleUpon, MyStrands, ChoiceStream, Netflix, Pandora, CleverSet and Whattorent.com (Deitel, 2016). To describe a few, Amazon recommends books to it users, based on what they have purchased or bought in the past and what other similar users have purchased in the past. Another example is Netflix, which recommends a movie or movies to its subscribers, based on member reviews, popular rentals and how they rate movies.

Recommender System cannot function without the Web. However, the Recommender System was initially designed to use information from Web contents, demographic and collaboration-filtering techniques, but the introduction of Web 2.0 has advanced the system's capability with the integration of social information such as friend's list, followers, followed, posts and tags (Salman et al., 2015). The integration of context-based filtering techniques was also introduced, where context is referred to real time, known information about the user, such as, location of the user at a given time and temperature of the location (Adomavicius & Tuzhilin, 2005). This system is promising in the Internet of Things environment where a lot of information about the user context will be available. The integration of the system into the network will provide more smart processes and services to support our education, economies, health and environment (Fleisch, 2010).

According to Rui and Danpeng (2015, p. 206), "the IoT technology continues to aim at building a set of networks where every object will be connected and, without efficient storage and computer power (which is the benefit of Cloud Computing), the concept of the Internet of Things will not be successful. The next subsection unpacks the technology of cloud computing."

3.14 Cloud Computing: Application in Education

The evolution of the IoT greatly rely on storage efficiency and computing capacity. High-storage efficiency can be regarded as one of the benefits of cloud computing which serves as the basis of the Internet of Things (Rui & Danpeng, 2015). In addition, the Internet of Things can be described as the combination of cloud-computing technology, information-processing equipment and sensing identification devices to collect and organize data and information which is then transmitted to the application layer of the cloud computing platform (Hamad, Smalov & James, 2009; Zhu, Yang& Yu, 2010). This process is described in Figure 3.7.

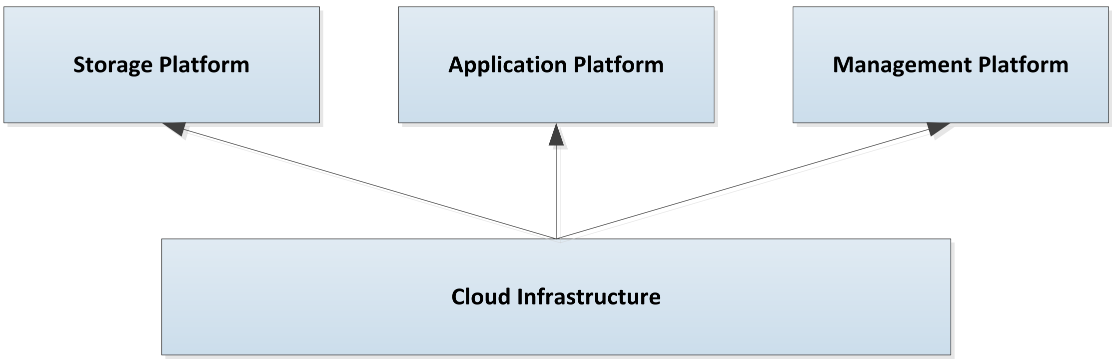


Figure 3.7 Cloud Computing Combined with the Internet of Things (Rui & Danpeng, 2015, p. 206).

In the application layer, data are shared and exchanged and users are also able to manage and control the entire system. Cloud computing is delivered with Internet connection with an advantage of nearly boundless storage capacity and computing capacity over the conventional computing model (de Leusse, Periorellis, Dimitrakos, & Nair, 2009; Yuriyama & Kushida, 2010; Zorzi, Gluhak, Lange & Bassi, 2010). The concept is about the delivery of information technology services that takes place in a Web browser via the Internet and the type of services provided ranges from modification of familiar tools like e-mail storage services and personal finance offered to social networks and virtual worlds (Masud & Huang, 2012). "The technology of cloud computing combines parallel, distributed and grid computing because it integrates multiple computer units to become a powerful computing system and the brilliant computing power is assigned to end-users through applicable technologies which makes it cost-effective" (Yuriyama & Kushida, 2010, p. 2).

The Cloud computing model/paradigm enables "convenient and on-demand network access to a shared group of configurable computing resources (i.e. servers, applications, platforms, networks, and services) that can be provided promptly with the smallest amount of management effort" (Ghazizadeh, 2012, p. 199). Recent information technology trends which include the ubiquity of broadband, advanced improvement in Internet-computing software and hardware, wireless networking and decreasing storage costs/charges are the driving forces behind cloud-computing technology (Alshuwaier, Alshwaier, & Areshey, 2012). This technology provides more efficient computing by combining computing capacity of PCs, servers, memory and storage (Al Noor, Mustafa, Chowdhury, Hossain, & Jaigirdar, 2010). Users of the technology do not require any form of knowledge and expertise to control the infrastructure part of clouds because an instruction manual or booklet is sufficient to utilize the services. The ease of use enables users to experiment with new services, request more capacity, as well as remove unwanted capacity (Zorzi, Glukah, Lange, & Bassi, 2010).

According to Ghazizadeh (2012), there are three different types of cloud computing:

- Public Cloud;
- Private cloud; and
- Hybrid cloud

The public cloud which is usually run by a third-party company and made available in a pay-as-you-go method to the public (Armbrust, et al., 2009). This type of cloud provides storage systems and network services to users or clients such as utility computing, meaning one pays for only what one uses (Jain & Bhardwaj, 2010). Typical examples of public cloud service providers are Amazon Web Services, Google AppEngine, and Microsoft Azure. Private cloud is the second and it is built by one client, this means, a company builds its own infrastructure and deploys its own data security, enterprise datacentre and quality of service. Hybrid cloud is the combination of both Public cloud and Private cloud models. In this category, external on-demand provision of networking and hardware facilities are provided.

The learning Cloud computing and the application of Cloud Computing can be relevant in different sectors of our everyday life such as in Business, Health and Education, but, for the purpose of this study, it will be narrowed down to its application in education. Alshuwaier, Alshwaier and Areshey (2012) describes education as a self-instructing process and an important aspect of human life because of its capability to equip people with the requirements needed to make their goals and dreams achievable. There are different definitions and descriptions to educational cloud computing, but one common denominator is that the application of cloud computing provides flexibility to all schools, institutions and universities (Armburst et al., 2009; Bala, 2010; Al Noor et al., 2010). IBM (2009) indicated that educational cloud computing has the capability to channel the power of thousands of computers to a problem which will allow scholars and researchers to search, find theories and make findings/discoveries faster than ever in order to help build a smarter planet.

Keeping pace with the ever-increasing resource requirements and low energy costs in institutions/universities are some of the efficiencies of implementing cloud computing (Ghazizadeh, 2012). Many universities are now recognizing the efficiencies of using cloud computing as it allows educators to focus on researching and teaching rather than on complex configurations of computers and systems (Alshuwaier, Alshwaier, & Areshey, 2012). “It provides the use of application facilities such as software applications, data access, storage resources and data management without requiring users of cloud computing to know the location and other details of the computing infrastructure” (Bimol, Saikia, & Devi, 2014, p. 223). Implementing Cloud computing in an educational environment will allow every kind of user from anywhere and anytime, access to databases and applications (Bala, 2010). Figure 3.8 depicts the structure of the main users of cloud computing in an educational environment.

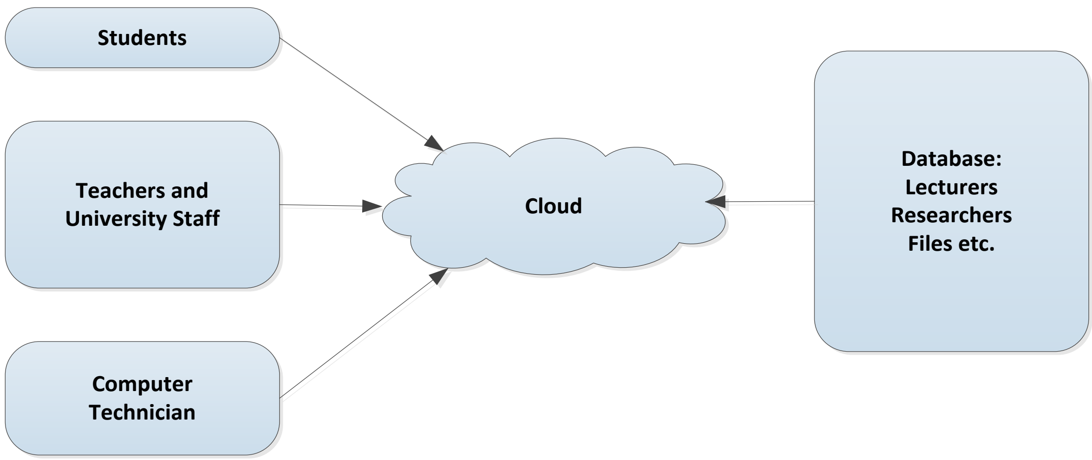


Figure 3.8 Users of Cloud Computing in Educational Environment (Ghazizadeh, 2012, p. 200).

Cloud computing allows users to use applications without the need for installation and gives access to their personal files in any computer provided it has Internet access (Voas & Jia, 2009). Students and university staff make use of many technologies in their personal space and using application-based cloud computing can improve the way they communicate while saving time (Ghazizadeh, 2012). University teachers/lecturers are able to manage, prepare and upload teaching materials such as documents, lecture slides, tutorial letters, presentations and articles, into the cloud with the use of modern technologies. Other users in educational-cloud computing are the Computer technicians who are able to build, provide and test cloud-based applications on the cloud infrastructure and servers. The service is available 24 hours and accessible everywhere there is Internet connectivity, at low cost.

According to Bimol, Saikia and Devi (2014), cloud computing is divided into three segments or levels: Application, Storage and Connectivity. Each of these segments has different cloud-computing services offered over the Internet and are also broadly categorized into three areas, namely, "Application Cloud Services – Software as a Service (SaaS), Storage Cloud Services, referred to as Platform as a Service (PaaS) and Processing Cloud Services known as Infrastructure as a Service (IaaS)" (Bimol, Saikia, & Devi, 2014, p. 223). Each of these cloud services offers different types of services as elucidated below:

- **Software as a Service (SaaS)**: This enables package interaction to a client that is completely hosted on an external infrastructure. It offers collaboration and online communication between university staff (i.e. Lecturers, Administrators) and students (Bala, 2010). "The applications are accessible from various clients' devices through either a client interface e.g. Web browser" (Mell & Grance, 2011, p. 2). Furthermore, the services provided allows users/clients to use the cloud computing applications that is administered on a cloud infrastructure;
- **Platform as a Service (PaaS)**: This is a substitute local file system (Bimol, Saikia, & Devi, 2014). It delivers software and associated services without the need for download or installation (Rouse, 2014). The educational platform consists of operating systems with storage and consumable web-based services; and
- **Infrastructure as a Service (IaaS)**: This serves the scalability and affordable computing for running enterprise programmes (Bimol, Saikia, & Devi, 2014). It offers virtual services including remote delivery of a full computer infrastructure. Using this type of service for education implies scaling with ease and speed to provide the efficient infrastructure needs of universities (Alshuwaier, Alshwaier, & Areshey, 2012).

The three services identified above are also called the 'SPI model' (SaaS, PaaS, IaaS) Mell & Grance (2011). In addition, Al Noor, et al., (2010) included e-Learning as a Service (EaaS) as another category of cloud service. It provides students with e-Learning services which include management of utilities and interfaces to support part of the learning process.

Cloud computing offers several benefits for e-Learning and educational systems by providing centralized data storage, virtualization and many other educational services (Ghazizadeh, 2012). Cloud computing supports collaboration as technology is frequently improving the ability to collaborate and communicate with each other (Bala, 2010). Many universities in Africa may still be in their adoption phase, but the universities that have adopted the cloud technology, are able to open their technology infrastructure to private and public sectors to enable research advancements (Alshuwaier, Alshwaier, & Areshey, 2012). Universities that are seeking to cut costs by eliminating the need to regularly renew and purchase licenses for software and learning technologies should opt for cloud computing-correlated services (Misra & Adewumi, 2015).

According to many studies conducted in the application of cloud computing in educational environments, the many benefits of cloud-computing implementation also have some risks and limitations. Even though it can assist in gaining access to applications anywhere, and can offer 24 hours accessibility to its services, adhering to policies can be a problem because not all applications are able to run in a cloud. It offers green technology and helps protect the planet, but solutions are still incomplete; it can be available and open to businesses and research environments, but can have safety issues for sensitive data and there are security problems (Pocatilu, 2010; Alshuwaier, Alshwaier, & Areshey, 2012; Chandra & Borah, 2012; Ghazizadeh, 2012; Misra & Adewumi, 2015). Generally, cloud-based learning is envisioned to provide support for pedagogical development, to increase teacher-students output and to reinforce best practice in education especially for developing countries such as Nigeria and South Africa (Oyelere, Suhonen, & Sutinen, 2016).

3.15 Smart-history Technology

Smart-history technology is one of the leading open-education resources for arts and cultural heritage that is freely available online today. Co-founded by Dr. Beth Harris and Dr. Steven Zucker of Khan Academy in 2005, the technology has a collaboration of over 200 art historians, curators, archaeologists and many other professionals who are interested in making the learning contents of art history with high resolution freely available online to global users (Smarthistory, 2016). The technology has since been supported by Khan Academy and has gained recognition by winning numerous awards with its audience increasing to almost 13.5 million views between 2007 and 2015. Several institutions across the world have collaborated in one way or another with the technology. These include Google Cultural Institute, the British Museum and the American Museum of Natural History to mention a few.

According to Harris and Zucker (2016), the Smart history technology features engaging and conversational essays in a continuously growing collection of essays, images and videos that are offered to audience at no cost. Ugoretz (2016) described the technology as one of the most important Open Education Resources available on the web. The recently upgraded Smart history technology places most available work on art within a timeline and allows learners to access additional resources that link with significant high-quality images with 360 degree views, allowing learners to dig deeply into their learning escapades (Harris & Zucker, 2016).

3.16 Top-Rated Learning Tools

This section of the study examined and identified the top 100 learning tools mostly used across the world. The report was compiled in September 2015 from the votes of over 2000 professionals using learning tools for educational and enterprise activities the world over (Hart, 2015). According to the Perpich Center for Arts Education (2016), the learning tool is something a learner or student uses in the process of learning. Learners are able to use learning tools to work through big ideas and concepts which could assist them to think, plan and/or for decision-making on methods of creating, executing and responding to learning activities.

In this study, a '*learning tool'* is referred to as any online tool, service, software and devices that can be utilized for teaching and learning, training and/or for personal learning purposes. There are over 240 learning tools and the combination of all the learning tools for "teaching and learning" can create a comprehensive learning atmosphere where instructors or lecturers can provide learning scenarios for learners to acquire necessary skills and have theoretical understanding of the tools which can be useful in their future jobs (Sancristobal, et al., 2012).

The list of the top 100 learning tools released in 2015 is shown in the Table 3.1 with brief descriptions of their functions.

Table 3.1 Top 100 Learning Tools (Hart, 2015)

Ranking	**Tool**	**Description**
1	Twitter	Social network and micro-blogging site
2	YouTube	Video sharing site
3	Google Search	Web search engine
4	Google Docs/Drive	Office suite & file storage service
5	PowerPoint	Presentation software
6	Dropbox	File storage & synchronization
7	Facebook	Social network
8	WordPress	Blogging/website tool
9	Skype	Text and voice chat tool
10	Evernote	Productivity tool
11	Prezi	Presentation creation and hosting service
12	Wikipedia	Collaborative encyclopaedia
13	Pinterest	Pinning tool
14	LinkedIn	Professional social network
15	Moodle	Learning management system
16	iPad and Apps	Apple tablet and apps
17	Kahoot	Game-based classroom response system
18	Blogger	Blogging tool
19	PowToon	Animated video software
20	Slideshare	Presentation hosting service
21	WhatsApp	Personal real-time messaging app
22	Google Chrome & Apps	Web browser and apps
23	Google Hangouts	Video meetings
24	Snagit	Screen capture software
25	Audacity	Audio recorder/editing tool
26	Articulate Storyline	e-Learning authoring software
27	Screencast-O-matic	Screencasting tool
28	Yammer	Enterprise social network
29	Padlet	(Prev. Wallwisher) Online noticeboard
30	Word	Word processing software
31	Camtasia	Screencasting tool
32	Socrative	Student response system
33	Khan Academy	Video learning platform
34	Adobe Connect	Web conferencing software
35	TED Talks/Ed	Inspirational tools/lessons
36	Feedly	RSS reader/aggregator
37	Canvas	Learning management system

38	Adobe Captivate	Simulation authoring software
39	Edmodo	Educational social networking platform
40	Google +	Social networking
41	iSpring Suite	e-Learning authoring tools
42	Diigo	Social bookmarking/ annotation tool
43	Google Scholar	Search engine for scholarly works
44	Coursera	MOOC platform
45	SharePoint	Enterprise collaboration platform
46	OneNote	Note taking software
47	Explain Everything	Interactive whiteboard app
48	Videoscribe – NEW	Whiteboard animation software
49	Pocket	Read it later software
50	Nearpod	Interactive presentation and assessment tool
51	Office Mix – NEW	PowerPoint add-in/interactive online video
52	Gmail	Web mail
53	Udutu	Collaborative course authoring
54	Google Translate	Online language translator
55	Keynote	Presentation software
56	Excel	Spreadsheet software
57	Jing	Screen capture and screencasting tool
58	Adobe Photoshop	Photo editing software
59	Google Apps	Branded Google Apps for Bus & Edu
60	Scoopit	Curation tool
61	Schoology	Learning management system
62	Outlook	Email client
63	GoAnimate – NEW	Animated video software
64	SurveyMonkey	Survey software
65	Kindle & App	e-Book reader device & app
66	Google Maps	Interactive maps
67	Notability	Note taking software
68	Google Sites	Web/wiki hosting platform
69	Quizlet	Flashcards & study games
70	Sway – NEW	Web content app
71	Vimeo	Video sharing site
72	WebEx	Web conferencing software
73	Instagram	Social network
74	Firefox & Add-ons	Web browser and add-ons
75	iTunes and iTunesU	Media player & course distribution platform
76	iMovie	Video creation software
77	Blackboard Collaborate	Collaborate Web conferencing software
78	Movie Maker	Video creation software
79	Poll Everywhere	Audience poling software
80	Tweetdeck	Twitter dashboard
81	Canva – NEW	Graphic design tool
82	Trello	Productivity tool
83	Slack – NEW	Team collaboration tool
84	IFTTT	Web-based services
85	EDpuzzle	Video lessons creator
86	Flipboard	Social magazine for iPad
87	Udemy – NEW	Online learning marketplace
88	TodaysMeet	Private backchannel service
89	ThingLink – NEW	Interactive media platform
90	Easygenerator	e-Learning authoring app

91	Lectora Inspire	e-Learning authoring tool
92	Haiku Deck	Presentation software
93	Piktochart – NEW	Web-based graphic design app
94	Adobe Acrobat DC	Adobe PDF app
95	Blackboard Learn	Course management system
96	Wordle	Word cloud generator
97	Mentimeter – NEW	Real-time audience interactive tool
98	SoftChalk	Content Authoring software
99	edX – NEW	MOOC platform
100	Delicious	Social bookmarking tool

The above 100 tools were categorized into four major headings, including Instructional Tools, Content Tools, Social Tools and Personal/Individual Tools. According to Hart (2015), learning tools that were categorized under *Instructional tools* include the MOOCs platforms (Khan Academy, Coursera, iTunesU, Udemy and edX), Learning management systems (Moodle, Canvas, Edmodo, Schoology and Blackboard Learn), Course authoring tools (Articulate storyline, Camtasia, Adobe Captivate, iSpring suite, Office mix, Udutu, Sway, Easygenerator, Lectora inspire and Softchalk) and Quizzing, survey and data collection tools (Google Form, SurveyMonkey and Quizlet).

The next category is the *Content tools* consisting of Presentation tools (Google Slides, Microsoft PowerPoint, Prezi, Slideshare, Keynote and Haiku Deck), Animation tools (PowToon, Explain Everything, Videoscribe, Office Mix and GoAnimate), Video hosting and editing tools (YouTube, TED Talks & TED Ed, Office Mix, Vimeo, MovieMaker and EDpuzzle), Screening tools (Snagit and Jing), Graphics/Inforgraphics tools (Canva and Piktochart), Photo/imaging tools (Adobe Photoshop, Instagram and ThingLink), Audio tools (Audacity), Documentation tools (Google Docs, Microsoft Word, Adobe Acrobat DC and Wordle) and Spreadsheet tools (Google Sheets and Microsoft Excel).

The third category, which is the *Social tools,* covers Webinar/meeting tools (Skype, Google Hangouts, Adobe Connect, WebEx and Blackboard Collaboration), Live event interaction tools (Kahoot, Socrative, Nearpod, Poll Everywhere, TodaysMeets and Mentimeter), Collaboration and Team tools (Google Docs/Drive, Padlet, Trello and Slack), File sharing platforms (Google Drive and Dropbox), Blogging and Website tools (WordPress, Blogger and Google Sites), Public Social Networks (Twitter, Facebook, LinkedIn and Google+) and Enterprise Social Platforms (Yammer, SharePoint and Google Apps).

The last category is the *Personal tools* that involve Search and Research tools (Google Search, Wikipedia and Google Scholar), Email Clients (Gmail and Outlook), Messaging Tools (Skype and WhatsApp), Social Bookmarking and Curation Tools (Pinterest, Diigo, Scoopit, Flipboard and Delicious), Note-taking Tools (Evernote, OneNote and Notability), Web Browsers (Google Chrome and Firefox), Personal Readers, Players and Dashboards (Feedly, Kindle & Reader App, iTunes and TweetDech), other personal productivity tools (Pocket, Google Translate, Google Maps and IFTTT) and lastly, Devices and Applications (iPad and Apps, Kindle and Reader App).

Before the completion of this study, an updated version of the top 200 learning tools was released in September 2016. The 2016 process of evaluating the 200 most used learning tools also adhered to that of the previous year(s). Tables 3.2, 3.3, 3.4 and 3.5 classified the top 200 learning tools for 2016 into the four categories described below.

Table 3.2 Instructional Tools

CATEGORY 1 – INSTRUCTIONAL TOOLS		
Course authoring tools (and related)	**Animated Explainers**	**LMS and Learning Platforms**
Camtasia (24)	Powtoon (22)	Moodle (27)
Articulate (25)	Videoscribe (78)	Canvas (67)
Adobe Captivate (39)	GoAnimate (89)	Google Classroom (80)
iSpring (44)	Explain Everything (95)	Edmodo (86)
EasyGenerator (51)	Adobe Animate (127)	Blackboard (99)
Udutu (61)	Moovly (156)	Desire2Learn (D2L) (108)
Lectora (83)	Explaindio (157)	Sakai (131)
Branchtrack (113)		Totara (133)
eXe (114)		Cornerstone (148)
Adapt (120)		Schoology (150)
Elucidat (135)		aNewSpring (153)
eLearning Brothers (140)		ILIAS (159)
CourseLab (142)		Showbie (162)
Claro (167)		Curatr (176)
		ClassCall (200)
		Portfolio Platforms
		Mahara (100)
		Pathbrite (196)
Webinar Tools	**Classroom and Audience Response Tools**	**Educational Tools**
WebEx (36)	Kahoot (15)	Quizlet (53)
Adobe Connect (62)	Socrative	Turnitin (126)
GoToMeeting (119)	Poll Everywhere (68)	Grammarly (128)
Blackboard Collaborate (123)	TodaysMeet (94)	Remind (160)
BigBlueButton (146)	Nearpod (110)	Doceri (181)
	Mentimeter (122)	
	Zeetings (158)	

Table 3.3 Content Development Tools

CATEGORY 2 – CONTENT DEVELOPMENT TOOLS		
Documentation Tools	**Presentation Tools**	**Spreadsheet Tools**
Google Docs (5)	PowerPoint (4)	Excel (46)
Word (16)	Prezi (14)	LibreOfficE (Calc) (117)

Adobe Acrobat Pro (87)	Slideshare (18)	
LibreOffice (Writer) (117)	Office Mix (42)	
Adobe InDesign (128)	Sway (59)	
Pixton (129)	Keynote (64)	
Scrivener (141)	LibreOffice (Impress) (117)	
Pages (145)	Haiku Deck (137)	
iBooks Author (188)	emaze (185)	
Flipbuilder (192)	Voicethread (193)	
	Presenter Media (194)	
Video Mashup Tools	**Screen Capture and Screen Casting tools**	**Audio Editing Tools**
TED Ed (21)	Snagit (26)	Audacity (28)
EdPuzzle (81)	Screencast-O-matic (31)	SoundCloud (98)
ThingLink (90)	Clarify (92)	Adobe Audition (125)
PlayPosit (163)	Jing (109)	
Video/Movie Making/ Editing/Platforms	**Photo/Imaging Tools**	**Games Editor**
YouTube (1)	Adobe Photoshop (48)	Construct 2
iMovie (69)	Adobe Illustrator (107)	VR tools
Vimeo (75)	Paintshop Pro (197)	Vrideo (166)
Movie Maker (77)		YouVisit (189)
Animoto (115)		
Adobe Premiere Pro (116)		
Adobe AfterEffects (121)		
Kaltura		
WeVideo (161)		
Periscope (165)		
Graphic and Diagramming Tools	**Blogging and Website Tools**	**Survey Forms**
Canva (57)	WordPress (8)	Google Forms (34)
Piktochart (850	Blogger (56)	SurveyMonkey (70)
Omnigraffle (180)	Weebly (87)	
Lucidchart (190)	Google Sites (93)	
GIMP (191)	Wix (112)	
Inkscape (195)	Tumblr (124)	
	Medium (146)	
Clipart library	Adobe Dreamweaver (149)	
Pixabay (101)		
Unsplash (199)		

Table 3.4 Social Tools

CATEGORY 3 – SOCIAL TOOLS		
Team/Group Messaging Apps	**Group Video Tools**	**Enterprise Social Platforms**
Skype (7)	Skype (7)	Yammer (12)

WhatsApp (13)	Google Hangouts (45)	SharePoint (38)
Slack (20)	Zoom (66)	Google Apps (40)
Trello (43)	Teamviewer (97)	Confluence (102)
HipChat (173)	Appear.In (138)	
Franz (176)	Join.Me (170)	
Other Collaboration Tools	**File Synchronisation & Sharing**	**Public Social Networks**
Google Docs (5)	Google Drive (5)	Twitter (3)
Padlet (35)	Dropbox (9)	Facebook (6)
	OneDrive (103)	LinkedIn (8)
	ownCloud (178)	Google Plus (45)
		Instagram (76)
		Snapchat (166)

Table 3.5 Individual Tools

CATEGORY 4 – PERSONAL/INDIVIDUAL TOOLS		
Online Resource Collections	**Online Courses/Learning Platforms**	**Bookmarking and Curation Tools**
YouTube (1)	Coursera (30)	· Pinterest (29)
Slideshare (18)	Lynda (37)	· Diigo (54)
TED Talks (21)	Khan Academy (52)	· Scoopit (72)
iTunesU (63)	Udemy (73)	· Flipboard (91)
Vimeo (75)	Duolingo (74)	· Pearltrees (136)
SoundCloud (8)	edX (84)	· Delicious (151)
Audible (143)	FutureLearn (105)	
	Degreed (138)	
	Codecademy (164)	
	Axonify (172)	
Search &Research Tools	**Mindmapping Tools**	**Note-taking**
Google Search (2)	MindManager (104)	Evernote (17)
Wikipedia (11)	XMind (106)	OneNote (19)
Google Scholar (60)	FreeMind (118)	Notability (151)
Bing (154)	MindMeister (171)	
Wolfram Alpha (198)		
Personal Productivity Tools	**Web browsers**	**Players, Apps & Dashboards**
Pocket (47)	Google Chrome (33)	iTunes (63)
Google Maps (49)	Firefox (65)	Tweetdeck (82)
Google Translate (93)	**Photo Sharing**	Buffer (132)
Wordle (110)	Instagram (76)	Pocket Casts (175)
Google Calendar (134)	Snapchat (166)	Overcast (183)
RoboForm (174)	Flickr (182)	Elevate (184)
Reflector (186)		
RSS/News readers	**Email Clients**	**Devices**
Feedly (23)	Gmail (32)	iPad & Apps (58)

Inoreader (168)	Outlook (50)	iPhone & Apps (71)
	Thunderbird (187)	Kindle & App (79)
		Apple Watch (144)

The descriptive information above depicts the wide array of learning tools that could be integrated in higher education in support of teaching and learning processes. As this study shows, higher education institutions are utilising only a fraction of these tools. Therefore, this reality suggests that there is enormous potentials for the inclusion of other tools in the teaching and learning processes at higher education institutions.

3.17 Successful Integration of Learning Technologies in Higher Education

Nawaz, Awan and Ahmad (2015) argued that successful integration of learning technologies (e-Learning tools) in higher education, such as the many listed in the previous sections are dependent on the quality of technology integration strategy between the new technologies and the organisational/managerial levels of the institution. The authors argued that the integration strategy is not a simple connection of wires and devices for teaching and learning, rather integration and choosing the right tools for pedagogical use should occur at the planning and development phases, which may require the use of specific eProjects when constructing the e-Learning environment. eProjects are web-based project management systems which can be used through applications to manage portfolios, projects and enables the increase of collaboration (Nitithamyong & Skibniewski, 2004).

Having opted for the right learning tools for educational use does not necessarily imply that technology integration will prosper. The success of integrating technology in higher education depends on the quality of technology integration strategy. A careful review and selection of integration strategies will produce sound technology integration in higher education. Nawaz, Awan and Ahmad (2015) further argued that the integration of learning tools does not only require the efforts of using different levels of technology integration strategies but the university management has to handle numerous issues which works as bottlenecks to successful technology integration practices.

To this end, the study reviewed recommendation on successful e-Learning integration amongst five higher education institutions in East Africa. Kituyi and Tusubira (2013) argued that any higher education institutions intending to integrate e-Learning into their teaching and learning practices should first acquire adequate ICT infrastructure. The setup of adequate ICT infrastructure will facilitate excellent e-Learning platforms to meet both academics and student's needs. The implication of setting up adequate ICT infrastructure will assist institutions in making the right choices on the tools of choice required for specific educational need. As a result, the study takes note that institutions of higher education should explore funding alternatives which may require institutions to partner with government to gain access to funds or partner with private sector players. The study further revealed that higher education institutions should implement training programmes and workshops to train their personnel in order to overcome the issue of lack of knowledge. In conclusion, emphasis was put on adequate infrastructure and ICT skills that must be achieved by the university management in order to attain a successful integration of technology in higher education.

3.18 Chapter Summary

In this chapter, it was established that a lot of research have been conducted on information technology integration, especially within the context of educational information and communications technology. The chapter presented the contextual literature that is pertinent to the study which included trends in ICT integration in higher education, the role and benefits of technology integration, background, evolution and trends of ICTs in Africa and other part of the world. The concepts of ICT for development solutions relevant to the study, were unpacked and included telecommunication infrastructure in higher education. Modern and emerging information and communication technologies that are relevant to the study were also presented, and the focus was on e-Learning mostly used and relevant to higher education. The next chapter presents an extensive review of literature to understand higher education landscape and strategic technology integration instances in higher education.

CHAPTER FOUR

HIGHER EDUCATION LANDSCAPE AND STRATEGIC TECHNOLOGY INTEGRATION IN HIGHER EDUCATION

4.1 Introduction

Chapter Three presented literature concerning the background of ICTs and the role, benefits and impact of integrating ICT into higher education. Chapter Four presents literature on the profile and the landscape of higher education in both Nigeria and South Africa, ICTs in higher education in general, and literature review on challenges and limitations to technology integration in higher education. The chapter also presents literature on strategic planning of the integration of technology into higher education.

4.2 Higher Education

According to the South African Department of Higher Education and Training (DHET, 2015, p. 2), "the term '*Higher Education*' is used to describe education that usually takes place at university and other higher education institutions." This includes public and private institutions that offer qualifications on the Higher Education Qualifications Framework (HEQF). The *Association des États Généraux des Étudiants de l'Europe* (AEGEE, 2016), well known as the European Students' Forum, describes higher education as post high school qualifications that are delivered by universities, colleges, professional schools and graduate colleges. The association indicated that the worldwide definition of post-school education is divided into two parts because there is no simple definition of higher education. The first part of this definition is called 'higher education' while the second part is described as 'further education'. The degree level of higher education when a person becomes a qualified professional requires a minimum completion period of three years, but typically four years in some other countries. Higher education offers qualifications ranging from higher national diplomas and foundation degrees to Honours degree, while further education is a postgraduate degree level like Masters and Doctorate degrees.

4.3 Higher Education Landscape in Africa

Following the movement of democratization (in the 90s), has been the establishment of Higher Education Councils and Commissions in Africa. These councils and commissions have been established in most African countries (such as Ghana, South Africa, Kenya and Mauritius etc.) in order to transform and provide the rapid improvement to higher education sector in Africa. (Chirwa, 2014). Some of the many purposes of continuous existence of higher education in Africa are to increase the students' knowledge and to create an intellectual society. This knowledge does not have to be confined to the university or other higher education providers because it can be achieved outside of these institutions. This kind of knowledge is classified as ‘borderless Education’ because it can be acquired outside the four walls of the University. For example, ideas generated by people in a marketplace or a manufacturing plant through dialogue and challenging each other’s understanding, will often lead to the acquisition of this kind of knowledge (Pityana, 2003).

The use of the e-Learning facility can also be termed as a medium through which education can be enhanced at higher education level. Flexibility of e-Learning process makes teaching and learning a lot easier for both lecturers and learners to interact irrespective of their geographical location. However, the main difficulty linked to this medium of teaching and learning in most African countries is lack of qualified lecturers who are familiar with e-Learning and the constant unavailability of the e-Learning facilities in institutions (Allison & Allison, 2014). Gibbons (2008) maintains that, during the 21st century, all graduates will be required to be computer literate, have re-configuration skills, be proficient in information management, networking, team-building and negotiation skills as all these skills, acquired through learning, will help nations create wealth and socioeconomic development.

4.3.1 The Higher Education Landscape in Nigeria

The Nigerian National Policy on Education describes higher education, or Tertiary Education as post-secondary education which includes Colleges of education, Polytechnics, Monotechnics and Universities and any other institution that may be associated to these groups, by offering correspondence courses (FRN, 2004). According to Iruonagbe, Imhonopi, & Egharevba (2015), higher education in Nigeria involves teaching and learning activities, research activities and community engagement or community services in order to develop a general workforce and to circulate essential knowledge needed in every walks of life.

Nigerian higher education universities include 40 federal-owned universities and 38 state-owned universities, totalling 78 public universities. In addition, “there are 50 private universities and 128 Polythecnics/Monotechnics, combined across the country, 117 colleges of education and 57 innovative enterprise institutions, bringing the number of higher education institutions or, as is popularly referred to in Nigeria as tertiary institutions, to 430” (Adesulu, 2014, p. 1).

Public universities have dominated the higher education landscape of Nigeria for many years and their failure to manage massification and admission-pressure became more marked in the 90s. According to Iruonagbe et al., (2015), Joint Admission and Matriculation Board (JAMB) statistics indicated that this condition has not improved. Access to higher education institutions and the system’s capacity to absorb the huge students’ enrolment into higher education institutions continues to create serious problems in the Nigerian higher education sector. Due to the need for enrolment, the number of Nigerian universities from 1999 to 2012, increased from 40 to 128, respectively (Adesulu, 2014). The need for private universities became critical for the provision of higher education.

4.3.2 The Higher Education Landscape in South Africa

DHET is the principal governmental body accountable for the provision of strategic directions in the development of effective higher education systems and the management of government's responsibilities in the regulation of the higher education system in South Africa. In addition to the governance of higher education in South Africa, Apart from DHET, there are two other key constitutional organizations, namely the Council on Higher Education (CHE) and the South African Qualifications Authority (SAQA) that are that regulate higher education qualifications. Both organizations were tasked with different functions. The CHE mandate is to provide advice, quality assurance and monitoring tasks through its Higher Education Quality Committee (HEQC) while SAQA was established to replace the *National Qualification Framework (NQF) Act* and to advance the NQF objectives, co-ordinate NQF sub-frameworks and oversee the improvement and application of the *NQF* (Bailey, 2014).

According to Bailey (2014), the South African higher education landscape includes Post-School Education and Training (PSET), which is made up of Adult Education and Training (AET) Centres, Further Education and Training (FET) Colleges and Higher Education Institutions. In South Africa, "there are 23 higher public education Institutions, 119 private higher education institutions, 50 further public education and training colleges, 536 privately owned further education and training colleges, 3150 adult public education and training centres and 150 adult private education and training centres, bringing the total number of higher education institutions to 4028" (DHET, 2015, p. 4). Over two million students were enrolled in private post-school education, public and training institutions in 2013. However, DHET's 2015 data show that students' enrolment in Higher Education Institutions is relatively higher compared to FET Colleges and AET Centres depicted below.

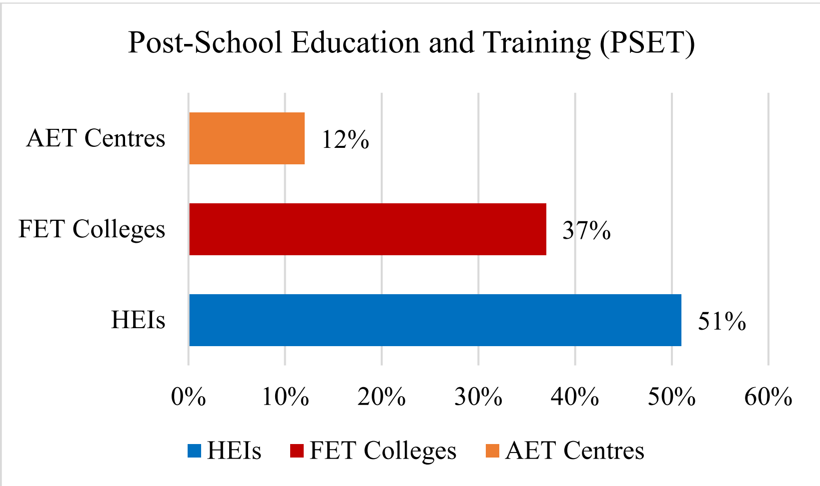


Figure 4.1 Percentage Distribution of Enrolled Students in PSET Institutions (DHET, 2015)

4.3.3 Higher Education Staffing Definitions:

An Academic staff member at a university is an employee who spends a minimum of 50% of their official time on the two duties that involve instruction activities and research activities. Some of the instruction activities include teaching, lecturing, tutorial or practical sessions, developing new curricula and marking assignments and examinations (Bunting, Cloete, & van-Schalkwyk, 2014).

Administrative staff members are non-academic members whose functions include executive management of the institution (such as Deans of faculties, who spend less than 50% of their official hours on teaching and research activities), heads of administrative departments and general administrative staff members who may include accountants, technicians, lab managers, office staff and others (Bunting et al., 2014).

4.4 The Roles of Academic Staff and Management Support in the Integration of Technology

The common roles of both academic and support staff is to ensure that ICT integration achieves its promised benefits in higher education. As such, academics facilitate technology-enhanced learning and have a positive impact on how information technology is implemented into teaching and learning process (Kituyi & Tusubira, 2013). In addition, academics possess a great deal of responsibility to ensure that students learn, and this include the methods of instruction delivery. Irrespective of the status of the instructors (i.e. junior or senior academics) they make the teaching and learning process take place in the higher education environment (Accuosti, 2014).

On the other hand, university managements' role is to encourage academics' curiosity regarding the use of information technology for their teaching and learning needs. Management also provide opportunities for staff development programmes which will allow academics to use acquired knowledge to integrate technology into curriculum design and development. In order to achieve the successful integration of information technology into the curriculum, academics are required to learn how to use information technology. Having learnt these skills, academics are then required to integrate the acquired knowledge into their teaching and learning process (MacCallum, Jeffrey & Kinshuk, 2014). It is the responsibility of the university management to source funds and make administrative decisions to ensure regular systems update within the university environment. The focus of management goals should ensure that the purpose of information technology integration in higher education is to fulfil ICTs promised benefits to higher education. The accomplishment of ICTs promised benefits will include but are not limited to some of the offerings of this study, such as to alleviate higher education challenges, enhance teaching and learning outcomes and provide strategies to sustain integrated technologies.

4.5 Understanding of Difficulties faced by Academics in the use of Technology

Despite the many efforts made through academic development programmes to experiment and support the use of information technology in higher education, academics are still faced with a number of difficulties (Russell, 2004). Integrating information technology into teaching and learning has not been universally accepted amongst academics in higher education (Kituyi & Tusubira, 2013). This is because some academics are comfortable with integrating technology into their teaching and learning process while some find it uncomfortable to do so. According to Englund, Olofsson and Price (2017), there are two different categories of academics: those who are novice and those who are experienced. The study revealed that novice academics tend to embrace technology into their teaching and learning process while some of the experienced academics tended to show little or no change in the concept of teaching and learning. This implies that novice academics show greater and more rapid change in the use and integration of information technology into their teaching and learning process than the experienced academics. In the foregoing, and to overcome such difficulty in the unanimous use of information technology amongst academics, "a central component of professional development programmes and activities will be effective to promote effective use and integration of information technology for educational purpose" (Englund, Olofsson & Price, 2017, p. 74).

4.6 Factors determining the Success of Information Technology Integration in Higher Education

Quality education remains one of the Sustainable Development Goals (SDGs) set in the United Nations' Millennium Development Goals (MDGs) in 2015. SDGs presents the importance of ensure inclusive and quality education for all, irrespective of their background in order to promote lifetime learning experience (UN, 2015). In addition, quality education is considered to be the key driver of sustainable development across the world, which include both developed and developing nations (Visvizi et al., 2018). In view of the foregoing statement, the role and the potentials of the use of information technology for educational purpose, most especially for teaching and learning become more than a watchword (Saunders & Gale, 2012). The role of information technology in relation to quality education, empowering people (i.e. academics and students), enhancing teaching and learning outcomes and alleviating higher education challenges in order to achieve ICTs promised benefits to higher education may be determined by some important factors (Abatan & Maharaj, 2017; Chaka & Govender, 2017; Govender & Chitanana, 2016).

After a review of several studies (Abatan & Maharaj, 2017; Daniela et al., 2018; Englund, Olofsson & Price, 2017; Esterhuizen, Blignaut and Ellis, 2013; Khodabandelou, et al., 2016; Kituyi and Tusubira, 2013; Pennarola & Caporarello, 2013), this study takes note of and identified some of the important factors that may determine the success and benefits of information technology integration in higher education to be but are not limited to:

- The time between introduction of technology and adoption of the technology for teaching and learning process;
- Personal interest in the use of information technology;
- Availability of funds to support technology integration;
- Physical space to accommodate teaching and learning process;
- Skilled professionals (i.e. academics);
- Institutions' high student intake capacity to gain access to education;
- Adaptive institutional policies;
- Adequate management support;
- Adequate training facilities/programmes; and
- Government support and intervention programmes.

The aforementioned factors were measured in this study's instrument to address the research problems in order to achieve the third objective this study. The objective three of the study sought to identify the challenges that may hinder the potential benefits of information technology in higher education. As depicted and discussed in Sub-sections 2.2.2 and 5.10.1.2 of the thesis in relation to the adopted frameworks, these factors formed the basis of the instrument used to measure the important factors that may determine the success of information technology integration in higher education. The study purposefully developed these specific factors, addressed the factors and developed the challenges thereafter. In other words, this study sought to first identify determining factors of information technology integration success before identifying the challenges that may hinder the use and integration of information technology for teaching and learning process. Findings of the study are presented in Chapters 6, 7, 8, 10 and 11.

This study took steps to conduct literature review to corroborate the choices made in the selection of factors used to support the construct of this study. According Fishman et al. (2004), time between introduction of technology and adoption of the technology for teaching and learning process, adequate leadership displayed by university management, adequate technology access and technical support were common factors found to enhance successful information technology integration in higher education. These findings were supported by Sang and Tsai (2009) study that applied diffusion of innovation theory to analyse strategies for integrating information technology into teaching and learning process in Taiwan. The study identified some of the factors listed above to be determinant of successful information technology integration. The factors included adequate management support to be responsible for the planning, supporting and co-ordinating of academics' teaching activities to promote technology integration. The study further stated that it usually takes an extended evaluation time or period and lots of effort is required for educational institutions to decide whether or not to adopt a new technology. This implies that 'time' is an important factor in determining the success of information technology integration in higher education. Time plays a crucial role in the integration process.

4.7 Higher Education Challenges and Limitations to Information Technology Integration

This section of the study is motivated by the research objectives and questions four respectively, that were outlined which is to perform an exploratory analysis in order to understand and identify the various challenges and limitations that hinders the success and potential opportunities of information technology as well as realisation of the promised ICT benefits to higher education. Some of the challenges and barriers that are associated with the use of information technologies were extracted from the factors described in the study's framework, underlining information technology success. The prognosis undertaken from the study's framework describes the following factors, namely, change management (which clarifies the need for technology), relative advantage (perceived need of technology), compatibility, complexity (ease of use), familiarization, utilization, re-orientation, time, social systems and communication channels, as key elements that lead to the success, adoption and, or, evolution of Information-technology in education (Hooper & Reiber, 1995; Keyshaw, 1996; Rogers, 2003). All these elements are measured when addressing higher education challenges and barriers to ICT integration. Limitation

When fully examining the challenges and barriers faced by technology integration in higher education, two broadly significant and driving factors were taken into consideration. These are, *Institutional Challenges*, and *Structural Challenges* or *Systemic Challenges.* Although, various classifications of challenges have been identified by other researchers to distinguish these challenges, (for the purpose of this study), only classification of challenges relevant to technology integration in higher education were reviewed in order to provide more insight into the two main challenges identified above. Ertmer (1999) and many other researchers, have divided the challenges to technology integration into two broad categories, namely: *extrinsic* and *intrinsic* challenges. Ertmer described extrinsic challenges as first-order type of challenges, where access, support, time, training and resources were cited and referred to and intrinsic challenges as second-order types of challenges where attitudes, resistance, practices, and beliefs to change were identified by stakeholders. In addition, extrinsic barriers were described to be more associated with organizations rather than with individuals while intrinsic barriers were identified as associated with individuals such as educators and administrators (Bingimlas, 2009; Kler, 2014; Al-Mulhim, 2014). British Educational Communications and Technology Agency (BECTA, 2014), identified more classifications of challenges and then categorized two challenges to information and communication technology integration as teacher's level challenges and school's level challenges. BECTA associated teacher's level challenges with individuals where resistance to change, absence of confidence and absence of time were the obstructing challenges while the school's level challenges were associated with institutions, identifying poor access to technology and/or resources and inadequate training in solving technical problems as obstructing challenges.

Balanskat et al., (2006) categorized barriers to technology integration in higher education into three major categories, namely, “Micro-level barriers; Meso-level barriers and Macro-level barriers.” Micro-level barriers are challenges related to an educators’ approach and attitudes to information and communications technology, whereas Meso-level barriers are in the context of the institutions and the latter. Macro-level barriers, also referred to as “System-level barriers”, are linked to the broader educational structure. Accordingly, this study hopes to answer the research question: “What challenges are associated with the use of information technology in higher education?” These are some of the challenges/limitations that may hinder institutions from taking full advantage of information technology in higher education. The following analysis focuses on stakeholders’ institutional and structural challenges to information and communications technology integration.

4.7.1 Institutional Challenges

Factors impeding successful information technology integration are proven to have been linked to both internal and external sources (Rogers, 2000). Firstly, the internal sources of barriers are described as the ‘Educator’s Perceptions or Attitude’ towards a technology, as well as the competency level of the educator with technology. While the external sources of barriers are linked to the accessibility and availability of hardware and software, presence of technically skilled personnel, stakeholder development programmes, mostly organized by the human resources unit, and general institutional support (Schieman & Fiordo, 1990). The term ‘Stakeholder’ is used to describe the faculty, staff and students. These two sources of barriers are liable to increase the level of institutional challenges towards the integration of technology and towards each contributing factor i.e. attitude of stakeholders, appropriate stakeholder development, time between introduction and adoption of technology, technology availability, access to funding, adequate institutional and technical support.

4.7.1.1 Attitudes of Stakeholders: Resistance to Change

According to Spotts (1999, p. 93), “there are five significant e-Learning variables, including the learner, the faculty, the technology, the environment and the perceived value, which are useful variables when obtaining beneficial information regarding the development of Technology Enhanced Learning (TEL) in higher education institutions’ faculties.” Continuous implementation of Technology Enhanced Learning as e-Learning at universities is mostly in the hands of the faculty members. However, “e-Learning could be a highly disruptive technology for education – if we allow it to be; if there is to be innovation and change in university teaching – as the new technology requires, as the knowledge economy requires, and as students demand - someone has to take responsibility for it. Who should that be, other than the university academic community?” (Laurillard, 2006, p. 60). To unpack this statement, university academic communities (including the major stakeholders) need intensive skills and knowledge in order to have an impact in educational practice (Esterhuizen, Blignaut, & Ellis, 2013).

Advocates of information and communication technologies insist that educators' knowledge, attitude and use of ICTs for educational purposes are of vital importance (Mabunda, 2010). Thus, information and communications technology integration is no longer a future situation for academics, rather it is already a way of improving education and increasing learning opportunities (Bauer & Kenton, 2005). Irrespective of the quality and the volume, technologies will not be useful, except when academics have the motivation, willingness, skills and knowledge to use and infuse it into their curricula (Kersain, Horton, & Garafalo, 2003).

Although, many academic associations have accepted information and communication technologies, it is often argued in the literature that higher educational institutions have been recorded to be slow in the adoption of information and communications technology as essential tools, and that academics have not universally adopted ICTs for teaching and learning (Mabunda, 2010). This is referred as 'lethargy', which ranges from the perceptions and negative attitude of educators, competency level of educators towards technology and inadequate professional development opportunities (Unwin, 2004).This sluggishness is a result of the perceptions of educators towards the rapidly changing information and communications technology landscape that places continuous pressure on the need to update curricula along with teaching and learning materials (Sheard & Carbone, 2008).

To overcome these challenges, Steketee (2005) proposed the integration of ICT into teacher education programmes. Henessy et al., (2010) supported the argument by pointing out that teacher development through technology integration is considered important to enhancing teaching and learning practices. This has raised educational standards in sub-Sahara Africa and other part of the world significantly.

4.7.1.2 Stakeholder Development: Faculty, Staff and Students

A wide range of literature that considers the potential and opportunities brought about by information and communication technologies and networked devices in many learning environments has mostly advocated for the matching of well-established methodologies that will account for the significance of teaching and learning in a blended way at higher education institutions (Pennarola & Caporarello, 2013). The engagement of students to actively participate in classroom discussions, rather than to passively listen to the instructors are attributed to improved teaching and learning practices, mostly referred to as Student-centred learning or Learner-centred pedagogy (Breen, Matusitz, & Wan, 2009). This type of teaching and learning methodology has been advocated for by many educators in the past decade. They have called for a revolution in higher education with the development of new curricula to put more emphasis on teaching and learning techniques that will enable students continually and actively to build their own skills and knowledge through technology (Mundell & Pennarola, 1999; Pennarola & Mundell, 2001; Venkatesh & Davis, 2000).

The understanding of where the instructors or educators are in terms of their level of technology adoption is an important step in unpacking and identifying the challenges and barriers to technology integration in any institution (Rogers, 2000). One of the first factors to consider in this regard is the internal barrier which is to understand the educator's level of confidence with technology in general (Spotts, 1999). Another important factor to consider for a resourceful integration of information technology into universities compels educators to be fully aware of the various learning approaches and to use regularly alternative approaches to technology, having considered that students also have their various ways of learning, either individually or in a group (Caporarello & Sarchioni, 2010).

The implementation of information technology into teaching and learning practices will not only enable participants to extend their learning experience outside of the classroom, but this will improve learners critical thinking approach as well as enhance their interaction and collaboration skills (Wenglinsky, 2005). Although, it may seem easy to figure out the many potential opportunities offered by integrating information technology into teaching and learning practices, but the integration process might still prove to be very difficult (Buckenmeyer, 2010). According to Pennarola and Caporarello (2015), the actual challenge is not just getting the technology into the classroom or the learning environment, but in the understanding of 'how' (function) and 'when' (time) to use the appropriate technology as well as 'why' (motivation and strategy) the teacher should use the technology for their teaching and learning activities (Zachman, 2003).

"The integration and the use of technology for learning in higher education has proven to have enhanced critical thinking and motivated students' learning processes" (Speaker, 2004, p. 241). Yet, some students do not possess the skills to accustom themselves to technology as fast as others and this has been a concern because the ability students have when using technology for learning remains a crucial aspect in their frequent use of the technology (McCoy, 2010). The use of technology in its various forms has grown in homes, businesses and schools across the globe. A study conducted in Zimbabwe, by Bhukuvhani, Zezekwa and Sunzuma (2011) sampled A-Level students' perceptions of information and communications technology tools and resources they have access to and their preparedness or readiness with regard to computer literacy in the successful integration of ICT facilities for teaching and learning concepts. The result of the research revealed that the institutions did not have Computer Aided Instruction software which meant that the Zimbabwean learners did not have ready access to computers. The study concludes that students' usage of computers for the purpose of learning were somewhat little and it was agreed by a large number of participants that integration of information and communications technology into teaching and learning practices would enhance their understanding of learning concepts. It is now almost inescapable to incorporate ICT into education and that this is a crucial issue that needs strategic planning if it is implemented widely (Goktas & Yildrim, 2003).

Another study conducted in Ghana, explained that the University of Ghana's strategic planning in the integration of ICT was to introduce ICT-enabled approaches to promote e-learning in order to change the way teaching and learning is conducted on the university campuses (Tagoe, 2012). The study addressed the issues surrounding ICT access, quality through e-learning and cost of higher education. The study concluded that Ghanaian students entered the first year at university with some level of computer skills which are important in the introduction of e-learning. Male students were identified to have been using the Internet more frequently and to possess more computer skills than their female counterparts. The study concluded by acknowledging and recommending that there should be implementation of further strategies to help students improve access to computers, broadband, several technological tools and extra efforts targeted at female students' computer skills.

According to Caporarello and Sarchioni (2010), there is no significant correlation between possessing or owning several high-tech tools (i.e. software, smartphones or computer devices) and being a tech expert. This means that learners might possess or own several high-tech tools, yet it does not necessarily indicate they are as tech-friendly as they portray. In conclusion, students would have to be educated or trained on how to get the most out the various technological tools they have or use. This will create the awareness of the link between learners' use of technological tools and their life outcome and, more specifically, they will gain an, appreciation of the opportunity that information and communications technology has provided (Abatan & Maharaj, 2014).

4.7.1.3 Time between Introduction and Adoption of Technology

Another important factor to consider in the challenges and/or barriers to the integration of technology into universities is 'time'. 'Time' is measured in terms of the period it takes the lecturers to implement information technology into educational settings. Therefore, this study considers an educator's ability to integrate information technology in order to meet learner's needs in higher education. According to Craig et al., (2008), educators are identified as the most important success-factor when it comes to using and integrating technology for educational developments. In actual fact, change in the learning process should only begin with educators, as they are the fundamental in creating the technology-integrated environments usually referred to as being learner-centred (Beckett, Marquez-Chrisholm, & Wetzel, 2003).

The issue of lack of time in the integration of technology could be the consequence of inadequate time to develop new courseware (e.g. e-Learning) or new skills and, sometimes, an advanced application may become a barrier to an individual, educator or the institution itself (Rogers, 2000). There is usually a period of time set for educators to build skills and, or, to create new teaching and learning materials recently introduced, especially in the case of recently-introduced technologies. However, panic may set in, often referred to as the 'fear factor', and this usually stops educators from successfully applying technology in their teaching and learning practices (Byers, 1996). Another factor to consider is the institutional time management. If the institution spends too much time in managing available or new technologies (such as, equipment delivery and setting up technical equipment), this can pose great challenges to realise the promised benefits of technology and deprive the use of technology for its purpose (Papo, 2001).

4.7.1.4 Funding Issues

Rogers (2000) noted that funding may also contribute to internal and external challenges to the integration of technology at universities. Therefore, lack of funding for technologies including hardware and software, employing technically-skilled personnel, [training for] staff development and student learning (training stakeholders) poses a serious external barrier to higher education. Another factor identified with funding issues has been traced to individual preferences in the allocation of funds to certain projects, programmes and disciplines. For instance, the preference to fund computer labs over student needs depends on the individual's attitude towards technology (Byers, 1996). However, Twigg (2000) argued for technology integration from a financial point of view that technology should simply be added to existing classroom instructions because technology itself constitutes additional cost. Byers' study added further that higher educational institutions should rather shift their focus from improving teaching, and focus on the improvement of student learning. With this shift in focus, higher education institutions will be able to realize better returns on their technology investment by reducing the cost of instruction and enrolling large numbers of learners in technology introduction courses which will offer the best potential returns on their technology investment.

Massy and Zemsky (1996) noted that broad usage of information technology on certain course area might not be cost-effective but, in actual fact, most technologies tend to enrich classroom instructions in all aspects. The major concern raised in Massy and Zemsky's study was that technology-based academic improvement strategies and goals include "doing-more-with-more", and better advantage is realised at a "higher unit cost." Yet, several existing universities do not possess the enormous funds required for the doing more-with-more strategy. Instead they opted for the doing more-with-less. This has helped most higher education institutions' faculties to evaluate their work procedures by replacing their labour-intensive responsibilities with technology-based alternatives. This is simply because labour costs have the tendency to increase over time while technology costs have the tendency to reduce or decrease over time. By and large, this strategy has been proven to be economically possible.

4.7.1.5 Institutional Support

Cited in UNESCO (2002b, p16), Kuhn noted that scientific revolution comes about when an old methodology and theory cannot stand a chance to solve new problems. In other words, higher education institutions were encouraged to increase the level of commitment by improving technical and infrastructural support as well as by providing sufficient time necessary or needed for users of new technologies to adopt these. (Murphy & Greenwood, 1998).

A study by Mabunda further explained the need for adequate institutional support to stakeholders by revealing the auditing process conducted by the Commonwealth of Learning at UNISA in 2008. It was noted in the study that the result of the audit specified that there is low utilization of online technology by educators at the institution and, because of this, the institution initiated various strategic plans: The 2015

Strategic Plan, identifies the need to utilize appropriate teaching and learning models and methodologies that will motivate technology-enhanced students' support as well as provide adequate processes and learning facilities through providing regular training and development programmes to staff members.

According to Mabunda (2010), the UNISA Institutional Operational Plan indicated that there is a need to consider recalculating the workload given to staff in line with the Open and Distance Learning context, which has been reformed to Open and Distance e-Learning (ODeL) in 2016. This type of consideration will allow UNISA staff to demonstrably add value to teaching and learning practices as well as fulfil their obligations to students.

4.7.1.6 Technical Training and Support

Scientific and research advances have helped develop information technology usage become the strategy to improve educational models in higher education institution environments (Surry, Ensminger, & Haab, 2005) and, the integration of instructional technology has been identified by the American Psychology Association as a significant concern in teaching and learning reform (Hannum, Irvin, Lei, & Farmer, 2008). Technical support, in the form of end-user services or technology specialists who provide assistance to staff members in their use and maintenance of different information and communication technologies may be categorized as an external source of challenges (Antonacci, 2002). Accordingly, the hiring of an insufficient amount of personnel to support technology in an institution may critically hinder the adoption or integration of technology because there may not be a sufficient number of technicians to support the needs of the stakeholders. Another challenge to consider may be traced to the quality of the technical personnel hired by the institution who may not have enough technical skills to meet the needs of the faculty as a result of lacking appropriate technical support expertise (Rogers, 2000).

Without suitable technical support both in the classrooms and outside the classroom (complete-school resources), educators will not defeat the challenges constraining them from utilizing information and communication technologies fully. (Lewis, 2003). Sicilia (2005) stated that, shortage of technical support is thought will be major challenge for educators in higher education. The identified challenges in Sicilia's study included time wasted on waiting for institutional websites and other useful web pages to download, connection failure the Internet and printers, educators having to work on old computers which might lead to the malfunctioning of computers without adequate or standby technical support. These sorts of challenges impede excellent delivery of lessons as well as the smooth flow of classroom activities for teaching and learning activities (Sicilia, 2005).

In a study conducted in Turkey, inadequate ICT support is identified as major obstacles to the integration of technology in institutions of higher education and it is considered 'Very Serious' (Toprakci, 2006). Another study conducted in Saudi Arabia indicated that educators acknowledged the need to introduce computers into science teaching, but their perceptions were that "they will encounter problems such as technical or hardware problems in the integration process, and may not have effective technical support"

(Bingimlas, 2009, p. 253). To a great extent, inadequate technical support will inhibit educators from integrating ICTs successfully into educational practices. However, Korte and Hüsing (2007) in the study conducted across 27 European countries (e.g. Czech Republic, Latvia, Netherlands, Malta and the United Kingdom), indicated the importance of technical support in assisting educators to use and integrate ICTs for educational purposes.

4.7.1.7 Access and Resources

All stakeholders should have direct access to technologies and, especially, the educators should possess "constant, on-demand access to all the various types of technologies they use and/or, intend to use either in the classroom or outside the classroom" (Leggett & Persichitte, 1998, p. 34).This form of constant access to technologies will re-enforce the model of technology adoption using the five-step hierarchical principles to understand the application of technology in education which will eventually lead to evolution, (Hooper and Rieber, 1995). The uninterrupted access to technologies by educators and all other stakeholders within the educational community (social systems) is also motivated by Rogers' diffusion of innovation theory which is based on four factors contributing to technology adoption.

Studies have shown that, in some cases, educators can have a feeling that they have inadequate access to ICTs, while in its presence, due to the fact that the technology does not work properly or, it may sometimes be because the available technology is not compatible or useful at that point in time (Zhao et al., 2002; Norris et al., 2003; Clark, 2006; Lim & Khime, 2006). Kopcha (2012, p. 1118) suggested that "gathering a number of educational activities into the principles of effective professional development may be the solution to provide educators with the appropriate knowledge and support required to integrate technology fully into their instructions." It was further noted that, frequent or regular evaluation of the relationship between the endorsed learning activities and educators' long-term practices with information and communication technologies, could be an essential procedure to enable long-term changes in the way educators utilize technology to support student-learning in higher education classrooms. (Kopcha, 2012)

4.7.1.8 Capacity Constraints

The negative implications of some of the challenges indicated above (i.e. lack of technical support, access and resources) can be linked to institutional capacity constraints. Higher education institutions all face capacity constraints, but the type of constraints and the scale of constraints may differ from institution to institution as does the type of support and provision they get from government. Some of the constraints within the higher education institution's system may include, but are not limited to, the inability to absorb the increasing number of students enrolled annually, as a result of poor human and infrastructural resources. More so, inadequate technical support and access for students with disabilities is particularly constrained in such instances, denying students access to infrastructure and basic information and communication technologies.

4.7.2 Structural or Systemic Challenges

This section of the study discusses the structural challenges of ICT integration into higher education, which are also referred to as *Systemic Challenges*.

4.7.2.1 Government Support and Interventions

Realizing the influence of ICT in education and in our everyday lives, higher educational institutions are making efforts to streamline academic syllabi and amenities available in the lecture theatres/rooms so as close the current technology gaps in education (Tomei, 2005). Therefore, the restructuring techniques require effective technology adoption models into the existing technology environment to provide and promote significant professional education and productivity. In an effort to provide institutions with adequate ICT infrastructure, major investment by many governments internationally has been made. The United States of America's expenditure on higher education institutions and K-12 schools was \$6 billion and the United Kingdom invested £2.5 billion on ICT education between 2008 to 2009 (Nut, 2010).

According to Johnson, Calvert and Raggert (2009), the New Zealand government has been spending almost \$410 million annually on ICT infrastructures and integration into schools. Several African countries such as South Africa, Nigeria, Ghana and Kenya, to mention a few, have invested immensely in ICT infrastructures, resources and professional development to improve their educational systems. In reference to the aforementioned African countries, their governments have invested several millions of dollars to equip their schools with modern information and communication technologies (Buabeng-Andoh & Totimeh, 2012).

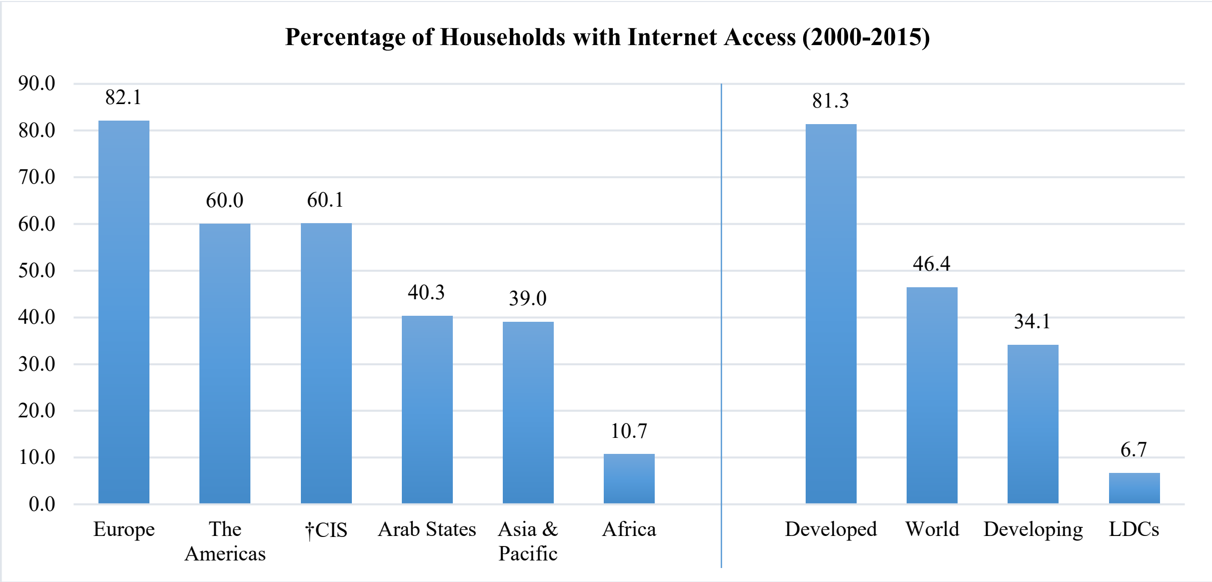
In addition, higher education institutions in the African continent including, Ghana, Nigeria and South Africa have amplified the deployment and ICT usage for educational purpose. Most African education systems (e.g. the Ghanaian higher educational system) have implemented the policy of the national ICT for Accelerated Development – ICT4AD, which is part of the policy, includes a compulsory ICT levy for students, which enables them to have unlimited access to broadband internet connection through computers in laboratories (Opoku-Mensah, 2015). This implemented policy does not only apply to higher education institutions in Ghana, but to higher institutions in general.

In spite of all the funds invested on information and communication technology infrastructure and the many efforts made in the restructuring of educational curricula across the world, the *e-Readiness Assessment Report* (2010) indicated "that the potential for ICT to transform educational systems (i.e. in teaching and learning) has not been realized." Challenge with regards to ICT potentials not realised is still in the lack of research and innovative use of ICT by educators. This area of challenge motivates this study, allowing it to further explore and investigate the innovative and strategic use of technologies to alleviate higher education challenges in Africa. One major structural or systemic challenge that has posed major barriers to technology integration is digital divide, the disparity in access to ICT. This is discussed in the next section.

4.7.2.2 Digital Divide

The inequality in access to ICTs (which may have resulted from the difference in race, culture, geographical location, class and many other factors) can effectively deny the participation of certain citizens in the global economic development (Kroukamp, 2005). The inequality in access to ICTs is described "as the Digital Divide and there is a need for governments across the world to bridge this gap." According to Mphidi (2004, p. 1), "This digital divide could be bridged if governments could use the power of the Internet to capture and provide access to appropriate and significant digital information in order to assist people." In this case, e-Government could serve as the appropriate tool, which, since its deployment, government communication with citizens has significantly been different.

Apart from the use of e-Government applications to bridge the gaps in the digital divide, the United Nations Millennium Development Goals (UNMDGs) was created for governments to bridge these gaps through infrastructure deployment, ICT falling prices and technological progression. The support from global leaders leading to the agreement of the MDGs in 2000 has tremendously revolutionized ICT's global development. According to ITU (2015), one of their many objectives is to connect everyone in the world, to create an inclusive informative society by providing high quality data to measure the world's progress in ICT-usage. Figure 4.2 depicts a 15-year ICT growth, based on what has been achieved in the digital divide through the deployment of the UNMDGs from years 2000 – 2015* in households percentage with Internet access. The data shows that by end of 2015, about 34% of households in the developing countries possess access to the Internet, in relation to over 80% in nations considered developed. It is also noted that only 7% of households have Internet access in the least-developed countries, compared to the world average of 46%.



Note: * Estimated; † Commonwealth of Independent States

Figure 4.2 Percentage of Households with Internet Access (2000 – 2015), (ITU, 2015)

An updated version of the percentage of households with Internet access was released in 2016 by ITU before the final submission of this project. Figure 4.3 depicts the current status of households with Internet access. The penetration rate of households with Internet access has increased for Africa within the period of a year from 10.7 to 15.4. This can be compared to developing countries with an increase from 34.1 in 2015 to 41.1 in 2016.

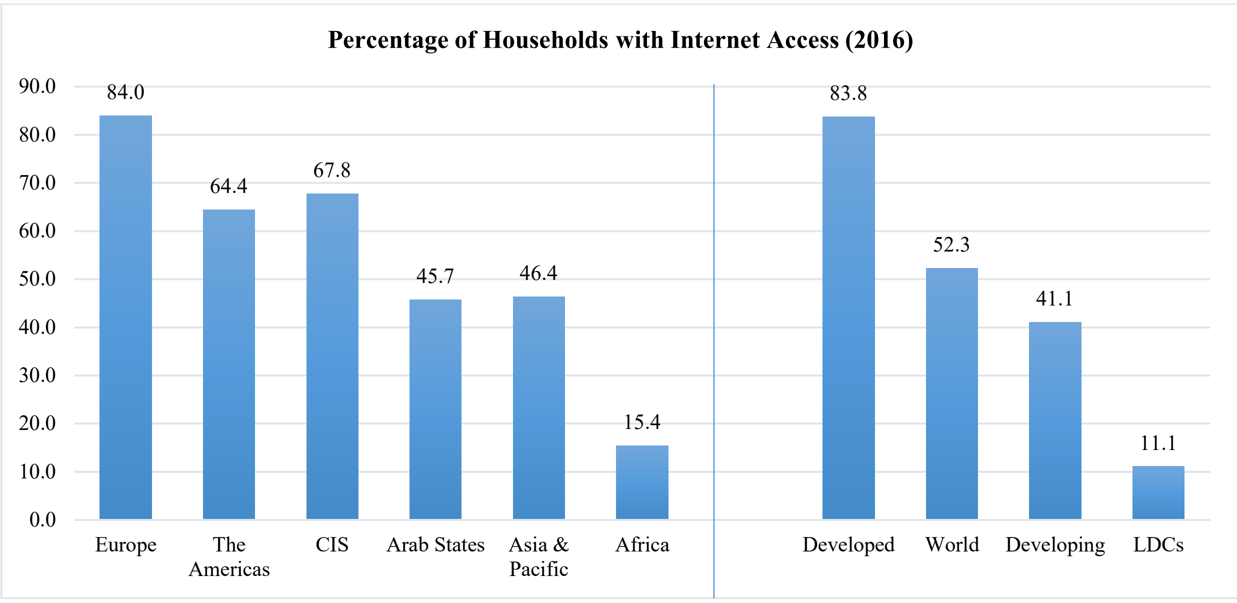


Figure 4.3 Percentage of Households with Internet Access (2016), (ITU, 2016)

As depicted in Figure 4.4, the data shows that Internet penetration in developing countries between 2000 and 2015 was at 35% while that of the least-developed countries lags behind by almost 10%. This indicates that 1 in 5 people use the Internet today in Africa as in relation to about 2 of 5 people in Asian countries and the Pacific, and with 3 of 5 persons using Internet in the Commonwealth of Independent States (CIS).

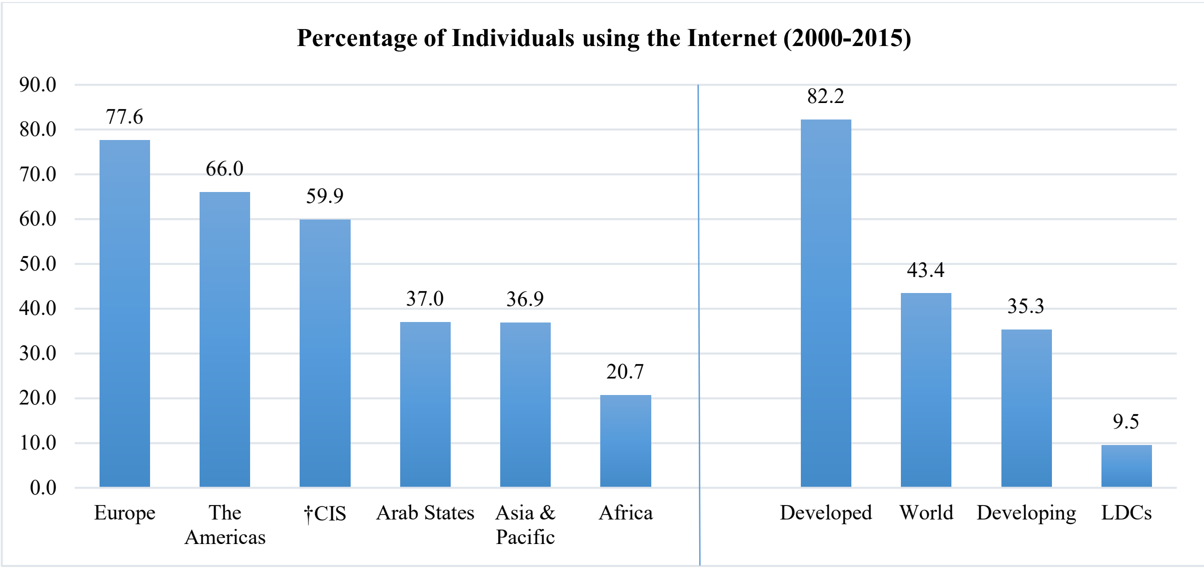


Figure 4.4 Percentage of Individuals using the Internet (2000 – 2015), (ITU, 2015)

The same applies to the rate of individuals using the Internet in the world in 2016. Figure 4.5 depicts the current state of the percentage of Internet penetration per individual. Africa has an increase from the previous 20.7 to 25.1 in 2016, while the penetration of individuals using Internet in developing countries has increased from 35.3 in 2015 to 40.1 in 2016. These facts are released by the ITU.

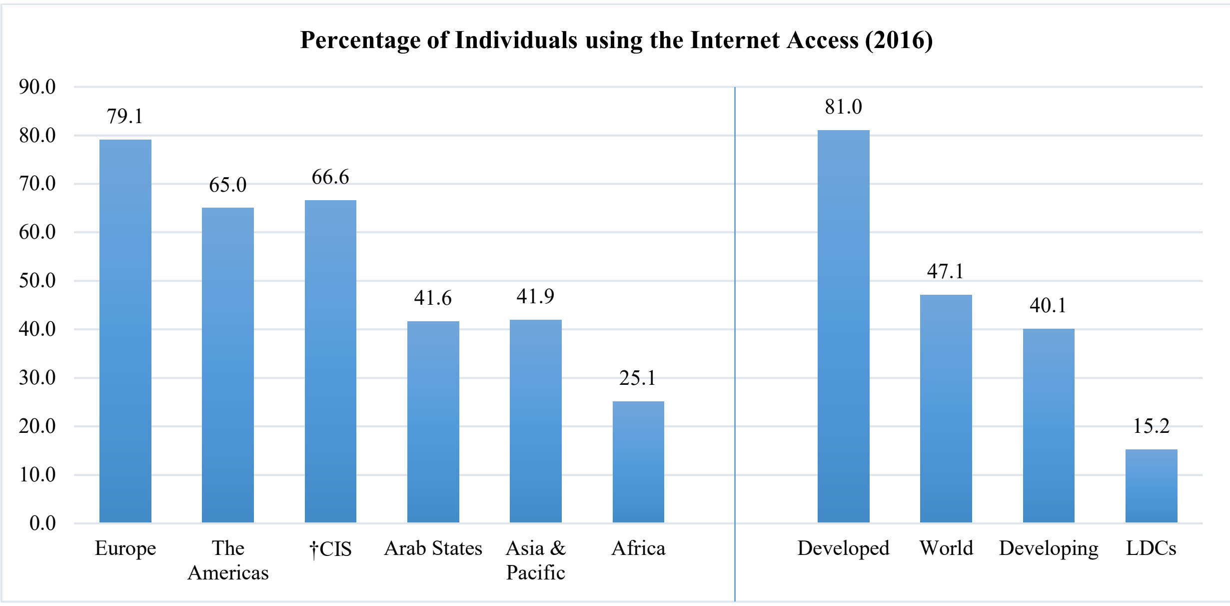


Figure 4.5 Percentage of Individuals using the Internet (2016), (ITU, 2015)

Having presented the percentages of households and individuals using the Internet across the world, it is necessary for the study to further narrow down and focus on the percentages of Africans with access to the Internet, most especially in Nigeria and South Africa. In what follows, the study consulted the Internet World Stats (2017) and found out that over 91 million Nigerians have access to the Internet which amounts to about 47.7% of the country's population of 191 million citizens. Nigeria also experienced a 45% Internet growth between the years 2000 to 2017 with 16 million Facebook subscribers. In the case of South Africa, almost 30 million of the population of just over 55 million citizens have access to the Internet. It amount to about 54% Internet penetration with 16 million Facebook subscribers.

Table 4.1 Internet Users Data in Nigeria and South Africa (IWS, 2017)

Country	Population (2017)	Internet Users (30 June 2017)	Internet Penetration (Population %)	Internet Growth 2000-2017	Facebook Subscribers (30 June 2017)
Nigeria	191,835,936	91,598,757	47.7%	45,699.4%	16,000,000
South Africa	55,436,360	29,935,634	54.0%	1,147.3%	16,000,000

4.8 Strategy: Definitions and Meanings

It is imperative to unpack the definitions and meanings of the term 'Strategy' as it reinforces the aims and objectives of this research. The term strategy has been defined by many scholars but the concept was initially adopted from the military for use in business. "Strategy is a term that originated from the Greek word *Strategia* which means 'Generalship' in the military and is often referred to as manoeuvring military troops (*deployment* of troops) into positions before attacking the enemy" (Nickols, 2012, p. 2). Once an attack has been launched on the enemy, there is a shift from manoeuvring to schemes where the "*deployment* of troops" becomes significant. The substitution of assets for the military will begin with sustenance. This is where the concept is transferred to the business world. The study indicated that strategy bridges the gap between policies and tactics as shown in Figure 4.6.

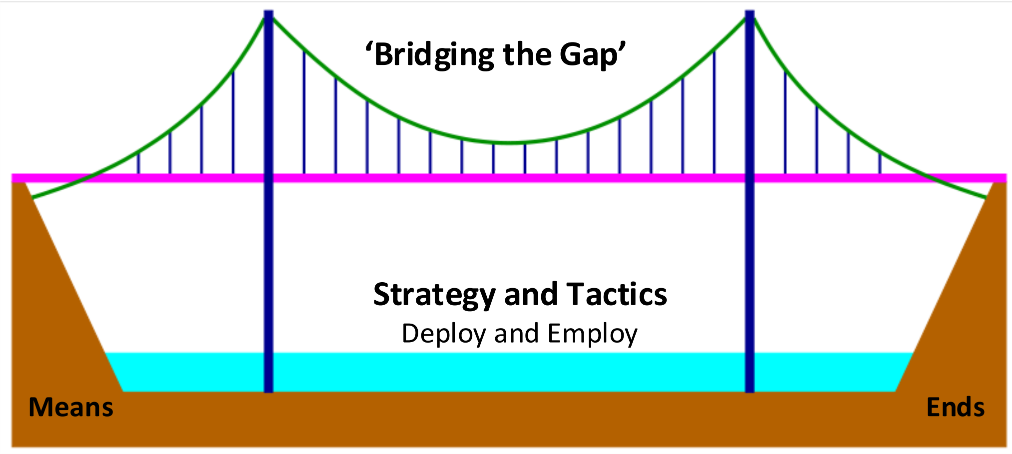


Figure 4.6 Strategy: Bridging the Gap, (Nickols, 2012, p. 1)

Given that strategy originates from the military, the above concept is further described with military views in the book by Liddell Hart (1991, p. 3), who "examined wars from the time of the ancient Greeks during the World War II" where strategy is referred to as the means by which policy is effected and he concludes by providing a description for strategy as "the art of distributing and applying military means to fulfil the ends of policy." The removal of the word "military" from the aforementioned description allows the concept to be applicable in business. This motivates the study to review research carried out by remarkable writers of strategic planning in the business world.

In a *Harvard Business Review,* Michael Porter (1996, p. 67) "argues that competitive strategy is all about being different and this simply means choosing a different set of activities to deliver a unique mix of values and the study concludes that strategy is about competitive positioning by differentiating yourself in the presence of the customer yet adding values through a mix of different activities from those used by competitors." By definition, strategy was described as "the creation of a unique and valuable position, involving a different set of activities" (Porter, 1996, p. 68). The unique and valuable positions "can be based on customers' needs, accessibility or the variety of a company's products and services." Porter's study further indicated that strategic positioning is often not obvious and finding such a position requires creativity, innovation and insight.

Another remarkable definition of strategy was found in the book, *Top Management Strategy*, where Tregoe and Zimmerman (1980, p. 3) defined strategy as "the framework which guides those choices that determine the nature and direction of an organization." In the final review on the meaning of strategy, the study considers the notes by a professor of management, George Steiner and noted that "strategy found its way into management literature as a way of referring to what was done to counter a predicted or actual move of the competitor" (Steiner, 1979, p. 7). Steiner outlines five different useful meanings of strategy as follows:

- **Strategy is that which top management does that is of great importance to the organization**
- **Strategy refers to basic directional decisions, that is, to purposes and missions**
- **Strategy consists of the important actions necessary to realize these directions**
- **Strategy answers the question: What should the organization be doing?**
- **Strategy answers the question: What are the ends we seek and how should we achieve them?**

Figure 4.7 Five Definition of Strategy (Steiner, 1979, p. 7)

According to Johnson (2001), Organizations (including universities) must constantly adapt to survive in a rapidly changing technological environment. Universities must be flexible in order to respond rapidly to competition and market change. Any organization that is stagnant and cannot innovate to meet developing environmental conditions will in the long run find itself no longer competitive in the increasingly multifaceted and technologically sophisticated economy.

4.8.1 Strategic Planning

The trend at which technology is evolving has not only affected the way organizations operate but it has affected the way organizations think and learn strategically, as never before, to cope with the ever-changing technological economy. Technology has contributed to the interconnection of universities and this requires building capacity for ongoing technology implementation, learning and strategic planning. Hence, leaders and managers of different sorts of organization face numerous and difficult challenges in the integration of technologies and strategic planning can help them to think, learn and act strategically to counter or overcome the various challenges (Bryson, 2011). The phrase 'strategic planning' means the same as strategic management but the difference is that strategic planning is more used in the business world while strategic management is used more in the academic environment (Jurevicius, 2013).

Strategic planning is the creation or the development of a specific framework for future policy that can provide an organisation with a unified direction that will lead to a successful achievement of organisational objectives (Mudrick, Steiner, & Pollard, 1992). In a *Harvard Business Review*, *Volume 72, Issue 1,* Mintzberg (1994, p. 107) argues that strategic planning and strategic thinking should be split into two different programmes as these two strategic programming activities deal with different issues. The arguments showed that strategic planning has always been about analysis and it requires breaking down of goals or objectives into steps and eventually formalizing these steps for almost automatic implementation into the system as well as emphasizing the expected results or the consequences of each step. Mintzberg (ibid) noted that, Michael Porter (one of the most prolific writer on strategy) is in favour of analytical techniques for developing strategy, whilst strategic thinking by contrast, is about synthesis as it involves creativity and intuition.

Strategic thinking is more involved with integrating the perspective of the organization and the process is usually an informal learning that is required by people at every level involved in the process. A few years after the Mintzberg's philosophy of strategic planning, Heracleous (1998) indicated that both strategic planning and strategic thinking are two distinct methods of strategy but strategic thinking should precede strategic planning in the sense that strategic planning over the years has evolved into strategic thinking and the purpose of strategic planning is to improve strategic thinking. The study clarifies the nature and distinction between both strategic planning and strategic thinking by proposing a dialectal view of their relationship or interrelated harmony and it is depicted in Figure 4.8.

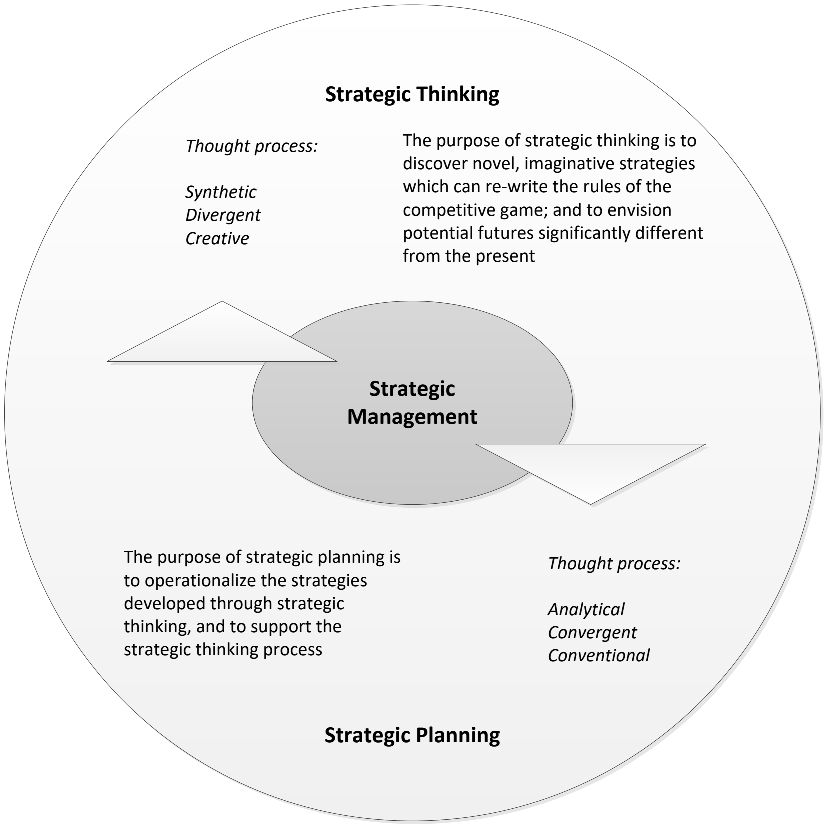


Figure 4.8 Strategic Thinking and Strategic Planning (Heracleous, 1998, p. 485)

Strategic planning can be used virtually in every organisation and at every level of management to achieve competitive advantage over competitors. In addition, strategic planning has become an essential process in the integration of information and communications technology to develop organisation's performance and productivity as well as to mitigate challenges. This concept is known as Strategic Information Systems Planning (SISP). According to Lederer and Sethi (1988) the primary objectives of the concept of SISP was to improve projected resource requirements, communication with users, management support and to determine advanced opportunities for Management Information Systems (MIS). An effective SISP will make a huge contribution to businesses and organizations across different sectors as it can help organizations to use ICT to reach their goals by which organisations can use information systems to considerably impact upon their planning strategies.

4.8.2 Strategic Alliances

ICT industries are undoubtedly on the rise and the leading ICT organizations – such as Hewlett Packard (HP), International Business Machines (IBM), Dell, Oracle and many more are required to set complex portfolios of strategic alliances in order to remain competitive or have competitive advantage over other ICT organizations (Chiaroni & Chiesa, 2008). Koza and Lewin (1988) have shown the relevance and need for strategic alliances in business practices which have also increased over the past decade. Scholars from various disciplines and fields such as economics, sociology, information technology and business sciences have investigated the phenomenon of strategic alliances with a number of methodologies and from a number of perspectives (Gulati, 1985) focusing on issues surrounding: inter-organizational networks and relationships; impact of collaborations on the participating organizations (Gulati, 1998); choice of the appropriate alliance mechanism i.e. acquisitions, internal growth and merger, (Powell, 1990; Hennart & Reddy, 1997); and lastly, understanding the relationship between organization's strategic alliance and its innovative performance which was indicated as the most important methodology in the investigation (Doz, 1996; Dussauge & Garrette, 2000).

Strategic alliances were identified to enable collaborating organizations to learn from each other's knowledge, products and technologies that breed an ideal example of exploration alliances, which involves innovation and research activities for new opportunities (Lei & Slocum, 1991; Lei & Slocum, 1992). This phenomenon can be attributed to higher education institutional collaborations by which researchers from various higher education institutions can collaborate with each other to produce ground-breaking research outputs. Strategic alliances will not only contribute to the development of research but will aid continuous Collaborative Educational Networking (CEN) amongst higher education institutions.

4.8.3 Strategic Planning in the Integration of Information Technology in Higher Education

Strategic planning in technology integration among institutions of higher education previously focused only around space planning as well as facilities in the late 50s during the era of rapid expansion in higher education systems which was held at the Massachusetts Institute of Technology (MIT) by 25 campus planners (Dooris, Kelly, & Trainer, 2002). Several meetings over a period of 7 years helped this group to grow to over 300 members by 1966 and this also helped them in the creation of the Society for College and University Planning (SCUP). Strategic planning involves any form of planning activities that focus on the long-term future of an organisation with summaries and outlines of objectives to achieve and resources to be used to achieve these objectives. The various planning processes and activities applied in contemporary higher education systems have developed over the years to the point where institutions now know what not to do when conveying institutional politics and planning together to develop and implement academic strategies to avoid creating unnecessary issues (Gee & Williams, 1991).

According to Mudrick et al. (1992), demands in physical facilities, funding and resources by students has always been issues surrounding higher education institutions. These demands put a lot of pressures on faculty members and likewise, the top management ‘i.e. Deans, Heads of schools and Managers’ all caught between unhappy faculty members who want to improve their administration, job performance and other funding resources. However, the study concludes that strategic planning is the essential means of developing not only the common goals and visions of the institution but a sense of revitalizing and empowering the faculty members and the top managements. Strategic planning will enhance the goals and drives that make the activities of a higher institution more reactive to its students, environment and the community at large. According to Kotler and Murphy (1981), higher education institutions have to lay strong emphasis on strategic planning, if they are to survive in the troubled years ahead.

4.9 ICT Strategic Integration in Nigerian Higher Education Institutions

Technology usage in higher education has influence on the perceptions of what the practice of instruction is and how it can be adopted to develop how higher educational institutions should be structured. However, educational technology is perceived as tools that promote efficiency in teaching and learning environment which in turn enhances learning outcomes. Higher education institutions’ demands no longer focus solely on content expertise but demands are also on the creation of active learning environments that integrate information technology within the contents (Jones, 2015). The integration of technology into learning contents is not as easy as it may sound but requires strategic decision-making and planning. This section of the study focuses on ICT strategic integration in higher education in Africa, with focus on higher education institutions in Nigeria and South Africa.

An empirical study for new insight on improving the effective integration of Web 2.0 technology tools in educational systems was conducted among three Nigerian higher education institutions, namely: University of Calabar, Veritas University and Cross River State University of Technology. Echeng and Usoro (2014) indicated that the research adopted a conversational data collection approach in focus groups that involved 36 lecturers and faculty management staff. Unstructured interviews were conducted in a workshop to create awareness regarding the significance of Web 2.0 technology usage to improve collaboration, problem-solving as well as to facilitate critical thinking skills. The study was used to obtain lecturers and faculty management’s perceptions on the acceptance and the effective Web 2.0 technology usage aimed at a better educational practices and experience.

Lecturers and faculty management perceived the eight research constructs used in the study to be relatively significant to the acceptance and effective use of Web 2.0 tools. The constructs included *perceived usefulness*, *performance expectancy*, *ease of use*, *prior knowledge*, *behaviour*, *facilitating conditions*, *motivations to use* and *social factors*. The findings shows that lecturers expressed their willingness to integrate the technology into their teaching and learning activities and practices while the Universities’ management promised to encourage not only the lecturers who will integrate the technology into their teaching and learning contents but also encourage the students to use the technology for learning and collaboration. They concluded that the implication of the research is that prior knowledge, facilitating conditions and other factors that formulate the study's construct should be borne in mind to encourage and enhance better technology integration.

A case study on students' acceptance of mobile phones for learning purposes was conducted at the University of Ibadan, Oyo State, Nigeria. Adedoja, Adelore, Egbokhare, & Oluleye (2013). That study aimed to support and encourage distance education students to use mobile phones for distance learning tutorials instead of using the technology only for communicating information. Technology Acceptance Model (TAM) was used for the research design and the study tested multiple hypotheses regarding the impact of perceived usefulness, perceived ease of use, technology self-efficacy and interest in the use of the technology for mobile tutorials.

Prior to the collection of data, it is important to highlight that the University of Ibadan distance learning centre serves the needs of adult and young adults distance learners, be it employed, unemployed or seeking employment. The initial focus and vision of the University was to build the learning environment ICT infrastructure but the focus shifted towards using the infrastructure to support and encourage teaching and learning processes, underlining the importance of interaction and collaboration among faculty staff and students in order to create an effective teaching and learning environment.

The data collected from participants confirms that mobile tutorials enhanced teaching and learning experience for distance education. However, the study highlighted several factors for successful integration of the technology which included:

- Provision of technical support to students;
- Use of a well-designed and user-friendly interface;
- Improvement of student ICT literacy;
- Reducing messaging and data cost; and
- Improving module/course developer capacity and technical staff.

Some of the challenges that participants encountered with regard to the use of mobile phones for distance learning tutorials included: *login problems*; *network problems*, *special need issues*; *inadequate ICT skills* and *user interface issues*. The study concluded by suggesting that the faculties and educational technologists require training and incentives to further explore the opportunities to enhance students' support quality through the integration of mobile technology into higher education. It also made note of the heavy initial support that is required when integrating mobile technology into teaching and learning and the need to evaluate the platforms/models with adopters before deployment. Adoption of a simple, straight and user-friendly technology interface for the integration of the technology is of utmost importance if students are to benefit from and enjoy the time they invested in the learning experience (Adedoja et al., 2013).

The traditional approach to teaching used to have more focus on the teacher than the students (lecture-driven) and this has been one of the most widely used mediums of knowledge delivery within academic circles. In recent times, this mode of teaching is considered an old style of teaching, such that teaching and learning has shifted from a teacher-centred to a student-centred teaching approach (Vosloo, 2014). To this end, Tabot and Hamada (2014) conducted a research that examined the role of Multimedia Learning Systems (MLSs) in the Nigerian higher education setting. The study also examined the development of multimedia learning systems and its widespread adoption across the Nigerian higher education sector. It was revealed that the study informed the design of new learning environments and technologies that take full advantage of the rising number of technologies such as mobile devices (tablets and smartphones), and educational technologies (LMSs) to cater for the informal and workplace learning.

The study described today's learners as 'Digital Natives', which means students/learners nowadays have spent a good part of their entire lives growing with technology such as video games, mobile phones and the Internet. Students have certain inborn characteristics which make the integration of multimedia learning systems into teaching and learning instructions imperative. Some of their characteristics include: parallel processing and multi-tasking; networking; fast responses; use of mobile devices; and electronic communication. The findings of the study revealed that there are some factors that affect technology integration in the Nigerian educational sector which have further delayed the adoption of multimedia learning systems. Some of the factors are:

- Inequality of access to technology;
- Internet connectivity;
- Energy related problems (interrupted power supply);
- Limited expertise;
- Government policies;
- Institutional issues;
- Lecturers and students' attitudes towards technology adoption; and
- License and software costs.

It was revealed that the integration of multimedia learning systems into teaching and learning practices in higher education comes with potential future benefits and a bag of immediate benefits, some of which are: *increased accessibility*, *learning activities flexibility*; *economies of scale*, *cost effective* and *appropriate for marginalized and disadvantaged groups*. The study confirmed that multimedia learning systems integration into teaching and learning takes less time, it is enjoyed more by students and it increases learning outcomes. Multimedia learning systems integration is pivotal in the transformation of higher education in Nigeria (Tabot & Hamada, 2014).

The next research investigated students' mobile learning experiences in Nigerian higher education. This is another initiative for integrating ICT into teaching and learning practices. Mobile learning has become a global phenomenon in higher education but developing countries such as Nigeria are yet to partake in the full potential and benefits offered by the technology (Oyelere, Suhonen, & Sutinen, 2016). The study established both undergraduate and post-graduate students' experiences with mobile learning of six Nigerian Universities by determining factors that influence their motivations and interest as well as identified factors that limit mobile learning adoption in the context of Nigerian higher education.

The study confirmed that students in Nigeria possess the basic tools required for mobile learning access but identified some of the factors that could affect mobile learning adoption to be: *insecurity*; *poor infrastructural development*; *ownership*; *affordability*; *acceptability*; *technical challenges* (i.e. different screen sizes); *added complexity*; *low computer literacy* and *poor learning environments*. The study made recommendations for the improvement of mobile learning adoption and integration into Nigerian higher education. It aimed to create greater awareness of the potential benefits and advantages associated with the technology for all the stakeholders involved. It was concluded that the usefulness of mobile devices with improved abilities to access study materials, store and retrieve data and connect to the Internet are obvious. Both instructors/lecturers and students' educational experiences can be enhanced through the use of this technology.

Shehu and Dabo (2013) contributed to the ICT strategic integration body of literature with a significant research report that examined the potentialities, problems and strategies of integration of ICT into technical and engineering education in Nigeria. The study revealed that ICT can be integrated into higher education teaching and learning practices through electronic encyclopaedia; computer-assisted instructions; CD/DVD ROMS; Computer Aided Design (CAD); animation and web-based platforms. It is noted that the use of ICT in developing countries such as Nigeria is still in its infancy stage, due to teacher's use of the technology as personal tools for word processing and record keeping. In addition, the mode of instructions in most of the Nigerian higher education institutions is still a traditional paper- based approach (Mador, Goncim, Kantiok and Ogunranti, 2010; Oguzor, 2011). However, Shehu and Dabo (2013) highlighted the potentialities of integration of ICT into higher education to be: improved students' academic achievements and attitudes towards technology use; paradigm shifts and broadening of the range of materials used in classrooms.

Challenges facing the efforts to integrate ICT into technical and engineering education and training were highlighted and they include:

- Institutional lack of the use of ICT;
- Unavailability of ICT facilities in institutions;
- Lack of training for lecturers/instructors;
- Maintenance issues; and
- Low reliability of ICT software and hardware.

In order to guarantee that instructors/teachers effectively integrate technology into their curriculum and or instructions, strategic recommendations should be provided by institutions and educational regulatory bodies which may include: the setting of comprehensive guidelines; teacher's capacity building and the enhancement of information technology infrastructure. Computer and other information technology facilities must be integrated into the entire pre-service curriculum to enhance professional development of teachers. ICT facilities and tools must be distributed and provided to all higher education institutions of learning in Nigeria (Shehu, Bada, & Enemali, 2012). In conclusion, it is acknowledged that teachers' role is shifting from being teacher-centred to learner-centred teaching and learning approaches, due to ICT development in Nigeria. The teacher's role should move from being the source of information and transmitter of knowledge to co-learners and collaborators. As such, the role of students/learners should change to active learners from passive learners.

The next research report investigates the exponential growth in the Nigerian population, together with ethno-religious crises and other action of terrorism that is challenging access to quality education. Chaka and Govender (2017) indicated in their study that about 26% of Nigerians have no access to education with inadequacies in the existing facilities of teaching and learning in higher education. Some of the inadequacies include lack of learning materials and facilities such as textbooks, classrooms and manpower which are totally inadequate (Ilogho, 2015). The study determines the perception of students in three Colleges of Education in Nigeria regarding the viability of mobile learning to address poor educational quality and inadequacies of teaching and learning facilities. Unified theory of acceptance and use of technology (UTAUT) model was used to analyse the findings of the research.

The findings suggest that performance and effort expectancy, mobile learning conditions and social influences are associated positively towards behavioural intention; and they also suggest that performance and effort expectancy, and mobile learning conditions considerably foresee student's intentions towards mobile learning readiness. The study confirms that mobile learning has not yet been integrated into the Nigerian Colleges of Education, but the result of the study shows that students are ready and optimistic that it will be a useful technology for the learning processes. In addition, students show their willingness to adopt the technology if introduced into the institutions' teaching and learning practices. It was further ascertained that the integration of mobile learning into colleges of education will not solve the challenges that Nigerian higher education is facing but it renders the opportunity to ease some of the challenges faced by the Nigerian educational systems.

4.10 ICT Strategic Integration in South African Higher Education Institutions

Higher education institutions in South Africa have been ushered into a complex transformation in the post-apartheid era, culminating in three different categories namely: *research-based institutions*, *comprehensive universities* and *universities of technology*. The University of South Africa being investigated in this study falls under the comprehensive institutions of learning, in the classification of open distance learning higher education institutions. The University of South Africa has shifted from being an open distance learning institution to being now an open distance e-Learning institution with more use of educational technology in teaching and learning delivery. More presence and use of technology involve the strategic adoption and implementation of blended learning in the university learning environment to deliver courses/modules.

Rambe (2016) conducted a research on the role that educational technology plays in the design and delivery of curricula programmes at a South African university of technology. Critical Discourse Analysis (CDA) model was used to explore how the discourse of technology integration was articulated in selected Strategic Transformation of Educational Programmes and Structures (STEPS) documents. The research also investigated the extent to which educational technology has been integrated into the new and revised educational programmes in the University of Technology under STEPS. Document analysis was deployed and interviews were conducted to gather information from middle-level managements, educational technologist and curriculum developers. The interview data was gathered from 3 Deans of faculty, one Head of Department and a Director of curriculum planning and e-Learning.

It was noted that South African Universities, most especially the Universities of Technology still struggle with the integration of educational technologies into their teaching and learning practices (curriculum design and delivery), which frequently leads to higher education institutional decisions that impedes technology adoption (Bozalek, Ng'ambi, & Gachago, 2013). Evidence from the findings suggests that the integration of technology into the curricula of the University of Technology was considered to increase access to technology use through learning materials and assessment by means of LMS, improving computer skills through skills training, increased use of smart classrooms for teaching, and broadening prospects for self-study through low-cost technology.

The narratives from the participants suggested that a straight and holistic teaching and learning strategy would be more effective for students learning than a random, uncoordinated strategy where technology would become the centrepiece for a wider range of educational activities. These strategies include but are not limited to:

- Accessing and delivering learning contents by educators;
- Accessing student-peer networks;
- Engaging in group work and discussions;
- Extending student and educators access to learning networks;
- Promoting computer numeracy; and
- Technical competence through students and educators training.

The study concluded that there are reports that indicate that University staff are trained in the use of various technologies and functionalities of certain information technology applications and platforms to strategically integrate technology into teaching and learning at the University of Technology. Yet, there are no evidence of practical examples indicating best practices of technology-mediated curricula integration and development. The statements provided on curricula development and delivery were unproven accounts of the potential of educational technologies to transform teaching and learning, and social practices that required factual information on technology impact to curricula transformation and educational structure. All the middle managers at the University of Technology indicated that there is evidence of technology integration in the offering of new programmes in the blended learning approach. Only one Dean at the University of Technology highlighted the need to promote technology integration: to increase access to learning resources through improved internet connectivity; through the provision of handheld devices and eBooks provided at the curriculum development and delivery stages; and by setting up educational technology training for teachers and students.

The next research focuses on academics that were identified as 'e-Learning Champions'. According to Gachago, Morkel, Hitge, van Zyl, and Ivala (2017, p. 2), these are the lecturers who demonstrate shared characteristics of the phrase 'design thinking mindset'. The design thinking mindset allows academics to shows empathy for students and to promote collaboration in the use of technology for teaching and learning. The study by Gachago et al., (2017) argued that the promotion of the academic mindset through staff development programmes and intervention in the use and integration of technology for teaching and learning practices could support potentially more academics to be innovative.

As mentioned above, in the first paragraph of section 3.8, with increased complexity in the South African higher education landscape, traditional thinking is losing grip and this is becoming typical of developing countries (Ng'ambi, Brown, Bozalek, Gachago, & Wood, 2016). However, it can be noted that digital technology has transformed our lives and works, its adoption in higher education has been slow and limited in many cases (Adams Becker, et al., 2017; Ng'ambi, et al., 2016). Gachago et al., (2017) examined the characteristics demonstrated by innovative higher education practitioners at a South Africa higher education institution. All the academics who participated in the research had participated in staff development activities and had been identified as having integrated technology into their teaching and learning practices.

The study analysed the interview findings from the group of participants who they referred to as 'e-Learning champions'. These are "academics known in their departments to use technology innovatively and who serve important functions of connecting central service units such as the Centre for Innovative Educational Technology with departments and faculties" (Gachago, Morkel, Hitge, van Zyl, & Ivala, 2017, p. 3). The study further revealed that e-Learning champions have nothing to do with teaching and learning experts and/or technology experts, but are academics who have used technology in innovative ways in their teaching and learning activities. The findings from the study generated the following 7 themes with the first 2 themes being the strongest:

- Collaboration and generosity;
- Learner empathy;
- Problem orientation;
- Exploration and play;
- Reflection and resilience;
- Focus on practice, and
- Change agency.

The above themes elicit academics' personal understandings and viewpoints on the impact of academic staff training programmes, such as informal and formal training (staff development) opportunities, collaborative research project on teaching and learning practices and consultation with staff developers. The research further mapped the generated themes onto an existing design thinking model called the d.mindset model that was developed by the Institute of Design at Stanford in 2011. The generated themes were easily matched with the d.mindset model as is depicted in Table 4.2 below:

Table 4.2 Generated Themes Mapped onto d.mindset Model, Gachago et al. (2017)

d.mindset Model	**Champion Mindset**
Radical collaboration	Collaboration and generosity
Focus on human values and needs/empathy	Learner empathy
Craft clarity	Problem orientation
Embrace experimentation	Exploration and play
Mindful of process	Reflection and resilience
Bias towards action	Focus on practice
Show don't tell	Change agents

The table above shows that radical collaboration matches collaboration and generosity; focus on human values corresponds to learner empathy; craft clarity matches problem orientation; embrace experimentation links to exploration and play; mindful of process relates to reflection and resilience. Bias towards action and focus on practice; show don't tell and change agents share many commonalities. In the findings, there are two overlapping themes. Having established that e-Learning champions share a design thinking mindset, the question raised was how such a mindset could be developed amongst other colleagues. Further to this question, the curiosity to understand if it is something people naturally possess or could it be acquired? And if it is the latter (acquired), how could it be achieved through initiatives such as staff development programmes?

The findings of the research offer exciting nuances that emerged from the Cape Peninsula University of Technology, South Africa in the context of teaching and learning practices and culture. Higher education institutions were encouraged to integrate strategies for the design of staff development programmes/initiatives that could promote an academic’s mindset around the use and integration of technology for teaching and learning practices. These initiatives will offer and support more academics to be innovative in their use and integration of technology.

Ng'ambi et al., (2016) indicated that the South African higher education has changed significantly in the context of digital network and technology integration for teaching and learning practices, due to pressures from local education imperatives, national development and global trends. Over the past 20 years, South African higher education has experienced shifts in technology-enhanced educational practices and the research around ICTs has had varying amounts of influences in higher education. The study takes a dive into the 20-year journey of technology-enhanced teaching and learning practices in South African higher education systems. A review of relevant literature was undertaken and presented in 4 sequential phases between 1996 and 2016.

Phase 1 (1996-200) of the literature review revealed practices predominantly in computer-aided instructions, with the consciousness of a digital divide. In phase 2 (2001-2005) the review focuses on South African higher institutions’ ICT infrastructure building, policy development, information democratization and comparison of the effectiveness of teaching with and without information technology. In phase 3 (2006-2010), the review concerned itself with how institutions started to integrate ICTs into their strategic visions and directions to bridge the digital divide with focus on epistemological access. Lastly, phase 4 (2011-2016) focused on mobile learning and social media. The research focus at phase 4 shifted the research agenda from whether or not students/learners would use technology, to how to exploit what students are already using to transform teaching and learning practices within higher education institutions in South Africa. Digital literacies and professional development were also focused on in phase 4.

The key questions shaping South African higher education from 2016 are about the responsibilities and roles that higher education should play in a student’s life. Given that most, if not all students now own a mobile device, connected and socially active, where digital contents are also freely available (with the presence of MOOCs). The research indicated that a good response to the key question will define the future of higher education both internationally and in South Africa for the next 10-year period.

The future of higher education was projected at the *NMC Horizon Project Summit* in 2013, where the future challenges of higher education with possible implications for higher education institutions in South Africa were underscored as follows:

- The concept of the term ‘teach’ should be revisited and revised as its roots involve oral traditions where knowledge was transferred from one generation to another;

- Online learning demand will increase and the need for new approaches will be necessary to meet learning needs of disengaged students;
- The perception of the term ‘failure’ needs to be revisited and revised, such that failure can be as powerful as success (higher education institutions are currently failure intolerant);
- The necessity to develop innovation as a learning culture becomes imperative, as innovation emerges from the liberty to connect ideas in new methods; and
- The importance of developing strategies to preserve digital expressions of institutional practices or else, higher education institutions will be at risk of losing generations of scholarly, creative and cultural contributions.

The research concluded that higher education institutions in South Africa have moved from being exclusively responsible for both their own relatively-poor ICT infrastructure and education provision to cloud-based ICT infrastructure with boundless educational resources that are easily, freely and openly available within and beyond the institutions. Due to the massive shifts in teaching and learning practices in higher education institutions, there are now multiple opportunities that exist for individual academics and students to shape their own teaching and learning experiences.

Minnaar (2013) presented a template analysis on strategic planning for Open and Distance Learning (ODL) or Technology Enhanced Learning in a study conducted at the University of South Africa (UNISA), which unpacks the various challenges for successful planning of ODL. Template analysis was used to construct some sort of road map for academics and ODL planners by indicating four major strategies for ODL successful implementation which consists of the *strategic planning phase*, the *policies*, *systems* and *challenges*. Minnaar recommended the template analysis for use as a foundation template for any ODL planning, execution, monitoring as well as evaluation. It of this researcher’s opinion that the template will be a very useful tool for residential Universities or face-to-face Universities in their strategic thinking processes before implementing the ODL and technology (eLearning) that enhances their teaching and learning strategy.

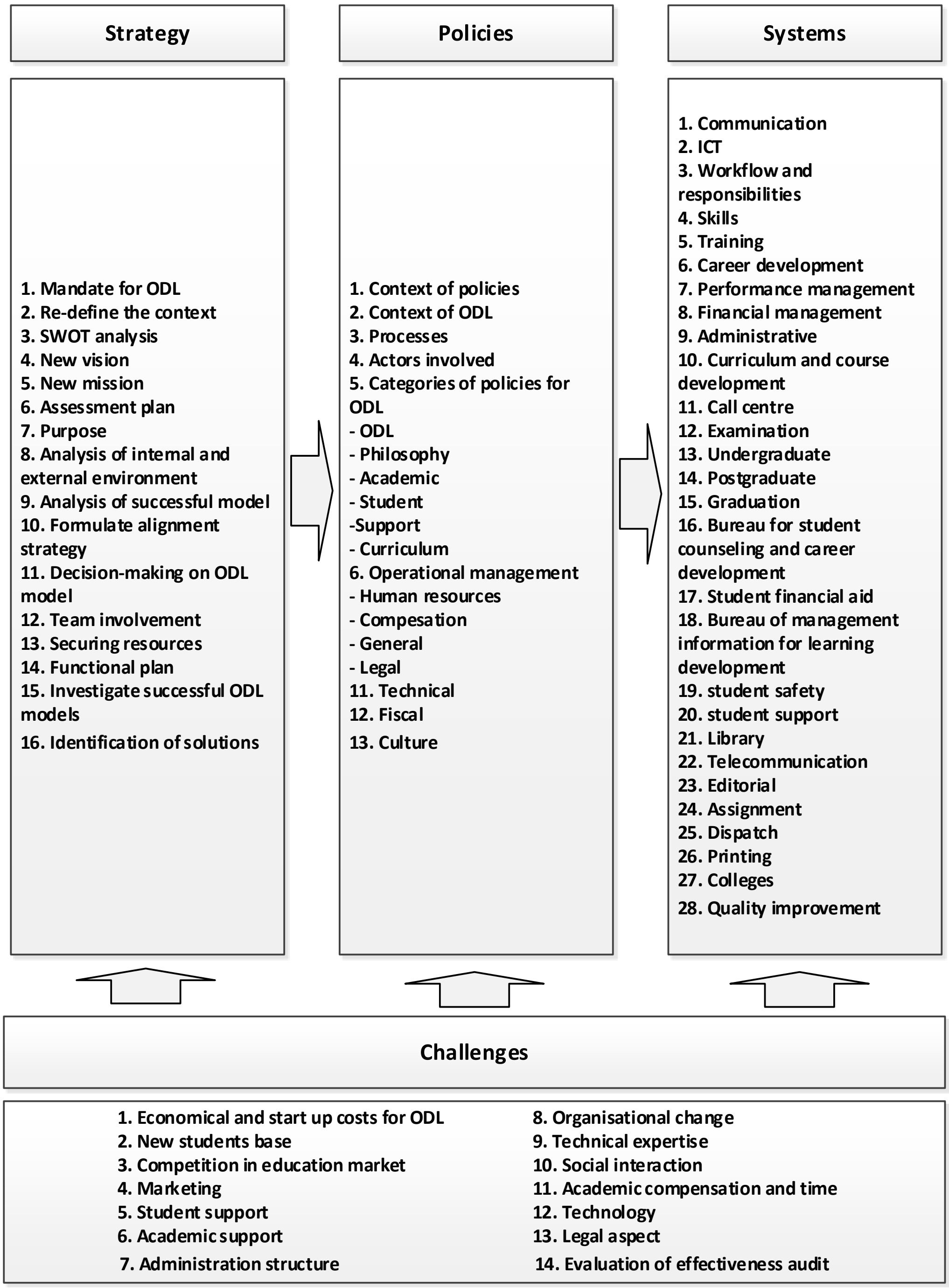


Figure 4.9 Successful Strategies for the Implementation of ODL facilities (Minnaar, 2013, p. 8).

Figure 4.9 shows how strategy precedes policies and systems. Each of the strategic processes depicted in the Figure 4.9 requires the incorporation of a set of decisions and they are fashioned by certain characteristics listed within each process. The different challenges also have continuous impact on all plans and processes identified. In conclusion, poor strategic planning in education environment may lead to ineffective interventions that are not sustainable for higher education institutions. For a successful open and distance learning institution, the need for complex and extensive systems must be recognised as there is no ODL institution that could survive and provide sufficient teaching and learning practices without a collection of systems in place for operation. The study further revealed that ODL institutions heavily and widely rely on a variety of systems to smoothly function in order to satisfy students' needs.

The next study draws on students' articulation of the effect of mobile telecommunications services on their academic and social endeavours. Abatan and Maharaj (2014) examined the impact of mobile telecommunication services on higher education intuitions in both Nigeria and South Africa. The study used the technology acceptance model as the theoretical framework to support the construct of the research. The study identified the mobile telecommunication services that students use to fulfil their academic and social endeavours. Some of which are *SMS*, *MMS*, *voice calls*, *data services*, *conference calls*, *international roaming services* and *GPS services*. The study also identified the challenges that students encounter in their use of mobile telecommunication services for academic endeavours. They included *call drop*; *delayed SMS delivery*; *delayed MMS delivery*; *poor voice quality*; *low data speed* and the *unstable network*.

The study concluded that students finds the use of mobile telecommunication technology relevant to their academic activities, such that they use the technology to *communicate with their lecturers/mentors/tutors*; *finding new information*; *getting examination results*, *research* and for *information sharing*. The study recommended that the integration of mobile telecommunication technology into teaching and learning in higher education institutions in Nigeria and South Africa would facilitate a student-centred learning approach. The integration of mobile telecommunication technology would enhance the efforts of implementing ICT into teaching and learning practices in higher education institutions across the world.

In another study, Tshabalala, Ndeya-Ndereya and van der Merwe (2014) investigated the perceptions of academic staff about blended learning and the identification of challenges they face in the adoption of the technology at a University in South Africa. The research revealed that teaching and learning approach offers a variety of advantages to academic staff but not all academics adopt blended learning when it is introduced by the institution. The study used both TAM and DOI theory to explore the qualitative research. Findings of the study were gathered through interview of focus groups among academic members including lecturers, Heads of Departments and Deans of Faculties. It was revealed that there are a variety of practical problems obstructing academics' adoption of blended learning in their teaching and learning practices. Some of these included the negative attitude of academics regarding blended learning and or e-Learning policies; students and lecturers computer skills; inadequate access of students to computers and management support.

The study concluded that lessons learnt in the research will be of great value and use to other developing Universities across Africa. The research noted that the failure of academic's adoption of e-Learning/blended learning at the institution was due to failure to plan properly for the integration, evaluation and monitoring of the technology by the University management itself. Despite the University's good intentions to introduce and integrate technology into teaching and learning practices, the LMS (Moodle) was not providing adequate assistance to enable students to excel. Students were meant to be the primary beneficiaries of the technology, due to the characteristics (student-centred learning) of the blended learning approach. Recommendations from the study suggests that developing Universities should introduce a more creative and innovative management of teaching and learning programmes that are suitable and significant to support students' learning. Universities should consider the introduction of mobile learning into their teaching and learning practices, since it was identified in the study that computer-related resources were inadequate to enhance teaching and learning (Tshabalala, Ndeya-Ndereya, & van der Merwe, 2014).

4.11 Instances of ICT Strategic Integration at other Higher Education Institutions

The integration of technology into higher education is a complex task based on the dynamic nature of ICT. However, planning for the integration of ICT is considered an important element for improvement and development in higher education. This section of the study focuses on instances of ICT strategic implementation at other Universities across the world. The literature investigates what was considered successful technology integration strategies, what were not successful and why and how these strategies were implemented and dealt with.

The adoption of LMS in a multi-campus higher education institution in Australia was examined using the several elements of the diffusion of innovation theory and actor-network theory. According to Samarawickrema and Stacey (2007), the study was examined across six Monash University campuses with 22 students who participated in the survey, who were chosen based on their use of web-based teaching tools prior to the investigation. The web-based teaching tool was the innovation that the University integrated following the university-designed training protocol that was conducted to enhance technology integration for teaching practices. Data were gathered through a purposive sampling approach with in-person interviews amongst students (participants), evaluation of teaching artefacts and field notes which provided the description and information of participants and their teaching and learning materials. The study then focuses on the University technology policies and the support available for technology resources.

Samarawickrema and Stacey's (2007) study provided a profile of the effect that an Australian University environment had on faculty behaviour towards technology integration. Workload, funding, time and tendency to learn new things constituted the profile of the faculty management. Within the understanding of the framework of the study, the authors established that university policies with regards to technology use have an impact on faculty actions and behaviour towards technology integration. The study concluded that in order to facilitate technology adoption in higher education institution environment, information technology policies must be driven by clear visions and expectations, must be adaptive, and should be able to address the continuous needs for professional development, mentoring and training.

Georgina and Olson (2008) conducted a study in the United States of America on faculty members in the colleges of education among 15 peer institutions of the University of North Dakota. The study examined how the University's faculty technology literacy skills related to educational practices in the integration of technology into their pedagogy. The study also examined the impact of technology training on educational practices of the faculty members. The majority of the survey participants constituted Assistant Professors, Associate Professors and Full Professors. The study revealed that technology literacy and technology training have an impact on the faculty members with regards to technology integration in their teaching and learning practices. The study further revealed that faculty technology training should be maximized for the integration of technology in higher education institutions. However, it was noted that many factors still impede the integration of technology within the institution, some of which included:

- The number of old school lecturers that are not willing to take the time to learn new teaching approaches;
- Use of technology not a priority in the Colleges and/or Departments;
- Time factors (i.e. time to create learning technology, time to learn technology, time to practice technology for teaching);
- The feeling of demoralization by having to use difficult/unfriendly technology tools;
- Not having access to equipped classrooms;
- Lack of departmental/administrative support and impetus in the integration of technology into pedagogy;
- Lack of technical support for night classes;
- Technology not uniformly available; and
- Isolation, due to lack of colleges understanding the importance of effectively integrating technology into learning contents that goes beyond a fancy Power Point presentation.

Recommendations from the study suggest that higher education institutions should organize technology-training workshops on a regular basis that will enhance the motivations and integration of technology. The concept of the workshop is to make technology-training options as available as possible with the use of campus wide technology forums, emails and newsletters for technology training awareness (Georgina & Olson, 2008).

Gikas and Grant (2013) conducted research into technology integration among three higher education institutions in the United States of America, namely: Coastal College, Lakeshore University and the University of Northbrook. The research aimed at examining students' perceptions on learning using mobile computing devices such as smartphones and the role that social media played in higher education. The study noted that the student's lecturers had integrated mobile computing devices into their course contents for a minimum of two semesters. Data were gathered through focus group interviews among the students from the three higher education institutions. The study revealed that the thematic analysis generated two major themes:

- The advantages of mobile computing devices for learning; and
- The frustration of students from learning with mobile computing devices.

The research findings indicated that mobile computing devices and the use of social media for students' learning created the opportunities for interaction, collaboration with other students and allowed students to engage in content creation and communication with the use of social media platform and Web 2.0 technology, through uninterrupted Internet connectivity (Gikas & Grant, 2013). The first themes which indicated the advantage of mobile computing devices for learning were further organized into: quick access to information; communication and content collaboration; variety of ways to learn; and situated learning. The second theme which was the frustration of students from learning with mobile computing devices was also categorized into three, namely: anti-technology instructors in other classes; mobile computing device challenges and; mobile computing devices as a distraction. Other limitations included the fear that the technology will not work properly and small mobile computing devices makes typing difficult.

The study concluded that the students who participated in the study recognized change in their learning regardless of the identified frustration and limitation in the use of mobile computing devices for learning. The integration of mobile computing devices into higher education institutions allows potential learning to occur irrespective of the location. The study finally noted that students who volunteered to participate in the study were those who found the integrated technology impactful in their learning and this suggested that findings from students who did not find the integrated technology could be different.

The concerns and perceptions of Iranian University instructors were investigated in a research project involving technology integration into their classes. Ashrafzadeh and Sayadian (2015) used sequential mixed-method design to conduct the research which included the diffusion of innovation theory and concern-based adoption theory. The study was conducted among 91 Iranian English and Foreign Language (EFL) University instructors. The study revealed that technology integration regarding 'relative advantage' and 'compatibility' attributes of DOI theory were proven to be significantly different and the University instructor's gender was also significantly different in their 'trialability' (sic) attributes. The study's main objective addressed the possible barriers to a University instructor's technology integration attempts in their classes.

The study indicated that there is still a cultural gap in the theories used for the study. It was revealed in the study that the need to consider culture in the integration of technology in higher education and the impact of instructor's beliefs on ICT integration are key determinant to enhance technology integration. The University instructors were concerned that if culture is overlooked, it could have a negative effect on technology integration. The need to consider culture when implementing and applying technology in education has been supported by other researchers (Afzalkhani & Lawwaf, 2013; Atashak & Mahzadeh P., 2010), which also mentioned that culture, cultural beliefs and values could be barriers to technology integration in Iran. However, the study concluded that instructors agreed and confirmed that the integration of technology is of enormous advantage to higher education but identified the complexity of technology in use and integration. The complexity is attributable to many factors, some of which are cultural readiness and perceptions of Asian lecturers in general. The study suggests that Asian teachers still require cultural preparation, introduction and persuasion to benefit the advantages associated with technology integration in their classes.

Higher education institutions are increasingly adopting a blended learning approach in teaching and learning practices which denotes the combination of face-to-face and technology enhanced instruction in the learning environment (Norberg, Dziuban, & Moskal, 2011). Porter, Graham, Spring and Welch (2014) indicated that additional research is required to provide guidance for higher education institutions on strategic adoption and implementation of blended learning in the university learning environment. The study revealed that there is an insufficient amount of research on blended learning that addresses higher education institutional adoption issues.

The authors used their proposed framework, the institutional blended learning adoption and implementation model, to identify three stages of adoption in higher education, namely: *awareness or exploration stage*; *adoption or early implementation stage* and; *mature implementation or growth stage*. The framework further identified key structure, strategy and support issues that universities may address at each of the stages identified above. The research by Porter et al., (2014) applied the institutional blended learning adoption framework to examine 11 cases of Unites States higher education institutions participating in a *Next Generation Learning Challenge* grant which also attempts to transition from awareness/exploration stage of blended learning to the adoption/early implementation stage. The study then compared institutional structure, strategy and support approaches to blended learning adoption in order to identify patterns and differences.

Table 4.3 shows the blended learning implementation stages used to summarize the blended learning adoption framework within the 11 U. S. higher education institutions.

Table 4.3 Blended Learning Implementation Stages Summarized from the *Blended Learning Adoption Framework* (Graham, Woodfield, & Harrison, 2013, p. 7).

Stages	**Description**
Stage 1: Awareness/Exploration	Institutional awareness of and limited support for individual faculty exploring ways in which they may employ blended learning techniques in their classes.
Stage 2: Adoption/Early implementation	Institutional adoption of blended learning strategy and experimentation with new policies and practices to support its implementation.
Stage 3: Mature implementation/Growth	Well-established blended learning structure, strategies, and support that are integral to university operations.

The next table describes the blended learning implementation categories used to summarize the blended learning adoption framework in higher education. The three themes in the table are the key markers of blended learning adoption in higher education

Table 4.4 The Key Markers of Blended Learning Adoption Framework (Porter, Graham, Spring, & Welch, 2014, p. 186).

Themes	**Description**
Strategy	Addresses issues relating to the overall design of blended learning, such as definition of BL, forms of advocacy, degree of implementation, purposes of blended learning, and policies surrounding it.
Structure	Addresses issues relating to the technological, pedagogical, and administrative framework facilitating the blended learning environment, including governance, models, scheduling structures, and evaluation.
Support	Addresses issues relating to the manner in which an institution facilitates the implementation and maintenance of its blended learning design, incorporating technical support, pedagogical support, and faculty incentives.

The study concluded that the key markers which included strategy, structure and support were recommendations that emerged from the research findings. There is a strategic need for institutions to develop blended learning advocates at multiple levels of institutions in order to be able to establish a shared technology integration vision, attract potential adopters and obtain important resources. The research added that institutions planning to integrate technology into teaching and learning practices need to define technology integration structure for the potential adopters while allowing the adopters the freedom to make instructional or educational decisions.

Porter et al., (2014) suggested that structural recommendations require the need for higher education institutions to develop adequate infrastructures that facilitate blended learning adoption. Also suggested that it is necessary to provide technical and education training to support the transformation of face-to-face modules/courses to blended learning experiences. In such a way that this process integrates the best components of online and in-person learning. Lastly, support recommendations should involve the need for higher education institutions to provide adequate technical and educational support continually not only for instructors/teachers but to students/learners who will partake in the blended learning modules/courses. As well as for those who may be lacking in the minimum skill to succeed in a blended learning classroom or learning environment.

In another research by Brown (2016, p.1), it was noted that colleges and universities are increasingly integrating online tools into face-to-face teaching and learning practices, such that the blended learning approach is projected to become “the new traditional model.” Despite the hype about technology integration and blended learning courses, Torrisi-Steele and Drew (2013) indicated that less than 5% of the scholarship on blended learning in higher education explores this academic practices (e.g. for curriculum design, teaching and learning, professional development and training for instructions). However, Brown (2016) conducted a systematic literature review of faculty adoption and use of online tools for face-to-face teaching. The following were identified as influencing factors towards the adoption and use of online tools in a face-to-face teaching institution:

- Faculty member's interactions with technology;
- Academic workload;
- Institutional environment;
- Interactions with students;
- The instructor's attitudes and beliefs about teaching; and
- Opportunities for professional development.

The empirical study concluded that faculty requires guided practices when using online tools, such as remedial support. It also revealed that professional development programmes should focus on strategies, pedagogical skills and technological skills. Some common approaches to skill development and training may include group workshops, guided instructions and instructional seminars.

Changing the perceptions of academics in developing countries towards ICT integration has always been a challenge (Chiome, 2013). In another study, Govender and Chitanana (2016) investigated the factors that influence lecturer’s adoption and use of e-Learning as a mode of instructional delivery at Midlands

State University in Zimbabwe. They used Actor-Networked Theory as the analytical framework to trace the path of the e-Learning programs at the higher education institution. The findings of the study revealed that there are various actors that influence academics through multiple associations created during the implementation of e-Learning programs. Some of the actors identified during the analysis of research data that the e-Learning network at the university included the:

- Human factors – (such as lecturers, students, faculty administrators and ICT staff);
- Structures – (such as senate, institutional policies, departments and library); and
- Technology – (such as e-Learning systems (LMS), Computers, the Internet connectivity and networked computers).

The above listed actors were found to have contributed to the success of e-Learning programs that have changed the Zimbabwean academics from being technophobic (negative) towards technology into being technologically savvy (positive). The study further mapped out the essential factors that influence lecturers' adoption and use of e-Learning as: ICT network infrastructure; provision of computers; e-Learning portal, lecturer training; library support; institutional policies and university administration. In conclusion, the research suggested that institutions should allow lecturers to be e-enabled in order to take the opportunity and full advantage of the use of information technology. This must be fulfilled by creating a collaborative teaching and learning environment with clear institutional policies that will raise more awareness, improve infrastructure and training programmes. e-Learning strategy at universities should be part of the systemic technology integration initiatives towards teaching and learning processes which would in-turn ensure the transformation of academics from being technophobic to technologically savvy.

4.12 Chapter Summary

In this chapter, a literature review on the profile and landscape of higher education as well as technical background of information technology in higher education were presented. The chapter also discussed the different types of challenges and limitations associated with technology integration in higher education. Also, literature on strategic planning of the integration of information technology in higher education were reviewed. The next chapter presents the research methodology.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 Introduction

The previous chapter presented a review of literature on higher education and its landscape in Africa. It discussed the profile and concept of higher education. A literature review on higher education challenges and strategic planning in the integration of information technology in higher education was presented to conclude the chapter. The research methodology applied in this study to accomplish the research objectives is discussed in this chapter. The research methodology and design used for data collection, analysis and interpretation are also presented. Other concepts that will be unpacked in this chapter include the research population, sampling and sampling techniques, the research instrument used, and the research philosophy and principles.

The flow of this research work is shown in Figure 5.1 and the description of each process of the research is presented below:

- The concept of the research was established, including preliminary research design and literature review. The research proposal was developed and defended. Ethical clearance was obtained thereafter.
- The primary literature review for the research was conducted which was more comprehensive than the preliminary literature review. It was an expansion of the preliminary literature review that provided a comprehensive background, development and evolution of information and communications technology.
- The systematic literature review helped to provide access to relevant literature in choosing the three models adopted in the study. The review of literature aided in the understanding and presentation of empirical evidence, case studies, ICT integration trends and an overview of the role of ICT in the higher education landscape.
- A survey was conducted using structured questionnaires. Data analysis of research findings was used to manage and achieve the research objectives.
- Comparative and statistical analysis of research findings was performed, which aided in designing the proposed technology integration framework. Reliability and statistical analysis of findings assisted in presenting the research results.

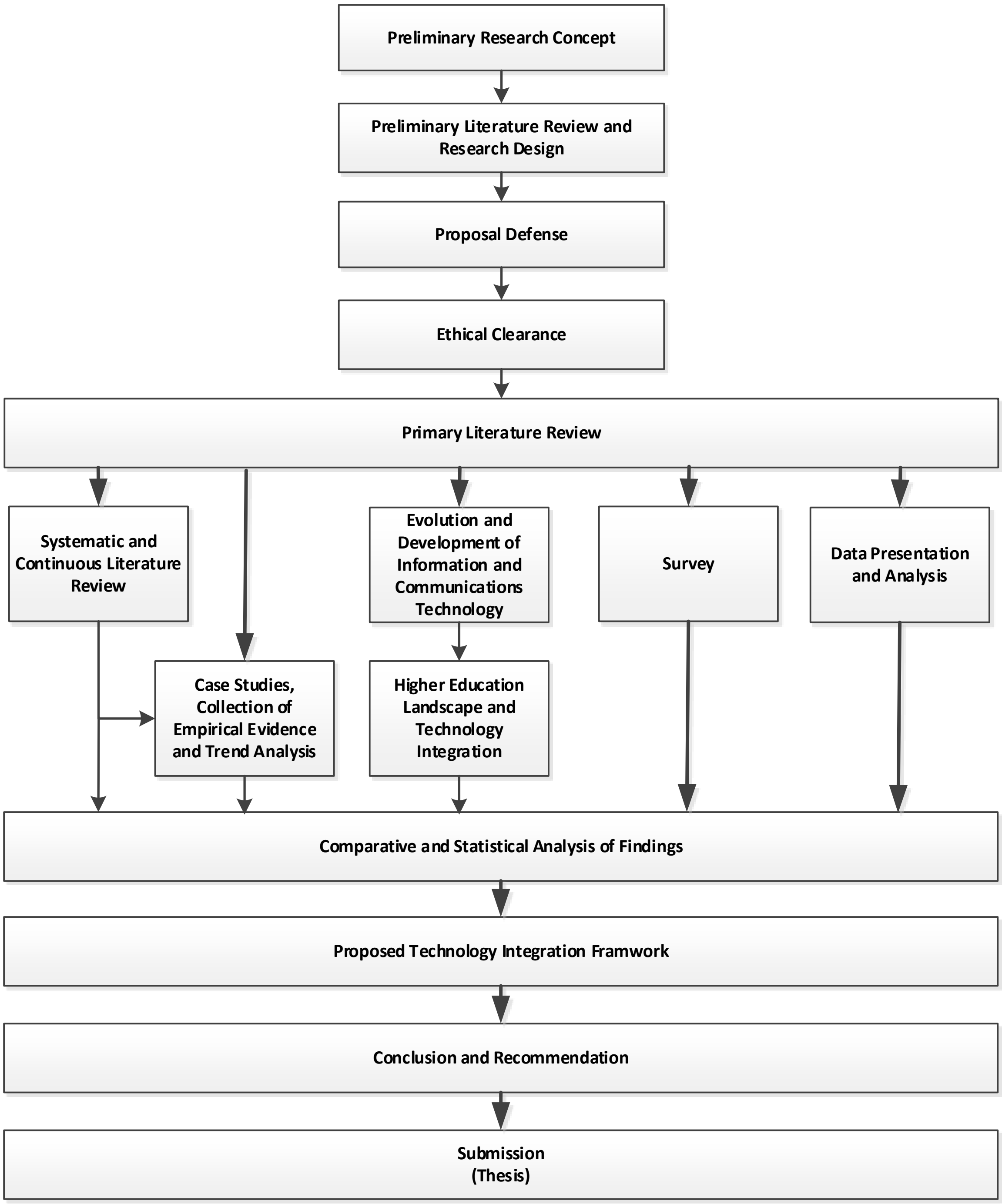


Figure 5.1 The Flow of the Proposed Research Work

The researcher reviewed literature on different research methodologies in order to understand their relative strengths and weaknesses. The study was able to align research methods with the research objectives and questions, which assisted the researcher to select appropriate research method suitable for this study. Therefore, the chapter presents a reiteration of the research objectives, questions and hypotheses proposed for this study.

5.2 Research Objectives

The primary objective of the study is to identify challenges facing the integration of technology into higher education at selected African Universities and to recommend means to alleviate these challenges through the strategic integration of technology. The following are the secondary specific objectives that are required to support the primary objective of the study:

1. To investigate the awareness of the rationale for the integration and use of information technologies at the selected universities in Africa;

2. To examine the historiography and pedagogical underpinnings of the integration of information technology in higher education;

3. To identify the challenges to information technology integration into higher education;

4. To identify the limitations of information technology integration in higher education; and

5. To propose solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education.

5.3 Research Questions

The following research questions seek to address and provide answers to the research questions, and are listed as follows:

1. What is the rationale for the integration and use of information technologies at the selected universities in Africa?

2. What are the historical trends and pedagogical underpinnings of the integration of information technology in higher education;

3. What are the challenges to information technology integration into higher education;

4. What are the limitations of information technology integration in higher education; and

5. What solutions can be proposed to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education?

5.4 Statement of Hypotheses

To achieve the study's objectives, the following propositions were tested empirically:

H0: Alleviating higher education challenges through strategic integration of technology has no direct impact on enhancing teaching and learning outcomes.

H1: Alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes.

5.5 The Research Design

The research methodology and design have a great influence on the capacity to generalize the findings and on the validity of a study. The validity of any study can be described as a measure of the ability of the study to measure what it intended to measure (Couglan, Cronin, & Ryan, 2007). In addition, it is advisable not to explore a research project with a single vision or mind-set but with a variety of views which will give room for multiple facets of the study to be discovered and explored (Baxter & Jack, 2008). Information and communications technology has attracted quite a number of researchers who have contributed to the body of knowledge from different fields of study including but not limited to health, agriculture, education and engineering. Researchers are exposed to different research designs that enable them to achieve their objectives and each of these research designs fits a particular study. Some of the commonly used research designs include casual comparative, correlational, descriptive, explanatory and exploratory research designs (Saunders, Lewis, & Thornhill, 2016).

Information systems and management researchers need to be aware of the philosophical commitments they make through their choices of research strategy because it has a significant influence on both the research activities and the understanding of what they are investigating (Johnson & Clark, 2006). In order to achieve a valid and reliable result for this study, a *pragmatic* research philosophical stance is adopted, with an *explanatory research design* and a *mixed method research approach* (i.e. quantitative and qualitative). These approaches were adopted to investigate, identify, analyse, describe and understand the various technologies and varying challenges in the integration of information technology into higher education institutions, in order to alleviate higher education challenges and enhance teaching and learning outcomes.

5.6 Research Philosophies

Research philosophies refer to the different types of beliefs or world views regarding a chosen enquiry which determine the strategies, design, processes and techniques of investigating the nature of existing knowledge of a construct/object (Saunders, Lewis, & Thornhill, 2016). The term object is referred to in a case of a natural or scientific enquiry and the term construct is referred to in the case of social sciences research (Creswell, 2009). This section of the study discusses the different types of research philosophies as portrayed in Figure 5.2, in accordance with Saunders et al.'s (2016) study on Research 'Onions' and how applicable they are to scientific enquiries.

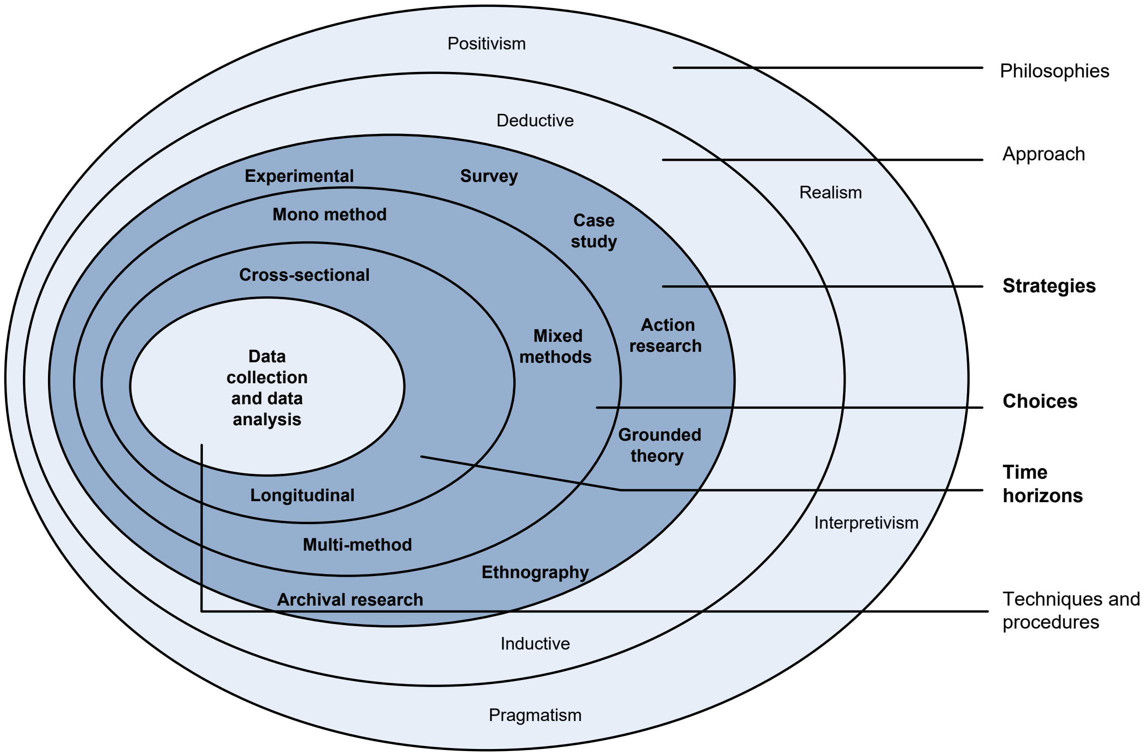


Figure 5.2 Research 'Onions' (Saunders, Lewis, & Thornhill, 2016, p. 108)

5.6.1 Positivism

Researchers who share this belief and/or employ this philosophy are usually referred to as positivists. Positivist research follows the path of natural scientists who emphasize objectivity in their research strategy (Saunders et al., 2016). Positivism from the epistemology viewpoint asserts that objects that are visible and assessable can be generalised as true knowledge. According to Bryman and Bell (2011, p. 15), an object undergoing examination and the meaning attached to such object have a separate existence that is different from that of the researcher. This is true in most scientific research endeavours where the realities of the objects are external to the actors. Positivists are of the view that the knower and the known are independent. According to Eriksson and Kovalainen (2015:46), positivists argue that measurement is the core of any scientific undertaking. Positivism is usually associated with quantitative research methodologies as well as studies pertaining to natural sciences (Fuchs, 2012:31).

5.6.2 Realism

According to Bryman and Bell (2011, p. 17), realism shares two major attributes of positivism. First, the assumption that scientific and social/management science research should use a uniform method for collecting data. Second, the orientation that is completely different from the object undergoing examination. This observation has led to two different types of realism (i.e. Empirical and Critical Realism).

Empirical realism (direct) suggests that the adoption of proper techniques will enhance knowledge advancement on a specific phenomenon (Bryman & Bell, ibid). However, there remains an argument between business research and natural science research that questions what empirical realism has to do with a social actor's opinion through their senses to provide a true picture of the world. This argument may be acceptable in natural science research but may not be totally acceptable in business research (Saunders et al., 2016). On the other hand, critical realism questions the extent to which a social actor's opinions give a true picture of the world. In this instance, all cited cases in human senses deceive social actors, which may lead to an inaccurate account of the world (Creswell, 2009; Saunders et al., 2016).

Social science researchers (actors) see things differently, relying upon the conditions or circumstances within reach. According to Saunders et al. (2016), critical realism posits that human information/knowledge of reality depends on shared training and cannot be expected if the social science actors are not involved with the learning procedure. Empirical realism may take the position that the world is relatively stable, dependent on the orientation of 'what we see, is what we get'. However, critical realism proposes that the business world is changing drastically, making it difficult to avow that 'what we see, is we get'. In this perspective, what one sees may not mean what one gets because of fluctuating and wrong views of what is by all accounts the correct reality.

5.6.3 Interpretivism

The interpretivism emphasises the differences between humans as social actors. This research philosophy advocates that it is essential for the researcher to understand differences between humans in the role of social actors. According to Saunders et al. (2016), interpretivism emphasises an understanding of the difference between conducting research amongst people rather than objects (e.g. trucks and computers). Interpretivism is considered an alternative research philosophy to positivism as they both relate to research in the natural sciences. Interpretivism lays emphasis on the need to reduce the difference between the researcher as a social actor and that which is being researched, which is also a social actor (Leedy & Ormrod, 2010). This indicates that the researcher and the human behaviour undergoing investigation are inseparable and this is sometimes applicable to researchers in the field of social/management sciences.

It is important in this instance to adopt the interpretivism viewpoint to enable full understanding of the social phenomenon undergoing investigation, so as to avoid a situation where researchers' viewpoint dominates the interpretation of the findings (Saunders et al., 2016). Although the interpretivist approach offers benefits to social/management sciences, it has challenges that pertain to reliability, validity and generalisation (Kelliher, 2011).

5.6.4 Pragmatism

According to Saunders et al. (2016), pragmatism argues that research questions are the most important determinant of the epistemology, axiology and ontology of any inquiry. Pragmatism holds as long as the research question does not suggest explicitly that either a positivist or interpretivist philosophy is adopted. The pragmatist mirrors a theme that suggests mixed methods (i.e. quantitative and qualitative) are possible and possibly highly appropriate within a study. In pragmatism, the researcher is at liberty to employ the appropriate method(s) based on the requirement to produce better results using pragmatic research questions (Creswell, 2009; Johnson & Clark, 2006).

Pragmatism also argues that the researcher sees the world as completely diverse in nature, which requires different techniques to find the most appropriate solutions to its challenges/problems (Creswell, 2009; Saunders, Lewis, & Thornhill, 2016). This argument suggests the need for multiple techniques in the data collection and analysis procedures in order to overcome the inadequacies of employing a mono method. The adoption of mixed methods or multiple methods does not necessarily indicate the researcher should not justify the reasons for chosing a research method or a combination of methods. Overall, choosing the pragmatic worldview offers opportunities for different assumptions, approaches, perceptions that lead to better data collection, analysis and interpretation of findings to produce holistic research results (Leedy & Ormrod, 2010).

As noted by Saunders et al. (2016), pragmatism presupposes that research questions inform or determine the choice of epistemology, axiology and ontology of an inquiry. The authors added that a specific philosophy may be more suitable than another or a combination of the three perspectives in the quest to answer and provide appropriate solutions to the question(s) being asked. This accounts for the creation of the mixed methods approach to solve social/management science problems. A summary of the four research philosophies discussed is presented in Table 5.1 below.

Table 5.1 Comparison of Four Research Philosophies in Management Research (Saunders et al., 2016, p 119)

	Positivism	Realism	Interpretivism	Pragmatism
Ontology: ***the researcher's view of the nature of reality or being***	External, objective and independent of social actors	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question
Epistemology: ***the researcher's view regarding what constitutes acceptable knowledge***	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements	Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data
Axiology: ***the researcher's view of the role of values in research***	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
Data collection techniques most often used	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple method designs, quantitative and qualitative

5.6.5 The Most Suitable Research philosophy for the Study

After a review of the different research philosophies, the study considered pragmatism the most appropriate research philosophy to underpin this study. This choice is based on the need to adequately investigate the relationship between alleviating higher education challenges through strategic integration of technology and its impact on teaching and learning outcomes at selected universities in Africa. The justification for choosing this philosophy is that this study employed mixed method (i.e. quantitative and qualitative) approach to collect and analyse data. Instructively, the mixed method is a cardinal feature of pragmatism.

To reaffirm, Leedy & Ormrod (2010) suggest that pragmatism provides the opportunity for different assumptions, approaches, perceptions that lead to better data collection, analysis and interpretation of findings to produce exceptional research results. This suggestion coheres with Morgan's (2007) view that the employment of pragmatism is one of the best ways to justify the mixture of numerical and non-numerical research methods to investigate a question in the social/management sciences. Furthermore, the mixture of both numerical and non-numerical data and analysis procedures generally lead to reliable research outcomes. Lastly, the three theoretical frameworks adopted in this study guide and accommodate the choice of mixed method research, which has a great effect on the quality of research results produced in this study.

This study aims to alleviate higher education challenges through the strategic integration of technology in order to enhance teaching and learning outcomes at selected universities in Africa. To achieve this aim, the study employed pragmatism as a philosophical stance along with its choice of concurrent transformative mixed method of data collection in order to ensure reliable and quality research outcomes. Against the backdrop of the discussion above, pragmatism was chosen as the philosophical justification for mixed methods of data collection and analysis procedures based on the requirements of the problem statements, research objectives and research questions of this study (Creswell, 2009; Leedy & Ormond, 2010; Saunders et al., 2016).

5.7 Research Approach

According to Saunders et al. (2016), research approach can be assessed from two distinctive perspectives, namely: deductive approach and inductive approach. It is relevant and of great value to integrate these two research approaches when developing theories in a study. The two approaches are further discussed below.

5.7.1 Deductive Approach

Deductive research approach is associated with the positivist philosophy which is typical in natural sciences (Saunders et al., 2016). This can also be associated with an objective assessment of existing law, knowledge and theoretical considerations to formulate hypothesis, data collection, analysis and interpretation of research findings in order to accept or reject hypothesis and re-assessment theory (Bryman & Bell, p. 11). The goal of the researcher in the deductive research approach is to test concepts and patterns known from theory using new empirical data (Bhattacherjee, 2012). However, the goal of theory-testing is not only for testing theory but to also improve, refine and possibly expand/extend the theory.

5.7.2 Inductive Approach

According to Bhattacherjee (2012), the goal of the researcher in the inductive research approach is to infer theoretical concepts and patterns from observed data. The inductive kind of approach is loosely referred to as *theory-building* research while the deductive approach is referred to as *theory-testing* approach. It is imperative to understand that the inductive research (theory-building) and the deductive research (theory-testing) are both significant for the development of social/management science. Generally, sophisticated theories are considered less valuable if they do not match reality. Similarly, enormous amount of data are also of little or no value except they can contribute to the construction of new theories (i.e. representation of knowledge), (Bhattacherjee, ibid., p. 7). Studies have shown that researchers in the social/management sciences acknowledge that inductive research could enable in-depth investigation of cause-effect links between two distinct variables in the effort to inductively develop/build theories. Research endeavours that adopt the inductive research approach are usually concerned with the methods of collecting data to procure first-hand information on phenomena. This has led to the reason why qualitative research approach is more likely applicable in an inductive investigation, especially, the use of interviews and observation to acquire in-depth knowledge and understanding about a social phenomenon so as to contribute inductively to the body of knowledge (Bhattacherjee, 2012; Kelliher, 2011; Leedy & Ormond, 2010).

5.7.3 Combining Research Approaches (Deductive and Inductive Research Approaches)

Saunders et al. (2016) discuss the relative strengths of the deductive and inductive research approaches. The strength of the inductive research approach lies in the application of rigorous and in-depth techniques for the collection of data, using appropriate qualitative approach to procure new and undiluted information directly from the source. On the other hand, an inductive research approach tends to focus more on smaller sample size with in-depth data collection and analysis techniques. On the other hand, the deductive research approach focuses on large sample sizes and quantitative data subjected to complex statistical analysis. Each of these research approaches has its shortcomings. Hence, scholars tend to recommend a combination of the two research approaches in the same piece of study in order to develop/build new theories and/or re-examine existing theories to be able to contribute to the body of knowledge (Bhattacherjee, 2012; Creswell, 2009; Leedy & Ormond, 2010; Saunders et al. 2016).

According to Ali and Birley (1999), the integration of both research approaches is logical in social/management science research due to the specific business nature that involves activities such as objects, constructs and social actors. Table 5.2 below shows the juxtaposition of the integrated, deductive and inductive research approaches.

Table 5.2 Integrated vs. Deductive and Inductive Research Approach (Ali & Birley, 1999, p. 106)

Step	Deductive	Inductive	Integrated/Combined Approach
1	Develop theoretical framework	Areas of investigation are identified; No theoretical framework developed	Develop theoretical framework based on constructs
2	Identify variables for relevant constructs	Respondents identify constructs and give explanation in the relationship between them	Certain variables are identified for relevant constructs: other variables can be identified by respondents
3	Develop research instrument	Identify broad themes for discussion	Research converts the a priori theoretical frameworks into theoretical questions
4	Collection of data from respondents	General terms of interest are discussed by respondents	Respondents discuss the general questions and identify constructs that are meaningful to them as well as explain the relationship between the constructs
5	Analysis of data in terms of priori theoretical framework	Theory developed by researcher only on inductive basis	Collected data from respondents are analysed according to existing theory; Otherwise, theory is developed based on inductive approach – with no regard to the existing theory.
6	Result: theory is tested based on the decision to accept or reject the formulated hypotheses	Result: Develop theory	Result: Either theory is improved/adapted or an alternative theoretical framework is presented.

Creswell (2009) also argued that it is not only perfectly possible to combine the deductive and inductive research approaches within the same piece of study but research experience has shown that the combination of both research approaches is of great advantage in a study. Saunders et al. (2016) indicated that the combination of both deductive (quantitative) research and inductive (qualitative) research in the same piece of study is referred to as mixed methods. In view of the merits associated with the integrated approach, this research study employs mixed-methods research approach (integrated approach) to investigate, analyse and present findings in order to develop new knowledge and contribute to the body of knowledge.

5.7.4 The Research Approach Adopted for the Study

The need to address the disparity between objective and subjective processes in the quest to develop new knowledge and/or re-examination of existing knowledge so as to provide detailed explanation of the important variables gave rise to the combination or the use of the two research approaches. This study adopts the integrated (combination of deductive and inductive) research approach to understand, analyse and interpret collected data through close-ended and open-ended questions that were included in the questionnaire distributed to academics at the selected universities in Africa. The in-depth interview responses obtained from administrative support staff from the selected universities were analysed and interpreted using the inductive research approach. The purpose of interviewing the administrative support staff was to authenticate the findings obtained from academics (through a questionnaire) with regards to their opinions/perceptions towards integration of technology in higher education and its impact on teaching and learning outcomes.

Having considered the relative strengths and weaknesses of the deductive and inductive research approaches (Ali & Birley, 1999; Creswell, 2009; Saunders et al., 2016), the researcher decided to select the integrated approach as the most adequate to investigate the relationship between alleviating higher education challenges through the strategic integration of technology and its impact on teaching and learning outcomes at selected universities in Africa. This choice is based on the strength these research approaches provide in presenting advanced explanatory analysis among two or more variables (Edmonds & Kennedy, 2012). This argument is also in line with the assumptions of pragmatism – the philosophical stance adopted in the study. The three theories (Change management model; Model of technology adoption in the classroom; and Diffusion of innovation) adopted in this study coupled with the integrated research approach assisted and enabled the researcher to provide relevant answers to the main research questions and solutions to the gaps between alleviating higher education challenges through strategic integration of technology and its impact on teaching and learning outcomes. This was achieved by means of an explanatory research analysis of how and why alleviating higher education challenges through strategic integration of technology impact teaching and learning outcomes. This is carried out using numerical and non-numerical data collection and analysis to provide reliable research outcomes and make relevant contributions to the body of knowledge (Leedy & Ormond, 2010; Saunders et al., 2016).

5.8 Research Strategies

Research strategies refer to the methods used by a researcher in a study to collect data with the aim of drawing realistic deductions (Azika, 2008). Research methodology can be performed through different types of research strategies. Research strategy can be described as the methodology employed by the researcher to probe the causes of a particular research problem by interpreting and incorporating research methodology into tools, instrument and techniques (Maylor & Blackmon, 2005). There are three major types of research studies which are subdivided into different forms of research strategies. These are discussed as follows.

5.8.1 Exploratory Studies

As Bhattacherjee (2012, p. 9) noted, an exploratory study is frequently conducted in new areas of investigation, where the objectives of the research are to:

- scope out the magnitude or extent of a particular phenomenon, problem/behaviour;
- generate some initial ideas (or "hunches") about that phenomenon; and
- test the feasibility of undertaking a more extensive study regarding that phenomenon.

The idea of an exploratory study coheres with the intent of qualitative studies that focus mainly on interviews and observations – sources of data collection in order to provide a new insight/knowledge on a phenomenon (Sekaran & Bougie. 2009). In addition, some strategies such as focus groups are appropriate for exploratory studies. A case research method is particularly appropriate for exploratory studies for discovering constructs of interest in areas where theory building is at the formative stages, for studies where the experiences of actors and context of actions are critical, and for studies aimed at understanding complex, temporal processes (why and how of a phenomenon) rather than factors or causes (what), (Bhattacherjee, 2012). This study employed the basic assumptions of an exploratory study by means of reviewing literature that revealed the gaps with regards to technology integration challenges. The study also utilised the qualitative approach by including open-ended questions in Section D: Questions 26b and 27 of the research questionnaire to produce vital information in the process of assessing solutions aimed at addressing drawbacks in the integration of information technology in higher education.

5.8.2 Descriptive Studies

A descriptive research is undertaken to ensure careful observations and detailed documentation of a phenomenon of interest. "These observations must be based on the scientific method (i.e., must be replicable, precise, etc.), and therefore, are more reliable than casual observations by untrained people" (Bhattacherjee, 2012, p. 9). As the name suggests, descriptive research involves a comprehensive discussion of a phenomenon, and this enables integrated discussion on previous exploratory study or sometimes both (Saunders et al., 2016). Descriptive research often builds on the foundations laid by exploratory research so as to provide elaborate discussions. Based on the integrated strategy mentioned above (ibid., p. 140), this study employed some of the principles of descriptive research by providing comprehensive description of the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa. It also offers a descriptive analysis of the challenges that academics at the selected universities grapple with in the integration of information technology for teaching and learning purposes.

5.8.3 Explanatory Studies

An explanatory research design is characterised by the use of hypothesis testing to ascertain or explain the nature of the association or difference between two or more variables rooted in a study (Saunders, et al., 2016). Explanatory research tends to provide answers to the question ‘why’ and ‘how’ and attempts to ‘connect the dots’ in a study by identifying causal factors and outcomes of the specific phenomenon (Bhattacherjee, 2012, p. 9). It is noted that some academic researches integrate some level of exploratory and/or descriptive research at the initial phases of research but most academic researches belong to the explanatory category (ibid., p. 9). In an explanatory research, seeking explanation for observed events often requires the researcher to have strong theoretical and interpretation skills as well as insights, intuition and personal experience. Saunders et al. (2016) added that data collection techniques and analysis procedures in an explanatory research can take the form of quantitative or qualitative or mixed methods approach depending on the nature of the research questions.

By and large, this study shares most of the principles of explanatory research by employing mixed methods of data collection and analysis procedures to provide comprehensive analysis and description of the link between alleviating higher education challenges through strategic integration of information technology and its impact on teaching and learning outcomes. This assumption is based on the pragmatism philosophical stance (Creswell, 2009; Saunders et al., 2016). The research questions and hypotheses formulated in this study were based on the gaps identified in the review of literature. Recommendations and a proposed theoretical framework on technology integration in higher education were proffered to alleviate higher education challenges, enhance learning outcomes and ensure that ICT achieves its promised benefits to higher education.

5.8.4 Experimental design

“The Experimental research is best suited for explanatory research (rather than for descriptive or exploratory research), where the goal of the study is to examine cause-effect relationships” (Bhattacherjee, 2012, p. 84). Experimental research design also works well for research that involves a relatively limited and well-defined set of independent variables that can either be manipulated or controlled (Saunders et al., 2016). Experimental research can be conducted in laboratory or field settings. Laboratory experimental research are common in pure scientific research than in social/management sciences research. This is due to the difficulties in the application of laboratory experiments or conditions into the social/management environment (Creswell, 2009). However, field experiments are popular and common in social/management sciences research, which often takes place in real-life situations (Edmonds & Kennedy, 2012).

For this study, experimental research design was not the best choice, hence, it was not employed. This is for the reason that the researcher does not have the intentions to manipulate the independent variables of the study. Further justification for not choosing experimental design was the difficulties in its application of laboratory conditions into social/management sciences (Creswell, 2009).

5.8.5 Research Strategy adopted for the Study

After a careful review of the strengths, weaknesses and principles associated with each research strategy as discussed in the previous sections, and taking cognisance of the objectives of the current study, the researcher employed the most relevant strategy in order to achieve the study's objectives. Hence, the study employed a non-experimental research design of ex post facto type (there will be no manipulation of independent variables in the study). This choice was supported with a mixture of observational (correlation) and a cross-tabulation (cross-institutional analysis) approaches, using an advanced *explanatory* design. This decision arose from the need to collect data from selected academics using multiple variables to validate the directions between variables (Edmonds & Kennedy, 2012). This type of research design was considered the most appropriate for this study and provides the space to infer relationship through the application of multiple regression and correlation to alleviate higher education challenges through strategic integration of technology and its impact on teaching and learning outcomes, in order to ensure that ICT integration achieves its promised benefits to higher education. This approach was justified from similar empirical studies that used similar approaches (Alfahad, 2012; Fishman et al., 2004; Rogers, 2002; Sang & Tsai, 2009; Schneckenberg, 2009; Zimmerman & Yohon, 2004). This decision further informed the various research choices in the formulation of the research design suitable for this study and are discussed below.

5.9 Research Choices

Research choices are formulated based on the information the researcher has and these choices form the various research techniques chosen for the collection and analysis of data in a study. When choosing a research technique for data collection and analysis procedure in a study, the researcher has the opportunity to choose between quantitative or qualitative data collection technique and data analysis procedure and/or a combination of both techniques. Saunders et al. (2016, p. 151) stated that "the terms quantitative and qualitative are used widely in business/management research to differentiate both data collection techniques and data analysis procedures." One way of distinguishing between the two is the focus on numeric (numbers) or non-numeric (words) data. The two techniques are further discussed below.

Quantitative Research approach

Quantitative research technique is often computationally or mathematically based in nature and it provides frequencies and probabilities for the research result. The approach also emphasizes the importance of using data to guide the choice of analysis techniques. Quantitative research can be associated with the positivist paradigm which is based on theory testing before realizing the research findings and units of analysis in quantitative research which are based on research questions or hypotheses (Saunders, Lewis,

& Thornhill, 2016). Quantitative research methodologies allow data collection from geographically dispersed respondents but the collected data must be presented in a controlled and formalized way (Leedy & Ormrod, 2010). Leedy and Ormrod further indicated that quantitative research methodologies are suitable research techniques for the collection of data from a very large sample size.

Qualitative Research Approach

On the other hand, qualitative research approach is usually associated with coding of themes and/or categories. The data obtained in a qualitative research are referred to as non-numeric data, that is, data that has not been quantified which may range from open-ended questions in a questionnaire to the gathering of more multidimensional data from in-depth interview (Saunders, Lewis, & Thornhill, 2016). In-depth interviews are used to analyse qualitatively in order to have a depiction of the important issues useful in the research. Qualitative data analysis includes both *deductive* and *inductive* approaches which also range from simple categorisation of responses to the process of identifying relationships between themes and/or categories. The inductive approach can be described as the collection of data which can then be explored to identify which themes and/or issues to develop and concentrate on (Leedy & Ormrod, 2010; Saunders, Lewis, & Thornhill, 2016).

As depicted in Figure 5.3, the way in which a researcher chooses to combine both quantitative and qualitative data collection techniques and analysis procedures is at the researcher's discretion. However, research choices include mono, multiple and mixed methods research (Saunders, Lewis, & Thornhill, 2016). These are discussed in subsequent sections below.

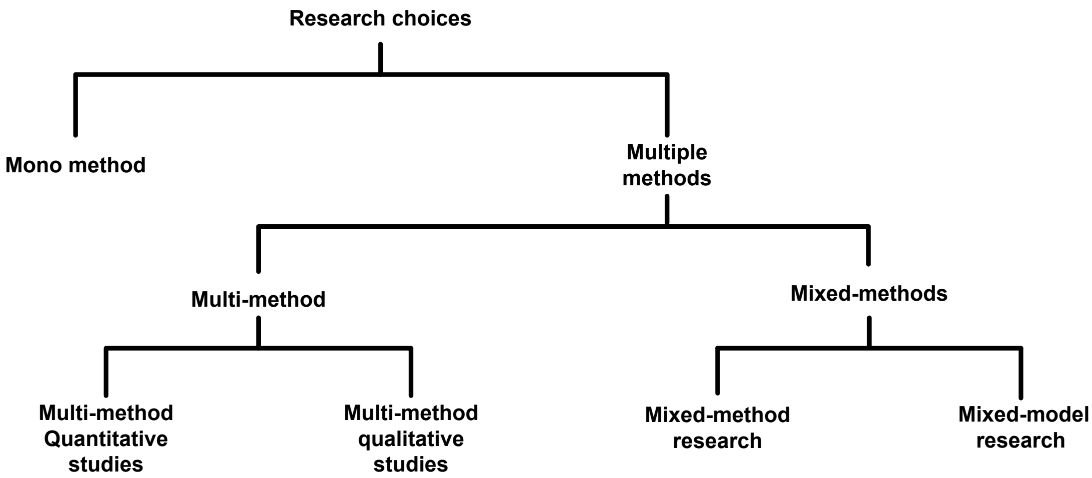


Figure 5.3 Research Choices (Saunders et al., 2016, p. 152)

5.9.1 Mono method

Saunders et al. (2016, p. 151) stated that "mono method research involves the adoption of data collection technique and conforming data analysis procedure." This refers to the context where data can be collected and analysed in either numerical (quantitative) form or non-numerical (qualitative) form subjected to complex statistical analysis to report/present findings in numerical forms. This research method has its shortcomings, which include lack of data triangulation. In addition, the reliability and validity of the instrument and data integrity might be questionable (Saunders et al., ibid.). Therefore, the researcher did not find this method appropriate for this study as it may not be adequate to answer complex and dynamic research questions, because such questions may require the use of multiple and/or mixed methods research techniques that support data triangulation (Wilson, 2010).

5.9.2 Multiple methods

In the multiple research methods, there are two or more data collection techniques involved in the corresponding data analysis procedures. Saunders et al. (2016) categorised the multiple methods into two major categories (i.e. multi-methods and mixed methods). Both methods also have their corresponding data collection and analysis techniques, as discussed below.

5.9.2.1 Multi-methods

According to Bhattacherjee (2012), multi-methods research may be more suitable for complex, uncertain, and multifaceted social phenomena, which may help leverage the unique strengths of each research method and generate insights that may not be obtained using a single method.

- **Multi-methods quantitative studies**

Saunders et al. (2016) stipulated that multi-methods quantitative studies are quantitative studies with combination of two or more quantitative data collection and analysis procedures. This type of research is common in social/management science studies such as finance, accounting and economics management. In this instance, quantitative data are collected either from primary sources or secondary sources of data and/or sometimes both sources of data and then processed utilising complex statistical methods to analyse data based on the study's objectives. Typically, researches that employ this method strive for objectivity in their investigation, which guides the analysis and interpretation of their findings. Creswell (2009) noted that the strengths of this research approach include reduced cost, less time to execute, and more time for data analysis especially when data are collected from different secondary sources. On the hand, Wilson (2010) noted that its shortcomings may include but not limited to the ability to manage large and complex data and challenges of familiarisation with secondary data set.

- **Multi-methods qualitative studies**

In the case of multi-methods qualitative studies, this approach combines two or more qualitative data collection methods and the corresponding data analysis procedures (Saunders, et al., 2016). This research approach has been found to be common in sociology, human resources management, anthropology and related social/management sciences research where qualitative collection of data is applied by combining different data collection techniques. Due to its qualitative nature, data are analysed using non-numerical procedures based on the objectives and questions of the study. One of the strengths in using this type of research approach is the richness of information collected with the aid of using different methods of data collection. A major shortcoming is its inability to focus on large sample size. Another shortcoming is its over-reliance on a subjective form of investigation and if not properly managed could lead to research bias (Saunders et al., 2016).

5.9.2.2 Mixed Methods Research

Mixed methods research approach as the name suggests is a general term when both quantitative and qualitative collection of data and analysis procedures are employed in a research design as depicted in Figure 5.3. Saunders et al. (2016, p. 152) stated that the approach "uses quantitative and qualitative data collection techniques and analysis procedures either at the same time (parallel) or one after the other (sequential) but does not combine them." This means that the usage of both quantitative and qualitative data collection techniques and analysis procedures could either be done concurrently (concurrent mixed methods) or sequentially (sequential mixed methods).

- **Concurrent Mixed Methods and Sequential Mixed Methods**

In the *concurrent mixed methods*, a good example is a cross-sectional survey utilising well-structured questionnaire with closed and opened-ended questions (Creswell, 2009). On the other hand, *sequential mixed methods* may allow the researcher to combine exploratory and explanatory research strategies. In this instance, the researcher first collects, analyses and interprets data qualitatively to fulfil exploratory objectives of the study and subsequently collects data from a large sample size, conducts analysis using statistical procedures to objectively fulfil the explanatory objectives of the same piece of study. This strategy typically depends on the discretion of the researcher as it may be done in reverse.

- **Transformative Mixed Methods**

The alternative method to both concurrent mixed methods and sequential mixed methods is the transformative mixed methods. *Transformative mixed methods* research approach permits numerical and non-numerical data to be collected and analysed either concurrently or sequentially depending on the problem, questions and objectives of the study. Table 5.3 below shows some of the reasons and description of using mixed-method approach.

Table 5.3 Mixed-methods Research (Bryman, as cited in Saunders et al., 2016, p. 154)

Reasons	Description
Triangulation	Use of two or more independent sources of data or data collection methods to corroborate research findings within a study.
Facilitation	Use of one data collection method or research strategy to aid research using another data collection method or research strategy within a study (e.g. qualitative/quantitative providing hypotheses, aiding measurement, quantitative/qualitative participant or case selection)
Complementarity	Use of two or more research strategies in order that different aspects of an investigation can be dovetailed (e.g. qualitative plus quantitative questionnaire to fill in gaps quantitative plus qualitative questionnaire for issues, interview for meaning)
Generality	Use of independent source of data to contextualise main study or use quantitative analysis to provide sense of relative importance (e.g. qualitative plus quantitative to set case in broader context; qualitative and quantitative analysis is to provide sense of relative importance)
Aid interpretation	Use of qualitative data to help explain relationships between quantitative variables (e.g. quantitative/qualitative)
Study different aspects	Quantitative to look at macro aspects and qualitative to look at micro aspects
Solving a puzzle	Use of an alternative data collection method when the initial method reveals unexplainable results or insufficient data

5.9.2.3 Mixed Model Research

This approach of research is a mixture of numerical and non-numerical methods of data collection and analysis procedures, which are integrated while generating research questions (Saunders et al., 2016). The approach affords researchers the opportunity to transform numerical data into narrative form of information that can be non-numerically analysed. Equally, it allows the transformation of non-numerical data into numerical codes that can be statistically analysed (Bryman, as cited in Suanders, et al. 2016, p. 153).

5.10 Data Collection Methods and Techniques

Research can employ different data collection techniques. The scientific investigation technique to implement in a research is attributed to the type of data to collect (Cohen & Morrison, 2007). For the purpose of this study, a concurrent transformative mixed method (i.e. quantitative and qualitative) research approach was employed. The researcher considered this approach suitable and appropriate to effectively investigate the alleviation of higher education challenges through the strategic integration of information technology and its impact on teaching and learning outcomes at selected universities in Africa. To further justify the adoption of concurrent transformative design, the researcher found the approach useful as it enables simultaneous collection of quantitative and qualitative data. The approach also offers the opportunity for skewed and equal priority to be given to both quantitative data and qualitative data (Creswell, 2009; Leedy & Ormrod, 2010).

In this case, the researcher gave higher priority to quantitative data rooted in a non-experimental research design of ex post facto type. This was achieved using a correlation approach with advanced explanatory design. Further justification for employing a concurrent transformative approach is that it creates a platform for separate analysis of quantitative data and qualitative data, yet integrated at the interpretation stage (triangulation) of research analysis (Bhattacherjee, 2012; Creswell, 2009; Leedy & Ormrod, 2010). This approach enables data triangulation in the course of investigation and provides access to information from diverse worldviews (Saunders et al., 2016). It also encourages respondents' opinions of the construct so as to better conceptualise a phenomenon from the respondents' point of view with regards to the theoretical propositions (Creswell, 2009). The research approach of this study obviates the shortcomings of a non-experimental research design (Johnson, 2001).

For the quantitative aspect of data collection, a self-administered and well-structured questionnaire was designed for primary data collection with the use of quantitative research approach/principles to collect and analyse data from the target population of the study (which included academics from LASU, UKZN and UNISA). A qualitative research approach was applied to the analysis of the open-ended questions (i.e. Question 26.b and Question 27) used in the research questionnaire. The same qualitative research approach was used in the design of the in-depth email interview employed to gather the opinions of the University management/administration (i.e. LASU, UKZN and UNISA) in order to validate the results obtained from academics at the same institutions. The in-depth interview can be found in Appendix 4. In addition, an inductive approach was used to analyse the responses to the open-ended questions in the questionnaire and to analyse the in-depth email interviews conducted with the University management/administration with the aid of Nvivo 11 software.

5.10.1 Primary Data

A questionnaire was designed as the source of primary data and it is fully described in the following subsections:

5.10.1.1 Questionnaire

One form of questionnaire was created and written in the English language. It was filled in anonymously. It had a brief introduction to the study, and a consent to participate form that contained the conditions for participation. Participants were requested to read this before they signed an agreement to participate. The questionnaires were distributed across the three higher education institutions with batches being sent to all three institutions. These questionnaires were self-administered and well-structured with a collection of close format, biographical, rating scale types of questions. Two open-ended questions were added to the questionnaire. The questionnaire can be found in Appendix 3.

5.10.1.2 Questionnaire for LASU, UKZN and UNISA

Collection of data was done using a formal standardized survey questionnaire and all questionnaires were distributed in hardcopy to academics at all Colleges at LASU and UKZN. Questionnaires distributed at UNISA were distributed online (in batches to 7 Colleges). There are 8 colleges at UNISA and 7 colleges received the questionnaire via email notifications and The College of Science, Engineering and Technology at Florida Campus is where the researcher resides and where he, received hardcopies of the questionnaires. The questionnaire was designed and arranged in the following format to address the five research objectives and answer the five main research questions:

Section A - Background Information

Section A of the questionnaire focused on the background information of academics at the three selected higher education institutions and such information included, gender, age, highest qualification and occupation/academic level information (Question 1 to 4).

Section B - Change in Management (Self-awareness)

The questions in this section focused on academics' perceptions concerning the use of information technology for change management values. Some of the questions included academics' self-awareness that change is required in the use of information technology.

Research Question One: What is the rationale for the integration and use of adopted information technologies at the selected universities in Africa?

This section sought to answer the first research question that required answers to academic's awareness of the rationale for the integration and use of information. These questions were aligned with the first theory (Change Management Model) adopted for this study. The theory argued that managing changes in higher education does not necessarily impose the introduction of new technology. Rather it is about encouraging the people involved in the delivery of instruction or education to change the way they do things and their view about their respective roles in the institution (Kershaw, 1996). This part of the study aims at understanding the rationale/justification behind academic's adoption and use of information technology by creating a group of questions that aligns with the awareness of the rationale for the integration and use of information technologies.

The group of questions (5 to 5.5) was adapted from Kershaw's Change Management principles and the questions began with the individual's understanding and acceptance that change is needed. In the quest to understand the strengths and weaknesses in the use of adopted technologies, academics were requested to indicate their disposition to the proposition that it is the university's obligation to provide strategies for implementing change in the use of technology (which may include certain policies that will enforce academics change to use of information technology whenever new ones are rolled out). An indication of agreement or disagreement with the proposition on the need of information technology for different/specific educational purposes implemented by the University was tested to address the first research objective. Lastly, the question looks into academics' perceptions that the University is responsible for and/or should create a suitable institutional structure to provide adequate support for promoting technology use.

Section C- Familiarity with Information Technology Platforms

This section of the questionnaire focused more on academics' background information and with the familiarization with information technology platforms.

Research Question Two: What are the historical trends and pedagogical underpinnings of the integration of information technology in higher education in Africa?

To address the second research objective and to answer the second main research question, historical trends were addressed in two different ways. Firstly, through review of literature which was presented in Chapter Two, Section 2.4 and secondly, through the research questionnaire. These objective were aligned with the second adopted theory (Model of Technology Adoption in the Classroom) of this study that utilised five step-hierarchical principles in order to better understand both traditional and modern applications of technology in education. There were five phases in the model and they included: *Familiarity*, *Utilisation*, *Integration*, *Reorientation* and *Evolution*. Each phase has its own concerns and corresponding support needed to provide an understanding to a lecturer's location within the construct of technology adoption. However, the full potential/benefits of any information technology could only be realised once the educator/teacher progresses through all the five phases, otherwise the technology could most likely be misused or quickly discarded from use (Hooper & Reiber, 1995).

In the questionnaire, academics were asked to indicate their level of computer competency (Questions 6 and 7) and to provide further information on any certification (training and/or retraining) in information technology that they held or have in related courses. This examines the *familiarisation* and/or *reorientation* of any form of IT training they have had or might have been exposed to in the past/present. Another section of the questionnaire (Question 8) focused on the types of computer systems and applications academics use or are familiar with (*familiarisation and utilisation*). These computer systems/applications included operating systems (computer and mobile operating systems) as well as computer and mobile application software they use. Further questions around the historical trends included the period (time) they have been using (*utilisation and integration*) information technologies for teaching and learning activities (Question 9). In Question 10a and 10b, academics were asked to indicate their involvement and experiences in the use of e-Learning for research, teaching and learning activities which addresses the pedagogical underpinnings of the integration of information technology in higher education. The pedagogical underpinnings sought to address the questions – What, How and Why integrate technology in higher education.

In addition to gathering information on historical trends and pedagogical underpinnings of the integration of information technology in higher education; and academics familiarisation with information technology platforms, Questions 11 were asked around the different types of technologies that academics think are the most important for technology integration in higher education as well as what they think of the efficacy (Question 12) of information technologies adopted by the selected institutions in Africa. The last two set of questions (13 and 14) focused on academics and the institutions' disposition towards the use of e-Learning tools/facilities.

Section D- Information Technology Integration

Section D is the last section of the questionnaire. It focused on academics motivations regarding the adoption of new technology followed by

Research Question Three: What are the challenges that may hinder the potential opportunities of information technology integration in higher education?

In the quest of answering the third research question, the study takes note and identifies the need to ask questions (Question 15) that indicate academics' motivations towards adopting new technology. This is attributable to the third adopted theory (Diffusion of Innovation Theory) that identified different categories of adopters in the diffusion process. A sub-question that supports the third research question sought to identify and evaluate the different factors that determines the success (or failure) of information technology integration in higher education (Question 16). These group of questions were informed by Rogers (2003) DOI theory's four main elements that communicates messages about new knowledge. Of the four elements, the study adapted three key elements which included communication channel, time, and social systems. These three elements were further broken down into 14 variables to formulate factors that determine the success of information technology integration in higher education. The responses of academics on the factors that determines technology integration success ranges from *very important* to *of no importance*.

The third group of questions (Question 17) focused on the challenges that may hinder the potential opportunities and benefits of information technology in higher education. In the creation of these sets of variables (considered challenges), the study further used Rogers' key elements to create challenging factors. These factors were created in contrary to the factors determining technology integration success.

Therefore, the twelve variables in Question 17 were created to measure the seriousness of the challenges academics are faced with or encounter in their use of information technology for teaching and learning purposes. Questions 18 and 19 focused on academics' overall experience in the use of information technologies for research, teaching and learning purposes.

Research Question Four: What are the limitations of information technology integration in higher education?

Other questions in Section D (ranging from questions 20 – 23) focused on the limitation of integrating information technology in higher education in order to answer the forth research question and address the corresponding research objective. Academics' overall experience in the use of information technologies for research, teaching and learning with regards to the quality of support they received from their institutions' administrative support division were measured. Dealings with unsatisfactory experience in the integration of information technology in their institution was considered a limiting factor, and their overall experience to administrative support response(s) to complaints was significant to measure limitation to technology integration in higher education.

Research Question Five: **What solutions can be proposed to mitigate the challenges and limitations that information technology may have on integration and transformation in higher education to enhance teaching and learning outcomes?**

In the concluding part of the questionnaire, two open-ended questions were asked with regard to the drawbacks (challenges and/or limitations) in the use of information technology and the support that participants thought that the institution could/should provide to address these challenges they experienced and/or encountered. These questions were proposed to find answers to the fifth research question and assist in achieving the fifth research objective. It also helped in providing overall answers to the main aim of the study. Questions 24 to 26a were close-ended questions to find solutions and ways in which the researcher would propose adequate recommendations and suggestions that could alleviate challenges associated with the integration of technology in higher education. These questions also served to address the research hypotheses. The perceptions of academics on information technology as being critical for higher education were also addressed by these questions. Lastly, the two open-ended questions (26b and 27) do not only provide answers to the aim of the study but also assist the researcher to link the gap between technology integration in higher education and the sustainability of the integrated/adopted technologies.

The last question focused on the impact of using information technology in higher education in general. The overall impact of the use of information technology include but not limited to its impact to alleviate higher education challenges; enhance teaching and learning outcomes; promote technology integration and transformation success in higher education; and realise ICTs promised benefits to higher education. Theorists (Creswell, 2009; Davis & Venkatesh, 1996; Saunders et al., 2016) have motivated for empirical studies to include properly designed structured questions in order to achieve and present a valid, reliable and effective research analysis as well as to be able to justify the necessity for the chosen research methodology.

5.10.1.3 In-depth Email Interview

It was suggested by the defence panel when the researcher defended the research proposal for this study that data validation of some sort must be conducted. It was further directed to be in form of an in-depth interview with university management staff that provide support services to academic staff. The purpose of this interview is to gather information from the university's management/administrators (in the IT Department/Unit only) in order to validate the feedback obtained from academics through the survey. These interview questions were designed as follow-up questions to the results obtained from academics. The follow up questions pertained to the challenges associated with the integration of technology in higher education and its impact on teaching and learning. Teaching using ICT in higher education presents many challenges and the tension academics commonly face in the integration of information technology in teaching and learning practices may include but not limited to the lack of time to adopt technology; insufficient support from management; inadequate infrastructure; inadequate development programmes; funding issues and government support/intervention (Esterhuizen, Blignaut & Ellis, 2013).

The in-depth interview questions were used to validate the primary research findings. Therefore, a qualitative research approach was used in the design of the in-depth email interview employed to gather the opinions of the university management/administrative staff at LASU, UKZN and UNISA. The in-depth interview can be found in Appendix 4 of the thesis.

In addition, an inductive research approach was used to analyse the responses to the in-depth email interviews with the aid of Nvivo 11 software. Analysis of themes were presented in Chapter Nine, Section 9.6 to address university's management/administrator perceptions. The interview questions suggested that management/administrator should first indicate their understanding of technology integration in higher education environment. Secondly, management/administrator were required to indicate the kind of challenges they have faced or aware of, that academics face in their use of technology for teaching and learning purposes. The kind of institutional and systemic challenges they think obstruct/hinder integration of technology in higher education follows through. The next was the drawback (challenges and/or imitations) of integrating information technology in higher education, and the last interview question sought to ask if management/administrator would consider information technology integration to be critical for higher education and why. The data obtained from the university's management/administrator sought to determine if the information given by the academics project a clear understanding of the issues that the research sought to unpack with reference to the contexts in the selected universities.

5.10.2 Secondary Data

The secondary sources of data for this research included relevant journals, books, research organisations, vendors, print media and this included magazines and newspapers. These sources were carefully consulted, analysed and referenced. The Internet was also a valuable source of information for this research and has provided a vast amount of data relevant to the study. Both forms of data obtained primarily and secondarily were synthesized in order to evaluate a strategic means of integrating information technology to alleviate higher education challenges and to enhance teaching and learning outcomes.

5.11 The Target Population

In the context of the study, the population is the total number of academics at the selected universities in Africa. This description of population is based on Saunders et al.'s (2016, p. 212) description of population as the "entire group from which a sample is drawn." The sample for this study comprised academics at Lagos State University, Nigeria, academics at University of KwaZulu-Natal and at the University of South Africa. Management/Administrative Support staff, from each institution mentioned above were interviewed. The proposed sampling procedure was presented and approved for final ethical clearance application. There are two countries involved (Nigeria and South Africa). Questionnaires were distributed on the basis of staff strengths/distributions of Departments that make up each institution. In this case, academics at LASU constituted 31% of the population, UKZN academics constituted 30% of the population and academics at UNISA constituted the largest population size of 39%. The estimated number of participants at the three institutions was 4806 academics at the time the study was conducted. 30% of these were sampled (i.e. 4806 x 30% = 1442). 1442 questionnaires were distributed across the three institutions and to obtain the Minimum Estimated Response Rate (MERR) of the 1442 academics, 20% MERR was set for the 1442 academics which would produce an estimate of 288 questionnaires to be returned.

Table 5.4 Proposed Sampling Procedure

Institution	No. of Academics	Sample Size %	Questionnaires
LASU	1500	31%	450
UKZN	1457	30%	437
UNISA	1849	39%	555
Total	**4806**	**100%**	**1442**
Size to Sample = 30%			
30% of 4806	1442		
MERR	20% of 1442 = **288**		

LASU = Lagos State University.

MERR = Minimum Estimated Response Rate.

UKZN = University of KwaZulu-Natal.

UNISA = University of South Africa.

5.11.1 Sampling Design

A Simple Random Sampling technique was implemented to justifiably use the results of the sample to extrapolate the results to the entire population. The other non-random sampling employed in this study is convenience sampling to draw sample, for the reason that it offers convenience to the researcher.

5.11.1.1 Simple Random Sampling

In order to realize the research objectives and to answer the research questions, a simple random sampling technique was used to condense the amount of collected data. According to Anderson et al. (2009) simple random sampling is characterized by choosing elements of the population randomly one step at a time, at each step taken, the remainder elements in the population are guaranteed that they have an equal probability of being selected.

5.11.1.2 Convenience Sampling

Convenience sampling is the other non-random sapling technique employed by the researcher to draw sample. This technique was chosen due to the reason that it offers convenience to the researcher in drawing sample. This technique was applicable, given the researcher's access to both countries of study (Nigeria and South Africa). The researcher was able to draw sample from both countries due to the fact that the researcher was originally from Lagos, Nigeria and lives in South Africa. In addition, convenience sampling technique helps researchers to overcome many challenges involved in sampling. Apart from the fact that it offers convenience to sample, it is less time consuming and less costly than other sampling techniques (Creswell, 2009). Most researchers' choice of convenience is associated with accessibility, easy proximity and the willingness of respondents to participate in the study (Saunders et al., 2016).

Despite its benefits, convenience sampling has its shortcomings. For example, the research may be considered not free of bias and may be plagued by the inability to infer generalisation (Johnson, 2001; Wilson, 2010). Having considered the strengths and weaknesses surrounding convenience sampling technique, the researcher found it useful for the study due to the busy work schedule of academics at the selected institutions. Convenience sampling was then chosen for the study due to its ease of use, cost effectiveness and proximity to sample.

5.11.2 Representative Sampling

The population of academics in LASU was estimated at 1500, the population of academics at UKZN was estimated at 1457 and lastly, the population of academics at UNISA was estimated at 1849 based on the 2016 staff roll for the three institutions. According to the proposed sampling procedure in Table 4.1, 31%, 30% and 39% simple random sample was attempted by distributing 450, 437 and 555 questionnaires to each population (academics) at LASU, UKZN and UNISA respectively. A total number of 193 questionnaires were obtained out of the 450 handed out at LASU, another total number of 198 questionnaires were obtained out of 437 handed out in UKZN and a total number of 201 questionnaires were obtained out of the 555 handed out in UNISA.

The total number of academics who participated in this study was ***592*** and the following tables present the description/breakdown according to institutions.

Table 5.5 showed the frequency of academics in LASU that questionnaires were obtained from after distribution. There were 152 male participants and 41 female participants constituting an estimated 78.8% and 21.2% respectively.

Table 5.5 Description of Sample - LASU

Gender [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	152	78.8	78.8	78.8
	Female	41	21.2	21.2	100.0
	Total	193	100.0	100.0	

a. Institution = LASU

Table 5.6 also shows the frequency of academics at UKZN who participated in the study after the distribution of the questionnaires. 121 male participants and 77 female participants took part in the study with an estimated 61.1% of male and 38.9% of female participants.

Table 5.6 Description of Sample - UKZN

Gender b

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	121	61.1	61.1	61.1
	Female	77	38.9	38.9	100.0
	Total	198	100.0	100.0	

b. Institution = UKZN

Table 5.7 is the representation of the frequency of participants at UNISA, where 106 male and 95 female participants took part in the study, both constituting estimated 52.7% male and 47.3% female participants.

Table 5.7 Description of Sample - UNISA

Gender c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	106	52.7	52.7	52.7
	Female	95	47.3	47.3	100.0
	Total	201	100.0	100.0	

c. Institution = UNISA

5.12 Method of Analysis and Linking Models

The quantitative research paradigm implemented for the study aimed to produce information about the important issues in the integration of information technology towards alleviating higher education challenges in Africa. In line with the chosen theoretical frameworks of the study, the questionnaire first measures the process of managing change in higher education environment which constituted 20% of the questionnaire design. The Change Management Model by Kershaw (1996) measures individual/academics understanding that change is actually needed in the integration of technology within the institution, it also measures individual/academics understanding and acceptance that they must change in order for technology to be integrated and lastly, it provides an understanding that academics actually intend to change or actually have changed.

The second adopted model by Hooper and Reiber (1995), Model of Technology in the Classroom constituted 40% of the questionnaire design which was applied using the questionnaire to measure the adoption of both ideas and technologies in education. It was further broken down into several questions that addressed academics' familiarity with information technologies. Academics' computer competencies, academics' use of information technology, integration of technology in their teaching and learning practices, the reorientation in the use of information technology and the actual adopted technology that led to evolution were all measured in this section of the study.

The third model that constituted the remaining 40% of the questionnaire was the Diffusion of Innovation Theory by Rogers (2003). The theory was deployed and used in the questionnaire design to measure information technology integration into higher education. The questions that were used were designed to measure academics' motivation with regard to the adoption of new technologies. DoI offers four elements including Innovation, Communication channel, Time and Social systems which were used to measure the different factors that determine the success of information technology integration into higher education. The challenges that hinder the integration of information technology in higher education were measured based on the four DoI factors explained in Chapter Two, Section 2.3.3 and they included: Relative advantage (perceived need), Technical compatibility, Technical complexity and Information technology ease of use. These four factors are determinants of information technology implementation success or adoption. These four DoI factors were further measured in the questionnaire based on the perceptions of academics of the use, quality and overall experience of information technology.

The construct of the method of analysis allows collected data and information to be pre-structured in accordance with the anticipated relationships among the conceptual frameworks adopted for the study (Mills, Durepos, & Weibe, 2010). Analysis of data was described and presented using statistical techniques for data analysis which include preparation of data, for inputting, checking of data, description of data and scale analysis to improve the reliability and validity of the research. Data collected were analysed through both descriptive and inferential statistical method for analysis. This study also utilised survey strategy, which enables the collection of quantitative data to be analysed quantitatively with the use of descriptive and inferential statistics (Saunders, Lewis, & Thornhill, 2016). The relevant and key features of data collected were interpreted and presented with the use of software packages such as SPSS 24, Microsoft Excel 2016, Microsoft Visio 2016 and Nvivo 11. The software packages were used to develop similarities, differences and statistical results based on the measurement of using the Likert scale that ranges from "strongly disagree" to "strongly agree." Finally, an Exploratory Factor Analysis (EFA) was used. This is a method of checking dimensionality and internal consistency in research (Tavakol & Dennick, 2011) hence, a coefficient of reliability was established to measure the scale of reliability in a related set of items for the study known as Cronbach's Alpha (defined in Chapter Six; Section 6.3.3.1).

5.13 Statistical Concepts

According to Pelham (2013), statistics are set of mathematical procedures that are used to summarize and interpret observations. Observations are generally categorical or numerical facts about certain things or people which are usually referred to as data. One of the major branches of statistics is known as 'descriptive statistics', which is used for summarizing and describing a set of observations. This study used descriptive statistics in the description and presentation of the research findings. Another branch of statistics that best interprets and draws inferences from a set of observations is known as inferential statistics. Both descriptive and inferential statistics are discussed in the following subsections.

Another statistical concept that is relevant to the study is referred to as probability. Probability of sampling and the significance of the findings were used for the analysis of the research findings. However, inferential statistics are rooted firmly in the logic of probability theory, hence, the theory of probability deals with the procedures and mathematical principles used in predicting and understanding chance events i.e. the relevant statistical principle of regression towards the mean can simply be derived from the theory of probability (Pelham, 2013). Then, the question is asked, what is probability? According to Sekaran (2003, p. 421), "Probability is the sample design in which the elements of the population have some known chances or probability of being selected as sample subjects." Pelham further described probability as "the number of all specific outcomes that qualify as the event in question divided by the total number of all possible outcomes" (Pelham, 2013, p. 16).

With this in mind, the result of the study will provide and confirm the theory/hypothesis by examining the p-value. The p-value helps determine the significance of the results when hypothesis tests are used to test the validity of a claim that is made about a population. The case on trial is referred to as the null hypothesis. In this study, the null hypothesis H_0 is 'Alleviating higher education challenges through strategic integration of technology has no direct impact on enhancing teaching and learning outcomes'. While the alternate hypothesis H_1 is 'Alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes'. The alternate hypothesis is tested and conclusions are made about the null hypothesis. If there is sufficient evidence in support of the alternate hypothesis, the null hypothesis is rejected, or alternatively the null hypothesis is not rejected. This decision is made based on the threshold p-value (normally set at 0.05). The p-value gives the researcher a measure of the probability that the result obtained is a 'matter of chance'. According to Saunders et al. (2016), all hypothesis tests utilises a p-value to weigh the strength of the evidence (i.e. collected data). The p-value is the number between zero (0) and one (1) and can be interpreted as follows:

- A p-value ($p \leq 0.05$) indicates a strong evidence against the null hypothesis, hence, null hypothesis is rejected;
- A p-value ($p > 0.05$) indicates weak evidence against the null hypothesis, hence, null hypothesis is not rejected.
- A p-value that is close to the cut-off (0.05) are considered marginal (i.e could go either way). It is important to report the p-value irrespective of the value for observers/readers to draw their own conclusion of the findings.

Consequently, the value of p when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the theory/hypothesis is statistically significant. This will establish significance in the research variables. The margin of error for the study is set to 5% and confidence interval is set to 95% confidence level. Power analysis revealed that the test for the research had a power of 0.95 in detecting a 0.05 change in the proportion of variance indicated above. This indicates that 5% of the time the study would have failed to detect a change of 0.05 existence. This low type II error emphasizes the significance of the research findings.

5.13.1 Descriptive Statistics

Descriptive statistics technique as the name implies can be used to describe research variables. The technique is mostly associated with the Exploratory Data Analysis (EDA) approach, which emphasizes the use of diagrams to describe and understand data (Saunders, Lewis, & Thornhill, 2016). According to Saunders et al., the simplest approach to summarize data for individual variables in order for specific values to be readable is to use tables (frequency distribution). Frequency distribution of the sample in the form of graphs and tables were used for the analysis of data. The study gave priority to descriptive statistics technique and the collected data under sections A, B, C and D of the questionnaire was analysed using descriptive statistics. For clarity, the descriptive statistics technique included frequency counts, simple percentage, mean and standard deviation which are presented in frequency distribution tables, and bar charts. According to Wilson (2010), the purpose of starting data analysis with descriptive statistics technique is to give the readers an overview of the collected data before detailed analysis is presented. This suggests the many reasons most researchers starts the data analysis chapter of their projects with descriptive statistics. This study also considers this technique necessary for the presentation and analysis of the demographics data collected in section A of the research questionnaire.

In this study, the measure of central tendency is the 'mean' referred to as the arithmetic average of the frequency distribution (Wilson, 2010). Also in this study, another descriptive statistical technique used for measuring dispersion is the Standard Deviation. Standard deviation was used to describe and/or compare the extent to which data value for a variable is spread around the mean value (Saunders et al., 2016). Standard deviation is a commonly used measure of dispersion, being a square root of the variance that indicates the range of variability in data, Sekaran (2003).

5.13.2 Inferential Statistics

The study finds inferential statistics technique most appropriate due to its simplicity to summarize the findings for individual variable of the study. It will help reach conclusion that extend beyond the immediate data alone and to describe what is going on in the collected data. Since this research is a comparative study that cuts across three higher education institutions and two African countries, priority is given to inferential statistics as it is useful to compare the average performance of two or more groups in a single measure to see if there are differences. Inferential statistics makes inferences about the sample using data drawn from the population under section C and D of the questionnaire. Therefore, correlation analysis was done with the aim of establishing the relationship between the research variables. Parametric and Non-parametric tests such as Analysis of Variance (Cronbach's alpha), Regression, F-tests and Chi-Square tests were performed to establish relationships between dependent variables and independent variables of the study.

5.14 Chapter Summary

The research methods deployed for the study were presented in this chapter. Methods of collecting and analysing both primary and secondary data were presented. Population and sampling techniques were highlighted in detail, and the procedures for linking the theory to research objectives were also presented. The following three chapters (Six, Seven and Eight) present the data and analysis of findings from LASU, UKZN and UNISA respectively.

CHAPTER SIX

DATA PRESENTATION AND ANALYSIS – INFORMATION TECHNOLOGY AT LASU

6.1 Introduction

Chapter Five presented the research methodology, design and data collection techniques in a way that foregrounded the questionnaire through which data for the study were generated. The chapter also presented the research population, sampling and sampling techniques as well as methods of data analysis and statistical concepts adopted for the study. Research findings of this study are presented in this chapter. As a prologue to the discussion of the findings of this study, background information of academics at LASU is presented with participants' self-awareness about change management practices.

The chapter identifies academics' familiarity with information technology at different levels of experience in Nigeria. The study identifies information technologies that are most important for technology integration in higher education and the efficacy of the information technology adopted by the particular institution. Academics' institutional and personal dispositions towards the use of information technology facilities at LASU is presented along with the motivations regarding the adoption of new technology. The study identifies the predisposing factors and challenges in the integration and adoption of new technology and lastly, identifies the utility of information technology to higher education.

6.2 Background Information – LASU

Background information of participants who were involved in this research is presented in this section.

6.2.1 Background Information of Academics – LASU

A total of 193 academics in LASU participated in the study. The background information with regard to gender, age, qualification and occupation is presented in this section.

Gender

Figure 6.1 below shows that there were more male participants than female. Male academics constituted 78.76% and female academics 21.24%.

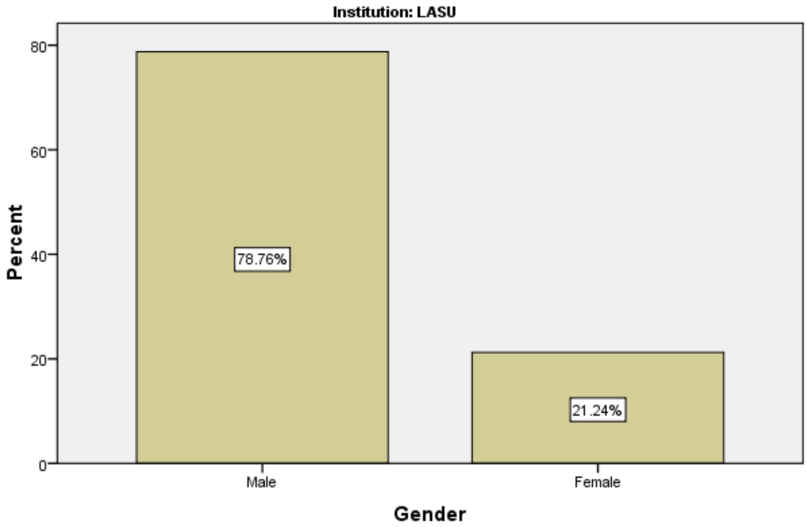


Figure 6.1 Gender distribution of participants in LASU

Age

As depicted in Figure 6.2 below, a substantial number – 69.43% of participants – were within the age bracket of 35-49, followed by academics within the age bracket 20-34 at 23.32%. Participants within the bracket 50-64 constituted 7.25%.

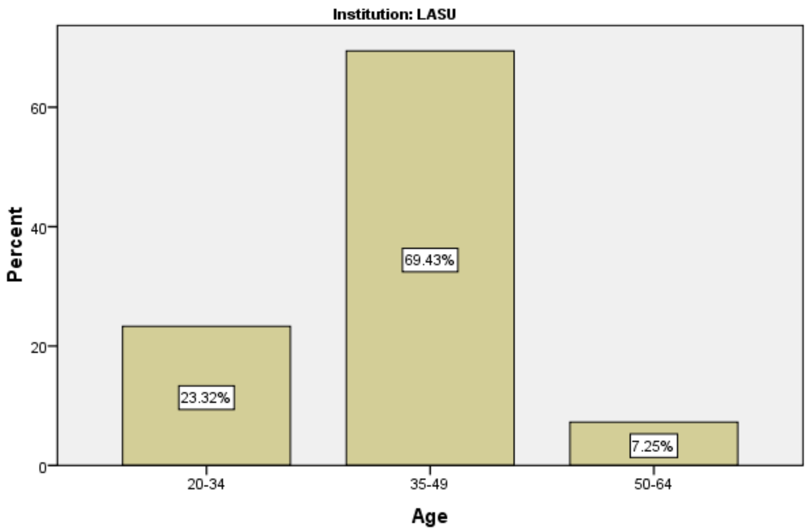


Figure 6.2 Age distribution of participants in LASU

Qualifications

80.83% of academics at LASU have a Masters degree, 15.54% have a Ph.D. and the smallest group of participants with Honours degrees constituted 3.63%.

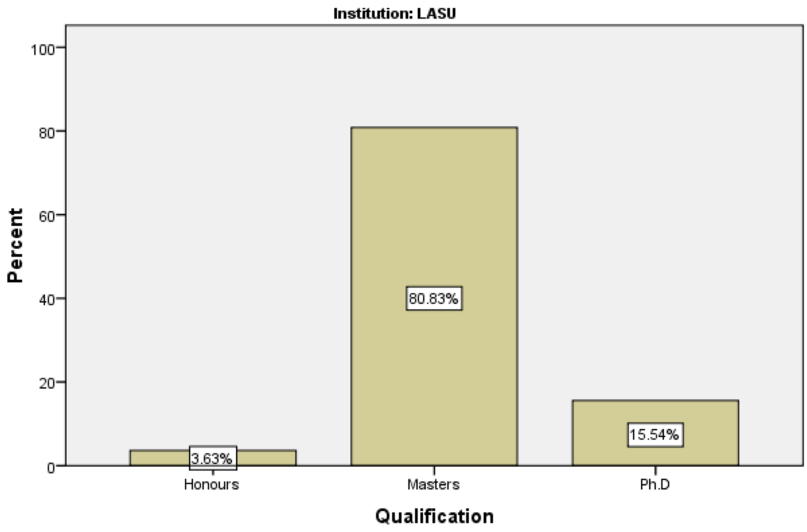


Figure 6.3 Qualification distribution of participants in LASU

Occupation (Academic level)

With reference to data collected at LASU, a substantial number (65.80%) of participants were lecturers, followed by junior lectures at 16.58%. 12.95% of participants were associate professors, 3.11% of participants were senior lecturers while 1.04% and 0.52% fall in the categories of professor and tutor/teaching assistant respectively.

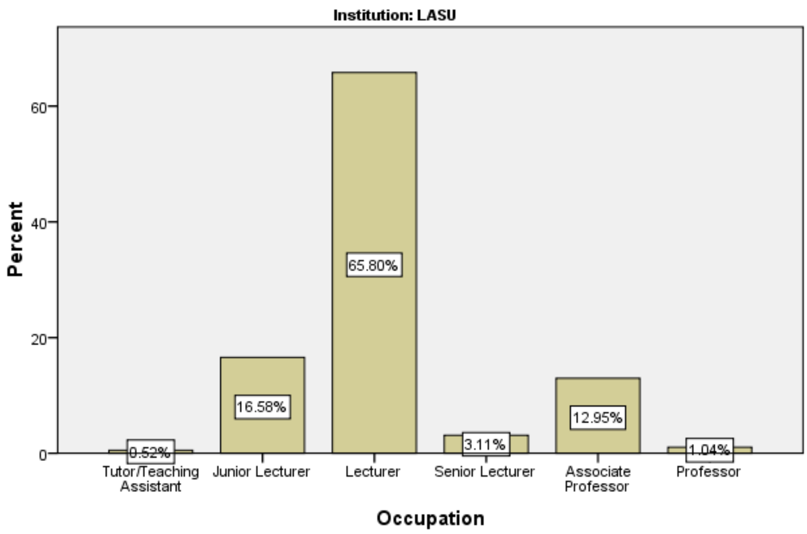


Figure 6.4 Occupation distribution of participants in LASU

6.3 Analysis of Research Questions

Before going any further, it is imperative to review the research questions of this study. The study mainly conducted investigation to alleviate higher education challenges through strategic integration of information technology at selected universities in Africa. To determine this, a number of research questions were developed which include:

1. What is the rationale for the integration and use of information technologies at the selected universities in Africa?

2. What are the historical trends and pedagogical underpinnings of the integration of information technology in higher education;

3. What are the challenges to information technology integration into higher education;

4. What are the limitations of information technology integration in higher education; and

5. What solutions can be proposed to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education?

In the analysis (Chapters Six, Seven and Eight), the researcher presents an analysis of research findings from LASU, UKZN and UNISA respectively. The analysis of findings presented in Chapters Six, Seven and Eight aimed at providing answers to address the research objectives discussed in Chapter Five. Evaluation of research findings presented in Chapter Six, Seven and Eight are presented in Chapter Nine by conducting a comparative statistical analysis on research findings. The discussions of findings of the research questions as they relate to individual institution are then discussed in Chapter Ten bearing in mind the findings of the literature review and the application of three adopted theoretical frameworks. The analysis of the five research questions developed to achieve the study's research objectives are presented sequentially below.

6.3.1 Objective One: The awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa

In order to achieve the first research objective, Question 5 (5.1 to 5.5) were developed to provide answers and gain insight on academics' level of information technology awareness of the rationale for the integration and use of adopted information technologies. This objective sought to understand the level of acceptance, resistance and awareness to change in the use of information technology for teaching and learning purposes. The analysis of findings are presented below.

6.3.1.1 Change Management Self-awareness - LASU

Questions 5.1 to 5.5 of the questionnaire were adapted from Kershaw's Change Management principles. To probe the construction of opinions about change management self-awareness, the researcher required participants to indicate the category that best represents how they feel about the imperative for use of information technology. This question was intended to offer insights into the awareness of academics on the need of change management, to understand how participants are encouraged to get involved in the use of technology to deliver instructions and how they viewed their respective roles in the institution. With respect to each opinion, participants were required to indicate on a scale of 1-4 their perceptions of change management with the possible answers being *strongly disagree, disagree, agree and strongly agree*. The researcher took cognisance of the opinions that may have direct impact on the participants' perceptions and understanding towards change management. The assumption is that the more strongly they agree, the more likely they understand that change is actually needed and tend to accept change in the use of information technology in higher education.

A significant number of participants indicated that: "change in the use of information technology begins with their individual understanding that change is actually needed" with 56.48% (agreeing) and 40.41% (strongly agreeing). The same can be said about participants who understand and accept that they must change to enhance the integration of technology into higher education: 67.88% (agree) and 28.50% (strongly agree). The third highest rating in terms of awareness to change management is the perceptions that the University should create a suitable institutional structure to provide adequate support for promoting technology use. 40.93% of the participants indicated that they agree and 53.89% indicated they strongly agree. What follows is the proposition that the University should clarify the need for information technology for different educational purposes, to which 56.99% indicated that they agree and 37.31% indicated they strongly agree. 20.21% of participants indicated that they disagree that university should provide strategies for implementing changes in the use of information technology while 53.89% and 25.91% indicated they agree and strongly agree respectively.

Table 6.1 Change Management - LASU

Opinions/Perceptions	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
Changes in the use of information technology begin with your individual understanding that change is actually needed.	0%	3.11%	56.48%	40.41%
You understand and accept that you must change to enhance integration of technology into higher education.	0%	3.63%	67.88%	28.50%
A university provides strategies for implementing changes in the use of information technology.	0%	20.21%	53.89%	25.91%
A university should clarify the need for information technology for different educational purposes.	0%	5.70%	56.99%	37.31%
A university should create suitable institutional structure to provide adequate support for promoting technology use.	0%	5.18%	40.93%	53.89%

6.3.2 Objective Two: The historical trends and pedagogical underpinnings of the integration of information technology in higher education

These objective was aligned with the second adopted theory (Model of Technology Adoption in the Classroom) of this study that uses five step-hierarchical principles in order to better understand both traditional and modern applications of technology in education. There are five phases in the model and they include: *Familiarity*, *Utilisation*, *Integration*, *Reorientation* and *Evolution*. Each phase has its own concerns and corresponding support needed to provide an understanding to a Lecturer's location within the construct of technology adoption. Question 6 to Question 14 sought to provide answers to objective two of the study. The findings are presented below.

6.3.2.1 Familiarity with Information Technology Platform - LASU

It is important to note that the level of competency is not the same as experience, as first time users can possibly be much more competent than someone who has used a computer for a long time (experienced). To help in determining the familiarity with information technology by academics in LASU vis-à-vis their use of information technology, it was necessary (using Question 6) to find out their level of computer experience. As represented in Figure 6.5, an overwhelming majority of academics (70.98%) are experienced in their level of computer skill, followed by 18.13% who are moderate in their level of computer skills. The number of academics who were very experienced constituted 10.36% of participants and only 0.52% indicated very inexperienced and none indicated inexperienced. The study rely on self-assessment which is entirely subjective. Hence, the study takes account of the possibility that some academics may find it difficult to declare technical incompetence in an age of high-tech and information handling.

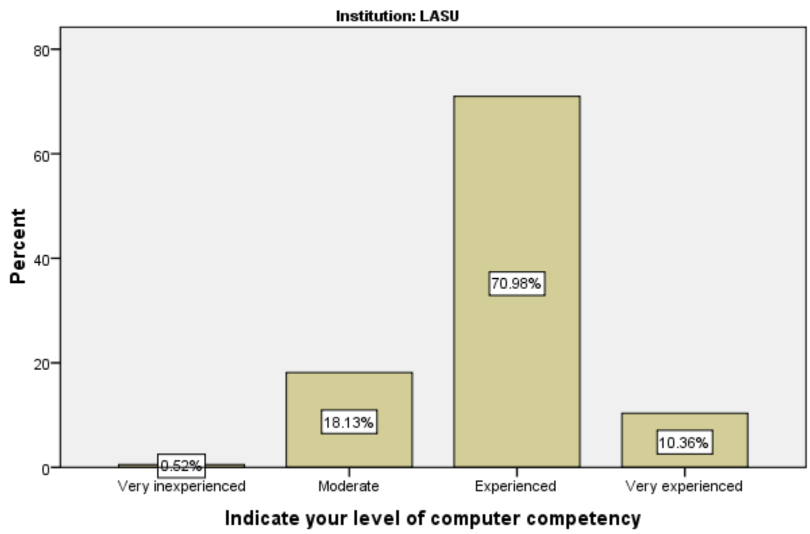


Figure 6.5 Level of Computer Competency - LASU

To further probe the familiarization with information technology among academics in LASU, Yes or No questions (Question 7a, b, c and d) were asked in order to determine the nature of certification(s), training and/or retraining programmes in the information technology field they may have had. An overwhelming number of academics indicated they have not acquired competency programmes in any other IT field. Yet, Figure 6.5 indicated that the majority say they are experienced in computer competency. This is an indication that the majority with experience of computer competency are self-taught. They have acquired the skills on their own initiative rather than through formal training or instruction. In what follows, another substantial number of participants constituting 86.53% and 74.61% indicated that they have not had any further training or retraining programmes and have not had any certification(s) in information technology or related courses.

Table 6.2 Certification, Training or Retraining Programmes in IT field - LASU

Certification(s), Training and or Retraining Programmes	**Participants' answers (%)**	
	Yes	**No**
Do you have any certification(s) in information technology or IT related courses?	25.39%	74.61%
Have you had any further training or retraining programmes in the IT field identified above?	13.47%	86.53%
Have you acquired competency in any other IT field?	0.52%	99.48%

Duration of Computer/Information Technology use for Teaching and Learning

To determine the experiences of academics with regard to their use of computer or information technology for teaching and learnings purposes, Question 9 was used to determine the number of years they have been using the technology. As shown in Figure 6.6 below, 29.53% had been using computer or information technology for teaching and learning purposes for more than 3 years but less than 4 years. The next group of participants (23.83%) indicated that they have been using the technology for more than 5 years while 16.58% had been using the technology for more than 4 years but less than 5 years. Another group of participants representing 12.95% indicated they have been using computer or information technology for more than 2 years but less than 3 years while 9.84% had been using the technology for more than 1 year but less than 2 years. The percentage of participants that had been using information technology for less than 6 months constituted 4.66% and a small number of them (2.59%) indicated they had been using the technology for more than 6 months but less than 1 year.

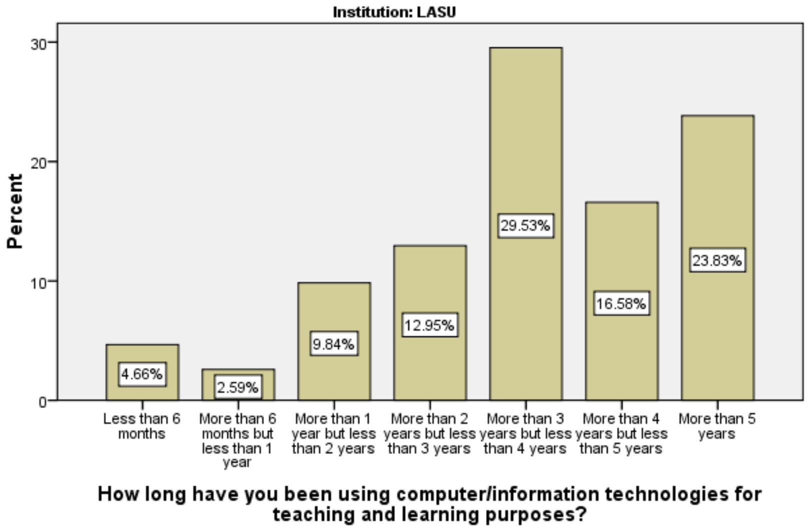


Figure 6.6 Length of time involved in the Use of Computer/IT for Teaching and Learning - LASU

6.3.2.2 Important Information Technology for Higher Education - LASU

Information technology offers a wide range of educational tools that can be integrated into higher education through which academics satisfy their teaching and learning needs. Hence, participants were asked (in Question 11) to indicate which e-Learning technologies are most important for technology integration in higher education with the possible answers being *I don't know, not important, less important, somewhat important and very important.* Table 6.3 below shows the corresponding percentages of academics who felt the need or importance of each e-Learning platform for technology integration in higher education. Significant numbers of participants rated mobile learning as important: 58.55% (somewhat important) and 37.31% (very important). The same can be seen for VLE in which 45.60% and 48.19% rated the technology as somewhat important and very important respectively. ODL had the highest rating in terms of importance with 66.32% of participants indicating that the technology was somewhat important while another 23.83% of participants indicated very important. In what follows, MOOCs was rated to be somewhat important by 37.31% of participants and very important by 39.90% of participants. In terms of e-Learning technology that academics answered with *does not know* or with low popularity or have no idea of what it is, OER was rated high where 52.85% of participants indicated *I don't know*. Another technology with low popularity is the Smarthistory technology that 51.30% of participants indicated *I don't know*. LMS was also not popular among academics in LASU where 48.19% of participants indicated *I don't know*.

Table 6.3 Important e-Learning Technology for Technology Integration - LASU

Information Technology (e-Learning)	I don't know	Not important	Less important	Somewhat important	Very important
Learning Management Systems or Course Management Systems (CMS)	48.19%	0%	16.58%	17.62%	17.62%
Open Education Resources (OER)	52.85%	0.52%	0%	37.31%	9.33%
Open and Distance Learning	8.29%	1.04%	0.52%	66.32%	23.83%
Mobile Learning	4.15%	0%	0%	58.55%	37.31%
Smarthistory Technology	51.30%	3.63%	1.04%	26.42%	17.62%
Virtual Learning Environment (VLE)	5.70%	0%	0.52%	45.60%	48.19%
Massive Open Online Courses (MOOCs)	22.28%	0%	0.52%	37.31%	39.90%
Collaborative Education Network (CEN)	30.21%	0%	0.52%	28.65%	40.63%

It was necessary to conduct a significance test on the results presented in Table 6.3 above based on the findings from participants in LASU. It is surprising that almost half (48.19%) of the participants indicated that they do not know how important LMS and/or CMS are for technology integration in higher education, which prompts the need to validate the significance of the results. Results obtained from participants in LASU shows that the 8 variables used in Table 6.3 are statistically significant to test the important e-Learning technologies to enhance technology integration in higher education. This test was performed in order to draw inferences about the given sample and to evaluate the population value as well as statistical confirmation of the significance of the variables tested. The results indicate that the majority of the participants in LASU do not know of the technologies, which is an indication that they may not be using the technologies at the time the study was conducted. Another inference drawn from the findings indicates that despite the fact that majority of the academics at LASU do know of the technologies (i.e. LMS, OER and Smarthistory Technology), a substantial number of them thought that the technologies are important for integration purpose in higher education. This suggest that if the technologies were made available or were to be integrated into their teaching and learning processes, academics at LASU will embrace these technologies based on their perceived importance and potential to enhance their teaching and learning processes. F-Test (ANOVA and Correlation) was conducted on the e-Learning technologies that academics at LASU thought were important for technology integration in higher education and the corresponding results are presented in Table 6.4 and 6.5 below.

H*0*: The variables are not significant;

H*1*: The variables are significant.

Test for ANOVA: There is difference in mean square across the e-Learning technologies. The associated p value is .000 where the value of p when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the hypothesis is statistically significant.

H*0* in this instance is the hypothesis (i.e. when H*0* is accepted, this implies that H*1* will be rejected and when H*0* is rejected, H*1* is automatically accepted). Variance analysis which is a test for statistical difference in means, a p value less than 0.05 indicates that there is a significant difference in means across the variables, which also indicates we accept H*1*: the variance are significant. Therefore, when there is a significant difference in means across the scale; it implies that the variances are not the same or equal. Conversely, a p value greater than 0.05 means that there is no significant difference in mean (which also means that we reject H*0*: The variances are not the same or equal). Because, no significant difference means that the variances are the same or equal.

In this case, we accept H*1* since the value of p is less than or equal to 0.05, a very strong evidence to reject the alternative null hypothesis (H*0*) of no significant difference in means across the scale (i.e. the variances are the same or equal) item. Therefore, the variances are significantly different and reliable. This means the variables are acceptable, internally consistent with no redundancy

Table 6.4 ANOVA Test on Important e-Learning Technology for Technology Integration - LASU

ANOVA [a]

		Sum of Squares	df	Mean Square	F	Sig
Between People		1391.125	191	7.283		
Within People	Between Items	797.979	7	113.997	91.292	.000
	Residual	1669.521	1337	1.249		
	Total	2467.500	1344	1.836		
Total		3858.625	1535	2.514		

Grand Mean = 2.42 | a. Institution = LASU

Table 6.5 Intra-class Correlation Coefficient on e-Learning Technology for Technology Integration - LASU

Intra-class Correlation Coefficient [d]

	Intra-class Correlation [a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.377 [b]	.319	.440	5.833	191	1337	.000
Average Measures	.829 [c]	.789	.863	5.833	191	1337	.000

Two-way mixed effects model where people effects are random and measured effects are fixed.

a. Type C intra-class correlation coefficient using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

d. Institution = LASU

The next Table 6.6 shows the efficacy of the e-Learning technologies adopted by LASU. Academics are to rate the efficacy of these technologies (in Question 12) with the possible answers being *not available*, if the technology is not useful or adopted by their institution, *not important, less important, somewhat important and very important*. In this case, quite a number of participants constituting 63.21% indicated that OER is not available in their institution. Other technologies that over 50% of participants indicated were not available or adopted by their institution included: Smarthistory (62.18%), MOOCs (61.66%), CEN (60.62%), LMS (60.10%), VLE (58.55%) and mobile learning (54.92%). This result shows why some of the participants indicated *I don't know* in Table 6.3 above.

Table 6.6 Efficacy Rating of e-Learning Technology Adopted by Institution - LASU

Information Technology (e-Learning)	Not available	Not important	Less important	Somewhat important	Very important
Learning Management Systems or Course Management Systems (CMS)	60.10%	0%	2.59%	31.09%	6.22%
Open Education Resources (OER)	63.21%	0%	5.18%	31.61%	0%
Open and Distance Learning	33.16%	4.15%	16.06%	45.60%	1.04%
Mobile Learning	54.92%	0%	2.07%	27.98%	15.03%
Smarthistory Technology	62.18%	3.63%	2.59%	17.62%	13.99%
Virtual Learning Environment (VLE)	58.55%	0%	3.11%	17.10%	21.24%
Massive Open Online Courses (MOOCs)	61.66%	0%	1.55%	21.76%	15.03%
Collaborative Education Network (CEN)	60.62%	0%	2.59%	18.13%	18.65%

6.3.2.3 Institutional and Personal attitudes towards use of IT - LASU

The Table 6.7 depicts Yes or No responses to the information technology that academics use at their institution and for personal use. Drawing from the ratings (in Question 13) on the importance of information technologies academics thought would be of relevance for technology integration in higher education and the efficacy of the information technologies adopted by their institution, it is not surprising that considerably fewer number of participants indicated that their institution enabled the use of information technology facilities. Email facility is the only highest rated tool that participants indicated their institution enabled usage, constituting 67.90% of participants. With regard to the facilities that their institution provides training support for, only Audio learning (Podcast) and Email facilities were rated high by participants with 20.20% and 30.60% respectively. As depicted in Table 5.7, academics' personal disposition in the use of information technology facilities are higher, 87.60% of participants indicated they use Email facility for their personal agendas. Discussion forums and Calendar (scheduling tool) both share 43.50% each among participants who indicated they use the facility.

Table 6.7 Institutional and Personal Disposition of IT facility Usage - LASU

Information Technology Facilities	My institution enables use of this facility		My institution provides training & support for this facility		I use the facility	
	Yes	No	Yes	No	Yes	No
Discussion forums	29.00%	71.00%	4.10%	95.90%	43.50%	56.50%
Audio Learning (Podcast)	27.50%	72.50%	20.20%	79.80%	6.20%	93.80%
Video Learning (Vodcast)	20.20%	79.80%	15.50%	84.50%	6.70%	93.30%
Instant Messaging (IM)	9.30%	90.70%	14.00%	86.00%	11.90%	88.10%
Content Management	10.40%	89.60%	14.50%	85.50%	5.20%	94.80%
Bulletin Boards	14.00%	86.00%	13.50%	86.50%	10.90%	89.10%
Chatrooms	0.50%	99.50%	0.50%	99.50%	17.60%	82.40%
Games and Leisure	0.00%	100.00%	1.00%	99.00%	28.50%	71.50%
Online tests and quizzes	0.00%	100.00%	0.50%	99.50%	18.70%	81.30%
Blogs	1.60%	98.40%	3.10%	96.90%	16.60%	83.40%
Email	67.90%	32.10%	30.60%	69.40%	87.60%	12.40%
Online IT Lab	10.90%	89.10%	10.90%	89.10%	15.50%	84.50%
FAQs	9.30%	90.70%	7.80%	92.20%	4.70%	95.30%
Q&A	6.20%	93.80%	8.30%	91.70%	9.30%	90.70%
Statistics	0.50%	99.50%	6.20%	93.80%	16.10%	83.90%
Wiki	10.40%	89.60%	3.60%	96.40%	25.90%	74.10%
Calendar (Schedule tool)	15.50%	84.50%	2.10%	97.90%	43.50%	56.50%
Dropbox	11.40%	88.60%	5.20%	94.80%	39.40%	60.60%

6.3.3 Objective Three: Challenges to information technology integration into higher education

In the quest of answering the third research question and meet the research objective three, the study first takes note and identify the need to ask questions (Question 15) that indicate academics' motivations towards adopting new technology. Another sets of questions that supports the third research objective sought to identify and evaluate the different factors that determines the success (or failure) of information technology integration in higher education which was developed in Question 16. Question 17 focused on the challenges that may hinder the potential opportunities and benefits of information technology in higher education. Lastly, Question 18 to 19 focused on academics' overall experience in the use of information technologies for research, teaching and learning purposes the analysis of findings are presented as follows.

6.3.3.1 Adoption of New Technology: Predisposing Factors and Challenges - LASU

Academics at LASU were required to indicate their motivations regarding the adoption of new technology in Question 15 of the questionnaire. Table 6.8 shows the different categories of adopters based on the assumptions of diffusion of innovation theory which include five elements namely; *innovators*, *early adopters*, *early majority*, *late majority* and *laggards* described in Chapter Two of this study. The responses of participants show that they agree to the adoption of new technology. The collective percentage was greater than 70% in the categories of agree and strongly agree, except for those participants constituting 58.0% who disagree to usually being the first to try new information technology among their colleagues. This group of participants who disagree to being the first to try out new technologies could be categorised as late majority based on the five elements identified by Rogers (2003). Early adopters would be those participants in LASU who strongly agree to experiment with new technology. Participants who specified that they have always tried to obtain the latest information technology could fall between early adopters and early majority. Those participants who indicated they would most likely use the technology if someone else used it could be categorised as the 'late majority'.

Table 6.8 Motivations for the Adoption of New Technology - LASU

	Strongly Disagree	Disagree	Agree	Strongly Agree
I like to experiment with new technology	0.50%	14.50%	37.80%	47.20%
I have always tried to obtain the latest information technology	0%	1.00%	79.30%	19.70%
Among my colleagues, I am usually the first to try out new IT	0.50%	58.0%	39.40%	2.10%
I would more likely use information technology if someone else used it	7.25%	18.65%	61.66%	12.44%
I intend to use information technology in the future	0%	0%	47.15%	52.85%

Factors Determining the Success of Information Technology Integration

To probe the formation of opinions about the integration of information technology in higher education, the researcher required academics in Question 16 to indicate the importance of factors that are thought to determine the success of technology integration in higher education. Participants' responses are presented in the Table 6.9 which shows that each factor identified is important in determining the success of information technology integration in higher education. With reference to all the factors, summary of participants' percentage who indicated *somewhat important*, *important* and *very important* was higher than 75%. This indicates that participants perceived these factors as critical to determining the success of information technology adoption in higher education and the potential to enhance or undermine teaching and learning outcomes.

Table 6.9 Importance of Factors - LASU

Factors	**Of no importance**	**Of little importance**	**Somewhat important**	**Important**	**Very important**
Time between introduction and adopting	1.55%	23.32%	13.47%	22.80%	38.86%
Personal interest in the use of technology	0%	0.52%	19.69%	38.34%	41.45%
Availability of Funds	0%	0%	8.81%	33.68%	57.51%
Availability of physical space	0%	0%	10.36%	55.96%	33.68%
Quality assurance	0%	0%	13.47%	65.28%	21.24%
Employment of Skilled professionals	0%	0.52%	1.04%	54.40%	44.04%
Low student enrolment into higher institution	0%	24.87%	9.33%	42.49%	23.32%
Increasing access to technology	0%	0%	1.55%	49.74%	48.70%
Institutional policies to support the use of IT	0.52%	0%	1.55%	69.43%	28.50%
Sufficient support from management level	0%	0.52%	4.15%	52.85%	42.49%
Availability of resources	0%	0%	3.11%	34.20%	62.69%
Adequate ICT infrastructures	0%	0%	3.11%	23.83%	73.06%
Adequate training facilities	0%	0.52%	6.22%	27.46%	65.80%
Government support and interventions	0%	0%	10.36%	48.19%	41.45%

In order to determine the overall experiences and perceptions of information technology integration, participants were asked in Question 17 to indicate the seriousness of challenges they encounter in their use of information technology for teaching and learning. These challenges are thought to be the barriers to information technology integration in higher education. As can be seen in Table 6.10 below, a substantial number of participants in LASU rated the seriousness of these challenges as high. Over 60% of participants rated the seriousness of each challenge as *somewhat serious* and *very serious*. This indication can be attributed to the fact that participants had encountered most of these challenges in their use of information technology, hence, rated these challenges as serious. Lack of time for adoption is the only challenge that over 50% of participants described as *less serious* in their use of information technology for teaching and learning.

Table 6.10 Seriousness of Challenges - LASU

Challenges	Not serious	Less serious	Somewhat serious	Very serious
Lack of time for adoption	1.04%	54.92%	32.64%	11.40%
Insufficient funds	0%	29.02%	23.83%	47.15%
Poor physical space	0%	22.80%	53.89%	23.32%
Lack of IT skills by academic staff	0%	8.81%	63.73%	27.46%
Lack of IT skills by students	0%	7.77%	73.06%	19.17%
Inadequate access to technology	0%	21.76%	15.54%	62.69%
Inadequate infrastructure	0%	10.88%	26.42%	62.69%
Poor technical support by management	0%	7.25%	56.99%	35.75%
Potential loss of personal revenue	0%	36.79%	36.79%	26.42%
Lack of training facilities	0%	8.81%	51.81%	39.38%
Excessive students' enrolment	0.52%	22.80%	53.89%	22.80%
Poor institutional policies	0%	21.76%	47.67%	30.57%

A Reliability Test is conducted on the 12 challenges that are thought to create barriers to information technology integration in higher education in LASU. This test was done at random in the study, and the same type of test would be carried out (in the next chapter) on factors that participants in UKZN thought are important in determining the success of information technology integration in higher education in order to validate the study's findings.

The challenges are identified as *variables* and statistics are based on all the cases with valid data for all variables in the procedure. The variable statement below lists all the 12 variables (challenges) using key identifier such as Q17.1, Q17.2 to Q17.12.The statement also included the statistical tests executed i.e. Anova and Intra-class Correlation Coefficient. The statement shows the procedure that implements the option to select Alpha to execute Cronbach's Alpha Analysis on all the 12 challenges identified in the study. Cronbach's Alpha test was performed as it measures internal consistency on the 12 variables. This further means that the test measures how closely related the variables are as a group. Since the study is exploratory in nature, Cronbach's Alpha test measures internal consistency in order to provide evidence that the scale in question is unidimensional. According to Saunders et al. (2015), Cronbach's Alpha test is not a statistical test rather, it is a coefficient of reliability or consistency. Cronbach's Alpha is written as a function of the number of test items and the average inter-correlation among the items. For conceptual purpose, the formula below shows the execution of Cronbach's Alpha:

$$\alpha = \frac{N\bar{c}}{\bar{\upsilon} + (N-1)\bar{c}}$$

Where; N = the number of items

$\bar{c}$ = the average inter-item covariance among the items

$\bar{\upsilon}$ = the average variance.

From the above formula, the more increase in the number of items, the more the increase in Cronbach's Alpha. If the average inter-item is low, Alpha will also be low. Therefore, as the average inter-item correlation increases, so will Cronbach's Alpha increases (making the number of items constant).

Anova with F-Test was conducted as well as Interclass Correlation Coefficient (ICC) where Confidence Interval (CIN) is set to 95% with mixed type of consistency. The execution result is presented in the tables below.

```
RELIABILITY   /VARIABLES=Q17.1 Q17.2 Q17.3 Q17.4 Q17.5 Q17.6 Q17.7 Q17.8
Q17.9 Q17.10 Q17.11 Q17.12   /SCALE('ALL VARIABLES') ALL   /MODEL=ALPHA
/STATISTICS=ANOVA   /SUMMARY=TOTAL   /ICC=MODEL(MIXED) TYPE(CONSISTENCY)
CIN=95 TESTVAL=0.
```

Alpha analysis was developed by Lee Cronbach to provide the measure of internal consistency of a scale or test and it can be interpreted in number between 0 and 1. The purpose of presenting internal consistency is to identify the extent to which all items in a scale or test measure the same construct or concept. Although Cronbach Coefficient Alpha analysis is necessary in a study of this nature with well over 300 participants but it is not sufficient for measuring 'unidimensionality' or homogeneity in a sample of test items (Tavakol & Dennick, 2011). The test is also used to understand the variance in Cronbach Coefficient Alpha. There have been different reports about the acceptable values of Alpha which ranges from 0.70 to 0.95. Tavakol and Dennick noted that Cronbach's Alpha value near 0.7 is acceptable but a lower value than 0.07 could be due to a low number of participants or redundancy in questions.

The resulting value of Cronbach's Alpha reliability test conducted for the 12 challenges is depicted in Table 6.11 below. As can be seen, Cronbach's Alpha is 0.90 for the case summary processing obtained in LASU among 193 participants. If the least acceptable Cronbach's Alpha value is near to or equal to or greater than 0.7 but less than 0.95, the reliability of the items measured on challenges is said to be acceptable, internally consistent and not redundant. Cronbach's Alpha 0.90 means there is 0.19 error variance or random error, calculated as follows:

$$0.90 \text{ x } 0.90 = 0.81;$$

$$1.00 – 0.81 = 0.19$$

Table 6.11 Reliability Test on Challenges (Cronbach's Alpha Analysis) - LASU

Case Processing Summary [b]

		N	%
Cases	Valid	193	100.0
	Excluded [a]	0	.0
	Total	193	100.0

a. List-wise deletion based on all variables in the procedure.

b. Institution = LASU

Reliability Statistics [a]

Cronbach's Alpha	N of Items
.900	12

a. Institution = LASU

F-Test was also conducted on the challenges that are thought to cause barriers to information technology integration in higher education and the results are presented in Table 6.12 and 6.13.

To test

H*0*: The variances are not the same or equal

H*1*: The variances are the same or equal

Test for ANOVA: There is difference in means across the factors that determines the success of information technology integration in higher education. The associated p value is .000 where the value of p when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the hypothesis is statistically significant.

The reason is that H*0* is the research hypothesis (i.e. when H0 is accepted, it implies that H*1* is rejected and when H*0* is rejected, automatically H*1* is accepted). In Analysis of Variance (which is a test for significant deference in means), a p value less than 0.05 means that there is a significant difference in means across the scale (which also means that we accept H*0*: The variances are not the same or equal). Therefore, when there is a significant difference in means across the scale; it implies that the variances are not the same or equal. Conversely, a p value greater than 0.05 means that there is no significant difference in mean (which also means that we reject H*0*: The variances are not the same or equal). Because, no significant difference means that the variances are the same or equal.

Therefore, H*0* is accepted since the value of p is less than 0.05, a very strong evidence to reject the alternative hypothesis (H*1*) of no significant difference in means across the scale (i.e. the variances are the same or equal) item. Therefore, the variances are significantly different and reliable. This means the variables are acceptable, internally consistent with no redundancy.

Table 6.12 ANOVA Test on Challenges (F-Test) – LASU

ANOVA [a]

		Sum of Squares	df	Mean Square	F	Sig
Between People		530.679	192	2.764		
Within People	Between Items	139.829	11	12.712	46.116	.000
	Residual	582.171	2112	.276		
	Total	722.000	2123	.340		
Total		1252.679	2315	.541		

Grand Mean = 3.13

a. Institution = LASU

Table 6.13 Intra-class Correlation Coefficient on Challenges – LASU

Intra-class Correlation Coefficient [d]

	Intra-class Correlation [a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.429[b]	.375	.489	10.027	192	2112	.000
Average Measures	.900[c]	.878	.920	10.027	192	2112	.000

Two-way mixed effects model where people's effects are random and measured effects are fixed.

a. Type C intra-class correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

d. Institution = LASU

Drawing from the high rating of specific challenges academics encounter in the use of information technology for teaching and learning activities, it is not surprising that a significant number of participants (response to Question 18), as shown in Figure 6.7 below, described the overall experience of using information technologies as average (34.20%). The next significant number of participants constituting 20.21% and 17.62% indicated that the overall experience of using information technology for teaching and learning as poor and very poor respectively. Significantly fewer number of participants described that the experience of using information technology as good (27.46%) and very good (0.52%). What this suggests is that overall experience is deemed to be poor.

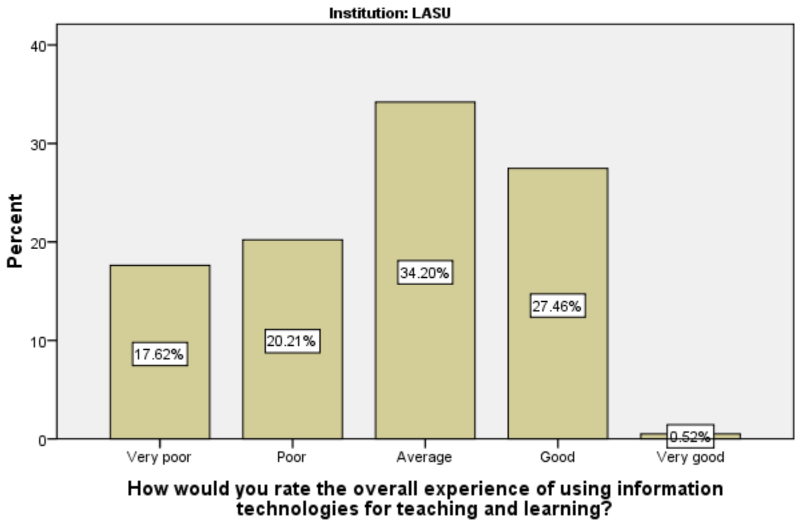


Figure 6.7 Overall Experience of IT for Teaching and Learning - LASU

A Z-test is conducted to determine whether or not the average and good results of the overall experience are significantly different.

Table 6.14 Frequency on the Rating of Overall IT Experience for Teaching & Learning – LASU

How would you rate the overall experience of using information technologies for teaching and learning? [a]					
		Frequency	Per cent	Valid Per cent	Cumulative Per cent
Valid	Very poor	34	17.6	17.6	17.6
	Poor	39	20.2	20.2	37.8
	Average	66	34.2	34.2	72.0
	Good	53	27.5	27.5	99.5
	Very good	1	.5	.5	100.0
	Total	193	100.0	100.0	
a. Institution = LASU					

Table 6.15 Proportion of Average and Good Results of IT Overall Experience for T & L – LASU

	Total	Frequency	Proportion
Average	193	66	34.20%
Good	193	53	27.50%
Overall	479	119	61.70%

The Z score tested two population proportions to know whether 2 groups (e.g. males and females, average and good) differ significantly on some single categorical characteristics or not.

The Requirements Are:

a. Categorical data; and

b. A random sample of each of the population groups to compare.

To Test:

H*0*: The 2 proportions are not equal;

H*1*: The 2 proportions are equal;

Null Hypothesis: H*0*: p1 – p2 = 0; i.e. p1 is the proportion from the first group and p2 the proportion from the second group

Test Statistic is $Z = \frac{(P_1 - P_2) - 0}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = 1.4329$

p1 = 66 (Average); Total population = 193

p2 = 53 (Good); Total population = 193

The Z-Score is 1.4329. The p-value is 0.15272. The result is not significant at $p < 0.05$. The proportion of Yes or No responses for Observation 1 is 0.342. The proportion for Observation 2 is 0.275.

Using Two-tailed hypothesis, the critical Z value at 5% significance level is 1.96. H1 is accepted since the test statistic is smaller than the critical value. Therefore, the two proportions are NOT significantly different, they are equal.

The same can be seen in Figure 6.8 where participants were asked to rate their overall experience of using information technologies for research purposes (in Question 19). A large number of participants constituting 62.69% indicated their overall experience as average. Another sets of participants indicated their overall experience of using information technology for research as very good (17.10) and good

(10.88%). A significantly fewer number of participants described the overall experience of using information technology for research as poor (7.25%) and very poor (2.07%).

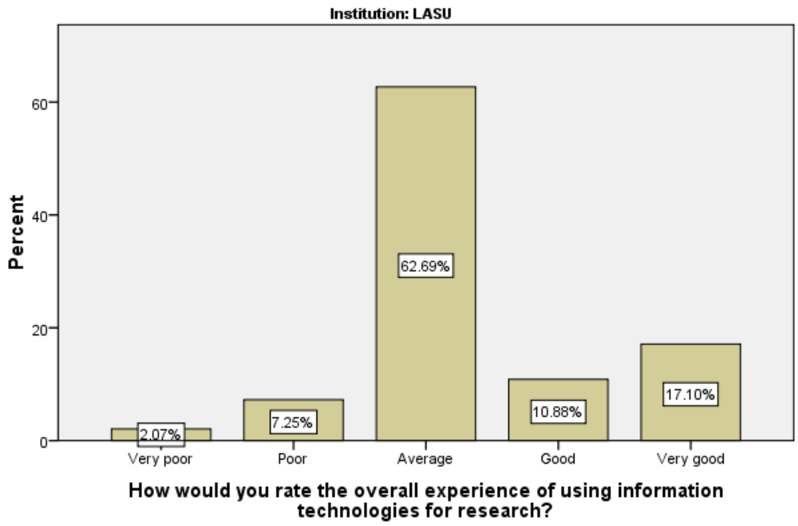


Figure 6.8 Overall Experience of IT for Research– LASU

Table 6.16 Frequency on the Rating of Overall IT Experience for Research – LASU

How would you rate the overall experience of using information technologies for research? [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very poor	4	2.1	2.1	2.1
	Poor	14	7.3	7.3	9.3
	Average	121	62.7	62.7	72.0
	Good	21	10.9	10.9	82.9
	Very good	33	17.1	17.1	100.0
	Total	193	100.0	100.0	

a. Institution = LASU

Table 6.17 Proportion of Average and Good Results of IT Overall Experience for Research – LASU

	Total	Frequency	Proportion
Average	193	121	62.70%
Good	193	21	10.90%
Overall	479	142	73.60%

To Test:

H*0*: The 2 proportions are not equal;

H*1*: The 2 proportions are equal;

Null Hypothesis: H*0*: p1 – p2 = 0; i.e. p1 is the proportion from the first group and p2 the proportion from the second group

Test Statistic is $Z = \frac{(P_1 - P_2) - 0}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = 10.5549$

p1 = 121 (Average); Total population = 193

p2 = 21 (Good); Total population = 193

The Z-Score is 10.5549. The p-value is 0. The result is significant at $p < 0.05$. The proportion of Yes or No responses for Observation 1 is 0.627. The proportion for Observation 2 is 0.109

Using Two-tailed hypothesis, the critical Z value at 5% significance level is 1.96. H*1* is rejected since the test statistics is greater than the critical value. Therefore, the two proportions are significantly different. So, H*0* is accepted.

6.3.4 Objective Four: Limitations of Information Technology Integration in Higher Education

Section D of the questionnaire with questions ranging from Question 20 to Question 23 focused on the limitations of information technology integration in higher education. This question aimed at identifying limitations (if any) of information technology integration in higher education amongst academics at the selected universities in Africa. The findings from the study provided answers to the fourth research question and objective. The outcome of the findings revealed how academics are able to describe the quality of support they received from their institution's administration/management in the integration of information technology. It also provides answers to how academics deals with unsatisfactory experiences in the integration of information technology. Revelation on how often they report complaints to institution's management during the integration of information technology and the general academics' ratings of responses from the institution management to their complaints/queries were further discussed

6.3.4.1 Quality of Support - LASU

In view of the rating of overall experience in the use of information technology in higher education to be generally average, most participants found the quality of support they received from the institution administration in the integration of information Technology to be not satisfactory (54.92%). Another significant number of participants found the quality of support to be somewhat satisfactory (33.68%) and very satisfactory (11.40%).

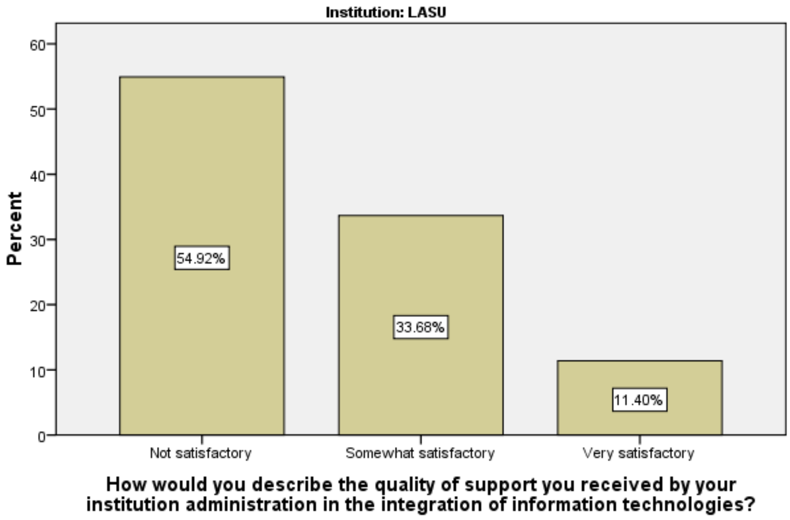


Figure 6.9 Quality of Support by Institution Administration - LASU

6.3.4.2 Unsatisfactory Experience - LASU

It is important to acknowledge that there can be glitches (malfunctions) or problems that could be associated with information technologies, which may affect the experience of users at a particular instance which could eventually discourage users from retrying to use the technology in future. The frequency of such problems may eventually affect user satisfaction and defeat the purpose of technology integration. To determine the responses and implications of such problems, academics in LASU were asked to indicate the action they took during unsatisfactory experience in the integration of information technology. A small number of participants at 9.84% specified that they called the support centre/ICT department. In view of others, 29.02% indicated that they ignored the problem and the highest number of participants (61.14%) reacted to unsatisfactory experience in technology integration by complaining to colleagues and others. This implies that by complaining to colleagues and others, colleagues who had more skills or knowledge of the technology could be of assistance. In any case whatever actions were taken by participants, continuous lack of support from support staff and institutional administration may prompt the kind of reaction which does not project a positive image of the institution's administration.

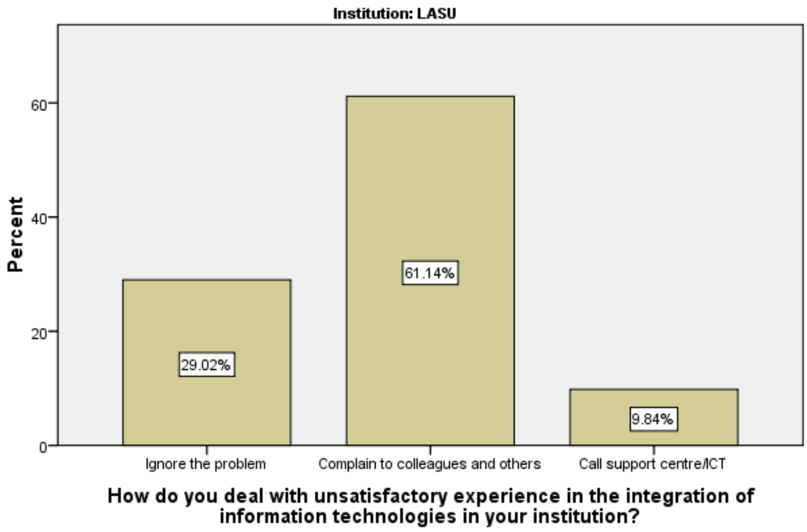


Figure 6.10 Unsatisfactory Experience by Academics - LASU

6.3.4.3 Complaint Report - LASU

Drawing from the unsatisfactory experience of participants that they generally complain to colleagues and others, it is not surprising that when the researcher required them to indicate the frequency of their complaints to institutions' administration, the majority, constituting 62.18% of participants specified *occasionally*. A significant number indicated that they *rarely complain* (23.83%) and *never complain* (13.99%). There was no record of *frequently* and *very frequently*.

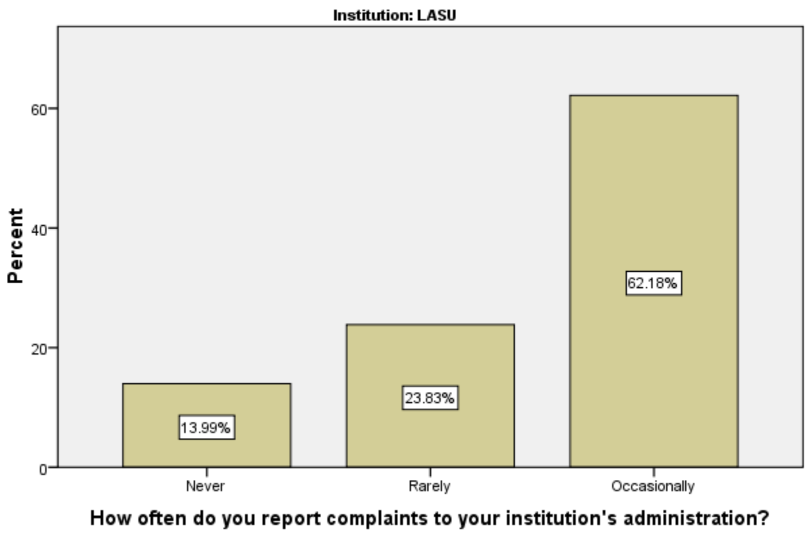


Figure 6.11 Frequency of Complaints to Institution Administration – LASU

6.3.4.4 Complaint Response - LASU

In view of the trends in which academics at LASU reacted to quality of support and unsatisfactory experience in the integration of information technology at their institution, a significant number of participants (67.36%) rated the response of institution administration to their complaints or queries as *not prompt nor satisfactory*. Other participants rated the response as *not prompt but satisfactory* (10.88%) and *prompt but not satisfactory* (1.55%). *Prompt and satisfactory* was rated by 20.21% of participants.

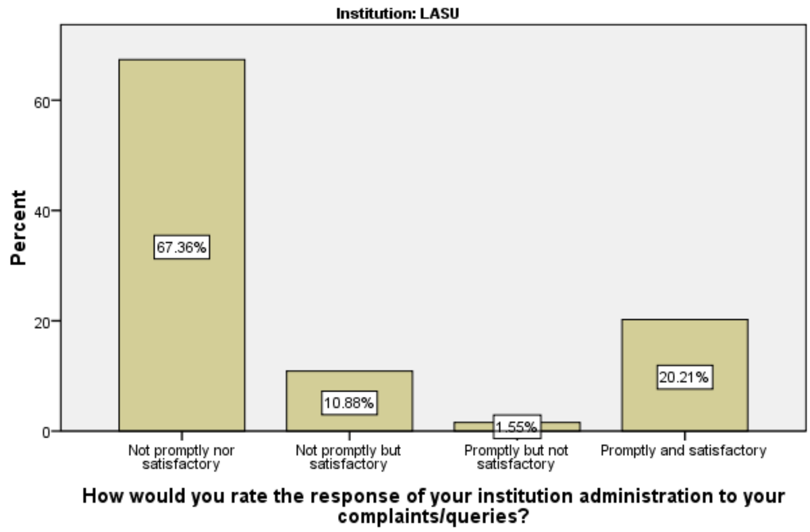


Figure 6.12 Rating of Response to Complaints - LASU

6.3.5 Objective Five: Solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education

Question 24 to Question 28 sought to provide answers to the fifth research question. In the concluding part of the questionnaire, two open-ended questions (Question 26*b* and Question 27) were asked with regard to the drawbacks (challenges and/or limitations) academics encounter in the use of information technology and the support they thought that the institution can/should provide to address these challenges they experienced and/or encounter. Although, academics were first asked (in Question 26*a*) to indicate if they have experienced and drawback(s) through a Yes/No question. The findings are presented below. However, findings from academics regarding Question 27: the support they thought the institution can/should provide to address these challenges they experienced and/or encounter is fully outlined in Chapter Nine, evaluation of research findings. Question 28

6.3.5.1 The Drawbacks of Information Technology in Higher Education - LASU

Drawing from the research objectives in order to identify and understand the challenges that may hinder the potential opportunities of information technology and to identify the limitations of information technology in higher education, participants were required to indicate if they knew of any drawback(s) in the use of information technology at their institution. Well over half, constituting 53.13% indicated (yes), that there were drawbacks in the use of information technology and 46.88% of participants indicated (no), they perceived no drawbacks.

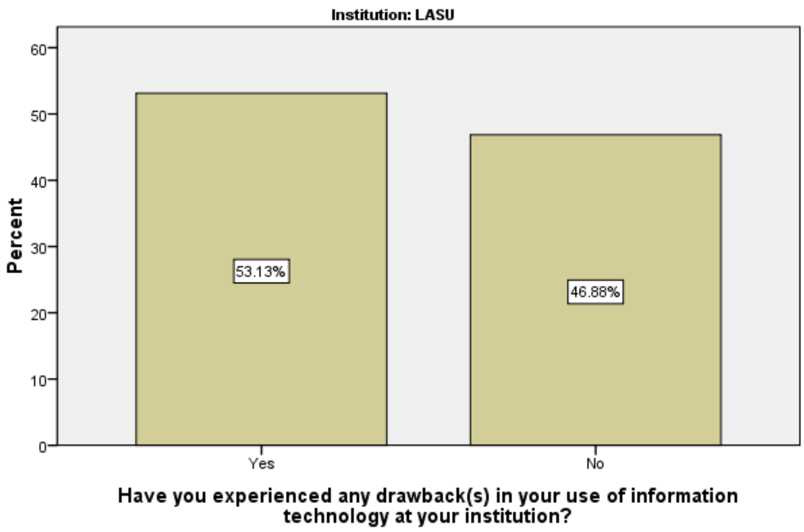


Figure 6.13 Drawback(s) in the Use of IT - LASU

Drawbacks in the use of Information Technology - LASU

To understand the different kinds of drawbacks participants are faced with, the researcher required participants to state the drawbacks they have experienced. With the use of an open-ended question (Question 26b) that was included in the survey, this technique allowed the study to obtain full and meaningful responses in order to fulfil the fifth research question and objective five of the study.

With the use of Nvivo 11 software to analyse the qualitative data obtained from participants, an analysis of themes is presented below in the attempt to address the survey question which suggests that participants should indicate the drawbacks they have experienced in the use of information technology at their institution. The above question was coded into themes and the qualitative analysis software indicated that there were 48 coded references in the responses from participants in LASU on *Drawbacks*. Coding of data was identified through Nvivo 11 and themes were extracted and identified. There were similarities and differences in themes among the selected institutions therefore, the study will discuss each generated theme and create generalizations respectively. All references to participant's response (quotes) can be found in the Appendices.

The following five themes (codes) were generated from the analysed data collected in LASU on drawbacks (or challenges) academics experienced in the use of information technology and these themes were the most common (similar) themes among the 3 selected institutions and are discussed as follow:

- Inadequate Internet Facilities;

- Inconsistent Power Supply;
- Lack of Information Technology Skills by Students and Academics;
- Irregular Systems Update;
- Insufficient Facilities; and
- Commercialization of Information Technology.

Inadequate Internet facilities– the focus on this theme was to establish participants' opinion on the availability of Internet facilities and usage in the delivery of teaching and learning materials as an effective approach to technology integration. However, the theme was generated from LASU participants' perceptions as follows: One participant in LASU indicated that there is "lack of Internet facilities", another participant indicated that there is "lack of Internet facilities functioning regularly." Another two participants' views were pointed in the direction of this theme – the first participant indicated that there are "No regular Internet facilities" and the other indicated that the "Drawback is lack of uninterrupted access to the Internet." To avoid duplication of responses, the remaining similar perceptions concerning poor Internet facilities were not presented. This theme shows that inadequate or lack of Internet facilities is a major drawback among academics in LASU and if not addressed, technology integration will remain ineffective and will continue to inhibit an enhanced teaching and learning experience.

Inconsistent Power Supply – this theme was the second theme generated from the perceptions of participants in LASU regarding the drawbacks that they experienced in the use of information technology. Not only did the participants use the term 'power supply' but the term 'electricity' was also used. The focus on the theme shows that inconsistent power supply or electricity could disrupt and pose a severe challenge in the integration of technology in higher education, as most information and communication technologies are customarily dependent on electricity to function. An inspection of participant's response to the question reveals that one participant indicated that there is "power failure always." Another participant in LASU also indicated that there is "no constant power supply." To quote a few more responses, a participant indicated that there is "Electricity shortage", and some of the responses indicated both lack of Internet facilities and Inconsistent power supply in their responses i.e. "No Internet access and electricity"; "Lack of constant power supply to ease the use of Internet facilities" and lastly, "No constant electricity and IT facilities that will enhance and support learning." The remaining responses were not included here to avoid duplication. In conclusion, constant power supply or electricity would undoubtedly improve information technology integration.

Lack of Information Technology Skills by Students and Academics – This theme was identified as one of the challenges academics face in the use of information technology for teaching and learning in the survey. The survey ratings on the challenges that academics thought were serious in the use of information technology for teaching and learning activities correlates and confirms the reliability of this drawback theme. In addition to this theme, one participant in LASU indicated that "Students do not have IT skills" which was indicated as a drawback in the use of information technology in higher education. This is an indication that academics may be more encouraged to use and integrate information technology if students make use of it.

Irregular Systems Update – This theme focuses on the need for consistent systems update. There should be a constant and efficient support system that provides this kind of service in higher education institutions. This would include not only the support staff but also the institutions' management. If technology integration is to be successful in higher education, the need for regular systems update is of major importance. One participant in LASU indicated that there is "No regular updates of system." Another participant indicated that there is "Lack of upgraded systems." This is an indication that participants in LASU found irregular systems update as one of the drawbacks in the use of information technology in higher education.

Insufficient Facilities – The attempt was made to understand the opinions of participants with regard to having access to basic facilities such as server capacity or digital data storage space, office machinery, support (in terms of managerial and technological support), and infrastructure. One participants in LASU indicated that there is "Constant breakdown of IT facilities." Another participant stated that there is "Inadequate access to computers" while the third participant highlighted the drawback by indicating that there is "No free access to information technology facilities to improve learning." To avoid repetition of opinions, the remaining responses were not presented. In addition, it is clear that participants understood the purpose of the questions and this theme was generated to support their responses pertaining to the drawbacks experienced in their use of information technology in higher education.

Commercialization of Information Technology – This theme is a new perception for this study as it was discovered as one of the major drawbacks in the use of information technology by academics in higher education. The term 'commercialization' in the context of drawbacks relates to the opportunity to make money. For instance, one academic indicated "Commercialization of IT, having to pay for Internet from my salary." This shows that the participant(s) pay to use Internet facilities within or outside the University premises. Another participant underscored this theme by making reference to "Paying of Internet services at own cost" and the third participant stated "Having to pay for the use of Internet access from monthly salary." If academics at higher education institutions are to pay for accessing Internet facilities, there is a slim chance for technology integration to be successful. However, free access to Internet services such as Wi-Fi and Ethernet (LAN) will encourage technology integration to its fullest potential.

Data were interrogated through the use of Nvivo 11 by identifying commonly occurring words and these were collated in relation to identified themes and concepts. Word Cloud (Figure 5.14) and Tree Map (Figure 6.15) of the concept "Drawbacks in the use of information technology by participants in LASU" is presented below. As can be seen, the figures below highlight key words such as *systems*, *facilities*, *students, network* and *electricity* which formulate the themes generated by Nvivo 11 with reference to the drawbacks academics experienced in the use of information technology in higher education.

6.3.5.2 The Utility of Information Technology in Higher Education

In light of the overall experiences of academics in the use of information technology in higher education and having identified the drawbacks they encounter in the use of information technology, this section presents participants' descriptions of the extent to which they consider the integration of information technology as necessary or critical for higher education and learning outcomes. Figure 6.14 depicts participants' perceptions on whether or not they consider the integration of information technology to be critical for higher education. A large number of participants constituting 64.25% indicated that the integration of information technology is critical for higher education. The second group of participants (35.75%) specified that the integration of information technology would be critical for higher education. none of the participants indicated that it was not critical at all.

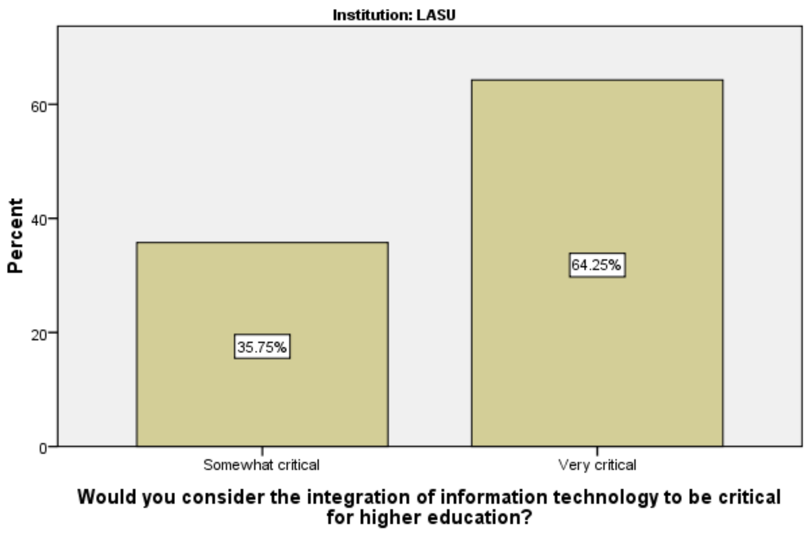


Figure 6.14 Necessity of Integrating IT into Higher Education - LASU

Drawing from the Figure 6.14 that illustrates that academics at LASU considered the integration of information technology to be very critical for higher education. Figure 6.15 shows that there was no doubt in the responses when participants were required to indicate how critical the integration of information technology would be in the enhancement of learning outcomes. A significant number of participants at LASU specified that integrating information technology would enhance learning outcomes. (43.01%) believed that the need for integrating technology was somewhat critical and (52.85%) thought that it was very critical. A small fraction amounting to 4.15% thought that the integration of information technology is not critical at all to enhance learning outcomes.

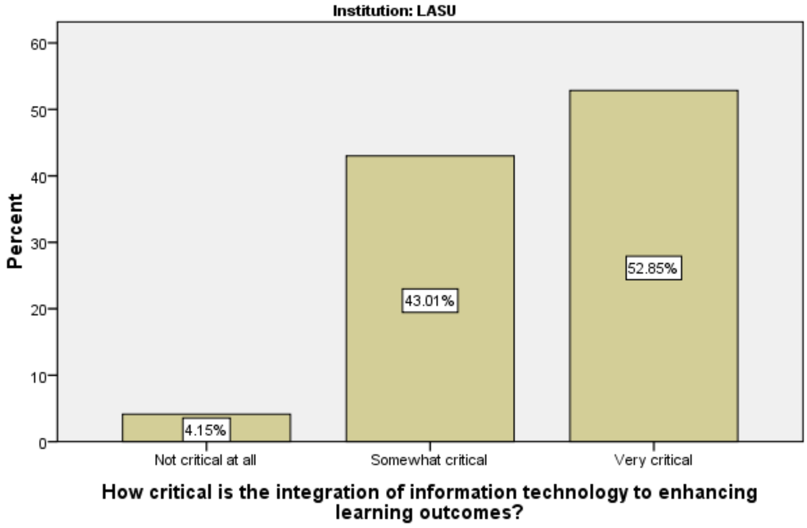


Figure 6.15 Necessity of Integrating IT to enhance Learning Outcomes - LASU

The Impact of Information Technology on Higher Education - LASU

This section of the study unpacks LASU academics' evaluation of the impact of information technology on higher education. Figure 6.16 depicts the assessment of academics in LASU based on the general impact of using information technology in higher education. The description of this finding is presented in order of sequence of impact assessment portrayed in Figure 6.16. Only 0.52% of the academics described the impact of information technology on higher education as negative. This is followed by a small number of participants (1.55%) who specified the impact of information technology as *somewhat negative*. Having seen that negative impact assessment is underscored despite the average overall experience in the use of information technology and the drawbacks associated with the use of information technology in higher education, a small group of participants representing 8.29% thought that the impact of information technology is *somewhat positive*. However, the highest number of academics (89.64%) described the impact of information technology on higher education as *Positive*. It can be argued then that participants in the last two categories (i.e. *somewhat positive* and *positive*) implied that a positive correlation between the integration of technology into higher education and the use of information technology are necessary or essential for teaching and learning outcomes.

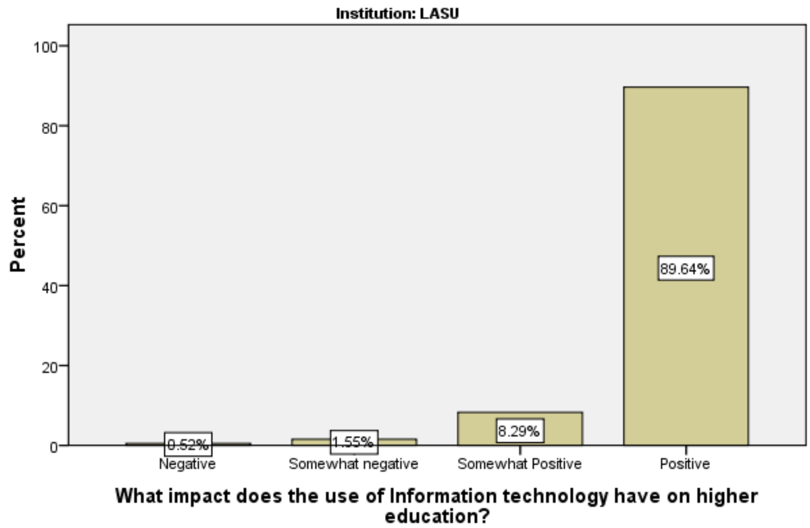


Figure 6.16 Impact of Information Technology on Higher Education - LASU

6.4 Chapter Summary

This section presents research findings at LASU in the form of academics' responses to research questions. Findings from the study' survey showed that academics at LASU were aware of change management. The chapter presented the different types of educational technologies that academics use for integrating information technology in higher education. Institutional and personal attitudes towards information technology facilities that academics at LASU use were identified. Findings in terms of predisposing factors and challenges in the adoption of information technology were presented. Overall experiences and perceptions in the use of information technology in higher education were described. The utility of information technology for higher education was indicated. Chapters Seven and Eight will present in replica format of this chapter, the findings from both UKZN and UNISA. Chapter Nine then evaluates the research findings presented in Chapters Six, Seven and Eight with a cross-institutional analysis with reference to the participants' responses from the three selected universities in Africa.

CHAPTER SEVEN

DATA PRESENTATION AND ANALYSIS – INFORMATION TECHNOLOGY AT UKZN

7.1 Introduction

This chapter presents UKZN academics' understanding of the value of information technology integration in higher education. Background information of academics at UKZN is presented followed by participants' change management self-awareness. This chapter investigates UKZN participants' familiarity with information technology and the information technologies that are most important for technology integration at UKZN, South Africa. The efficacy of the information technologies adopted by UKZN is presented and an attempt is made to determine the institutional and the academics' personal attitudes towards the use of information technology facilities. Motivation for the adoption of new technology is presented with factors and challenges to the integration of technology. Lastly, the chapter identifies the value of information technology to higher education from the perspective of academics at UKZN.

7.2 Background Information– UKZN

Background information of participants in UKZN who were involved in this research is presented in this section.

7.2.1 Background Information of Academics – UKZN

198 academics from UKZN participated in the study and their background information vis-à-vis gender, age, qualification and occupation is presented below:

Gender

As was the case in the gender profile of participants at LASU, more male academics participated in the UKZN component of the study. Participants' distribution of gender was 61.11% for male and 38.89% for female.

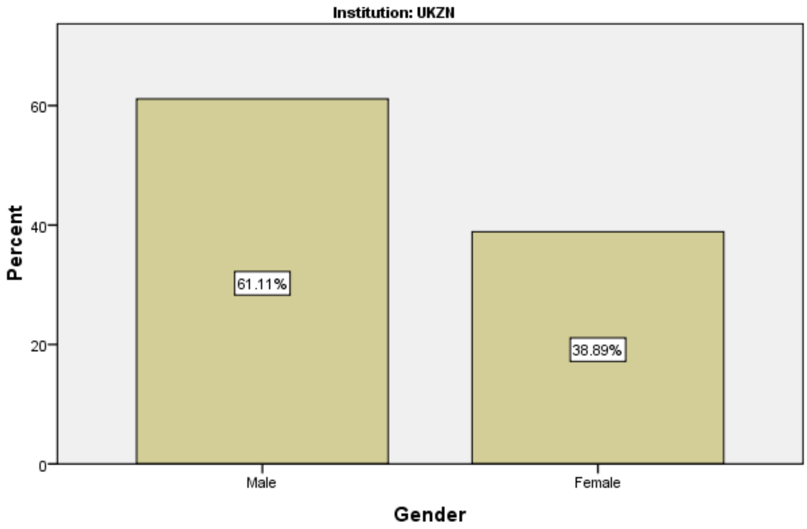


Figure 7.1 Gender Distribution of Participants - UKZN

Age

The majority of participants constituting 49.49% and 48.99% were within the age bracket of 20-34 and 35-49 respectively. These categories of participants were followed by a fraction of participants who constituted 1.52% within the bracket of 50-64.

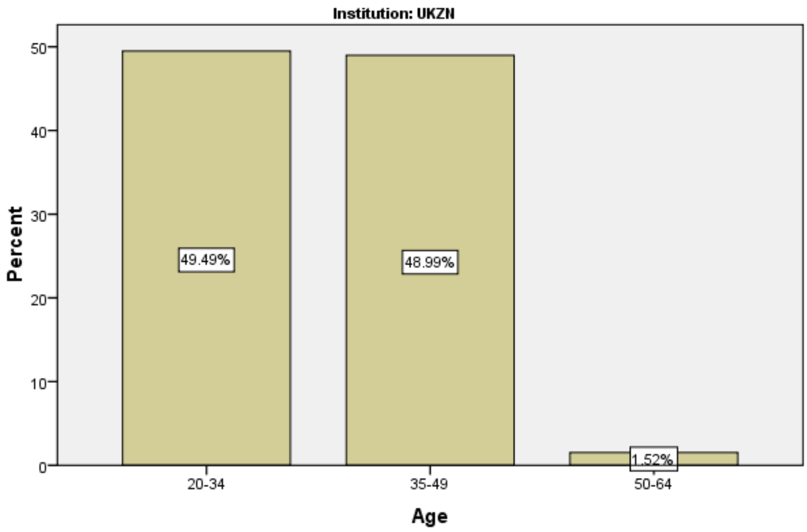


Figure 7.2 Age Distribution of Participants - UKZN

Qualifications

A significant number of participants constituting 61.62% held Masters Degrees, followed by 25.25% for participants with Ph.D. qualifications. The next sizable group (9.09%) indicated that they hold Honours degrees while another group of participants (3.54%) indicated they have a Degree. The smallest number of participants (0.51%) hold Diplomas.

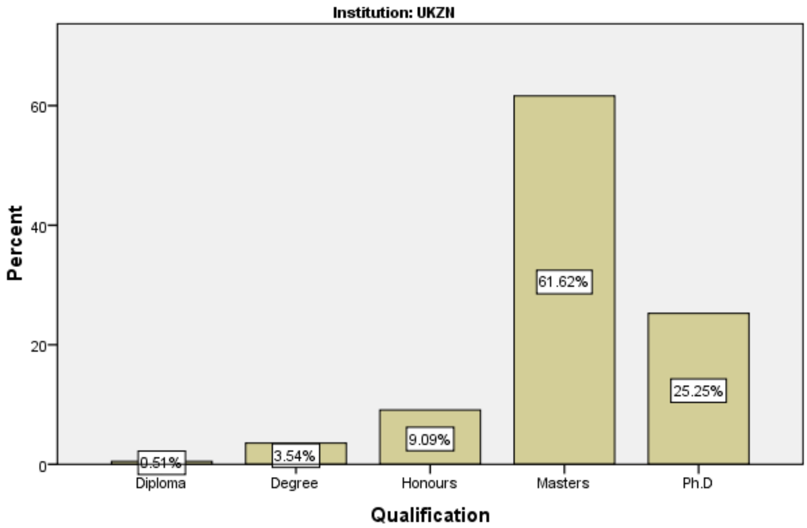


Figure 7.3 Age Distribution of Participants - UKZN

Occupation (Academic level)

Similar to their counterparts in LASU, the majority of participants from UKZN, constituting 48.99%, are lecturers. The next sizable category was Tutor/Teaching assistants who constituted 24.24% of participants. Senior lectures were 11.11% of the participants while Junior lectures constituted 8.08%. A small number of Associate professors constituted 6.57% and a fraction of 1.01% are Professors.

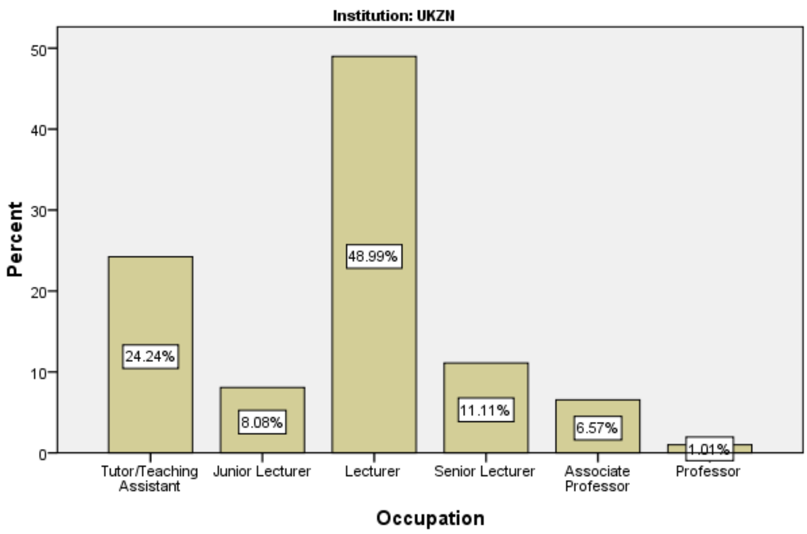


Figure 7.4 Occupation Distribution of Participants - UKZN

7.3 Analysis of Research Findings – UKZN

This section of the study presents research findings in relation to the five research questions and the five research objectives of the study with regards to findings obtained from academics at UKZN. The analysis of the five research questions developed to meet the study's objectives are presented sequentially below.

7.3.1 Objective One: The awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa

Research question one was developed to provide answers and gain insight on academics' level of information technology awareness of the rationale for the integration and use of adopted information technologies. The analysis of findings are presented below

7.3.1.1 Change Management Self-awareness – UKZN

In order to understand the formation of the opinions of participants about change management self-awareness, participants in UKZN were required to specify the choice that best represents how they felt about the imperative for the use of information technology in higher education on a scale of 1-4 with possible answers being strongly disagree, disagree, agree and strongly agree. To achieve the research objective that sought to investigate the awareness of the rationale for the integration and use of adopted information technologies, the responses presented in the Table 7.1 offer understanding of the perceptions of academics regarding change management in the adoption of information technology. Participants' responses presented in the Table 7.1 show that each opinion/perception is imperative to change management as a high percentage of participants (over 90%) specified *agree* and *strongly agree* to the propositions about change management. This is a clear indication that most academics who participated in the UKZN survey agree to change and perceived these opinions as critical to the adoption and integration of information technology into higher education.

Table 7.1 Change Management - UKZN

Opinions/Perceptions	Strongly Disagree	Disagree	Agree	Strongly Agree
Changes in the use of information technology begin with your individual understanding that change is actually needed.	0.50%	4.50%	46.50%	48.50%
You understand and accept that you must change to enhance integration of technology into higher education.	0.50%	1.50%	47.50%	50.50%
A university provides strategies for implementing changes in the use of information technology.	2.45%	6.55%	55.1%	35.9%
A university should clarify the need for information technology for different educational purposes.	0%	4.50%	37.40%	58.10%
A university should create suitable institutional structure to provide adequate support for promoting technology use.	0.50%	2.00%	27.80%	69.70%

7.3.2 Objective Two: The historical trends and pedagogical underpinnings of the integration of information technology in higher education

Question 6 to Question 14 of the questionnaire sought to provide answers to second research question and objective two of the study with regards to findings obtained at UKZN. The findings are presented below

7.3.2.1 Familiarity with Information Technology – UKZN

To determine the familiarity of academics at UKZN with the use of information technology, it was indispensable to find out their level of computer competency. As described in Figure 7.5, a significant number of academics, constituting 48.48%, specified their level of computer competency as experienced. The next group of participants (28.28%) specified moderate as their level of computer competency, followed by another group of participants constituting 22.22% who indicated very experienced in their level of computer competency. The last group constituted a fraction (1.01%) of participants who indicated that their level of computer competency as ‘very inexperienced’. As was the case of their LASU counterparts, the study rely on self-assessment which is entirely subjective. Hence, the study takes account of the possibility that some academics might be hesitant to declare their technical incompetence in an age of high-tech and information handling.

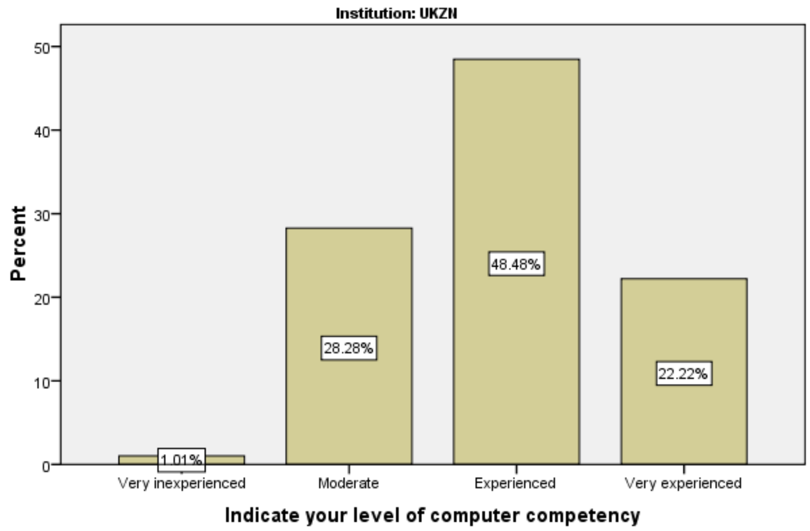


Figure 7.5 Level of Computer Competency – UKZN

To further understand academics' familiarisation with information technology at the UKZN, participants were required to indicate a yes or no to show if they have had any form of training or retraining in information technology or related fields. As was the case in terms of certifications, training and retraining in information technology at LASU, an overwhelming number of academics (with over 75%) at the UKZN indicated that they have not acquired training programmes in information technology or related fields. Yet, well over 50% indicated experienced and very experienced in Figure 7.5. This lends credence to the assumption that the majority of the participants who indicated 'experienced' and 'very experienced' in computer competencies are self-taught.

Table 7.2 Certification, Training or Retraining Programmes in IT field - UKZN

Certification(s), Training and or Retraining Programmes	**Participants' answers (%)**	
	Yes	**No**
Do you have any certification(s) in information technology or IT- related courses?	24.24%	75.76%
Have you had any further training or retraining programmes in the IT field identified above?	17.77%	82.23%
Have you acquired competency in any other/a different IT field?	16.24%	83.76%

Duration of Computer/Information Technology use for Teaching and Learning

To confirm the period of experiences and the usage of computers and or information technology for teaching and learning purposes by academics in UKZN, the researcher required participants to indicate the period they have been using technologies. As shown in Figure 7.6, over half (51.52%) of participants specified they have been using computer/information technologies for teaching and learning purposes for more than 5 years. The next group of participants constituting 17.17% indicated they have been using the technologies for more than 3 years but less than 4 years. Another sizable number of participants (12.63%) indicated they have been using the technologies for more than 2 years but less than 3 years. A few participants (7.07%) specified their use of computer/information technologies for teaching and learning to be more than 4 years but less than 5 years. Some academics specified they have been using computers/information technologies for more than 6 months but less than 1 year (5.56%). 4.55% indicated more than 1 year but less than 2 years and a fraction (1.52%) have used computer/information technologies for the purpose of teaching and learning for less than 6 months.

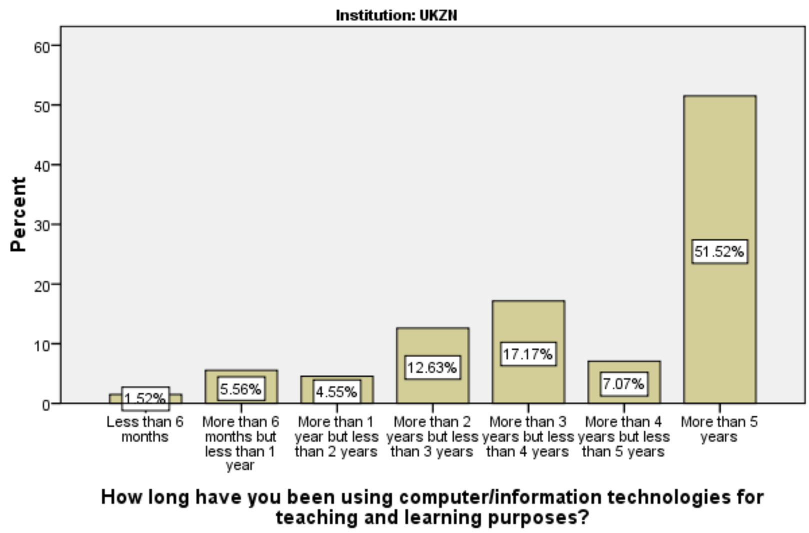


Figure 7.6 Length of time involved in the Use of Computer/IT for Teaching and Learning – UKZN

7.3.2.2 Important Information Technology for Higher Education – UKZN

This section presents UKZN academics' views on the information technologies (e-Learning) that they found to be important for technology integration in higher education, with the possible answers being *I don't know*, *not important*, *less important*, *somewhat important* and *very important*. Table 7.3 shows a slight variation from the case of LASU where Open education resources and Smarthistory technology were the two (less popular/important) technologies they elicited the response of *I don't know* from over half of the participants. Smarthistory technology was the least popular e-Learning technology producing a (41.91%) *I don't know* and a (4.55%) *not important* at UKZN. The Majority of participants at the UKZN were receptive to the concept of technology integration with over 70% indicating that each of the e-Learning technologies presented are *somewhat important* or *very important* for technology integration in higher education.

Table 7.3 Important e-Learning Technology for Technology Integration - UKZN

Information Technology (e-Learning)	I don't know	Not important	Less important	Somewhat important	Very important
Learning Management Systems or Course Management Systems (CMS)	6.06%	1.01%	1.01%	35.86%	56.06%
Open Education Resources (OER)	12.12%	1.01%	3.03%	28.79%	55.05%
Open and Distance Learning	9.14%	1.51%	5.08%	34.52%	49.75%
Mobile Learning	7.07%	0.50%	10.61%	38.89%	42.93%
Smarthistory Technology	41.91%	4.55%	9.60%	28.28%	15.66%
Virtual Learning Environment (VLE)	14.14%	1.01%	5.05%	32.33%	47.47%
Massive Open Online Courses (MOOCs)	15.15%	1.52%	10.61%	35.35%	37.37%
Collaborative Education Network (CEN)	14.65%	1.51%	4.55%	29.29%	50.00%

Table 7.4 presents the efficacy of the e-Learning technologies adopted by UKZN. Participants in UKZN were required to rate the efficacy (in terms of availability, usefulness and importance) of these e-Learning technologies with possible answers being *not available*, *not important*, *less important*, *somewhat important* and *very important*. Table 7.4 shows the corresponding number and percentage of participants' who rated the efficacy of each e-Learning technology adopted by their institution. As was the case in terms of information technology adopted in LASU, UKZN participants rated Smarthistory technology as not available. (70.71%). A relatively sizable number with an average of 20% of participants rated each e-Learning technology as not available at UKZN. Another group to consider were those participants constituting well over 50% who rated the efficacy of technology adopted in UKZN high, including LMS, OER, VLE and CEN as somewhat important and very important.

Table 7.4 Efficacy Rating of e-Learning Technology Adopted by Institution - UKZN

Information Technology (e-Learning)	Not available	Not important	Less important	Somewhat important	Very important
Learning Management Systems or Course Management Systems (CMS)	5.56%	0%	7.07%	24.75%	62.63%
Open Education Resources (OER)	21.72%	1.52%	4.55%	37.88%	34.34%
Open and Distance Learning	39.90%	6.06%	11.62%	22.73%	19.70%
Mobile Learning	33.84%	8.08%	9.60%	27.78%	20.71%
Smarthistory Technology	70.71%	7.58%	3.54%	10.10%	8.08%
Virtual Learning Environment (VLE)	29.29%	3.03%	8.08%	27.27%	32.32%
Massive Open Online Courses (MOOCs)	41.92%	5.05%	9.09%	25.76%	18.18%
Collaborative Education Network (CEN)	33.84%	3.54%	3.54%	32.83%	26.26%

7.3.2.3 Institutional and Personal attitudes towards use of IT – UKZN

This section of the study shows UKZN participants' responses concerning their institutional and personal disposition towards the use of information technology (e-Learning) facilities. These information technology facilities were explicated in section 2.11.3 of the literature review (Chapter Three) in order to provide a better understanding as to their various functions and usefulness. In what mirrored the case with academics at LASU, participants at UKZN indicated that their institution also enables the use of email for 84.30% of the participants. A similar trend is the use of email for personal use where 81.30% of participants indicated that they have this. Discussion forums, Podcast, Vodcast, IM, Content management, Online tests and assessments, FAQs, Q & A, Statistics, Calendar and Dropbox are the tools/facilities that participants at UKZN rated highly in terms of institutional and personal disposition towards use.

Table 7.5 Institutional and Personal Disposition of IT facility Usage - UKZN

Information Technology Facilities	My institution enables use of this facility		My institution provides training & support for this facility		I use the facility	
	Yes	No	Yes	No	Yes	No
Discussion forums	65.70%	34.30%	42.90%	57.10%	56.10%	43.90%
Audio Learning (Podcast)	37.90%	62.10%	33.30%	66.70%	30.80%	69.20%
Video Learning (Vodcast)	48.00%	52.00%	38.40%	61.60%	36.40%	63.60%
Instant Messaging (IM)	35.90%	64.10%	15.20%	84.80%	36.90%	63.10%
Content Management	44.40%	55.60%	27.80%	72.20%	23.70%	76.30%
Bulletin Boards	48.00%	52.00%	23.70%	76.30%	29.30%	70.70%
Chatrooms	36.90%	63.10%	19.20%	80.80%	32.80%	67.20%
Games and Leisure	20.70%	79.30%	10.60%	89.40%	26.80%	73.20%
Online tests and quizzes	46.00%	54.00%	26.80%	73.20%	27.30%	72.70%
Blogs	39.90%	60.10%	16.20%	83.80%	32.80%	67.20%
Email	84.30%	15.70%	42.90%	57.10%	81.30%	18.70%
Online IT Lab	29.80%	70.20%	17.20%	82.80%	14.60%	85.40%
FAQs	40.40%	59.60%	17.70%	82.30%	21.70%	78.30%
Q&A	39.90%	60.10%	23.20%	76.80%	25.30%	74.70%
Statistics	40.90%	59.10%	17.20%	82.80%	22.20%	77.80%
Wiki	35.90%	64.10%	11.60%	88.40%	22.70%	77.30%
Calendar (Schedule tool)	49.50%	50.50%	18.20%	81.80%	32.30%	67.70%
Dropbox	46.00%	54.00%	19.20%	80.80%	48.50%	51.50%

7.3.3 Objective Three: Challenges to information technology integration into higher education

Question 15 to Question 19 of the questionnaire sought to provide answers to third research question and objective three of the study with regards to findings obtained at UKZN. The findings are presented below

7.3.3.1 Adoption of New Technology: Predisposing Factors and Challenges – UKZN

With reference to UKZN, participants were asked to specify the motivations towards the adoption of new technology based on their personal knowledge and experiences. Table 7.6 shows the different number and percentage of participants' responses to the motivations for adopting new technology. A substantial number of participants indicated 'agree' and 'strongly agree' to all the motivations for adopting technology except for a another group of participants 50.30% and 8.10% who specified disagree and strongly disagree to usually being the first to try out new information technology respectively. This group of participants could be referred to as *late majority* in the assumptions of diffusion of innovation theory. Those who strongly agree to experiment with new technology would be referred to as early adopters. Participants who specified that they have always tried to obtain the latest information technology could fall between early adopters and early majority based on whether or not they have adopted the technology earlier when it was released/introduced and those who were upgrading but had obtained the technology when the technology became popular or reliable. Those who indicated that they would most likely use the technology if someone else used it could be categorised as 'late majority'.

Table 7.6 Motivations for the Adoption of New Technology - UKZN

	Strongly Disagree	Disagree	Agree	Strongly Agree
I like to experiment with new technology	0%	6.10%	25.30%	68.70%
I have always tried to obtain the latest information technology	0%	13.10%	44.20%	42.60%
Among my colleagues, I am usually the first to try out new IT	8.10%	50.30%	32.00%	9.60%
I would more likely use information technology if someone else used it	3.00%	15.70%	55.30%	25.90%
I intend to use information technology in the future	2.50%	0.50%	24.40%	72.60%

Factors Determining the Success of Information Technology Integration

To determine the opinions of academics in UKZN vis-à-vis the importance of factors that determine the successful integration of information technologies into higher education, the majority of the participants indicated *somewhat important*, *important* and *very important*. The summation of these three categories of participants in UKZN is above 90%. This is an indication that academics in UKZN thought that the factors listed are important in determining the success of information technology integration in higher education. Amongst the 14 factors listed, the only factor rated low by 54.60% of participants as *somewhat important, important* and *very important* is low students enrolment into higher education. 45.40% of participants thought that this was of *no importance* and *of little importance* in determining the success of information technology integration in higher education. This indicates that high student enrolment 'massification' in higher education is not a barrier to successful information technology integration.

Table 7.7 Importance of Factors - UKZN

Factors	Of no importance	Of little importance	Somewhat important	Important	Very important
Time between introduction and adopting	0.50%	4.00%	12.60%	45.50%	37.40%
Personal interest in the use of technology	0%	1.00%	7.10%	48.20%	43.70%
Availability of Funds	0%	0.50%	9.60%	27.80%	62.10%
Availability of physical space	1.00%	1.00%	13.10%	32.30%	52.50%
Quality assurance	0%	0.50%	9.60%	37.40%	52.50%
Employment of Skilled professionals	1.00%	2.50%	7.10%	27.30%	62.10%
Low student enrolment into higher institution	16.20%	29.20%	20.20%	17.70%	16.70%
Increasing access to technology	0%	1.00%	6.10%	28.30%	64.60%
Institutional policies to support the use of IT	0%	0.50%	7.60%	21.70%	70.2%
Sufficient support from management level	0%	0.50%	5.60%	26.80%	67.20%
Availability of resources	0%	0%	2.50%	23.20%	74.20%
Adequate ICT infrastructures	0%	1.50%	3.00%	24.20%	71.20%
Adequate training facilities	0%	0.50%	4.00%	27.80%	67.70%
Government support and interventions	0%	2.50%	10.10%	25.30%	62.10%

A Reliability Test was conducted on the 14 factors (variables) to determine the success or failure of information technology integration in higher education. These factors are identified as variables and statistics are based on all cases with valid data for all variables in the procedure. The variable statement below lists all the 14 variables (items) using key identifiers such as Q16.1, Q16.2 to Q16.14. The statement depicts the procedure that implements the option to select Alpha to execute Cronbach's Alpha Analysis of all the 14 factors identified in the study. Anova with F-Test and Intra-class correlation coefficient was conducted where the confidence interval is set to 95% with a mixed type of consistency. The results are presented in the tables below.

```
RELIABILITY   /VARIABLES=Q16.1 Q16.2 Q16.3 Q16.4 Q16.5 Q16.6 Q16.7 Q16.8 Q16.9
Q16.10 Q16.11 Q16.12 Q16.13 Q16.14   /SCALE('ALL VARIABLES') ALL   /MODEL=ALPHA
/STATISTICS=ANOVA     /SUMMARY=TOTAL     /ICC=MODEL(MIXED)  TYPE(CONSISTENCY)
CIN=95 TESTVAL=0.
```

The resulting value of Cronbach's Alpha reliability test on factors determining the success of information technology integration in UKZN is 0.865 as can be seen in Table 7.8. This test was conducted randomly to understand the variance of the Cronbach's Alpha coefficient on factors.

Table 7.8 Reliability Test on Factors (Cronbach's Alpha Analysis) - UKZN

Case Processing Summary [b]

		N	%
Cases	Valid	197	99.5
	Excluded [a]	1	.5
	Total	198	100.0

a. Listwise deletion based on all variables in the procedure.

b. Institution = UKZN

Reliability Statistics [a]

Cronbach's Alpha	N of Items
.865	14

a. Institution = UKZN

Since the acceptable Cronbach's Alpha value is near to or equal to or greater than 0.7 but less than 0.95, the reliability of the items measured on factors is said to be acceptable, internally consistent and without redundancy. Cronbach's Alpha is rounded up to 0.87 from 0.865 which means that there is a 0.24 error variance or random error, calculated as follows:

$$0.87 \times 0.87 = 0.76;$$

$$1.00 - 0.76 = 0.24$$

The F-Test conducted on factors determining the success of information technology integration in higher education is presented in the tables below.

To test:

H*0*: The variances are not the same or equal.

H*1*: The variances are the same or equal.

Test for ANOVA: There is difference in means across the factors. The associated p value is .000 where the value of p when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the hypothesis is statistically significant.

The reason is that H*0* is the research hypothesis (i.e. when H*0* is accepted, it implies that H*1* is rejected and when H*0* is rejected, automatically H*1* is accepted). In Analysis of Variance (which is a test for significant deference in means), a p value less than 0.05 means that there is a significant difference in means across the scale (which also means that we accept H*0*: The variances are not the same or equal). Therefore, when there is a significant difference in means across the scale; it implies that the variances are not the same or equal. Conversely, a p value greater than 0.05 means that there is no significant difference in mean (which also means that we reject H*0*: The variances are not the same or equal). Because, no significant difference means that the variances are the same or equal.

Therefore, H*0* is accepted since the value of p is less than 0.05, a very strong evidence to reject the alternative hypothesis (H*1*) of no significant difference in means across the scale (i.e. the variances are the same or equal) item. Therefore, the variances are significantly different and reliable. This means the variables are acceptable, internally consistent with no redundancy.

Table 7.9 ANOVA Test on Factors (F-Test) - UKZN

ANOVA [a]

		Sum of Squares	df	Mean Square	F	Sig
Between People		569.711	196	2.907		
Within People	Between Items	535.144	13	41.165	104.963	.000
	Residual	999.284	2548	.392		
	Total	1534.429	2561	.599		
Total		2104.139	2757	.763		

Grand Mean = 4.38

a. Institution = UKZN

Table 7.10 Intra-class Correlation Coefficient on Factors - UKZN

Intra-class Correlation Coefficient [d]

	Intraclass Correlation [a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.314 [b]	.267	.369	7.412	196	2548	.000
Average Measures	.865 [c]	.836	.891	7.412	196	2548	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. Type C intra-class correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

d. Institution = UKZN

The next table presents UKZN academics' perceptions on the seriousness of challenges they encounter in the use of information technology for teaching and learning. Table 7.11 shows that participants in UKZN rated the seriousness of listed challenges high in the use of information technology for teaching and learning purposes. Over 50% of participants rated most of the challenges as *somewhat serious* and *very serious*. As can be seen from Table 7.11, 53.60% of participants in UKZN rated excessive students' enrolment as *less serious* and *not serious*. This can be referenced to the findings of the factors (low student enrolment into higher institution) in Table 7.7 that participants indicated as less important in the integration of technology. The same was indicated in the challenges (excessive students' enrolment), where majority of participants in UKZN rated as less serious challenge in the use of information technology for teaching and learning purposes.

Table 7.11 Seriousness of Challenges - UKZN

Challenges	Not serious	Less serious	Somewhat serious	Very serious
Lack of time for adoption	7.60%	29.90%	34.00%	28.40%
Insufficient funds	2.00%	15.20%	33.00%	49.70%
Poor physical space	7.10%	29.30%	32.30%	31.30%
Lack of IT skills by academic staff	6.10%	21.20%	38.90%	33.80%
Lack of IT skills by students	1.00%	20.20%	37.90%	40.90%
Inadequate access to technology	6.10%	17.70%	31.30%	44.90%
Inadequate infrastructure	6.60%	17.20%	34.30%	41.90%
Poor technical support by management	9.60%	15.70%	34.80%	39.90%
Potential loss of personal revenue	15.20%	29.30%	31.30%	23.70%
Lack of training facilities	11.60%	16.70%	33.30%	38.40%
Excessive students' enrolment	17.70%	35.90%	23.20%	23.20%
Poor institutional policies	6.60%	22.30%	34.50%	36.50%

Figure 7.7 presents the overall experiences of UKZN academics' articulation in the use of information technology for teaching and learning purposes. Despite the high ratings of the various challenges in the use of information technology, majority of participants in UKZN (51.01%) and (27.78%) indicated the overall experience of using information technology for teaching and learning purposes as good and very good respectively. 19.70% of participants indicated their overall experience as average and a fraction of 1.52% indicated the overall experience of using information technology for teaching and learning as poor. No participant chose the option of *very poor*.

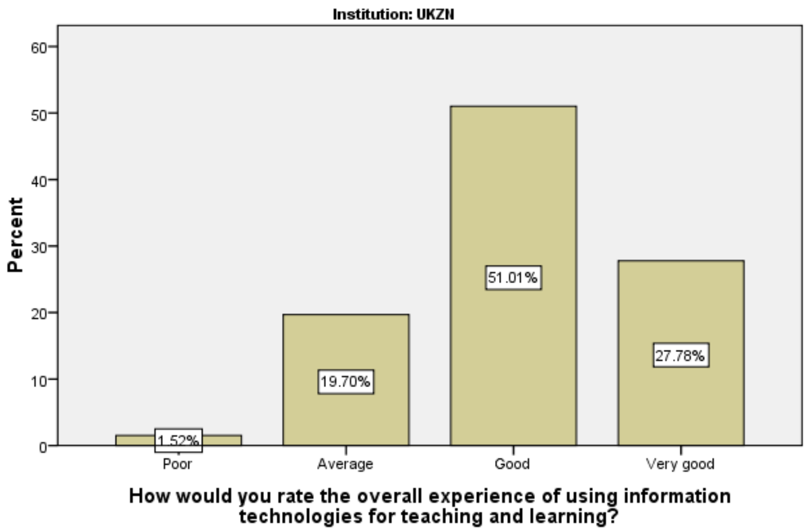


Figure 7.7 Overall Experience of IT for Teaching and Learning – UKZN

Figure 7.8 follows suit by presenting UKZN academics' overall experiences in the use of information technology for research purposes. As can be seen in Figure 7.8, majority of participants constituting 42.42% and 40.91% indicated the overall experience in the use of information technology for research purposes as good and very good respectively. A few participants (15.66%) indicated that their overall experience of using information technology for research purposes was average and a fraction of (1.01% of) participants specified their overall experience as being 'poor'. No participant indicated 'very poor'.

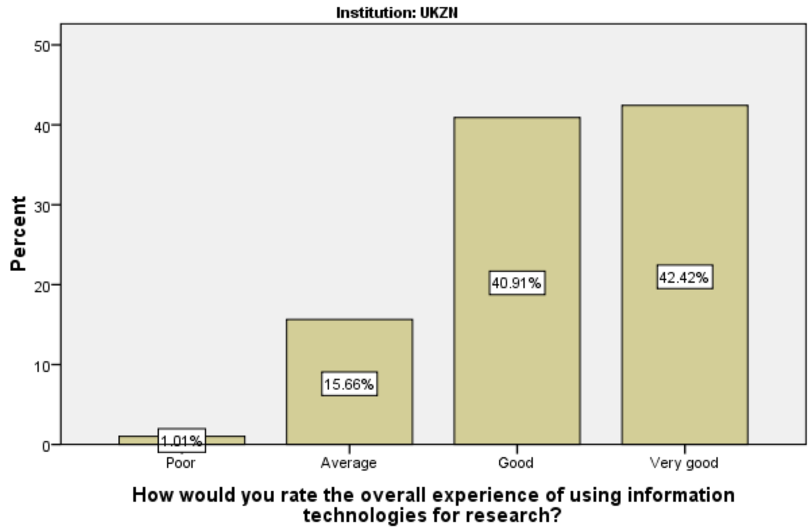


Figure 7.8 Overall Experience of IT for Research – UKZN

7.3.4 Objective Four: Limitations of Information Technology Integration in Higher Education

Question 20 to Question 23 of the questionnaire sought to provide answers to fourth research question and objective four of the study with regards to findings obtained at UKZN. The findings are presented below.

7.3.4.1 Quality of Support - UKZN

Given that UKZN academics view the overall experience in the use of information technology in higher education as good, it is not surprising that a significant number of participants constituting 73.74% and 19.70% described the quality of support received by the instituting administration in the integration of information technology as *somewhat satisfactory* and *very satisfactory* respectively. 13 academics, with the lowest percentage of 6.57% described the quality of support by the institution administration in the integration of information technology as *not satisfactory*.

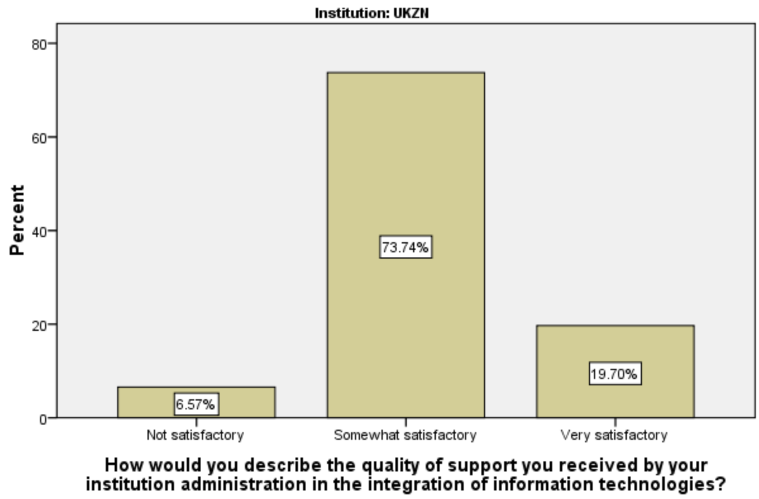


Figure 7.9 Quality of Support by Institution Administration – UKZN

7.3.4.2 Unsatisfactory Experience - UKZN

Having identified possible problems that could occur in the use of information technology by academics in higher education, in which the frequency of the problems could affect user satisfaction and engender discouragement, participants in UKZN were required to indicate the action they took during the unsatisfactory experience. In contrast to the case of the majority of participants at LASU (who indicated that they took their complaints to colleagues and others), the majority of participants at UKZN constituting 73.47% indicated that they call the support centre/ICT Department to deal with the unsatisfactory experience in the use of information technology for integration in higher education. Some UKZN participants (18.88%) signalled that their reaction to unsatisfactory experience in the integration of information technology would take the form of complaints to colleagues and others. A small number of participants (7.65%) indicated that they would ignore the problem.

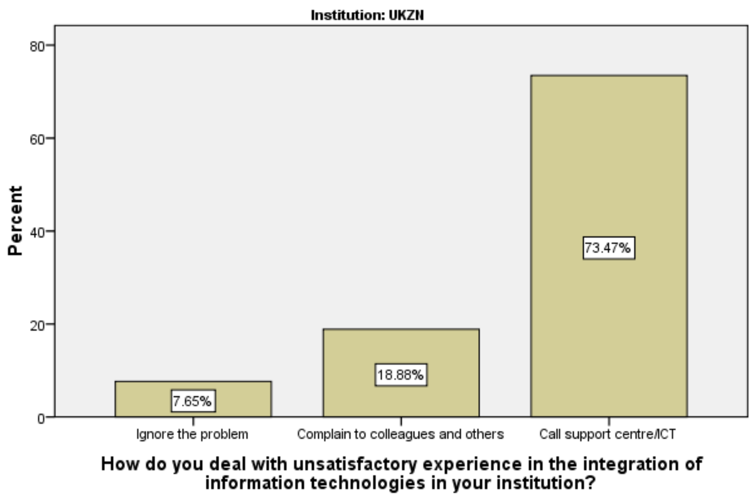


Figure 7.10 Unsatisfactory Experience by Academics – UKZN

7.3.4.3 Complaint Report – UKZN

The next figure shows UKZN academics' frequency of reporting unsatisfactory support and complaints to the institution's administration. A significant number of participants 46.97% and 35.35% indicated the frequency of reporting complaints to the intuition's administration as *occasionally* and *rarely* respectively. A small number of participants constituting 9.09% indicated that they frequently report complaints to the institution's administration. Participants who indicated *never* constituted 8.59%.

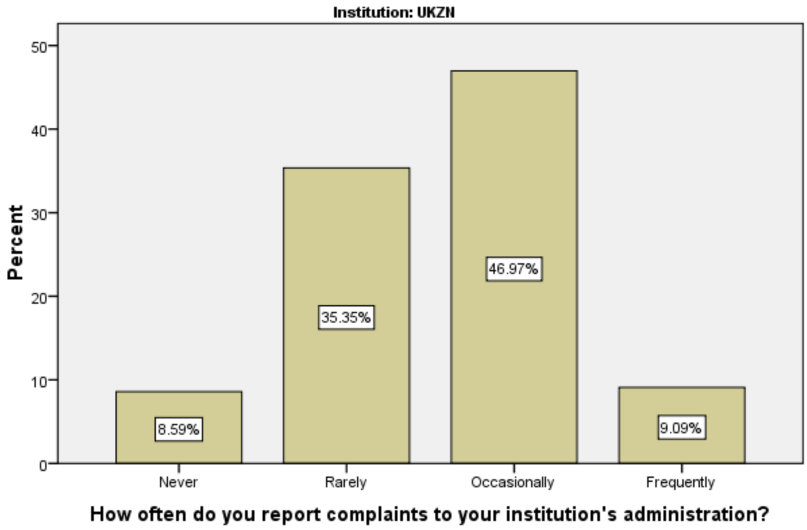


Figure 7.11 Frequency of Complaints to Institution Administration – UKZN

A Z-test is conducted to determine whether the *rarely* and *occasionally* results are significantly different.

Table 7.12 Frequency of Complaints to Institution Administration – UKZN

How often do you report complaints to your institution's administration? [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	17	8.59	8.59	8.6
	Rarely	70	35.35	35.35	43.9
	Occasionally	93	46.97	46.97	90.9
	Frequently	18	9.09	9.09	100.0
	Total	198	100.0	100.0	

a. Institution = UKZN

Table 7.13 Proportion Table for *Rarely* and *Occasionally* – UKZN

	Total	Frequency	Proportion
Rarely	198	70	35.35%
Occasionally	198	93	46.97%
Overall	396	163	82.32%

To test:

H*0*: The two proportions are not equal.

H*1*: The two proportions are equal.

Test Statistic is $Z = \frac{(P_1 - P_2) - 0}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = 2.3486$

p1 = 93 (Occasionally)

p2 = 70 (Rarely)

The Z-Score is 2.3486. The p-value is 0.01878. The result is significant at $p < 0.05$. The proportion of Yes or No responses for Observation 1 is 0.47. The proportion for Observation 2 is 0.354.

Using Two-tailed hypothesis, the critical Z value at 5% significance level is 1.96. H*1* is rejected since the test statistic is greater than the critical value. Therefore, the two proportions are significantly different. H*0* is accepted.

7.3.4.4 Complaint Response - UKZN

With reference to UKZN academics' reaction to complaints of unsatisfactory experience and the frequency of complaints reported to institution administration vis-à-vis the use of information technology in higher education, participants were required to rate the response of their institution administration to complaints or queries. 32.83% of participants rated the response of the institution administration to complaints as *prompt* and *satisfactory*. Another group of participants (29.80%) thought that the response rate to their complaints by the institution administration was *not prompt but satisfactory*. In view of others, 19.19% indicated that the response rate to their complaints or queries was *not prompt* and *not satisfactory*, whilst 18.18% of participants indicated that the response rate to their complaints or queries was 'prompt' but 'not satisfactory'.

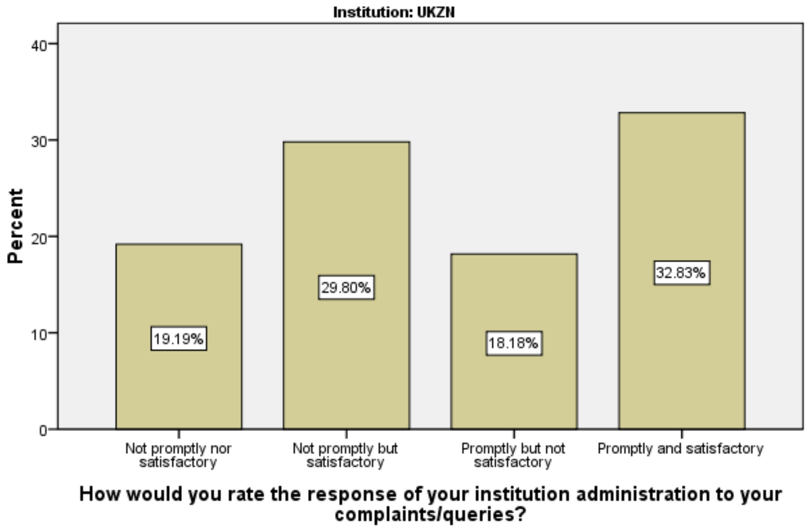


Figure 7.12 Rating of Response to Complaints – UKZN

7.3.5 Objective Five: Solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education

Question 24 to Question 28 were questions in the questionnaire that sought to provide answers to the fifth research question and objective five of the study with regards to findings obtained at UKZN. The findings are presented below.

7.3.5.1 The Drawbacks of Information Technology in Higher Education – UKZN

To gain insight into the barriers to information technology integration, participants in UKZN were required to indicate the drawbacks they have experienced in the use of information technology at their institution. In contrast to the case of LASU where over 50% of participants indicated *Yes* to have experienced drawbacks, a smaller number of participants (16.67%) in UKZN indicated *Yes* to have experienced drawbacks in the use of information technology. However, a majority of participants in UKZN constituting 83.33% indicated *No*, they have not experienced drawbacks in the use of information technology.

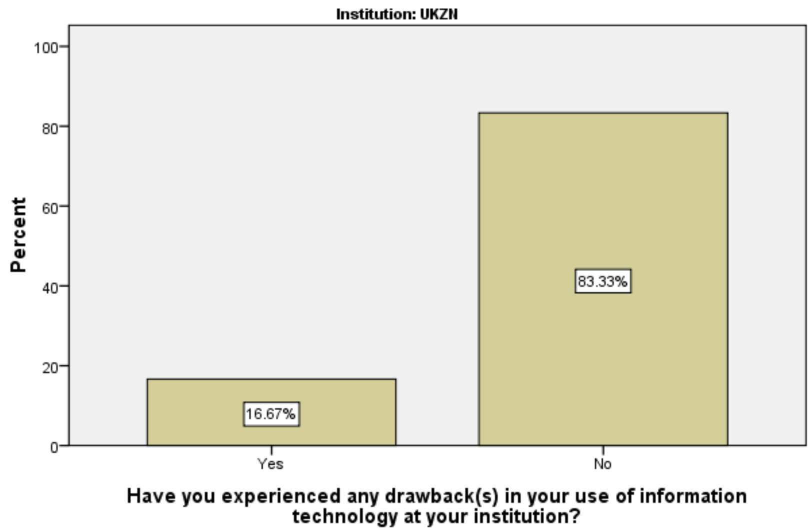


Figure 7.13 Drawback(s) in the Use of IT – UKZN

Drawbacks in the use of Information technology – UKZN

This section of the study unpacks the different kinds of drawbacks that participants in UKZN have experienced in the use of information technology in higher education. As was the case in LASU, the following themes were generated from the analysed data collected in UKZN:

- Inadequate Internet facilities;
- Inconsistent Power Supply;
- Lack of Information Technology Skills by Students and Academics;
- Irregular Systems Update; and
- Insufficient Facilities.

Inadequate Internet Facilities – In contrast to the lack of Internet facilities that was identified with regards to the drawbacks LASU participants experienced in the use of information technology (and noting the absence of free Internet facilities), UKZN participants indicated poor Internet facilities that denote the presence of Internet facilities but poor or deprived services. One participant in UKZN indicated that there is *Poor Internet service*. Another participant indicated *Network failure* as the drawback that was experienced in the use of information technology. The third significant response was *Slow Internet connection* and to avoid duplication of response, the last significant response was identified as *Wi-Fi failure*. The above responses can be attributed to the theme: poor Internet facilities in terms of its availability and speed.

Inconsistent Power Supply – A participant in UKZN attributed the drawback to inconsistent power supply. With reference to the inconsistent power supply (Electricity), identified by more than one participant in the case of LASU, only one UKZN participant indicated that "At times, the network is down, due to recent issues with load Shedding." Load shedding in the context of South Africa refers to inconsistent electricity supply that the South African government has been dealing with for the past 6 years. Eskom which is South Africa's electricity supply company, described load shedding as: the power system that requires prudent management of supply to meet demand. This is a similar and common theme that needs to be addressed in the context of technology integration in Africa.

Lack of Information Technology Skills by Students and Academics – This theme focuses on the importance of providing appropriate skills for both students and academics who will be using information technology for higher education purposes. Information technology awareness fits well into this theme, because if they are aware of the potentials of the technology, it will stimulate their interest to use and to integrate it. Two participants in UKZN identified this theme. The first participant indicated that "there is no silver bullet for all students" and so being aware of a correct digital pedagogy is important when using e-Learning. The second participant identified the drawback associated with this theme as "Lack of interest from students and academics staff in using information technology." If both students and academics lack interest in the use of information technology, there will be little or no motivation to integrate information technology into higher education. Hence, this raises pertinent questions: Who should create awareness of information technology? Who should make the use of information technology a thing of interest to students and academics? Should it be self-generated or should it be promoted by the institution? These questions were addressed in the study's survey under Section B: Change management (Self-awareness). The generalised response to these questions was presented in section 7.3 where the majority of the participants (over 90%) specified *agree* and *strongly agree* to the perceptions of change management.

Irregular Systems Update **–** The focus here was identified by participants in UKZN where one participant indicated that the drawback in the use of information technology was "Very slow and outdated systems." Another participant indicated that the drawback was that "Somehow, information technology does not update all computers especially with different Windows." This is an indication that academics are finding the use of information technology problematic when they use outdated systems. Irregular systems updates need to be addressed as it has been identified as a common trend among the selected higher education institutions.

Insufficient Facilities – In the context of the responses from participants in UKZN, the Insufficient Facilities theme is attributed to the provision of amenities such as server capacity (digital data storage space), office automation, technical support and infrastructure. The office automation system refers to the various computer technology/machinery and software that is utilized to electronically/digitally create, collect, manipulate, store and communicate office information needed to accomplish basic office tasks (Padariya, 2014). According to the first participant in UKZN, "Inadequate server capacity during tests" was indicated as the drawback that was experienced in the use of information technology in higher education and can be associated with insufficient data storage space available on the network. Another participant indicated that "Too many people wanting to use the infrastructure at the same time" and this can be associated with storage space and server capacity of the network which can make access to the network slow in response rate. In terms of insufficient facilities, one participant indicated that the drawback in the use of information technology was “Lack of LAN space for students and inability to book LANs for Teaching.” “Slow Internet connection, sometimes location of IT facilities such as Copier, Printers and Scanner” were indicated by another participant in UKZN as drawbacks, all of which are associated with office automation. Another significant response was “Insufficient number of projectors” which was also identified as a drawback in the use of information technology in UKZN. To avoid duplication of perceptions, the remaining responses were not presented in the study.

Word frequency was queried by identifying commonly occurring words and allocated in relation to the identified themes in UKZN. The Word cloud and the Tree map figures below show that systems, facilities, students and network are the most commonly occurring words in the query that makes up the themes explained above.

7.3.5.2 The Utility of Information Technology to Higher Education – UKZN

This section presents UKZN participants’ description of the extent to which they consider the integration of information technology as necessary or critical for higher education and learning outcomes. As was the case in LASU in terms of the utility of information technology to higher education, the majority of participants in UKZN constituting 80.30% also considered the integration of information technology to be *very critical* for higher education. The remaining percentage of participants (19.70%) thought that the integration of information technology was *somewhat critical* for higher education. There was no data recorded for *Not critical at all* by participants in UKZN.

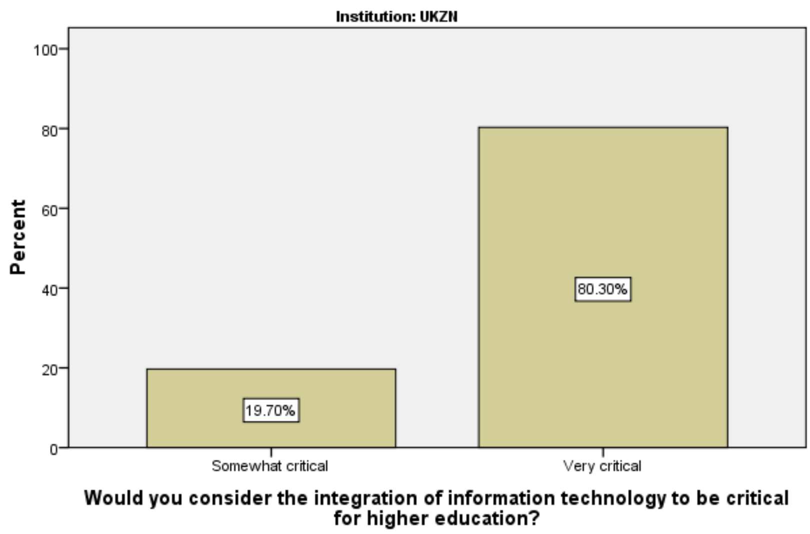


Figure 7.14 Necessity of Integrating IT into Higher Education – UKZN

Figure 7.14 above shows that academics at UKZN agree with the proposition that information technology is necessary or critical for higher education. Therefore, it is not surprising that 76.77% of participants in UKZN thought that information technology is *extremely important (very critical) in order to enhance* learning outcomes in higher education. Another significant number of participants (23.23%) indicated that integration of information technology is *somewhat critical* to enhancing learning outcomes in higher education and none was recorded for *Not critical at all*.

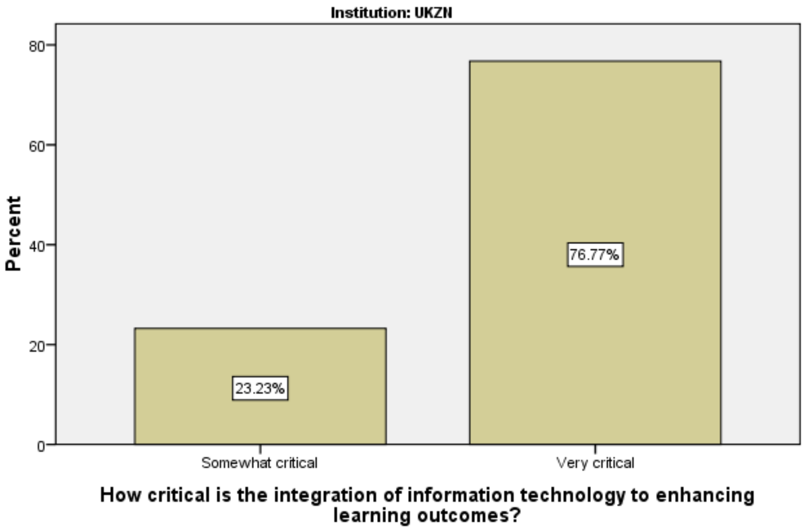


Figure 7.15 Necessity of Integrating IT to enhance Learning Outcomes – UKZN

The Impact of Information Technology on Higher Education - UKZN

The concluding phase of the information required by academics in UKZN was to unpack their articulation of the impact of information technology on higher education. The findings on the impact that information technology has on higher education by participants in UKZN is presented in Figure 7.16 in the order of impact assessment portrayed. A fraction of academics constituting 2.53% described the impact of information technology on higher education as somewhat negative. This is an indication that the negative impact assessment is underrated by participants in UKZN. In addition, 19.19% and 78.28% of participants in UKZN described the impact that information technology has on higher education as somewhat positive and positive respectively. It can be analysed that academics who indicated the impact as somewhat positive and positive lend weight to the suggestion that the integration of technology in higher education and the use of information technology are necessary or critical for teaching and learning outcomes.

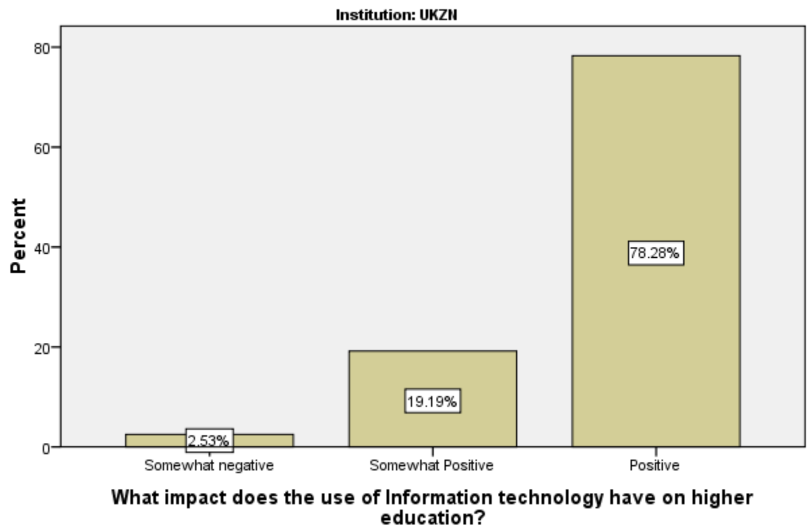


Figure 7.16 Impact of Information Technology on Higher Education - UKZN

7.4 Chapter Summary

UKZN academics' evaluation of information technology in higher education was presented in this chapter. The chapter also presented the different types of information technologies suitable for technology integration in higher education. Institutional and personal attitudes towards information technology facilities and academics' use of such facilities were identified. Findings in terms of predisposing factors and challenges in the adoption of information technology in higher education were presented. Overall experiences and perceptions in the use of information technology for higher education purposes were described, followed by the impact of the use of information technology on higher education. The next chapter presents data and analyses of findings obtained at UNISA.

CHAPTER EIGHT

DATA PRESENTATION AND ANALYSIS – INFORMATION TECHNOLOGY AT UNISA

8.1 Introduction

The previous chapter presented UKZN academics' views of the integration of information technology in higher education. Chapter Eight presents UNISA academics' views. The background information of academics at UNISA is presented, followed by an evaluation of participant's change management self-awareness. This chapter presents UNISA participants' familiarity with information technology and the identification of information technologies that are most important for technology integration at UNISA, South Africa. The efficacy of the information technologies adopted by the institution is investigated and an attempt is made to identify institutional and academics' personal attitudes towards the use of information technology facilities. Academics' motivation for the adoption of new technology is presented with predisposing factors and challenges to the integration of technology at UNISA. Lastly, the chapter identifies the utility of information technology in higher education and the impact this has on higher education.

8.2 Background Information – UNISA

The background information of academics who participated in this research is presented in this section.

8.2.1 Background Information of Academics – UNISA

201 academics at UNISA took part in the study. Their background information with reference to gender, age, qualifications and occupation is presented in this section.

Gender

More males than females participated at UNISA, as was the case in the other two institutions, the gap was less marked, however, in terms of gender profile of participants at UNISA. Figure 8.1 shows that male participants constituted 52.74% and female participants constituted 47.26%.

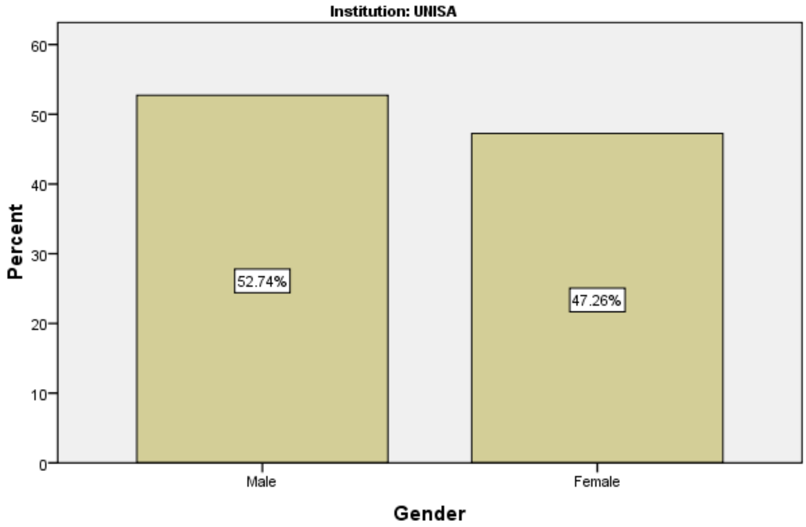


Figure 8.1 Gender Distribution of Participants - UNISA

Age

Figure 8.2 shows that a substantial number of participants (43.28%) were within the age bracket 35-49, followed by participants within the age bracket 20-34 at 35.32%. Participants within the age bracket 50-64 constituted 18.41%. Only 1.99% were 65 and above, and 2 participants representing 1.00% were less than 20.

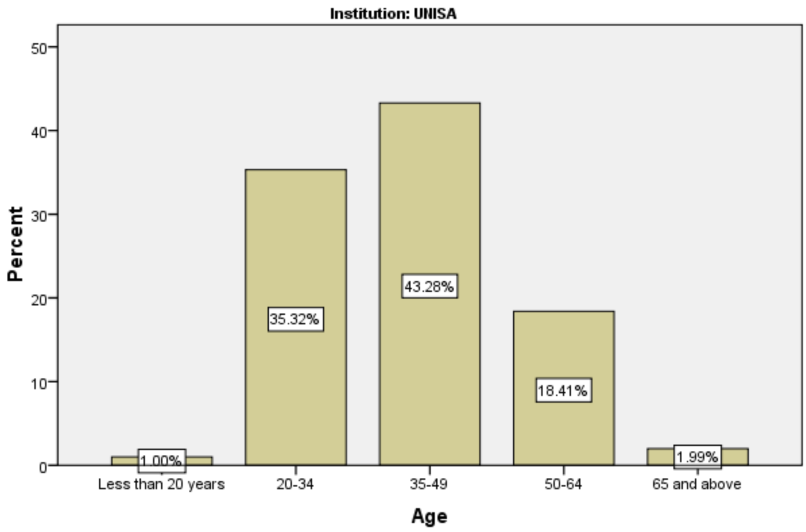


Figure 8.2 Age Distribution of Participants - UNISA

Qualifications

Figure 8.3 below shows the highest qualifications of academics who participated in the research. According to the findings, 39.30% of participants indicated that they have a Masters degree and 22.89%

indicated that they hold Ph.Ds. Those who were qualified as academics with Honours constituted 26.37% and another group (8.46%) indicated they possess a first degree. A small fraction of participants (2.99%) indicated that they have a Diploma.

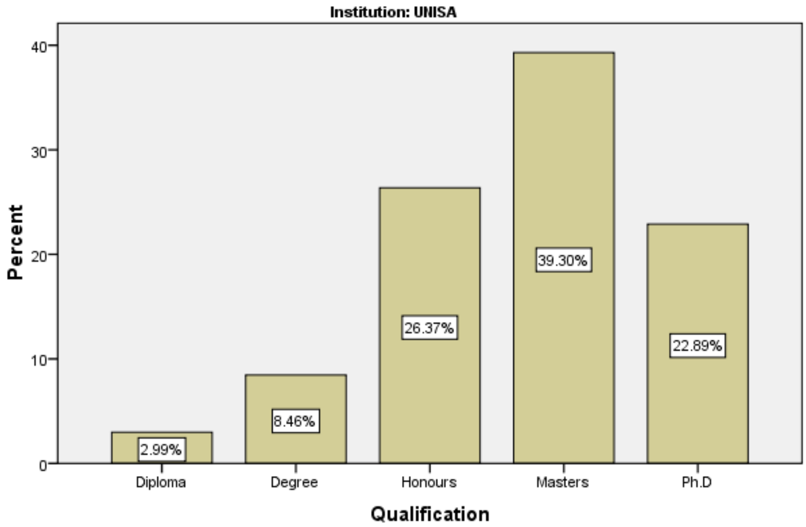


Figure 8.3 Qualification Distribution of Participants - UNISA

Occupation (Academic level)

With reference to the different academic levels of academics who participated in the study, Figure 8.4 shows that there were 31.34% of participants who were lecturers and the next group constituting 30.35% of participants were Tutors or Teaching Assistants. Junior lecturers constituted 11.44% and Senior lecturers constituted 9.95% of participants whilst 9.45% and 7.46% of participants indicated that they were Professors and Associate Professors respectively.

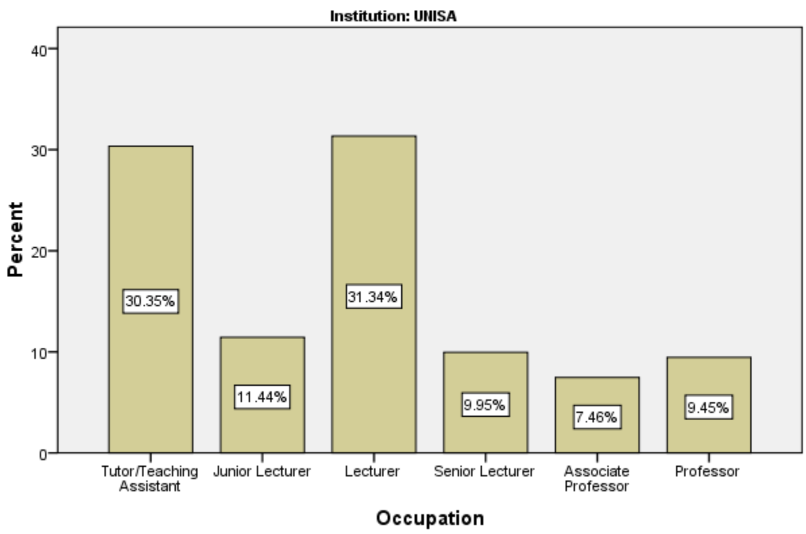


Figure 8.4 Occupation Distribution of Participants - UNISA

8.3 Analysis of Research Findings – UNISA

This section of the study presents research findings in relation to the five research questions and the five research objectives of the study with regards to findings obtained from academics at UNISA. The analysis of the five research questions developed to meet the study's objectives are presented sequentially below.

8.3.1 Objective One: The awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa

Research question one was developed to provide answers and to gain insight on academics' level of information technology acceptance, resistance and awareness to change in the use of information technology for teaching and learning purposes. Question 5 (5.1 – 5.5) of the questionnaire south to provide answers to the first research question and objective one of the study.

8.3.1.1 Change Management Self-awareness – UNISA

To investigate the formation of consciousness about change management self-awareness among academics at UNISA, participants were required to select the responses that best represent their opinions about the imperative for the use of information technology. From Table 8.1, academics at UNISA who specified *agree* and *strongly agree* to the five perceptions about change management self-awareness constituted an overwhelming number of over 86% combined. In actual fact, the findings suggest that participants (49.80%) *agree* and (43.80%) *strongly agree* that change begins with their *individual understanding* that change is needed in order to integrate information technology into higher education. The majority of participants (47.80%) agree and (44.80%) strongly agree that they have to *accept* change to enhance the integration of technology in higher education. Another significant number of participants *agree* (at 60.50%) and *strongly agree* (at 26.00%) that the University should provide strategies for implementing changes in the use of information technology. The same can be said of the participants who *agreed* that the University should clarify the need for information technology for different educational purposes, in which case 45.80% and 48.80% *agree* and *strongly agree* respectively. "The University should create suitable institutional structure to provide adequate support for promoting technology use" had the highest rating in which 29.40%agree and 68.20% strongly agree to the proposition on change management. It can be seen from Table 8.1 that participants generally perceived change management as a model to enhance the integration of information technology in higher education.

Table 8.1 Change Management - UNISA

Opinions/Perceptions	Strongly Disagree	Disagree	Agree	Strongly Agree
Changes in the use of information technology begin with your individual understanding that change is actually needed.	3.00%	3.50%	49.80%	43.80%
You understand and accept that you must change to enhance integration of technology into higher education.	3.50%	4.00%	47.80%	44.80%
A university provides strategies for implementing changes in the use of information technology.	3.50%	10.00%	60.50%	26.00%
A university should clarify the need for information technology for different educational purposes.	3.50%	2.00%	45.80%	48.80%
A university should create a suitable institutional structure to provide adequate support for promoting technology use.	2.00%	0.50%	29.40%	68.20%

8.3.2 Objective Two: The historical trends and pedagogical underpinnings of the integration of information technology in higher education

Question 6 to Question 14 of the questionnaire sought to provide answers to second research question and objective two of the study with regards to findings obtained at UNISA. The findings are presented below.

8.3.2.1 Familiarity with Information Technology Platform – UNISA

To determine the familiarity of UNISA academics with reference to information technology platforms, participants were required to specify their level of computer competency. As can be seen in Figure 8.5, a significant number of participants rated their level of computer competency as follows: 46.77% (Experienced) and 35.32% (very experienced). Another 15.42% of participants rated the level of computer competency as moderate. This was followed by 1.99% of participants who rated their level of computer competency as very inexperienced and 0.50% rated their level of computer competency as inexperienced. The study rely a lot on academic’s self-evaluation to provide data regarding their level of computer competency. The study takes note of the possibility of veracity or otherwise of their personal testimony.

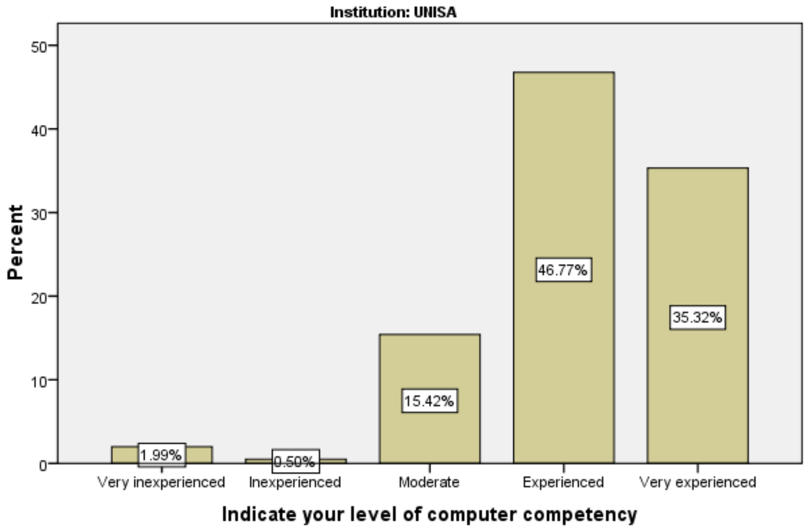


Figure 8.5 Level of Computer Competency - UNISA

To further investigate UNISA academics' familiarization with information technology, *Yes* or *No* questions were posed to determine the nature of certificates, training and or retraining programmes that participants have had in the information technology field. With reference to the training profile of participants in both LASU and UKZN, more participants at UNISA indicated yes to have had certifications, training and/or retraining programmes in information technology and related field(s). As can be seen in Table 8.2, 42.50% of the participants indicated *yes* to having been certified in information technology or IT-related courses. Another sizable number of participants (36.20%) indicated they have had undertaken further training or retraining programmes in the IT field. The same can be said about the acquired competency in any other or different IT field, in which 36.20% indicated *yes*.

Table 8.2 Certification, Training or Retraining Programmes in IT field - UNISA

Certification(s), Training and or Retraining Programmes	**Participants' answers (%)**	
	Yes	**No**
Do you have any certification(s) in information technology or IT related courses?	42.50%	57.50%
Have you had any further training or retraining programmes in the IT field identified above?	36.20%	63.80%
Have you acquired competency in any other/a different IT field?	36.20%	63.80%

Duration of Computer/Information Technology use for Teaching and Learning

This section further examines UNISA academics' experience with regard to the use of information technology in higher education. Figure 8.6 shows that a higher number (58.21%) of participants at UNISA had been using computer/information technology for teaching and learning purposes for more than 5 years. As can be seen in the sequence of period assessment, a small number (4.48%) of participants indicated that they have been using information technology for teaching and learning for less than 6 months, another 2.99% indicated more than 6 months but less than 1 year and 5.97% of participants specified the period of using information technology as more than 1 year but less than 2 years. Participants who indicated that they have been using the technology for more than 2 years but less than 3 years, more than 3 years but less than 4 years and more than 4 years but less than 5 years constituted 9.45% apiece. It can be seen from Figure 8.6 that UNISA had the highest number of academics with more years of experience (5 years and above) in the use of information technology for teaching and learning purposes amongst the selected higher education institutions. This can be attributed to the fact that UNISA utilizes an Open and Distance Learning mode of teaching and learning where technology is the key element for teaching and learning processes.

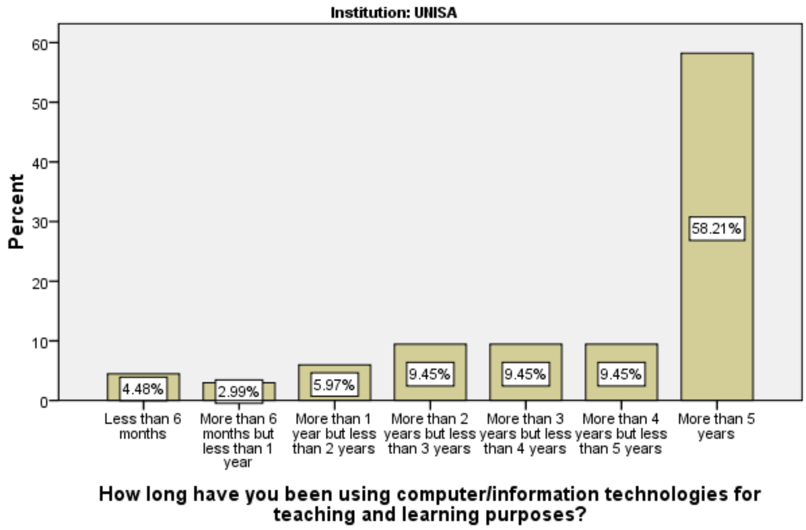


Figure 8.6 Length of time involved in the Use of Computer/IT for Teaching and Learning - UNISA

8.3.2.2 Important Information Technology for Higher Education – UNISA

As discussed earlier in the study's literature (Chapter Two and Three) information technology offers a variety of technology that can be utilized and integrated into higher education practices. Participants at UNISA were required to indicate the e-Learning technologies that are thought to be very important for technology integration in higher education. The possible responses to the investigation were *I don't know, not important, less important, somewhat important* and *very important*. Table 8.3 shows that a substantial number (26.90%) and (56.70%) of participants thought that LMS/CMS are somewhat important and very important respectively. The same can be said of OER, in which case 25.40% and 56.20% rated the technology as somewhat important and very important respectively. ODL had the highest rating in terms of importance for technology integration in higher education with 23.00% participants indicating that it was somewhat important while 69.50% indicated that the technology was very important. Mobile learning had the third highest rating in which 29.40% of participants stated that it was somewhat important and

57.20% indicated it was very important. Smarthistory technology was the least rated e-Learning technology where a sizable number of participants (45.80%) indicated *I don't know*, but 25.40% and 17.40% indicated that the technology was *somewhat important* and *very important* respectively. The next in line is the VLE, in which 30.30% indicated it was *somewhat important* for technology integration and 49.80% of participants indicated *very important*. The sixth rated technology was the MOOCs, where 32.80% of participants thought it was *somewhat important* and 36.80% of participants indicated *very important*. The last technology on the table is the CEN, which 30.00% of participants indicated that it was *somewhat important* and 39.00% indicated it was *very important*. It can be seen that all the e-Learning technologies listed in the table were thought to be important for technology integration in higher education except for the Smarthistory technology that a sizable number of participants indicated they do not know because it is less popular.

Table 8.3 Important e-Learning Technology for Technology Integration - UNISA

Information Technology (e-Learning)	**I don't know**	**Not important**	**Less important**	**Somewhat important**	**Very important**
Learning Management Systems or Course Management Systems (CMS)	11.40%	3.00%	2.00%	26.90%	56.70%
Open Education Resources (OER)	10.90%	1.50%	6.00%	25.40%	56.20%
Open and Distance Learning	4.50%	1.00%	2.00%	23.00%	69.50%
Mobile Learning	3.50%	2.50%	7.50%	29.40%	57.20%
Smarthistory Technology	45.80%	1.50%	10.00%	25.40%	17.40%
Virtual Learning Environment (VLE)	11.40%	1.50%	7.00%	30.30%	49.80%
Massive Open Online Courses (MOOCs)	10.00%	3.50%	16.90%	32.80%	36.80%
Collaborative Education Network (CEN)	21.00%	0%	10.00%	30.00%	39.00%

The table that follows shows the efficacy of the e-Learning technologies adopted by UNISA and participants were asked to indicate *not available* if the institution does not make provision for a specific information technology. Otherwise, participants were required to respond to the assessment by indicating *not important, less important, somewhat important* and *very important*. The findings of the study in Table 8.4 below show that a significant number of participants rated LMS/CMS as an *important* technology in the setting of their institution: 32.30% (*somewhat important*) and 49.30% (*very important).* OER is the third highest rated technology that participants indicated was important in the setting of their institution at 34.30% (*somewhat important*) and 38.30% *(very important*).As was seen in Table 8.3, ODL also had the highest rating in terms of technology adopted and used by the institution with 17.00% participants indicating that it was *somewhat important* while 72.00% indicated it was very important. The fifth highest rated technology is mobile learning, which 31.30% indicated that it was *somewhat important* and 33.30% indicated that it was *very important*. Smarthistory technology remained the lowest rated in terms of technology adopted and used by the institution, which 52.20% participants indicated it was not available. Yet, 19.40% and 11.90% rated the technology as *somewhat important* and *very important* respectively. VLE had the fourth highest rating: 35.30% indicated that it was *somewhat important* and 33.30% indicated *very important*. MOOCs was rated just behind the least rated technology (Smarthistory) as the seventh highest rated, which 24.10% of participants indicated that it was *not available*, another 20.60% of participants thought it was *less important*. However, 22.10% and 27.60% of participants indicated *somewhat important* and *very important* respectively. CEN was the sixth rated technology by participants at UNISA in which 29.50% indicated that it was *not available*. Yet, 27.00% of participants indicated that it was *somewhat important* and 24.50% indicated that the technology was *very important*.

Table 8.4 Efficacy Rating of e-Learning Technology Adopted by Institution - UNISA

Information Technology (e-Learning)	Not available	Not important	Less important	Somewhat important	Very important
Learning Management Systems (LMSs) or Course Management Systems (CMSs)	10.4%	1.50%	6.50%	32.30%	49.30%
Open Education Resources (OER)	13.90%	3.00%	10.40%	34.30%	38.30
Open and Distance Learning	6.00%	2.0%	3.00%	17.00%	72.00%
Mobile Learning	14.90%	4.00%	16.40%	31.30%	33.30%
Smarthistory Technology	52.20%	3.00%	13.40%	19.40%	11.90%
Virtual Learning Environment (VLE)	16.90%	4.50%	10.00%	35.30%	33.30%
Massive Open Online Courses (MOOCs)	24.10%	5.50%	20.60%	22.10%	27.60%
Collaborative Education Network (CEN)	29.50%	5.50%	13.50%	27.00%	24.50%

8.3.2.3 Institutional and Personal attitudes towards use of IT – UNISA

Academics at UNISA were required to specify their institutional and personal disposition towards the use of information technology facilities and to respond with a thick in the box to indicate a Yes or No answer in relation to the training and support they get in the use of the facilities. Based on the efficacy ratings, it is not surprising that participants' percentage of responses to *Yes* in the disposition of information technology is high. 90% of participants indicated that the institution enables the use of the information technology facility. Another 79.10% indicated that the institution provides training and support for discussion forums while 83.10% admitted to using the facility for personal use. Audio learning (Podcast) was rated high by participants in which 52.20% indicated that the institution enables the use of the facility but received lower ratings (41.30%) and (26.40%) in terms of the institution's provision of training and personal use respectively.

Video learning (VODcast) was rated high by 67.70% who said that the institution enables the use of the facility while another 57.20% of participants indicted that the institution provides training and support yet, few (36.60%) indicated they use the technology for personal use. The next technology on the high ratings was online tests and quizzes in which 57.20% of participants indicated that the institution enables the use of the facility. Blogs had 66.70% in which participants indicated that the institution enables the use of the technology while 49.40% and 41.30 indicated the institution provides training and that they use the technology for personal use respectively. Email had the second highest ratings besides discussion forums in which 83.60% indicated the institution enables the use of the facility, 54.70% indicated the institution provides training and support for the use of the facility while 78.60% indicated that they use the facility for personal activities.

Next on the list is the FAQs facility that was rated by 67.20% of participants as being enabled by the institution and that they use the facility for personal use at 57.70%. Q&A facility was rated high in which 58.70% of participants indicated that the institution enables the use of the technology while 50.20% admitted to using it for personal use. The calendar tool (schedule tool) was rated by 66.20% of participants as being enabled in the institution while 55.20% of participants rated the facility for personal use.

Table 8.5 Institutional and Personal Disposition of IT facility Usage - UNISA

Information Technology Facilities	My institution enables use of this facility		My institution provides training & support for this facility		I use the facility	
	Yes	No	Yes	No	Yes	No
Discussion forums	90.00%	10.00%	79.10%	20.90%	83.10%	16.90%
Audio Learning (Podcast)	52.20%	47.80%	41.30%	58.70%	26.40%	73.60%
Video Learning (Vodcast)	67.70%	32.30%	57.20%	42.80%	36.60%	63.70%
Instant Messaging (IM)	39.80%	60.20%	26.90%	73.10%	27.40%	72.60%
Content Management	49.30%	50.70%	37.30%	62.70%	34.30%	65.70%
Bulletin Boards	28.40%	71.60%	18.40%	81.60%	13.90%	86.10%
Chatrooms	30.30%	69.70%	21.40%	78.60%	17.90%	82.10%
Games and Leisure	4.00%	96.00%	4.00%	96.00%	8.00%	92.00%
Online tests and quizzes	57.20%	42.80%	41.30%	58.70%	36.30%	63.70%
Blogs	66.70%	33.30%	49.80%	50.20%	41.30%	58.70%
Email	83.60%	16.40%	54.70%	45.30%	78.60%	21.40%
Online IT Lab	40.30%	59.70%	27.90%	72.10%	24.90%	75.10%
FAQs	67.20%	32.80%	45.80%	54.20%	57.70%	42.30%
Q&A	58.70%	41.30%	45.80%	54.20%	50.20%	49.80%
Statistics	41.30%	58.70%	31.80%	68.20%	29.40%	70.60%
Wiki	33.80%	66.20%	25.40%	74.60%	21.90%	78.10%
Calendar (Schedule tool)	66.20%	33.80%	39.30%	60.70%	55.20%	44.80%
Dropbox	49.80%	50.20%	32.80%	67.20%	45.80%	54.20%

8.3.3 Objective Three: Challenges to information technology integration into higher education

Question 15 to Question 19 of the questionnaire sought to provide answers to third research question and objective three of the study with regards to findings obtained at UNISA. The findings are presented below.

8.3.3.1 Adoption of New Technology: Predisposing Factors and Challenges – UNISA

It was noted that the diffusion of innovation theory defined five different categories of adopters namely, the innovators, early adopters, early majority, late majority and laggards. Based on this assumption, academics in UNISA were required to indicate the motivations towards the adoption of new technology. Table 8.6 shows that a substantial number of participants *agree* that they like to experiment with new technology in which 35.80% *agree* and 57.70% *strongly agree*. Participants who indicated agree to always try to obtain the latest information technology constituted 42.30% (*agree*) and 35.80% (*strongly agree).* It is a different case for participants who were asked if they are usually the first to try out new information among their colleagues, in which 9.00% and 42.30% indicated *strongly disagree* and *disagree* respectively. It can be said that over 50% of participants disagree to being the first to try out new information technology among colleagues. Another set of percentages (48.30%) and (18.40%) of participants chose agree and *strongly agree* respectively in terms of the proposition that they are more likely to use information technology if someone else used it.

Participants who indicated that they intend to use information technology in the future were the highest rated at 30.50% (*agree*) and 63.50% (*strongly agree).*According to the assumptions of diffusion of innovation theory, those who *strongly agree* to experiment with new technology would be referred to as 'early adopters'. Participants who specified that they have always tried to obtain the latest information technology could fall between 'early adopters' and 'early majority' based on whether they have adopted the technology earlier when it was released/introduced and those who were upgrading but had obtained the technology as 'early majority' when the technology became popular or reliable. Those who indicated that they would most likely use the technology if someone else used it could be categorised as 'late majority'.

Table 8.6 Motivations for the Adoption of New Technology - UNISA

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
I like to experiment with new technology	1.00%	5.50%	35.80%	57.70%
I have always tried to obtain the latest information technology	2.00%	19.90%	42.30%	35.80%
Among my colleagues, I am usually the first to try out new IT	9.00%	42.30%	31.30%	17.40%
I would more likely use information technology if someone else used it	7.50%	25.90%	48.30%	18.40%
I intend to use information technology in the future	2.50%	3.50%	30.50%	63.50%

Factors Determining the Success of Information Technology Integration

To investigate UNISA academics' perceptions about the integration of information technology into higher education, participants were required to indicate the factors that are thought to determine the successful integration of technology with possible answers being *of no importance, of little importance, somewhat important, important* and *very important*. Of all the factors listed, low student enrolment into higher education was rated lowest, in which 26.00%, 19.50% and 13.50% indicated *somewhat important, important* and *very important* respectively, constituting a total of 59.00% of participants. Apart from the "low student enrolment into higher education" factor, the other 13 listed factors were rated high with at least 89.00% of participants who indicated *somewhat important, important* and *very important*.

Table 8.7 Importance of Factors - UNISA

Factors	Of no importance	Of little importance	Somewhat important	Important	Very important
Time between introduction and adopting	2.50%	4.50%	12.40%	44.30%	36.30%
Personal interest in the use of technology	1.00%	2.00%	9.50%	39.80%	47.80%
Availability of Funds	2.00%	2.00%	8.50%	25.90%	61.70%
Availability of physical space	3.50%	7.50%	18.40%	35.30%	35.30%
Quality assurance	2.00%	5.00%	9.50%	31.30%	52.20%
Employment of Skilled professionals	1.50%	2.00%	5.50%	27.40%	63.70%
Low student enrolment into higher institution	15.50%	25.50%	26.00%	19.50%	13.50%
Increasing access to technology	1.00%	2.00%	6.00%	30.50%	60.50%
Institutional policies to support the use of IT	1.00%	3.00%	8.00%	26.90%	61.20v
Sufficient support from management level	1.00%	1.50%	7.00%	21.40%	69.20%
Availability of resources	0.50%	0.50%	4.50%	19.90%	74.60%
Adequate ICT infrastructures	1.00%	0.50%	4.00%	15.40%	79.10%
Adequate training facilities	1.00%	0.50%	6.50%	23.40%	68.70%
Government support and interventions	3.50%	5.00%	21.90%	24.40	45.30%

Another random Reliability Test is conducted on UNISA responses to validate the reliability of the factors assessed. The reliability test was conducted on the 201 responses from the findings obtained at UNISA. The factors were identified as variables (14 cases) and statistics are based on all cases. Cronbach's Alpha analysis with ANOVA (F-Test) and Intra-class correlation coefficient where confidence interval is set to 95% was executed on the factors data obtained.

Table 8.8 Reliability Test on Factors (Cronbach's Alpha Analysis) - UNISA

Case Processing Summary [b]

		N	%
Cases	Valid	199	99.0
	Excluded [a]	2	1.0
	Total	201	100.0

a. List-wise deletion based on all variables in the procedure.

b. Institution = UNISA

Reliability Statistics [a]

Cronbach's Alpha	N of Items
.884	14

a. Institution = UNISA

The executed result shows that Cronbach's Alpha is 0.884 on all 14 cases. Since the least acceptable Cronbach's Alpha is near to or equal to or greater than 0.7 but less than 0.95, the reliability of cases measured on challenges on the 201 UNISA responses is said to be internally consistent and possibility of no redundancy. The Cronbach's Alpha is rounded off to 0.88 which means there is 0.23 error variance or random errors as calculated below:

$$(0.88 \text{ x } 0.88 = 0.77;\ 1.00 - 0.77 = 0.23)$$

Result of the F-Test conducted on the factors is presented in the tables below:

To test:

H*0*: The variances are the same or equal.

H*1*: The variances are not the same or equal.

Test for ANOVA: There is difference in means across the factors. The associated p value is .000 where the value of p when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the hypothesis is statistically significant.

The reason is that H*0* is the research hypothesis (i.e. when H0 is accepted, it implies that H*1* is rejected and when H*0* is rejected, automatically H*1* is accepted). In Analysis of Variance (which is a test for significant deference in means), a p value less than 0.05 means that there is a significant difference in means across the scale (which also means that we accept H*0*: The variances are not the same or equal). Therefore, when there is a significant difference in means across the scale; it implies that the variances are not the same or equal. Conversely, a p value greater than 0.05 means that there is no significant difference in mean (which also means that we reject H*0*: The variances are not the same or equal). Because, no significant difference means that the variances are the same or equal.

Therefore, H*0* is accepted since the value of p is less than 0.05, a very strong evidence to reject the alternative hypothesis (H*1*) of no significant difference in means across the scale (i.e. the variances are the same or equal) item. Therefore, the variances are significantly different and reliable. This means the variables are acceptable, internally consistent with no redundancy.

Table 8.9 ANOVA Test on Factors (F-Test) - UNISA

ANOVA [a]

		Sum of Squares	df	Mean Square	F	Sig
Between People		881.198	198	4.450		
Within People	Between Items	555.037	13	42.695	82.654	.000
	Residual	1329.606	2574	.517		
	Total	1884.643	2587	.729		
Total		2765.841	2785	.993		

Grand Mean = 4.28

a. Institution = UNISA

Table 8.10 Intra-class Correlation Coefficient on Factors - UNISA

Intra-class Correlation Coefficient [d]

	Intra-class Correlation [a]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.352 [b]	.303	.409	8.616	198	2574	.000
Average Measures	.884 [c]	.859	.906	8.616	198	2574	.000

The two-way mixed effects model shows where people effects are random and measures effects are fixed.

a. Type C intra-class correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

b. The estimator is the same, whether the interaction effect is present or not.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

d. Institution = UNISA

The next table provides insight into UNISA academics' overall experiences and perceptions of using information technology in higher education. Participants were required to rate the seriousness of the challenges they encounter in the use of information technology in higher education for teaching and learning purposes, with possible answers being *not serious, less serious, somewhat serious* and *very serious*. As can be seen in Table 8.11, poor physical space was rated as the least serious among all the challenges, in which 28.40% and 24.40% indicated *somewhat serious* and *very serious* constituting 52.80% of participants. The next challenge that follows in the low ratings is the potential loss of personal revenue, in which 27.90% and 23.40% indicated somewhat serious and very serious, constituting 51.30% of participants. Other than these two challenges that were rated low, the remaining 10 challenges were rated high with a minimum of 63% indicating that the challenges were *somewhat serious* and *very serious*. It can be seen that participants generally perceived the challenges to be *serious* in the use of information technology for teaching and learning purposes.

Table 8.11 Seriousness of Challenges - UNISA

Challenges	Not serious	Less serious	Somewhat serious	Very serious
Lack of time for adoption	6.00%	15.90%	40.80%	37.30%
Insufficient funds	7.00%	23.40%	35.80%	33.80%
Poor physical space	14.90%	32.30%	28.40%	24.40%
Lack of IT skills by academic staff	10.90%	20.90%	24.90%	43.30%
Lack of IT skills by students	4.50%	10.00%	30.80%	54.70%
Inadequate access to technology	4.50%	11.40%	28.40%	55.70%
Inadequate infrastructure	5.50%	11.40%	30.80%	52.20%
Poor technical support by management	8.00%	17.90%	25.90%	48.30%
Potential loss of personal revenue	19.40%	29.40%	27.90%	23.40%
Lack of training facilities	9.00%	25.40%	29.40%	36.30%
Excessive students' enrolment	12.40%	23.90%	29.90%	33.80%
Poor institutional policies	9.50%	25.90%	25.90%	38.80%

Figure 8.7 shows UNISA academics' ratings on overall experience of using information technology for teaching and learning purposes. 44.28% of participants at UNISA rated the overall experience of using information technology as *good*. Another 25.87% indicated *very good,* while 22.89% rated the overall experience as *average*. 4.48% and 2.49% rated the overall experience of using information technology for teaching and learning as *poor* and *very poor* respectively. It can be said from Figure 8.7 that participants perceived the overall experience of using information technology for teaching and learning as *good*.

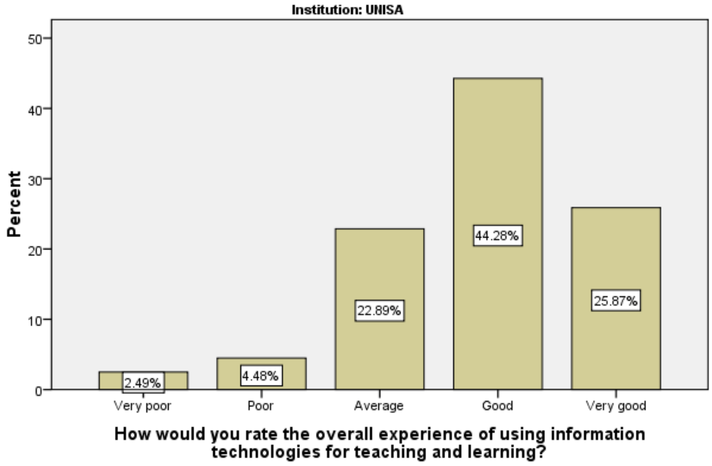


Figure 8.7 Overall Experience of IT for Teaching and Learning - UNISA

The same can be seen in Figure 8.8, as an overwhelming percentage of participants rated the overall experience of using information technology for research activities as *good* (39.30%) and *very good* (36.32%). Some participants (18.41%) rated the overall experience of using information technology for research purposes as *average*. Only 3.98% and 1.99% rated the overall experience of using information technology for research as *poor* and *very poor* respectively.

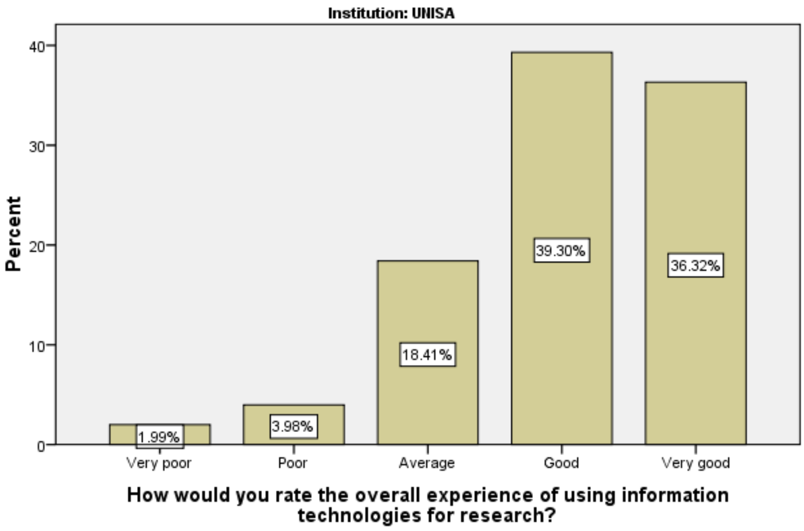


Figure 8.8 Overall Experience of IT for Research - UNISA

8.3.4 Objective Four: Limitations of Information Technology Integration in Higher Education

Question 20 to Question 23 of the questionnaire sought to provide answers to fourth research question and objective four of the study with regards to findings obtained at UNISA. The findings are presented below.

8.3.4.1 Quality of Support – UNISA

In view of the quality of support ratings by academics at UNISA, an overwhelming percentage of participants, constituting 62.19% rated the quality of support they received by the institution administration in the integration of technology process as *somewhat satisfactory.* Another sizable percentage (26.37%) rated the quality of support by institution administration as *very satisfactory*. Only a few participants, constituting 11.44% thought that the rating of the quality of support they got from the institution administration was *not satisfactory*. It can be generalized that participants at UNISA perceived the quality of support by institution administration as *satisfactory*.

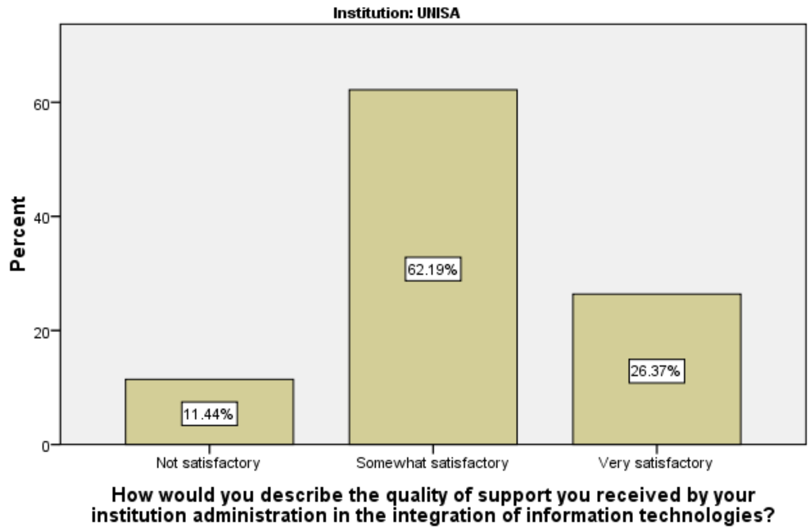


Figure 8.9 Quality of Support by Institution Administration - UNISA

8.3.4.2 Unsatisfactory Experience – UNISA

The acknowledgement of possible problems in the use of information technology, which may affect the experiences of academics in the integration of information technology, is presented in Figure 8.10. As can be seen, a significant number of participants (72.08%) indicated that they would call the support/ICT Department to complain about unsatisfactory experience in the integration of information. 20.30% of participants specified that they react to unsatisfactory experience in the integration of information technology by complaining to colleagues and to others. 7.61% of the participants specified that they would react by ignoring the problem. This presupposes that this fraction of participants would do nothing about unsatisfactory experience in the integration of information technology in the institution. Irrespective of the action specified by participants, the study shows that unsatisfactory experience in the integration of technology elicits some kind of reaction, which does not project a positive image of the support services by the institutional administration.

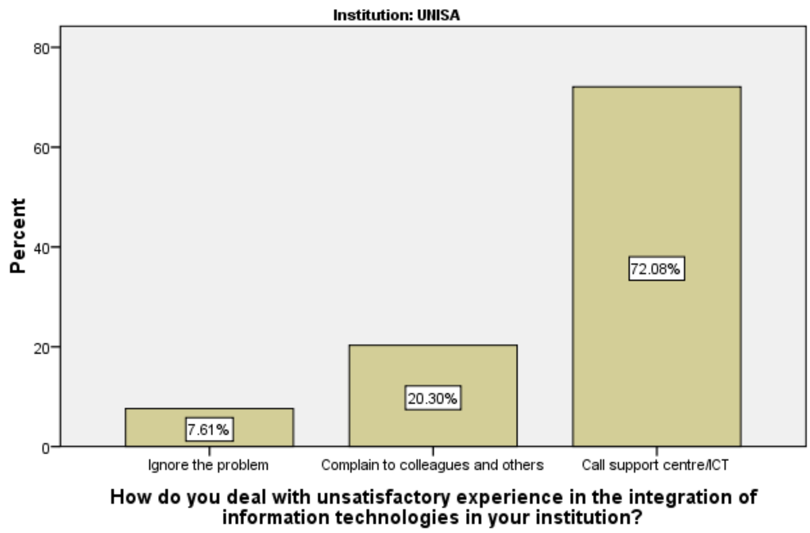


Figure 8.10 Unsatisfactory Experience - UNISA

8.3.4.3 Complaint Report – UNISA

Drawing from the reactions of participants to unsatisfactory experience in the integration of information technology in higher education, UNISA participants were required to indicate the frequency of complaints to the institution administration. A significant number of participants (47.26%) report complaints to the institution administration *occasionally*. Furthermore, in terms of frequency, 24.38% of participants *rarely* report complaints to the institution administration. 19.40% of participants indicated that they *frequently* report complaints while a small fraction (2.99%) indicated that they lodge complaints *very frequently*. A tiny number of participants (5.97%) *never* report complaints to the institution administration.

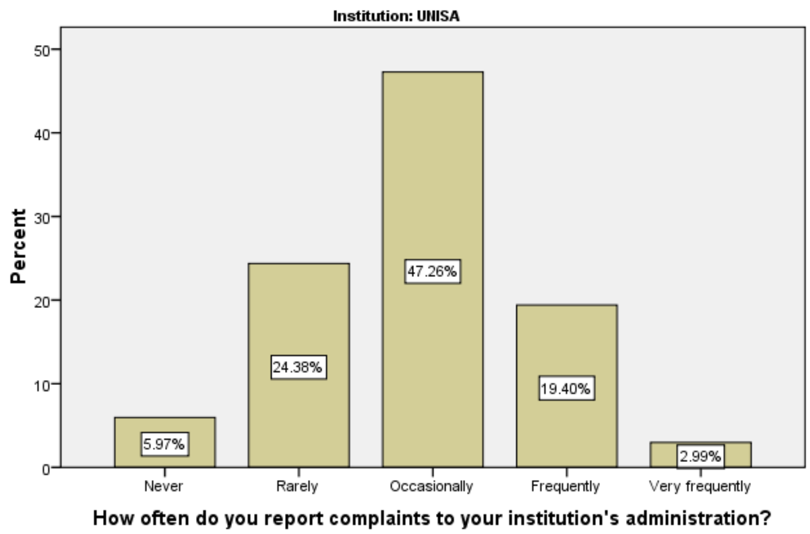


Figure 8.11 Frequency of Complaints to Institution Administration – UNISA

8.3.4.4 Complaint Response – UNISA

In the light of the above-mentioned, it is necessary to find out from participants' perspective the rating of response to complaints reported to institution administration. The figure shows that about one-third of participants, that is 38%, rated the response to complaints as *prompt and satisfactory*. Participants who rated the response to complaints as *prompt but not satisfactory* and *not prompt but satisfactory* had the same percentage components of 24% each. The last group of participants (14%) rated the response to complaints or queries as *nether prompt nor satisfactory*.

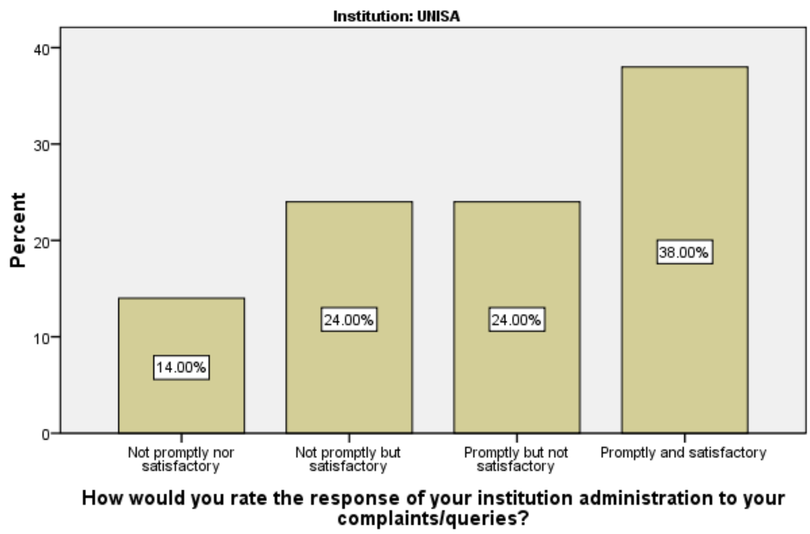


Figure 8.12 Rating of Response to Complaints - UNISA

8.3.5 Objective Five: Solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education

Question 24 to Question 28 were questions in the questionnaire that sought to provide answers to the fifth research question and objective five of the study with regards to findings obtained at UNISA. The findings are presented below

8.3.5.1 The Drawbacks of Information Technology in Higher Education – UNISA

This section of the study presents participants' viewpoints on the drawbacks they have experienced in the use of information technology. Answers on the drawbacks were gathered through *yes* or *no* question presented in Figure 8.13, followed by two open-ended questions to obtain full and meaningful answer to the drawback questions. As can be seen in Figure 8.13, more than half of the participants, that is 57.21%, indicated not to have experienced drawbacks while 42.79% of participants indicated yes to having experienced drawbacks in the use of information technology.

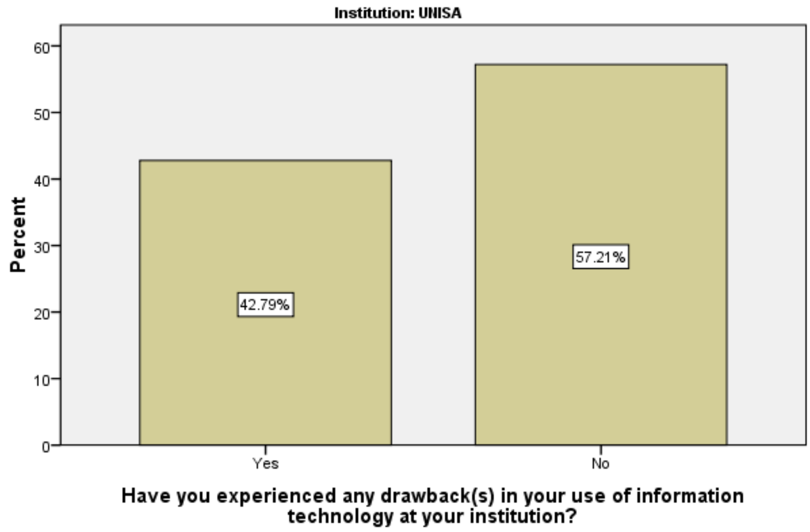


Figure 8.13 Drawback(s) in the Use of IT - UNISA

Drawbacks in the use of Information technology – UKZN

UNISA participants who indicated yes to having experienced drawbacks in the use of information technology in higher education were expected to respond to the open-ended question that required them to specify the kinds of drawbacks they were faced with. The responses to the question were used to generate the following six themes with the aid of Nvivo 11 software:

- Inadequate Internet Facilities;
- Inconsistent Power Supply;
- Lack of Information Technology Skills by Students and Academics;
- Irregular Systems Update;
- Insufficient Facilities; and
- Institutional Policy.

Inadequate Internet facilities– This first theme was raised by academics at UNISA as a major drawback in the use of information technology in higher education. The following responses were presented as they highlight different perceptions of participants regarding the theme. One respondent indicated that the drawback that was experienced was "Bad infrastructure (slow/no internet) on my side." The second identified response indicated that there was "unavailability of internet connection." Another participant claimed that "Poor internet at times causes drawbacks in the use of information technology." Two other participants stated that "experiencing offline most of the time" and "Bandwidth" were the drawbacks they experienced in the use of information technology in higher education. This theme was also evident in the cases of LASU and UKZN. The commonality of this theme across selected universities suggests that the issue of poor Internet facilities and/or services needs to be addressed in higher education institutions generally.

Inconsistent Power Supply–In the case of inconsistent power supply at UNISA, only one participant indicated this theme as a drawback in the use of information technology in higher education. The participant pointed out that "Power outage causes no Wi-Fi connectivity." This is an indication that the load shedding program by the government of South Africa actually affects productivity. There will be no Wi-Fi connectivity, hence, no internet connection and academics or with business people could be found to be unproductive during this period. The issue of power supply is a known systemic challenge that universities have little or no control over but this needs to be taken into serious consideration as a major drawback in the integration of information technology into higher education.

Lack of Information Technology Skills by Students and Academics–This theme supports the drawbacks that participants experienced in relation to the lack of interest in the use of information technology and the lack of skills in the use of technology by both students and academics. These challenges have the potential to inhibit technology integration. Considering some of the responses from participants at UNISA, one academic indicated the "Lack of interest" in the use of information technology as the drawback in the use of information technology. Another participant noted that "Students not using the technology" is the drawback experienced in technology integration. It can be established that when information technology is integrated into a certain learning process and students choose not to use the technology because they lack interest and skills, and they have an alternative option to conduct their study, information technology integration can frustrate and discourage academics in the integration process. However, the awareness and training of students before the start of courses/programmes will play a vital role in this scenario/case. Another participant that was considered indicated that "many students do not complete assignments by due date when they are not promptly assisted when they have problems accessing online systems." One view supports another, a participant noted that "Only 20 students participated in an online virtual classroom that had 200 students." This is an indication that learners/students need some kind of training and possibly more awareness of the benefits of using online learning platforms (i.e. e-Learning).

To avoid repetition of perceptions, the last participant that was considered indicated "Staff resistance due to potential loss of jobs more especially employees working at production, assignment section and Dispatch as there will be no need for these services anymore. Some students in rural areas have challenges of access to technology and going fully online is likely to disadvantage them." This drawback presents the reason why support staff are resistant to technology integration as they feel threatened by technology that could take over their responsibilities. This results in the fear of losing their jobs to information technology.

Irregular Systems Update–this theme also considered the need for regular systems update, which will allow fully functioning and productive working environments with the integration of information technology. UNISA participants showed that irregular systems update is a major drawback in the use of information technology in higher education. The first participant stated that the institution "deploy[s] systems that are not properly tested." Five other participants found the deployment of an untested system before integration a drawback in the use of information technology in higher education. The first participant indicated that "Systems do not adequately support the online marking system, which has been improved somewhat recently." The second participant noted that "Systems are unsupportive and unreliable" while the third participant said "Systems not in place and the testing of [a] system before implementation [was] not done." The next participant thought that "Systems are not sufficiently tested before [being] implemented" and the fifth participant indicated that "Systems are often implemented before testing."

Another two participants thought that the current systems are not being updated regularly and that has been a drawback in the use of information technology. As was captured from participants' responses, the first participant indicated "Software crashes [in an] outdated system." The other participant stated that "Our main interface with students is built on a Sakai 5 base that isn't being updated anymore." These responses have assisted in generating the Irregular systems update theme, which forms an important type of drawback that academics are faced with in the use of information technology.

Insufficient Facilities – as indicated earlier, the context of Insufficient Facilities theme is associated with the provision of basic amenities such as storage space (server capacity), office automation, technical support, regular access to systems and infrastructure. If the facilities available in any organisation are insufficient, queries and complaints will increase from the facility users. Hence, it is very important for higher education institutions' management to consider these factors as a major issue or challenge to address. Participants at UNISA were clear on the perception of insufficient facilities and one participant indicated that the drawback experienced was "Lack of access to information technology infrastructure." Another participant indicated that "The size limit of documents that can be shared in the online learning environment" was the drawback that was experienced in the use of information technology in higher education. One participant mentioned "MyLabPlus [is] not responding." MyLabPlus is one of Pearson's Learning Management Systems that is used to conduct online practical. It is a very useful tool in an open distance learning environment (the researcher has been using this tool for over 3 years with well over 25,000 students enrolled yearly for the course). Sometimes, it times-out and then students and instructors would find it not responding. Another response that was considered indicated that "Every time an assignment due date comes around, the server crashes", the participant further suggested that the institution should "rent a petabyte of space from Google or Amazon and be done with it." Petabyte is a thousand million million (10^{15}) units of information.

Another participant reminded us that "Support systems are often inadequate to support the volume of queries." This means that the support system available cannot meet the number of requests/queries made by users of the facilities. One view supports another, where a participant mentioned that the drawback in the use of information technology was that there were "Few support staff." In line of support system, two other participants indicated that there was "Lack of specialized support in terms of capacity of support staff" and the other indicated "Poor institutional support; weak VLE platform; delays in improving the student platform" respectively. Insufficient support systems are a major participants' drawback in the use of information technology. A participant stated that "Sometimes one requires additional support outside of official working hours and no ICT staff are available on duty to assist." This suggests that there should be a 24-hours support system available to assist academics in order to accomplish the purpose of technology integration in higher education.

Institutional Policies–In this theme, the study sought to establish participants' understanding of institutional policy by describing it as the different policies that are usually framed within provincial and national policies, which are paramount to an institutional vision, mission and mandate (Magetse, 1997). Magetse further stated that these policies are usually established and implemented by the institution itself to ensure that the vision, mission and mandates of the institution are accomplished through the implemented policies requiring the development of a strategic plan. The strategic plan would become the primary instrument of institutional policy, which would provide the framework to manage and allocate resources to accommodate change and further development of the institution. UNISA participants found that the implemented institutional ICT policy has a drawback in the use of information technology. A participant stated that "There is a policy trying to force us to use technology that does not work." The second participant who thought that institutional policy are a drawback in the use of information technology stated that "ICT [is] not open to incorporate and address IT issues. They are miles behind and have no vision to at least try and keep up with the latest technology."

The last person did not describe too much but indicated bureaucracy as a drawback in the use of information technology in higher education. This is an indication that political influence could play an important role on the issue of institutional policies, which some people may find as a shortcoming in their use of information technology based on what their political views are.

8.3.5.2 The Utility of Information Technology for Higher Education – UNISA

In view of the overall experiences of participants in the use and integration of information technology into higher education, it is essential to find out from a participants' perspective the extent to which they consider the integrating of information technology as necessary or critical for higher education. Figure 8.14 shows how participants perceive integration of information technology into higher education as critical or not. The highest number of participants (75.12%) thought that the integration of information technology into higher education was very critical. Another 21.39% of participants deemed integration of information technology as somewhat critical for higher education. The third category of academics representing a fraction of 3.48% of participants felt that the integration of information technology into higher education was not critical at all.

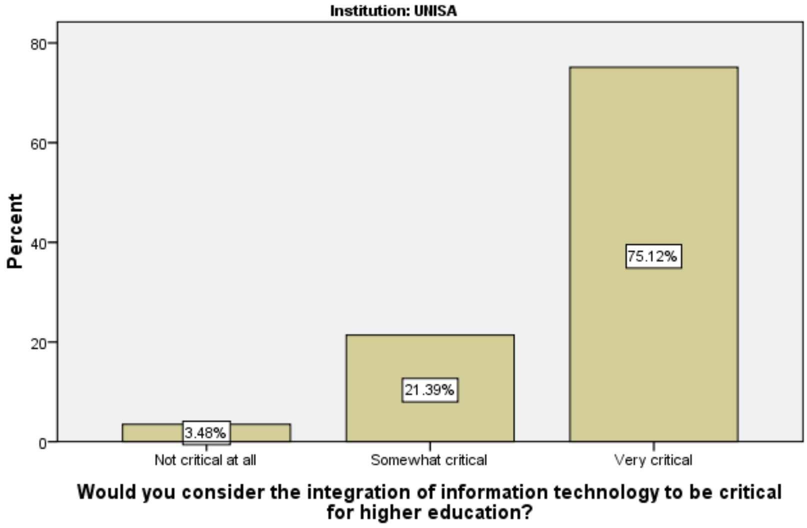


Figure 8.14 Necessity of Integrating IT into Higher Education - UNISA

The question pertaining to how participants perceived the integration of information technology as critical to enhancing learning outcomes was posed to establish the relevance academics attached to information technology in enhancing learning outcomes. The Figure 8.15 shows that 68.16% of participants thought that the integration of information technology was very critical to enhancing learning outcomes. Another sizable number of 27.86% of participants perceived the integration of information technology to be somewhat critical in enhancing learning outcomes and a small number (3.98%) of participants felt that the integration of information technology was not critical at all in enhancing learning outcomes in higher education.

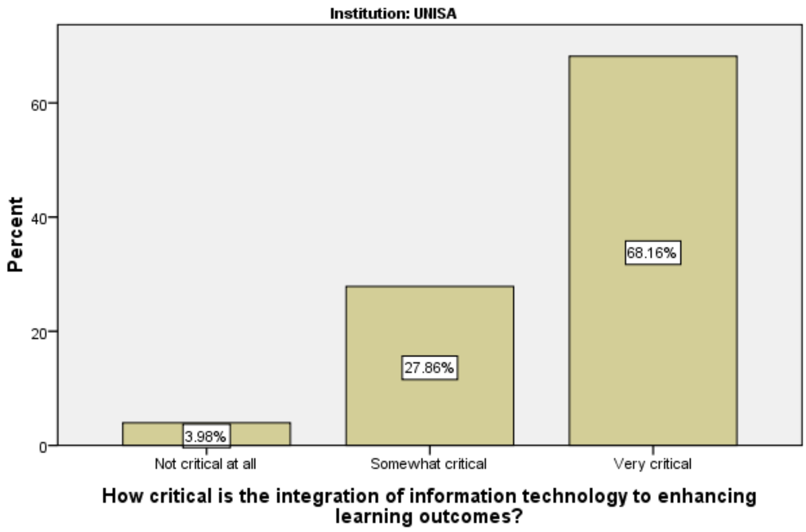


Figure 8.15 Necessity of Integrating IT to Enhance Learning Outcome - UNISA

The Impact of Information Technology on Higher Education - UNISA

In view of the utility of information technology to higher education and the necessity of integrating information technology into higher education, the study considered participants' opinions of the impact that information technology has on higher education. The description of the results and/or findings of this section of the study is presented in the sequence of impact assessments as depicted in Figure 8.16. The lowest number of participants (1.99%) described the impact of the use of information technology on higher education as negative. This is followed by a group of participants (4.98%), who described the impact of the use of information technology in higher education as somewhat negative. It can be said that negative impact assessment is underscored by the actual drawback and challenges associated with the use of information technology in higher education. The next group of participants constituting 11.44% described the impact of the use of information technology on higher education as somewhat positive. The highest number of participants (81.59%) identified the impact of the use of information technology on higher education as positive. It can be said that academics in the last two groups (somewhat positive and positive) implied a positive correlation between the use of information technology in higher education and the integration of information technology to enhance learning outcomes.

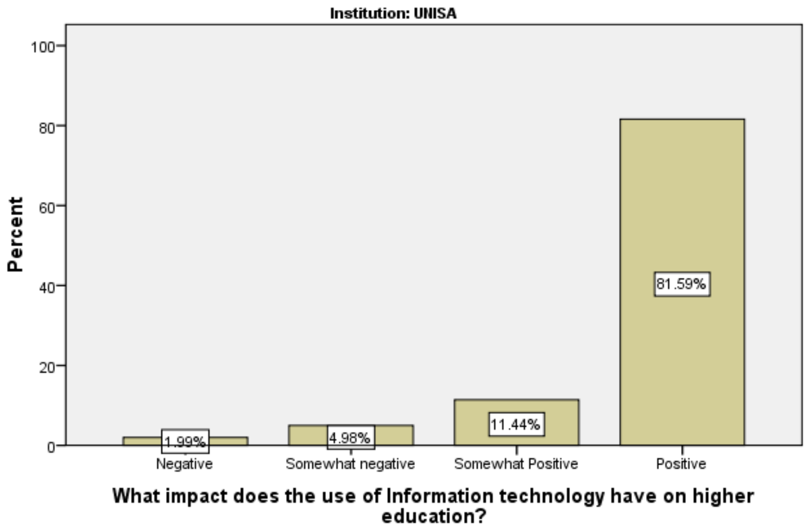


Figure 8.16 Impact of Information Technology on Higher Education - UNISA

8.4 Chapter Summary

This chapter of the study presented research findings in the form of participants' perceptions to research questions among academics at UNISA. Findings from the study survey showed that academics in UNISA were aware of change management. The chapter also presented the different types of educational technologies that academics use in the integration of technology. Institutional and personal attitudes towards information technology facilities that academics use were identified. Findings in terms of challenges to the adoption of new information technology were presented. Overall experiences and perceptions in the use of information technology for higher education purposes were described. Chapter Nine will evaluate the research findings presented in chapters Six, Seven and Eight. Cross-institutional analysis with reference to participants' responses from LASU, UKZN and UNISA will be presented.

CHAPTER NINE

A COMPARATIVE EVALUATION OF RESEARCH FINDINGS

9.1 Introduction

This chapter of the study evaluates the research findings presented in the chapters Six, Seven and Eight by conducting a comparative statistical analysis on findings. Having understood the comparative perspective of the study, the chapter deals with the cross-institutional analysis of significant aspects of the study with reference to the responses from participants at LASU, UKZN and UNISA. Lastly, analysis of findings obtained from institutions' administration/management on their opinions of the understanding, challenges and significance of information technology integration in higher education were discussed.

9.2 Cross-institutional Analysis and Significance of the Research Findings

Evaluation of the research findings was conducted in the context of the research questions with the use of inferential statistics in cross-tabulation form and Chi-Square tests. This method of analysis validates the understanding of the significance of the variables and their influence on the perceptions of participants. The responses of the total number of participants (592) are cross-tabulated and Chi-Square tests are conducted to establish the significance of variables that could offer suitable answers to the main research questions. The cross-tabulation will produce a table of three category variables (i.e. LASU, UKZN and UNISA) in order to be able to compare the incidence of one characteristics against another. Therefore, if there is no association within the categorized variables, the p value will be greater than 0.05 and this indicates no evidence of bias but a lower p value indicates the rejection of H0 (null hypothesis) and indicates bias. Therefore, the results of the study will provide and confirm the hypothesis by examining the p-value. The value of p when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the hypothesis is statistically significant, that is to say, significance is established.

The overriding question that the study sought to address was the perceptions of academics about the overall experience of information technology integration into higher education. To have an understanding of their perceptions, participants were required to indicate the overall experience and the impact of information technology integration on higher education. With reference to overall experience of information technology integration into higher education, a number of variables were taken into consideration. These include the use of information technology for research, teaching and learning purposes. In the order of analysis, the final part of the analysis sought to conduct an impact assessment of information technology integration in order to enhance learning outcomes. It is summed up in a few categories that may be broadly represented as *Very poor* or *Very good* and *Negative* or *Positive*.

An inferential analysis of the research sub-question pertaining to the awareness of the rationale for the integration and use of adopted information technologies in higher education is presented below in line with the description of cross-tabulation, where significance is established when $p \leq 0.05$.

As can be seen in Tables 9.1 and 9.2 below, data from LASU, UKZN and UNISA show a significant correlation between information technologies and teaching and learning experience. It can be inferred from these tables and from Figure 9.1 that a significant number of academics from the three selected Universities perceived the overall experience of using information technologies for teaching and learning activities as being good. This perception is due to the usefulness and effectiveness of information technologies to perform a number of academic tasks.

Table 9.1 Cross-tabulation Results of Using IT for Teaching and Learning Activities

Institution * How would you rate the overall experience of using information technologies for teaching and learning? Cross-tabulation

Count

		How would you rate the overall experience of using information technologies for teaching and learning?					Total
		Very poor	Poor	Average	Good	Very good	
Institution	LASU	34	39	66	53	1	193
	UKZN	0	3	39	101	55	198
	UNISA	5	9	46	89	52	201
Total		39	51	151	243	108	592

Table 9.2 Chi-Square Tests of Using IT for Teaching and Learning Activities

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	171.861[a]	8	.000
Likelihood Ratio	200.233	8	.000
Linear-by-Linear Association	105.495	1	.000
N of Valid Cases	592		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.71.

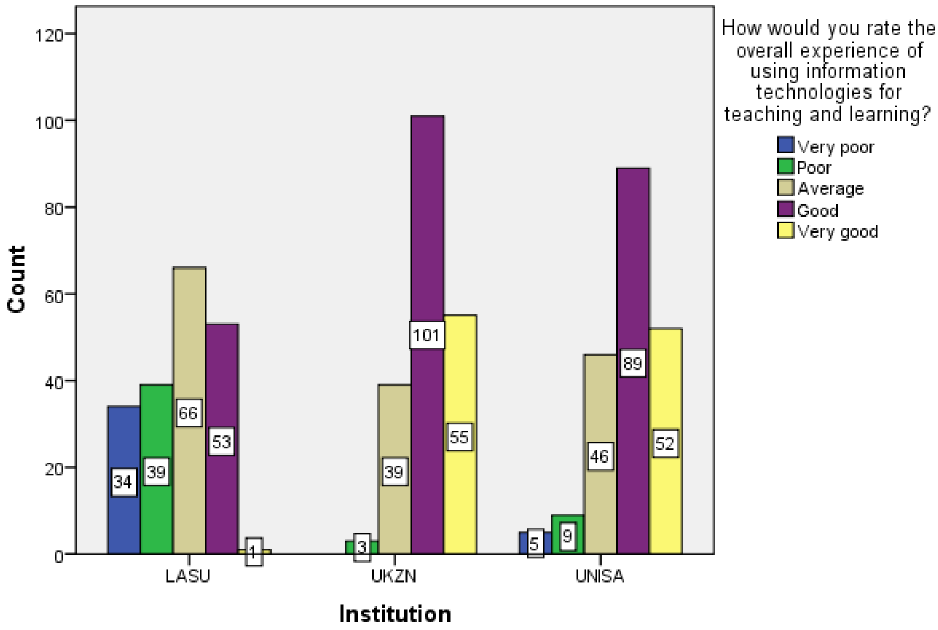


Figure 9.1 Clustered Bar Chart of Using IT for Teaching and Learning Activities

Still on academics' perception on the use of information technologies, the next sub-question relating to the overall experience of using information technologies for research activities also engendered useful information which is Cross-tabulated and subjected to Chi-Square tests in Tables 9.3 and 9.4 below. The tables show the significance of using information technologies for research activities.

Table 9.3 Cross-tabulation Results of Using IT for Research Activities

Institution * How would you rate the overall experience of using information technologies for research? Cross-tabulation

Count

		How would you rate the overall experience of using information technologies for research?					Total
		Very poor	Poor	Average	Good	Very good	
Institution	LASU	4	14	121	21	33	193
	UKZN	0	2	31	81	84	198
	UNISA	4	8	37	79	73	201
Total		8	24	189	181	190	592

Table 9.4 Chi-Square Tests on Using IT for Research Activities

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	156.210[a]	8	.000
Likelihood Ratio	162.180	8	.000
Linear-by-Linear Association	52.266	1	.000
N of Valid Cases	592		

a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is 2.61.

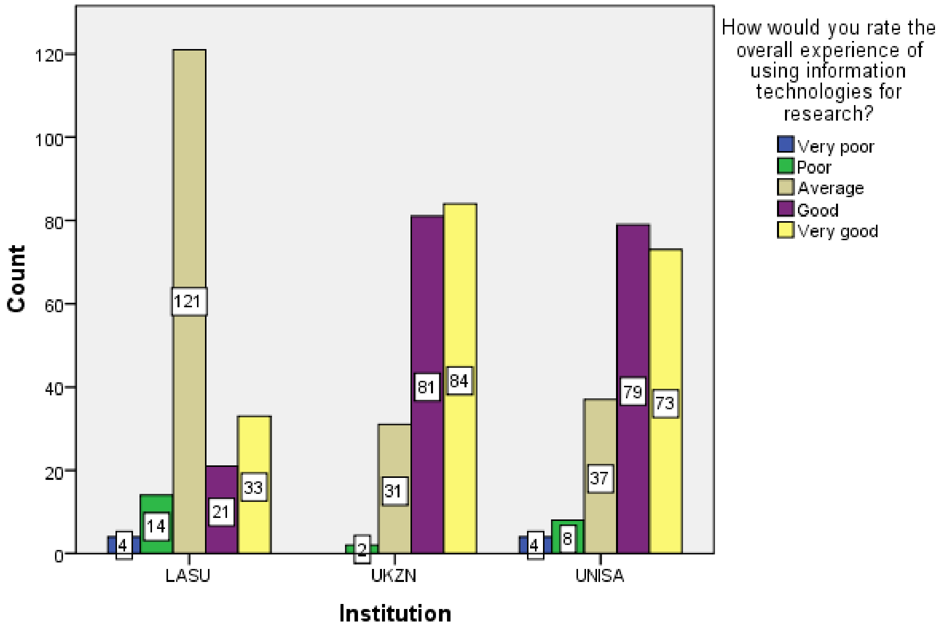


Figure 9.2 Clustered Bar Chart of Using IT for Research Activities

Apart from the above research sub-questions, the study sought to establish an understanding of the effect that the integration of information technology has on learning outcomes as well as to conduct an impact assessment on academics' perceptions of the integration of information technology into higher education. The data collected from the responses of participants at LASU, UKZN and UNISA shows that the extent to which academics considered the integration of information technology to be important for higher education may be statistically significant. The majority of the responses by participants at LASU, UKZN and UNISA indicated that they considered the integration of information technology to be *somewhat critical* and *very critical* for higher education. In this case, the effective use, adequate support system and or resources may be significant factors in determining the success of information technology integration. On the other hand, a handful of responses from participants at UNISA in relation to the extent to which they considered the integration of information technology to be for higher education may not be statistically significant. In this case, the research findings suggest that unsatisfactory experience in the integration of information technologies could have an effect on academics' behaviour towards technology integration in higher education.

Table 9.5 Cross-tabulation Results on the Extent to which Integration of IT is considered to be Critical for Higher Education

Institution * Would you consider the integration of information technology to be critical for higher education? Cross-tabulation

Count

		Would you consider the integration of information technology to be critical for higher education?			Total
		Not critical at all	Somewhat critical	Very critical	
Institution	LASU	0	69	124	193
	UKZN	0	39	159	198
	UNISA	7	43	151	201
Total		7	151	434	592

Table 9.6 Chi-Square Test on the Extent to which Integration of IT is considered to be critical for Higher Education

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.084 [a]	4	.000
Likelihood Ratio	30.058	4	.000
Linear-by-Linear Association	2.284	1	.131
N of Valid Cases	592		

a. 3 cells (33.3%) have an expected count of less than 5. The minimum expected count is 2.28.

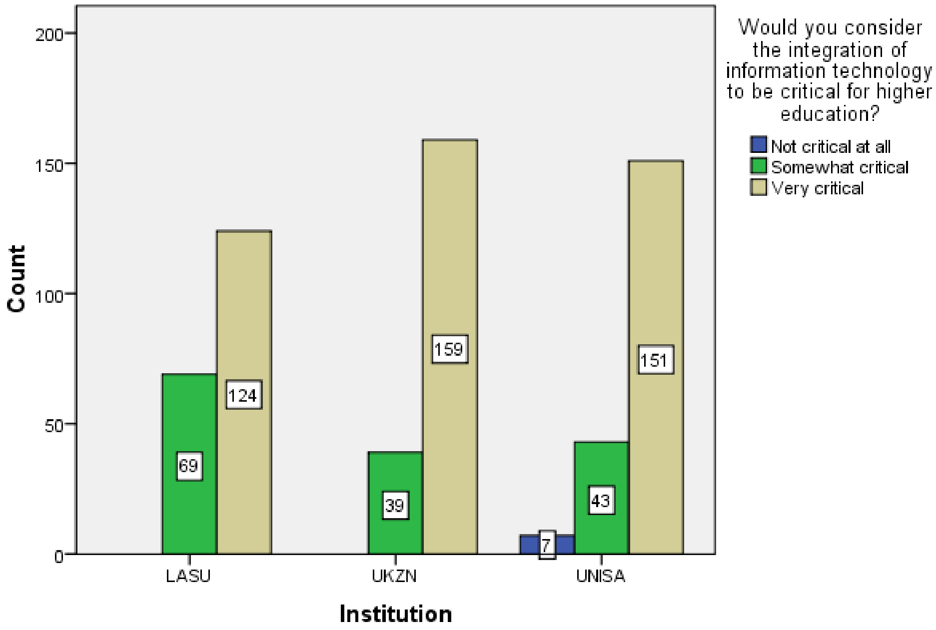


Figure 9.3 Cluster Bar Chart on the Extent to which Integration of IT is considered to be critical for Higher Education

Tables 9.7 and 9.8 show the statistical significance of how critical the integration of information technology is to enhancing teaching and learning outcomes in higher education. The findings suggested that academics at LASU, UKZN and UNISA considered the integration of information technology to be critical to enhancing teaching and learning outcomes in higher education. As can be seen in the tables below, a significant number of participants indicated that the integration of information technology to enhancing teaching and learning outcomes is *somewhat critical* and *very critical* in higher education.

Table 9.7 Cross-tabulation Results on the Extent to which IT Enhances Learning Outcomes

Institution * How critical is the integration of information technology to enhancing teaching and learning outcomes? Cross-tabulation

Count

		How critical is the integration of information technology to enhancing teaching and learning outcomes?			Total
		Not critical at all	Somewhat critical	Very critical	
Institution	LASU	8	83	102	193
	UKZN	0	46	152	198
	UNISA	8	56	137	201
Total		16	185	391	592

Table 9.8 Chi-Square Tests on the Extent to which IT Enhances Teaching and Learning Outcomes

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.067[a]	4	.000
Likelihood Ratio	34.780	4	.000
Linear-by-Linear Association	7.933	1	.005
N of Valid Cases	592		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.22.

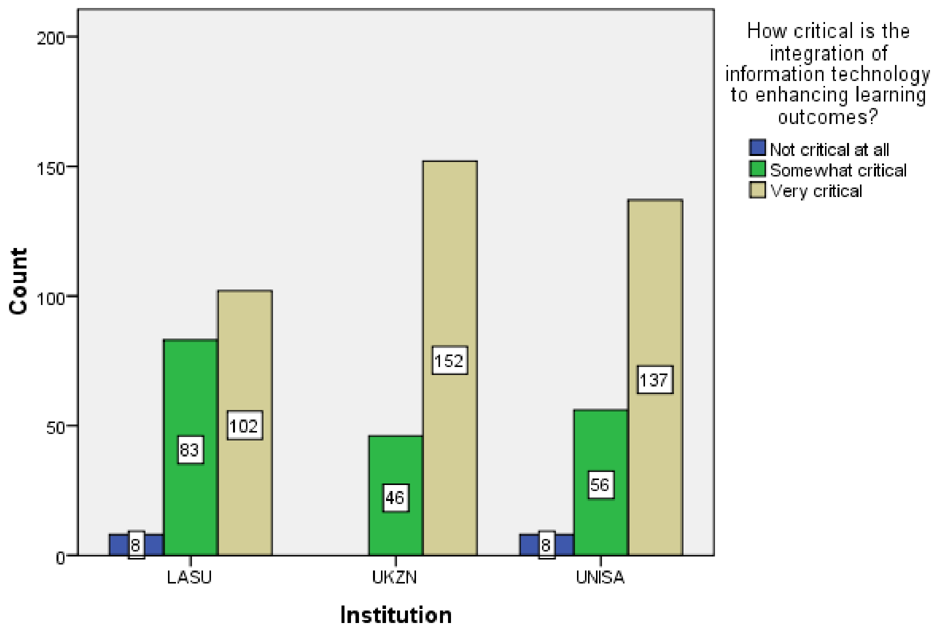


Figure 9.4 Cluster Bar Chart on the Extent to which IT Enhances Teaching and Learning Outcomes

The last set of tables in the cross-tabulation analysis of findings sought to establish the understanding of the impact of information technology on higher education. In order to understand the perceptions of academics, they were asked to state the impact that the use of information technology has on higher education. Tables 9.9 and 9.10 below confirm the foregoing as p≤0.05 and it indicates the perceived significance of information technology for higher education. This perception is based on the reliance of academics on information and communication technologies to conduct numerous research, teaching and learning activities in order to improve learning processes and delivery.

Table 9.9 Cross-tabulation Results on the Impact of IT on Higher Education

Institution * What impact does the use of Information technology have on higher education? Cross-tabulation

Count

		What impact does the use of Information technology have on higher education?				Total
		Negative	Somewhat negative	Somewhat Positive	Positive	
Institution	LASU	1	3	16	173	193
	UKZN	0	5	38	155	198
	UNISA	4	10	23	164	201
Total		5	18	77	492	592

Table 9.10 Chi-Square Tests on the Impact of IT on Higher Education

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.190[a]	6	.003
Likelihood Ratio	20.691	6	.002
Linear-by-Linear Association	7.210	1	.007
N of Valid Cases	592		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.63.

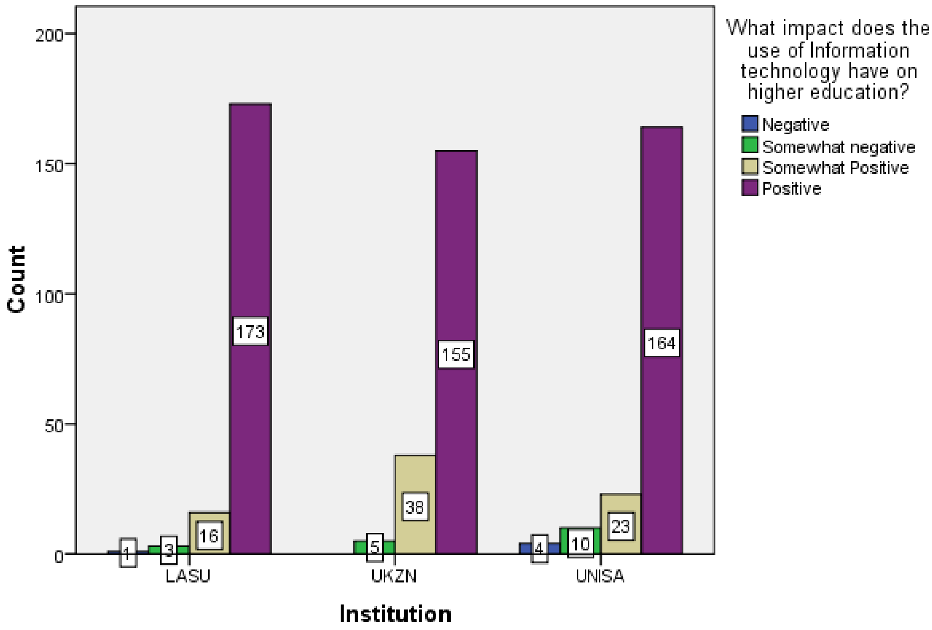


Figure 9.5 Cluster Bar Chart on the Impact of IT on Higher Education

9.3 Factor Analysis of Research Findings (LASU, UKZN & UNISA)

In addition to the computation of Cronbach's Alpha coefficient of reliability conducted in the previous chapters, the need to investigate the dimensionality of the scale is necessary. Hence, a factor analysis was conducted on the total number of responses constituting 592from LASU, UKZN and UNISA to execute the evaluation of the research findings.

As can be seen in Table 9.11 below, Kaiser-Meyer-Olkin (KMO) number is .848 and KMO can be described as the number that measures the proportion of variance in the variables that is explained by the underlined factors. A high value close to 1.0 usually denotes that the factor analysis may be useful for data, and the value less than 0.50 in the factor analysis indicates that the results may not be useful (Tavakol & Dennick, 2011). In addition, Guttman suggests the coefficient that provides a simple method for testing a series of variables for 'unidimensionality' to be between 0.80 and 0.90 as acceptable approximation for a perfect scale (Guttman, 1945). Bartlett's Test of Sphericity suggests that all the 14 factors identified to be useful in determining the success of information technology integration in higher education are significant at .000 where the value of p is set to be less than or equal to 0.05 ($p \leq 0.05$).

Table 9.11 Factor Analysis - KMO and Bartlett's Test on Factors

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.848
Bartlett's Test of Sphericity	Approx. Chi-Square	3704.952
	Df	91
	Sig.	.000

The initial communalities shown in Table 9.12 are correlation analyses of the proportion of variance accounted for in each variable by the rest of the variables while the extraction communalities are the estimated variance in each variable accounted for by the factors in the factor solution. Each extraction has high value above 0.1, which makes each factor analysis useful.

Table 9.12 Factor Analysis – Communalities on Factors

Communalities

	Initial	Extraction
[Time between introduction and adopting]	1.000	.694
[Personal interest in the use of technology]	1.000	.688
[Availability of funds]	1.000	.715
[Availability of physical space]	1.000	.710
[Quality assurance]	1.000	.581
[Employment of skilled professionals]	1.000	.425
[Low student enrolment in higher institution]	1.000	.807
[Increasing access to technology]	1.000	.714
[Institutional policies to support the use of IT]	1.000	.720
[Sufficient support from management level]	1.000	.718
[Availability of resources]	1.000	.721
[Adequate ICT infrastructures]	1.000	.772
[Adequate training facilities]	1.000	.763
[Government support and interventions]	1.000	.459

Extraction Method: Principal Component Analysis.

Looking at Table 9.13, labelled *Total Variance Explained*, it can be seen that the Eigenvalue of the first factor in determining the success of information technology integration into higher education is a bit larger than the Eigenvalue for the next factor with 5.3 as opposed to 1.9 (*Time between introduction and adoption* Versus *Personal interest in the use of technology*). The next thing to observe with regard to the same table is that the first factor accounts for 38% of the total variance and the next accounts for 14% of the total variance. This suggests that the scale items are 'unidimensional' based on the recommendation by Reckase (1979) that suggested that the first component of the variables should account for a minimum of 20% of the variance. Furthermore, without any given reason(s), Lumsden (1961) recommended that the measure of the first and second Eigenvalues should provide a reasonable index of 'unidimensionality' without a fixed maximum value.

In addition, only the first four factors in the initial solution have Eigen values greater than 1.0, together the first four factors account for almost 68% of the variability in the original variables. This is a suggestion that the four latent factors are associated with the success of information technology integration. However, there remains room for unexplained variation (i.e. the remaining variation is unexplained). Lastly, no variation described in the initial Eigen solution is lost in the extracted solution; the value remains the same at almost 68%.

Table 9.13 Factor Analysis - Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.346	38.184	38.184	5.346	38.184	38.184
2	1.971	14.078	52.261	1.971	14.078	52.261
3	1.149	8.205	60.467	1.149	8.205	60.467
4	1.023	7.308	**67.774**	1.023	7.308	**67.774**
5	.767	5.477	73.251			
6	.674	4.815	78.066			
7	.629	4.489	82.556			
8	.514	3.673	86.228			
9	.453	3.233	89.462			
10	.411	2.936	92.398			
11	.331	2.363	94.761			
12	.305	2.180	96.941			
13	.251	1.793	98.735			
14	.177	1.265	100.000			

Extraction Method: Principal Component Analysis.

It can be seen in Table 9.14 that each component has items with very strong factor loading above the absolute value of 0.3 which is considered to be the standard minimum value or most popular value of factor loadings. In Component 1, items 9, 10 and 13 appeared to have the strongest loadings. In

Component 2, item 1 has the strongest factor loading followed by items 2, 3, 4 in the 0.4 factor loading range. Component 3 recorded the highest factor loading of all other Components with item 7. The last Component (4) shows that item 8 is with the strongest factor loading.

Table 9.14 Factor Analysis –Component Matrix

Component Matrix [a]

	Component			
	1	2	3	4
Time between introduction and adopting	.467	.566	-.231	.320
Personal interest in the use of technology	.495	.454	-.406	.270
Availability of funds	.597	.498	-.153	-.295
Availability of physical space	.534	.441	.216	-.428
Quality assurance	.667	.362	-.042	-.058
Employment of skilled professionals	.613	.161	.119	-.097
Low student enrolment into higher institutions	.156	.257	.842	.086
Increasing access to technology	.653	-.101	.267	.454
Institutional policies to support the use of IT	.734	-.164	.036	.392
Sufficient support from management level	.736	-.370	.022	.198
Availability of resources	.691	-.483	-.009	-.102
Adequate ICT infrastructures	.681	-.512	-.124	-.179
Adequate training facilities	.751	-.332	-.154	-.256
Government support and interventions	.621	-.020	.155	-.223

Extraction Method: Principal Component Analysis.

a. 4 components extracted.

9.4 Comparative Analysis of Research Findings

This section of the study presents a comparative analysis of research findings on institutional and personal attitudes towards information technology facilities and/or tools that participants indicated in the figures below as useful to higher education. As can be seen in Figure 9.6, there are similarities and differences in the information technology facilities that LASU, UKZN and UNISA enabled for use. In terms of similarities, Email facility is the information technology facility of choice that is enabled by all selected Universities. It is the most convenient and easy to use form of communication to a large number of audience within the institutions. The differences can be related to the varying levels of usage of, for instance, discussion forums, Vodcast, online tests and quizzes, Calendar and Dropbox. Research findings suggest that more UNISA and UKZN academics use all the facilities than their LASU counterparts do.

In addition, more UNISA academics also use the above listed facilities than their UKZN counterparts. On the other hand, More UKZN academics make use of Bulletin Boards, Chartrooms, Wiki and Games & Leisure facilities than both UNISA and LASU counterparts. A similar result can be said of Figure 9.7 and 9.8 except that there are more LASU academics who indicated their personal use of information technology facilities (i.e. Email, Games & Leisure, Wiki and Calendar Tool) than their UNISA and UKZN counterparts in Figure 9.7 below.

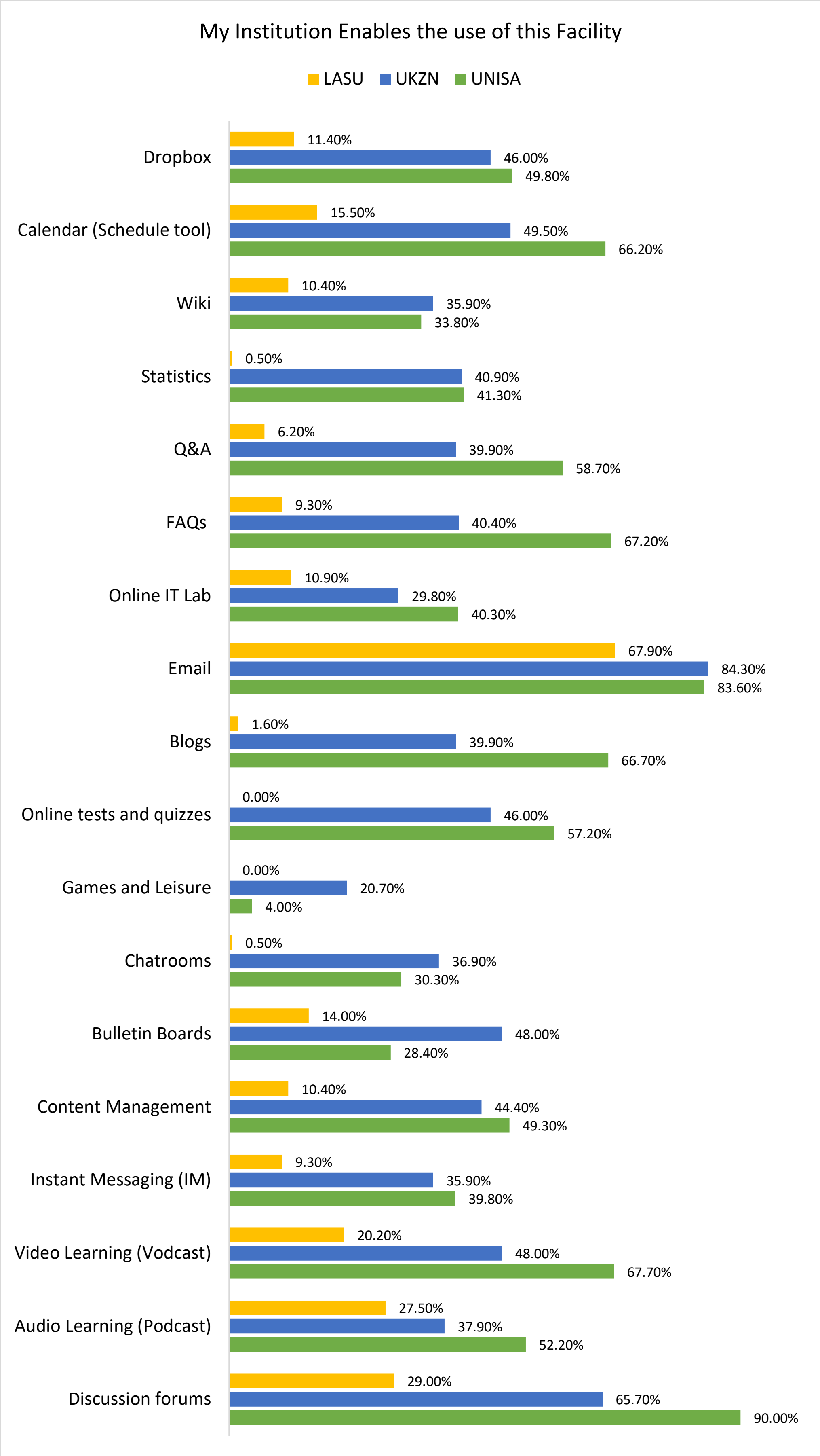


Figure 9.6 Comparative Use of Information Technology Facilities – Institution Enabled

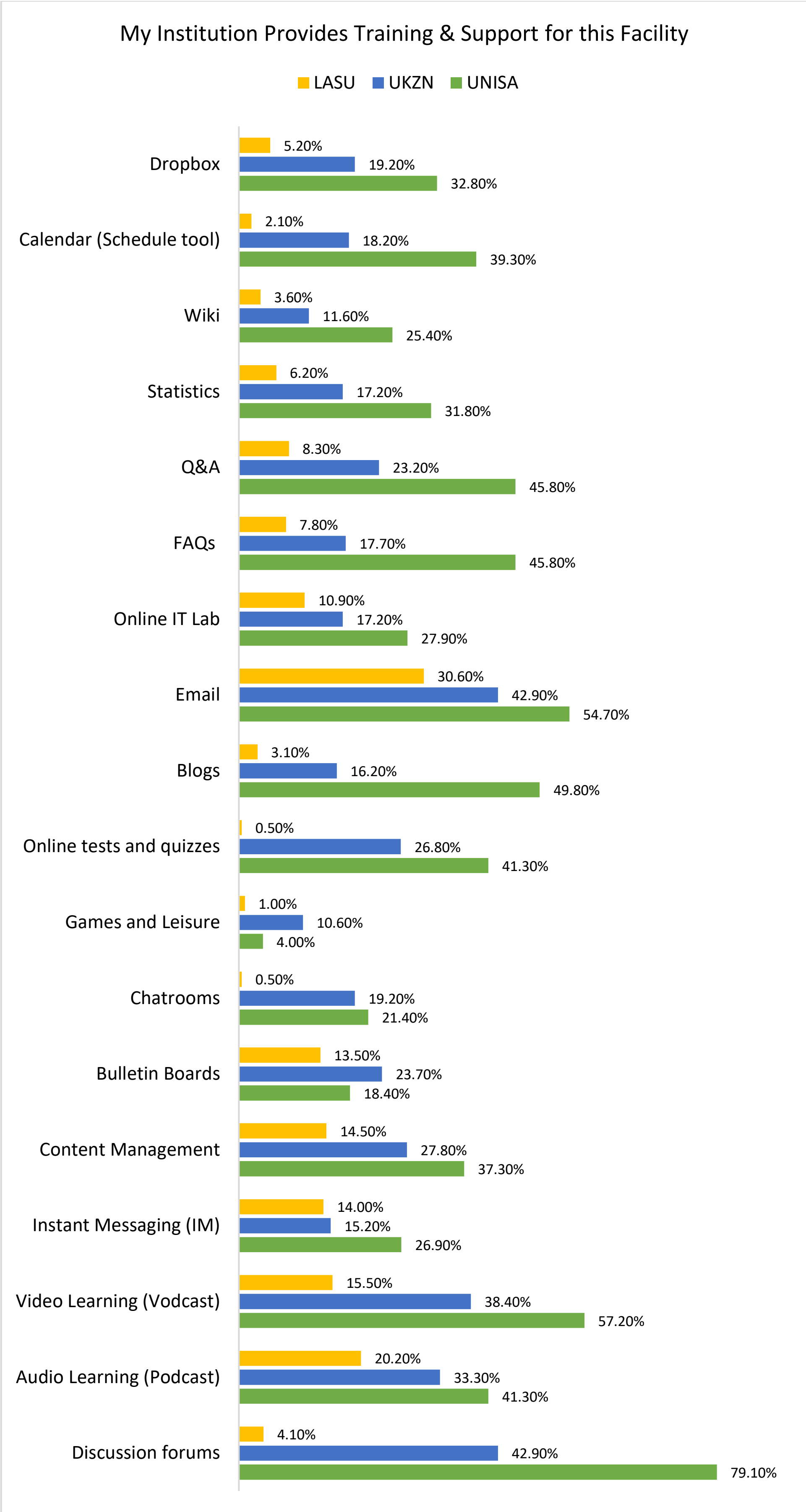


Figure 9.7 Comparative Use of Information Technology Facilities – Institutional Training & Support

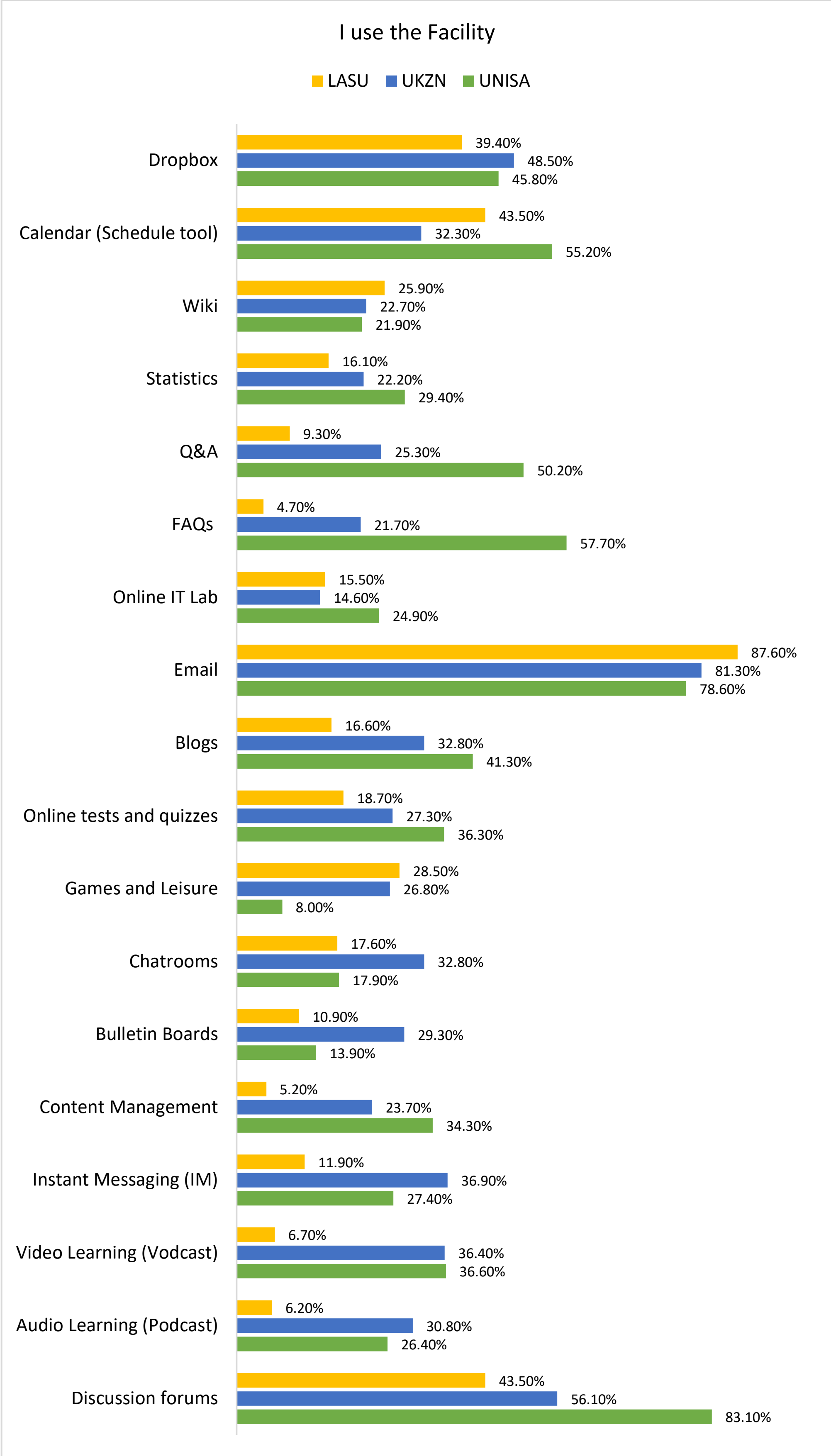


Figure 9.8 Personal Use of Information Technology Facilities

9.4.1 Suggested Institutional Support to Address Drawbacks (LASU, UKZN & UNISA)

Having identified the drawbacks that academics experienced in the use of information technology in LASU, UKZN and UNISA in the form of themes/codes generated by Nvivo 11 software, the follow up question required participants to indicate and suggest the type of support they thought the University could or should provide to address the drawbacks. The themes generated for the suggested institutional support to address drawbacks were in the context of the common themes generated and associated to the identified drawbacks described in chapters Six, Seven and Eight. The six most common and valuable themes are:

- Adequate Internet facilities;
- Uninterrupted Power Supply;
- Provision of Information Technology Skills training to Students and Academics;
- Regular Systems Update;
- Sufficient Facilities; and
- Institutional Policy

The analysis of suggested institutional support indicated by academics at the selected higher education institutions are presented as combined responses obtained from participants at LASU, UKZN and UNISA but separated into themes. To avoid duplication of academics' perceptions, valuable and significant responses that suggest institutional support are presented and generalized under each theme.

Adequate Internet Facilities – As indicated earlier that this theme focuses on the perceptions of participants who found Internet facilities to be inadequate for information technology integration in higher education, a participant suggested that "there should be easy access to Internet." Another participant indicated that there should be "Provision of better access to Internet facilities." The third participant associated to this theme suggested that "Making Internet facilities free of charge" would enhance the integration of information technology in higher education. In the light of others, a participant thought that Universities should "Adopt measures to increase Internet access by students." These suggested solutions by academics to Universities will actually contribute to the success of information technology integration into higher education. University's management needs constantly to take into account the need of academics and students to improve technology integration for an enhanced-learning outcome.

Uninterrupted Power Supply – This drawback theme is typically not a direct institutional challenge but a systemic/structural challenge that the government of South Africa and more especially, the government of Nigeria needs to address. Most information and communication technologies rely heavily on electricity; hence, Inconsistent Power Supply which is a systemic challenge tends to have a direct impact on institutional challenges in such a way that there would be limited access to available resources if there is no power supply at Universities. A participant indicated that institutions could address this drawback by providing "Standby generators for constant power supply since it is a national problem." Another participant indicated that "Constant electricity supply by providing powerful generators" would address the drawback in the use of information technology in higher education. Another participants' view on the inconsistent power supply was that "Schools should find solutions to provide power supply." This indicates that regardless of the national problem faced by the country, the University should find means to address the drawback by providing constant power supply. "Alternative source of power" was suggested by another participant to address the drawback of this theme. The last valid response identified by participants indicated that University needs "To ensure constant power supply." Other responses have been omitted to avoid repetition. To finalise this theme, the provision of constant electricity by the institution would be to install stand-by generators. However, the installation of these generators would also generate more expense in the purchase of fuel, maintenance of the machinery and employment of staff.

Provision of Information Technology Skills Training to Students and Academics–This theme focuses on the type of skills both students and staff members need in order to use information technology effectively. Without adequate resources, awareness and training facilities available to both students and academic staff to use information technology, successful integration of technology in higher education may not be achievable. According to a participant, it was suggested that the university "Need[s] to provide more training on new technologies outside of institutional platform, plus reward innovative use of technology." Another participant thought that the university should "Promote awareness." This suggests that technology awareness would mitigate the drawback and enhance information technology integration. A participant thought that "Effective Internet and human resources to address the problems experienced by teaching staff" would mitigate the challenges. Another participant thought that "Interacting with both students and lectures in knowing if they are facing any challenge" would address the drawback. One view supports another, a participant suggested that to "Train students to make the most of the available resources" would address the drawback.

A participant suggested that "Retraining of people" would address the drawback in the use of information technology in higher education. Re-Training of people was suggested in the construct of the research framework as a factor to determine the success of information technology integration. The research findings suggested that re-training (Reorientation) of people is an important key in the success of information technology integration into higher education. At this stage, learning to use the technology is emphasised and technology is a part of the learning framework rather than a distinct application (Hooper & Reiber, 1995). This is the stage where changes occur the most because academics are more willing to change the method of giving instructions and media to improve learning outcome. In addition, it is important that students should also be trained to use information technology before the start of course(s). If students were trained, there is the possibility that it would aid academics' interest in the use and integration of technology in the classroom or for virtual education.

Regular Systems Update – This drawback is associated with irregular update of systems where systems are outdated and new software and hardware are not available to replace the old ones. As such, a participant suggested that for the institution to address this drawback, there is need to "Keep up with current trends and adopt new methods available." Another participant suggested that "Regular upgrade of systems" would mitigate the drawbacks in the use of information technology in higher education. A participant thought that "Update[ing] current systems and employ[ing] more trained experts" would address the drawback. To avoid duplication of opinions, the last considered response indicated that the University should "Make sure software packages have been tested by involving academics" before updating and implementing into the system. This suggestion addresses the drawback identified by participants where two or more indicated that systems are not sufficiently tested before they are implemented.

Sufficient Facilities – This theme addresses all the drawbacks that have to deal with the provision of amenities such as server capacity (digital data storage space), office automation, technical support and infrastructure. A participant suggested that the University needs "To improve more access to computers and the Internet." Another participants' view was that "Procurement of better facilities" would address the drawback. A participant thought that "Equipment provision, space/venue and workshop on the importance of IT integration into education" is rather a better solution to the drawback. This suggestion rather indicates that the provision of information and communication technology tools, creation and or construction of more learning space/venue and workshops on the importance of information technology integration (training facilities) would create more awareness and skills in the use of information technology in higher education. 'Technical support' was a key suggestion in this category. A participant indicated that the "provision of more funds to support IT" would address the drawbacks. Another suggested that a "24 hour helpline" would address the drawback and another thought that "Specialized call centre that can assist the magnitude of the problems" would be a better way to address the drawbacks.

Institutional Policy – This theme was the last theme considered in the qualitative analysis of collected data from participants in LASU, UKZN and UNISA. The theme focuses on the policies that the University has in place to achieve its vision, mission and mandate. It was noted from the analysis of the drawback associated with institutional policies that implementing policies requires the development of strategic plans to ensuring the accomplishment of the institutional goals. To present the suggested institutional support to address the drawbacks associated with institutional policies, the first identified participant specified that the University should "Establish policies that will enforce the use of IT in Education" which is in contrast to the drawback specified by another participant who stated that "There is a policy trying to force us to use technology that does not work." This is an indication that some participants may not find the implemented policies as problematic as others did. There is freedom of expression of opinions and the study would suggest that Universities should develop strategic plans in the implementation of policies in such a way that will accommodate the goals of the institution as well as fulfil the requirements of the academic staff. In addition to the suggested institutional support on policies obtained from participants, another participant stated that "Policy and training interventions" would address the drawback in the use of information technology in higher education.

9.4.2 Academics' Involvement and experiences with e-Learning for Teaching and Learning

Findings from this study with regard to academics' involvement with technology show that the majority of the participants from both UKZN and UNISA are aware of or have been involved in the use of information technology for research, teaching and learning purposes (e.g. curriculum delivery; course delivery; online instruction; assessment and or seminars). While their counterparts from LASU indicated less experience and less involvement with e-Learning for teaching and learning purposes. Themes were used to establish findings regarding academics involvement and experiences with e-Learning for research, teaching and learning purposes at the three institutions. The research findings suggest that a substantial number of participants from LASU, UKZN and UNISA are involved in e-Learning activities within their own work depicted in Table 9.15 and 9.16 below. The chi-square tests results show that there is *no significant* correlation between academics' involvement with e-Learning activities within their own work and the integration of technology in higher education. It can be said that the significance of academics' involvement with e-Learning transcends their own personal work; it holds the potential to promote technology integration into teaching and learning in higher education in order to alleviate some of the teaching and learning challenges and achieve ICTs promised benefits to higher education.

Table 9.15 Cross-tabulation of Academics' e-Learning Involvement with Own Work

Cross-tabulation

			Your involvement and experiences with e-learning for teaching and learning purposes - I am involved in e-learning activities within my own work		Total
			Yes	No	
Institution	LASU	Count	165	28	193
		% within Institution	85.5%	14.5%	100.0%
	UKZN	Count	172	26	198
		% within Institution	86.9%	13.1%	100.0%
	UNISA	Count	168	33	201
		% within Institution	83.6%	16.4%	100.0%
Total		Count	505	87	592
		% within Institution	85.3%	14.7%	100.0%

Table 9.16 Chi-Square Tests on Academics' e-Learning Involvement with Own Work

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.868[a]	2	.648
Likelihood Ratio	.865	2	.649
Linear-by-Linear Association	.296	1	.587
N of Valid Cases	592		

a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 28.36.

In the next table (9.17 and 9.18), participants from UKZN and UNISA answered "Yes" to have been involved in e-Learning activities in collaboration with Departments at their institutions, other than their own Department. Participants at LASU indicated "No" to having been involved in e-Learning activities in collaboration with Departments at their institutions, other than their own Department. There is a significant correlation between academics' collaboration with other Departments and their involvement and experiences with e-Learning for teaching and learning purposes.

Table 9.17 Cross-tabulation Results on Academic's e-Learning Collaboration with Departments

Crosstab

			Your involvement and experiences with e-learning for teaching and learning purposes - I am involved in e-learning activities in collaboration with Departments at my institution, other than my own		Total
			Yes	No	
Institution	LASU	Count	54	139	193
		% within Institution	28.0%	72.0%	100.0%
	UKZN	Count	109	89	198
		% within Institution	55.1%	44.9%	100.0%
	UNISA	Count	77	124	201
		% within Institution	38.3%	61.7%	100.0%
Total		Count	240	352	592
		% within Institution	40.5%	59.5%	100.0%

Table 9.18 Chi-Square Test on Academic's e-Learning Collaboration with Departments

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.342 [a]	2	.000
Likelihood Ratio	30.549	2	.000
Linear-by-Linear Association	4.104	1	.043
N of Valid Cases	592		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 78.24.

In addition, Table 9.19 and 9.20 shows that a significant number of participants from LASU, UKZN and UNISA indicate that they would like to be involved in e-Learning activities in the future. The result shows that there is a significant correlation between academics' involvement and experiences with e-Learning for teaching and learning purposes and future involvement with e-Learning.

Table 9.19 Cross-tabulation Results on Academic's involvement with e-Learning in the Future

Crosstab

			Your involvement and experiences with e-learning for teaching and learning purposes - I would like to be involved in e-learning activities in the future		Total
			Yes	No	
Institution	LASU	Count	129	64	193
		% within Institution	66.8%	33.2%	100.0%
	UKZN	Count	106	92	198
		% within Institution	53.5%	46.5%	100.0%
	UNISA	Count	99	102	201
		% within Institution	49.3%	50.7%	100.0%
Total		Count	334	258	592
		% within Institution	56.4%	43.6%	100.0%

Table 9.20 Chi-Square Test on Academic's Involvement with e-Learning in the Future

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.390 [a]	2	.001
Likelihood Ratio	13.577	2	.001
Linear-by-Linear Association	12.278	1	.000
N of Valid Cases	592		

a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 84.11.

It can therefore logically be suggested that the promotion and integration of e-Learning methods into teaching and learning practices should be a continuous approach to enhance technology integration, improve teaching and learning performance and to alleviate some challenges higher education institutions are faced with in Africa.

9.5 Change Management Awareness in the Integration of IT (Nigeria & South Africa)

This study has examined change management awareness among academics at three prominent higher education institutions in Africa, namely Lagos State University in Nigeria, the University of KwaZulu-Natal in South Africa, and an open and distance learning institution, the University of South Africa. The results generally indicate that academics are not only aware of change management, but believe changes are needed to integrate technology into higher education. However, a group of participants in Nigeria disagreed, arguing that it is not the responsibility of the institution to provide strategies to implement changes in the use of information technology. This could mean that changes in the use and integration of information technology into higher education should begin with individuals' understanding and their acceptance of change.

The study suggests that the majority of participating academics thought that change management awareness would help to facilitate and improve technology integration in higher education institutions. The study creates a platform for higher education institutions to understand that academic staff are aware of change, and it can serve as a useful tool for initiating the process of change. Academic change management awareness will enhance the integration as well as the introduction of technology into the teaching and learning processes. Change management awareness could serve as a motivational tool to assist higher education institutions in obtaining funds to acquire more technology to enhance learning outcomes.

9.6 Findings from Institutions' Management (LASU, UKZN & UNISA)

This section of the study presents the interview findings obtained from the management staff of the selected institutions. The goal of the interview was to have an understanding of the opinions of the institutions' management and their thoughts on the significance of information technology integration into higher education. The interview was able to gather information from the management staff in order to identify possible challenges they face or are aware of that academics face in their use of information technology for teaching and learning purposes. The study suggested that, it is the university's management or administrators who implement and maintain the information technology systems. Without management support, innovation does not prosper. The institution's management provides support to academics in their use and integration of information technology in higher education. Hence, the need for the interview became necessary in order to validate the findings obtained from academics at LASU, UKZN and UNISA.

The institutions' administrators/managers were asked five in-depth email interview questions in order to probe the responses from academics at LASU, UKZN and UNISA regarding the question of whether or not they perceived the University administration to be providing them with suitable or adequate support. The institution administrators' responses were analysed with Nvivo 11 software to generate the following five themes:

- Understanding of Technology Integration in Higher Education;
- Information Technology Integration Challenges;
- Institutional and Systemic Challenges;
- Drawbacks of Information Technology Integration; and
- Significance of Information Technology for Higher Education.

The findings associated with each theme are presented as follows:

Understanding of Technology Integration in Higher Education – it was necessary to unpack the understanding and opinions of the institutions' administration on technology integration into higher education, since they are the ones who provide support and who maintain the systems. One participant indicated that "My understanding of technology integration in higher education environment is simply the use of technology to solve/ease the day-to-day working of the higher education." The participant added, "Simply put, technology integration is the use of technology to solve institutional problems." The second participant that responded to this interview question indicated that "Technology integration is the use of technology resources such as computers, mobile phone, tablets and social media with the use of Internet and software applications on a daily basis." The next participant thought that "Technology integration is the introducing technology that we use daily into a learning environment." This participant further explained that "in the past, we used paper-based learning as this was a norm in our everyday lives . . . the world is constantly changing and technology integration makes study easier and enjoyable." To have a different taste of the opinions of the institutional administrators, the last participants added to this theme by stating that "It is the implementation and effective use of technologies in the internal management of institutional education and external learner educational resources towards achieving effective and much more enhanced learning experiences as opposed to traditional and historical learning and teaching methodologies which are more linear and far less content rich.” To this end, it can be assumed that those administrators who participated in this email interview clearly understand the concept and meaning of technology integration into higher education. Hence, providing support for academics to integrate information technology into teaching and learning practices should be an easy effort as long as there are available resources.

Information Technology Integration Challenges – This theme highlights the kind of challenges that the administrators have faced or the challenges they are aware of that academics are faced with in the use of information technology for teaching and learning purposes. The first participant specified four points: the first being “Most academics are not IT-compliant i.e. they do not have the basic knowledge of IT.” The second point noted by the same participant stated that “It is not easy convincing them to embrace IT for teaching since most of them have been teaching for years.” The third opinion stated that “The classrooms are not constructed to be integrated with technology” and the fourth point highlighted that “A lot of financial spending has to be made to kick start IT, which the institution might be reluctant to do.” These four opinions can be correlated to the various challenges identified in the research questionnaire. The opinion of the participant validates the reliability and the extent to which the items of the research instrument measures the seriousness of the challenges in the use of information technology for teaching and learning purposes.

The next participant indicated that “Challenges faced using technology in teaching and learning practices can be: pace of change in technology, distraction and technology out -thinking the instructor.” This indicates that the speed at which technology changes or evolves could pose challenges on technology integration. This correlates with the study’s objective of making *change management awareness* an important factor in the framework for integrating information technology into higher education. The next participant thought that “Accessibility is a big challenge for students, especially in the rural areas. Cost also plays a big part, as students cannot afford data charges and devices are expensive.” The last participant had not personally experienced any major challenges, yet, stated that “Educators and their intuitions lack the vision, determination and technology know-how in achieving media and technologically rich teaching and educating of the technically more able and capable students in the modern world.” The same participant further added: “Educators are unskilled in new e-Learning methods and also are more alarmingly not aware of teaching tools and systems that are already succeeding in modern countries worldwide.”

Institutional and Systemic Challenges – This theme sought to unpack the kind of institutional and systemic challenges that the university management thought could be obstructing or hindering the integration of information technology in higher education. The first participant to respond to the email interview highlighted 5 major challenges. The first was “Bureaucracy.” The second on the list was “Lack of necessary training of the integrated technology” followed by “Lack/inadequate support – technical support." The fourth was "The presence of a leader that does not support technology and does not understand its importance." The poor interest of leaders in the use of technology was thought to be the cause of the fifth challenge, and was highlighted as "Lack of constant training of the technical teams concerning the integrated technology as it changes over time."

The second participant specified the "Challenges that hinder technology integration include: support, time to implement, resources, and access to material to be used." The next participant thought that "Unwillingness of people to try new things and change, Connectivity – Government infrastructure delays, Cost and Accessibility" were the institutional and systemic challenges that hinder the integration of information technology into higher education. The fourth participant stated that "The slow reduction of technological cost – affordability – of data, infrastructure, ICT systems in emerging and third world countries as compared to first world costs and pricing models." The participant further added that "this make it slower, by many years to implement solutions that remain very expensive for average African institutions." The final note from the fourth participant stated that "The Large mind-set and willingness of old-school educators are major hindrance, merely because they are not as tech- savvy as their learners or younger colleagues or counterparts and also they are largely tech-phobic. Educators in Africa also largely are unwilling to get skilled in modernised teaching and learning methods. The large e-Learning events I have attended show poor participation and poor confidence but rather a hesitance to embrace large scale e-Learning techniques and systems."

Drawbacks of Information Technology Integration – In this theme, the same drawback questions requested of academics were put to the University administrators. Therefore, administrators were required to respond to the email interview that asked what they thought to be the drawbacks of technology integration into higher education. A participant mentioned five major drawbacks to technology integration as follows. The first drawback stated was stated as "Lack of adequate technical experts to manage the integrated technology." The second drawback was "Lack of upgraded systems, this is so because technology improves at the speed of light and unfortunately, most higher education are left with archaic technologies." The third drawback identified was "Lack of constant support from the heads of the higher education centres." Fourth being the "Lack of understanding of the reasons why the technologies are the way they are." Lastly, the participant stated that "Sabotage by the labour force of the higher education who thinks the presence of technology will affect them negatively in the long run."

The second participant indicated that the "Drawbacks include maintenance of equipment, lack of support, incompatibility issues and timing in deploying equipment." These four drawbacks correlate with the identified drawback themes of the research findings, hence they validate the extent to which academics perceive the drawbacks experienced in their use of information technology in higher education. The next participant though that "Not everyone would be able to afford it" and "A certain measure of computer skills is needed to use technology" were the drawbacks of technology integration into higher education. The last participant in this theme thought that "the only drawback is the current cost of students in the poorer African environment and capital outlay to the institutions themselves, which is recaptured over time." The participant further stated that: "Unskilled government leadership and lack of keeping abreast with the global technology pace will be unprepared to deal with system integration and maintenance."

Significance of Information Technology Integration for Higher Education – This last theme presents the extent to which institutions' administration/management consider the integration of information technology as significant or critical for higher education. The first participant indicated "Yes" to considering information technology integration to be critical for higher education. The participant further stated that "IT integration in learning would be interesting, improves skills, increase collaboration and reduce hard copy books." The second participant also indicated "Yes" to considering information technology integration to be for higher education and further stated that "Information technology integration is very critical (sic) for higher education in so many ways part of which are: it improves the online presence of the institution." The second highlighted significance was that "It makes processing of data easier and faster." The second participant also indicated that "Labour force gets impressed as they constantly receive training support' and lastly "It improves the competition level of the institution and gives it an edge over others."

The third participant also indicated "Yes, it is critical (sic) as once a student has finished his or her studies, that person will have to function in a fast paced technological environment as technology is key in this modern day and age." The last participant agreed to "Yes" by considering information technology integration to be critical for higher education. it was also noted by the last participant that "Since technology speeds up learning and allows more practical learning to be achieved, even remote to the learning institutions viz. lab can be online, practical can be viewed repeatedly and performed under live tutors or via video etc.." This indicates that "Teaching and learning can be repeated at the learners' leisure until concepts and objectives are achieved. Mastery of learning is a not a question of doubt anymore."

In summary, all the participants (administrators/managers) who took part in the in-depth interview clearly understood the significance of technology integration and its usefulness to higher education. It is with no doubt that the interview findings validate the research findings on academics' opinions of whether or not they perceived the University administration/management to provide them with quality and adequate support to enhance technology integration in higher education.

9.6.1 Quality of Administrative Support in Correlation with Technology Integration in Higher Education

The tables (9.21 and 9.22) below show the cross-tabulation of data from LASU, UKZN and UNISA. The results show that there is a significant correlation between the quality of support academics received from the University management and its prospect for technology integration into higher education. Apart from participants in LASU who perceived the quality of support they received by their institution's administration/management to be *not satisfactory*, the majority of participants from both UKZN and

UNISA indicated that the support they received was *somewhat satisfactory* and very satisfactory.” The negative response from participant in LASU could have been associated with the fact that the e-Learning platforms are not available and adopted by their institutions judging from the indication in the efficacy rating questions. Other reasons could be linked to their responses to the seriousness of challenges they encounter in the use of information technology for teaching and learning practices such as: poor technical support by management, potential loss of personal revenue, lack of training facilities and poor institutional policies.

Table 9.21 Cross-tabulation Results of the Quality of Support for Technology Integration

Institution * How would you describe the quality of support you received by your institution administration in the integration of information technologies? A Cross-tabulation.

Count

		How would you describe the quality of support you received by your institution’s administration in the integration of information technologies?			Total
		Not satisfactory	Somewhat satisfactory	Very satisfactory	
Institution	LASU	106	65	22	193
	UKZN	13	146	39	198
	UNISA	23	125	53	201
Total		142	336	114	592

Table 9.22 Chi-Square Tests of the Quality of Support for Technology Integration

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	155.942[a]	4	.000
Likelihood Ratio	151.331	4	.000
Linear-by-Linear Association	77.075	1	.000
N of Valid Cases	592		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 37.17.

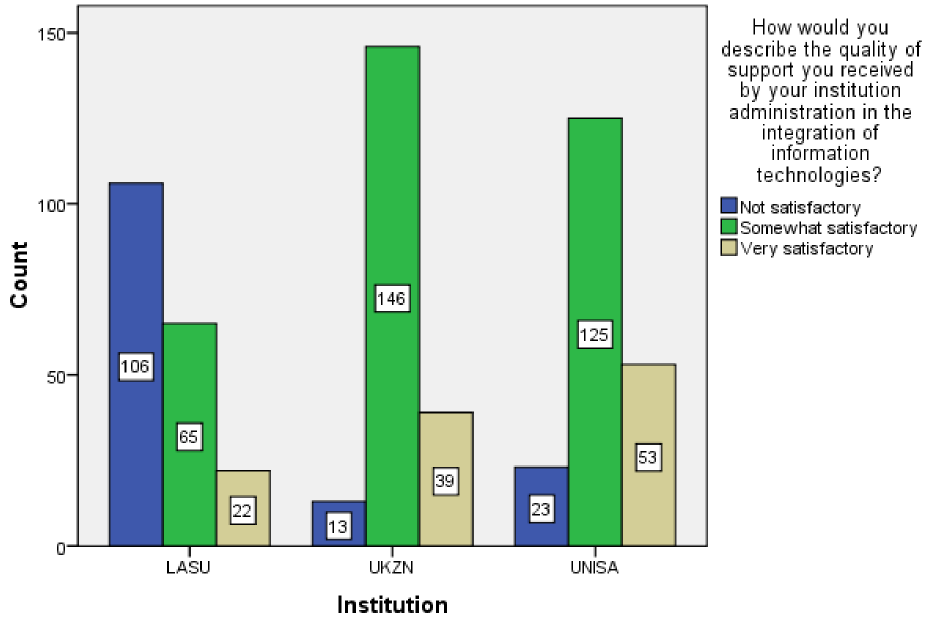


Figure 9.9 Clustered Bar Chart of the Quality of Support for Technology Integration

Having been able to correlate the interviews from the University management with the academic findings at the three institutions in Africa, it can be suggested that adequate and effective support from University administrations will promote technology integration in higher education for teaching and learning purposes and this should enhance learning outcomes. Therefore, it is important to address challenges and problems of poor access to information technology. Government and Universities, especially in Nigeria should combine forces to increase infrastructure within the learning environments. Universities should also endeavour to equip faculty administration (such as the ICT Department) with adequate and necessary ICT facilities and skills that will facilitate teaching and learning practices. In general, Faculty administration support should not only focus on promoting and encouraging educators' technology integration into teaching and learning practices but should provide adequate support to motivate students, support student technical competency, student-to-student interaction, infrastructure reliability and easy access to technology (Nasser, Cherif, & Romanowski, 2011).

9.7 Correlation of Research Findings: Nigeria versus South Africa

This section of the study will discuss the correlation of research findings in Nigeria versus South Africa in terms of resources, technology involvement, population, economic status of the country, and the concept of early adopters versus late adopters of technology in higher education.

Evidence from research findings and the literature findings shows that South Africa is richer in terms of technology and infrastructure (Ng'ambi et al., 2016) with the arrival and presence of European and American organisations using South Africa as a launching pad to penetrate the rest of Africa. Nigeria on the other hand is still in its infancy with regards to infrastructure and technology (Chaka & Govender, 2017). Energy related problems, poor internet connectivity, inequality of access to education and government policies among many others have been major obstructions to technology advancement and infrastructural development in Nigeria. Although, the Nigerian population is more than double the population of South Africa yet, the potentials of information technology in higher education has still not fully been tapped.

Although information technology has not been maximized fully at African higher education institutions (Chaka & Govender, 2017; Govender & Chitanana, 2016), yet the findings from this study ascertain that the perceptions that academics have at the three higher education institutions are positive. They seem to be enthusiastic and ready to accept and be involved in the use of information technology as a pedagogical tool.

9.7.1 Early Adopters against Late Adopters – Nigeria Vs South Africa

Rogers (2003) contribution to the concept of innovation adopters in the diffusion of innovation theory identified five different groups of adopters which have been described in Chapter Two. This section of the study presents a correlation of the research findings in respect of the two major groups of adopters (i.e. e*arly adopters* versus *late adopters).* To further probe the categories where participants of this study fall, regarding the motivation towards the adoption of new technology in higher education, the study takes note of Woodell and Garofoli's (2003) contribution to the characteristics of both early versus late innovation adopters, and this is depicted in Table 9.23.

Table 9.23 Characteristics of Early Adopters versus Late Adopters (Garofoli & Woodell, 2003)

Early Adopters	**Late Adopters**
Favour revolutionary change	Favour revolutionary change
Visionary	Pragmatic
Project oriented	Process oriented
Risk takers	Risk averse
Willing to experiment	Wants proven application
Generally self-sufficient	May need significant support
Horizontally connected	Vertically connected

Correlating the findings of this study with the proposed characteristics depicted in the table above, it is important to note that, adopters have different reasons for adopting innovation or new technology. The most significant technique to motivate a common reason for innovation adoption should be the integration strategy employed by the higher education institutions. A proposed strategy is recommended in the final chapter. Findings from the study show that the majority of academics at UNISA fall under the early adopters of new technology. This may be attributed to the ODL teaching and learning approach (with no physical contact with students), where they use technology at different levels of the ODL systems to communicate and collaborate with students. Although, both UNISA and UKZN participants agreed on the same level that they would be likely to experiment with the new technology but they differ on whether or not they would be more likely to use information technology if someone else used it.

While a few participants at LASU in Nigeria disagree on the likelihood of experimenting with new technology, the majority agree to have always tried to obtain the latest information technology. In addition, The LASU participants may have indicated that “they do not know” and or “do not have” access to e-Learning technologies at their institutions when asked to rate the efficacy of e-Learning adopted by their institution, but 100% of LASU academics agreed and strongly agreed that they intend to use information technology in the future. This is consistent with the literature findings that indicated that e-Learning is still in its infancy in Nigeria (Chaka & Govender, 2017; Oyelere, Suhonen, & Sutinen, 2016), but the findings of the study show that academics at LASU are fully ready and optimistic that they will use the technology when implemented.

It can be concluded from the findings that the majority of the South African (UNISA) participants are early adopters of information technology in higher education, followed by their UKZN counterparts. The Nigerian participants fall under the late adopters’ category, due to the highest number of participants who disagree to being the first to try out new information technology among their colleagues. Late adoption of technology in Nigeria has also been attributed to poor infrastructural development, poor energy supply, lack of instructional materials at higher education institutions and inadequate professional development programmes for academics (Oyelere, Suhonen, & Sutinen, 2016; Tabot and Hamada, 2014).

9.8 Chapter Summary

In this chapter, an evaluation of the research findings was presented in the form of cross-institutional analysis of some significant aspects of the study. Factor analysis on total variance, component matrix and significance of factors were presented in the chapter. Comparative analysis of findings including findings of suggested institutional support to address drawbacks in the use of information technology and findings from institutions’ administration/management on their opinions of information technology integration in higher education were presented. The next chapter presents the discussion of findings in relation to the research objectives and questions.

CHAPTER TEN

DISCUSSION OF FINDINGS

10.1 Introduction

The focus of this chapter is two-fold. First, it presents results pertaining to the testing of the study's hypothesis that alleviating higher education challenges through strategic integration of technology can enhance teaching and learning outcomes. Second, it addresses the implications of the research questions in relation to the research objectives and discusses veritable lessons that can be learnt from the strategic integration of technology in higher education. In doing so, the chapter highlights the potential benefits of ICTs to higher education. Overall, the discussion in this chapter is relative to the study's research questions and objectives and it foregrounds the implications of the findings in relation to the research questions.

10.2 Hypothesis Testing

The hypothesis of the study stated that alleviating higher education challenges through strategic integration of technology can enhance teaching and learning outcomes. In order to achieve the study's objectives, the following propositions were tested empirically:

H0: Alleviating higher education challenges through strategic integration of technology has no direct impact on enhancing teaching and learning outcomes.

H1: Alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes.

As noted in the data presentation and analysis chapters, Table 10.1 below indicate that about 95.9% of academics at LASU feel that the integration of technology will enhance teaching and learning outcomes while 4.1% did not think so. 100% of academics at UKZN feel that integration of technology will enhance teaching and learning outcomes, none of the academics felt otherwise. In the case of UNISA, 96% of academics feel that the integration of technology will enhance teaching and learning outcomes while 4% did not think so. Compositely in the three cases, 97.3% of academics were positive that alleviating higher education challenges through strategic integration of technology has direct impact on enhancing teaching and learning outcomes while 2.7% were negative.

Table 10.1 How critical is the integration of information technology to enhancing teaching and learning outcomes at the selected universities in Africa

How critical is the integration of information technology to enhancing teaching and learning outcomes?

Institution			Frequency	Percent	Valid Percent	Cumulative Percent
LASU	Valid	Not critical at all	8	4.1	4.1	4.1
		Somewhat critical	83	43.0	43.0	47.2
		Very critical	102	52.8	52.8	100.0
		Total	193	100.0	100.0	
UKZN	Valid	Somewhat critical	46	23.2	23.2	23.2
		Very critical	152	76.8	76.8	100.0
		Total	198	100.0	100.0	
UNISA	Valid	Not critical at all	8	4.0	4.0	4.0
		Somewhat critical	56	27.9	27.9	31.8
		Very critical	137	68.2	68.2	100.0
		Total	201	100.0	100.0	

* 'Not critical at all' comprises those participants who indicated the assumptions that 'technology integration *has no direct* impact on enhancing teaching and learning outcomes' and those who answered 'somewhat critical' and 'very critical' actually meant 'technology integration *has direct* impact on enhancing teaching and learning outcomes'.

In testing for the significance of variables that impact on the hypothesis, a descriptive analysis of the data in Table 10.8 (above) shows a statistically significant (χ=30.067, df=4, p=.000) difference between the proportion of participants (97.3%; n=576) who are of the view that alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes and the proportion that does not (2.7%; n=16). This represents a rejection of the null hypothesis (H0) and an acceptance of the alternative hypothesis (H1). The study can confirm the existence of widely held perceptions amongst academics at the selected universities in Africa that alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes. The conclusion regarding this perception applies in the three study locations: at LASU, 95.9% (n=185) in the sample has the perception, compared to 100% (n=198) at UKZN and 96% (n=193) at UNISA, depicted in Figure 10.1.

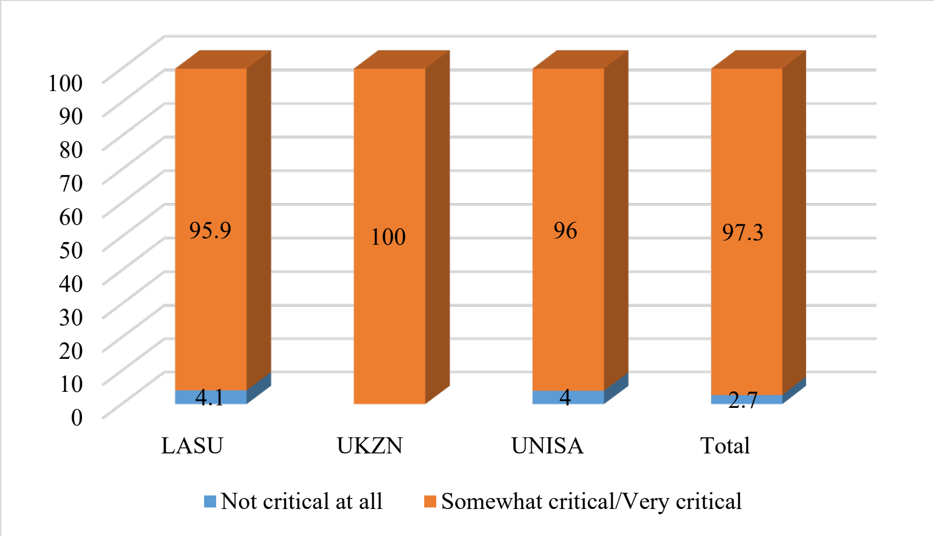


Figure 10.1 Integration of technology has direct impact on enhancing teaching and learning outcomes

In addition, a vast majority of academics at the three study locations shared the view that information technology integration has a positive impact on higher education in general. The assumptions of this perception is that 'negative' and 'somewhat negative' comprise of those who did not consider technology integration to have direct impact on higher education. The assumptions of those who answered 'somewhat positive' and 'positive' actually meant that information technology has a positive impact on higher education. The overall impact of the use of information technology includes but not limited to its impact to alleviate higher education challenges; enhance teaching and learning outcomes; promote technology integration and transformation success in higher education; and contribute to the realisation of ICTs' potential benefits to higher education. As shown in Table 10.10, the statistically significant differences (χ=20.190, df=6, p=.003) in the proportions, in the respective locations suggest that academics who participated in the study find the integration of information technology to more likely have a positive impact on higher education.

10.2.1 Implications of the Relationship between Overall Experience and the Extent to which Technology Integration is Critical to enhance Teaching and Learning Outcomes

In order to further probe the characteristics and perceptions of the participants who were likely or unlikely to hold the perceptions that alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes, the assumption was tested using linear regression model. The linear regression model procedure was used to test the relationship between the overall experience of participants in the use of information technology and the extent to which they perceived information technology integration to be critical to enhancing teaching and learning outcomes. The primary data collected from the three geographic locations of the study at the selected universities in Africa were screened through SPSS 24. This test was conducted by the researcher in order to ensure the accuracy of data entry, missing values, outliers and normality prescribed by Pallant (2011).

As prescribed by Pallant (2011), missing data were replaced with sample median value and preliminary test of multivariate variables was performed to avoid the violation of the assumptions of normality, linearity, homoscedasticity and multicollinearity in the study.

To ensure that there is no violation of assumptions, the following log was generated after the regression test was performed in SPSS, showing all the criteria and procedures followed in executing the regression model. Tables 10.2, 10.3 and 10.4 shows the model summary, Anova and coefficient values of the observation respectively.

```
REGRESSION
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Q25
/METHOD=ENTER Q18
/PARTIALPLOT ALL
/RESIDUALS NORMPROB(ZRESID)
```

The researcher used one predictor variable (overall experience of academics in the use of information technology for teaching and learning) against one outcome variable (extent to which the integration of information technology is critical to enhancing teaching and learning). This procedure was used to test the relationship between the 'overall experience' of participants in the use of information technology and the extent to which they perceived the integration of information technology to be 'critical' to enhancing teaching and learning outcomes. Overall experience as depicted in this study is not only limited to academics' use of information technology but also encompasses any formal/informal education or training they have obtained; their competency level in the use of technology; the types of computer systems they are familiar with and the period they have been using such technologies (Sang & Tsai, 2009; Summak, Samancioğlu, & Bağlibel, 2010; Tallent-Runnel et al., 2006). The overall experience also includes academics' involvement in the use of technology for teaching, learning and research activities, which may include the use of information technology as tools for curriculum development, course delivery, online instructions, seminars and assessment purposes (Sang & Tsai, 2009). Factors that determine the success of technology integration in higher education and factors that hinder the integration of technology (i.e. challenging and limiting factors) were considered part of the overall experience of academics in the use of information technology. These factors contribute significantly to the success of this study in order to the address the problems of the research and to achieve the study's objectives.

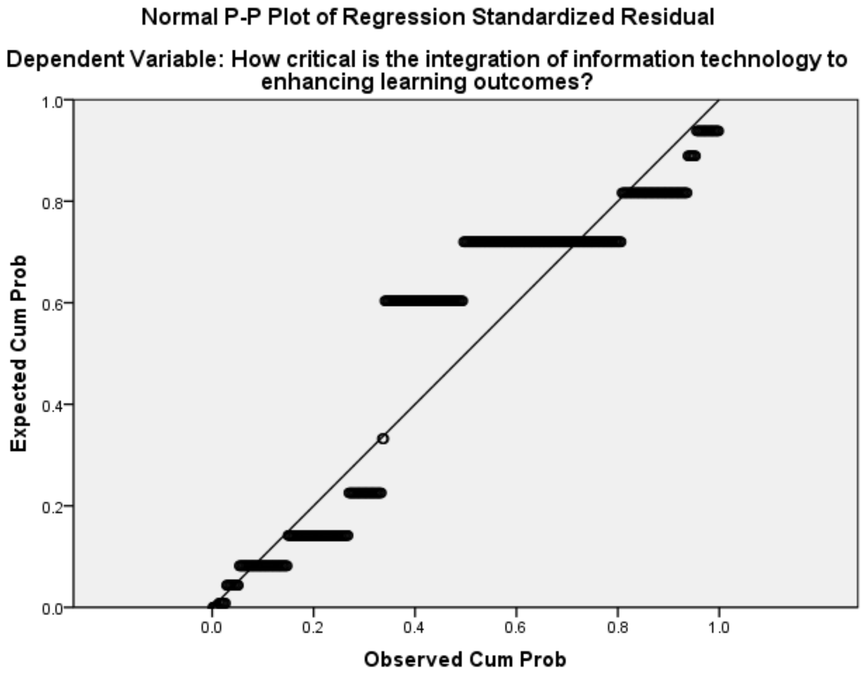


Figure 10.2 Normal P-P plot of Regression Standardised Residual

The study ensured that no violation of assumptions of multicollinearity occurred by checking the outliers, normality, linearity, homoscedasticity and independence of residuals. By means of ensuring there is no violation of assumptions, maximum Mahal Distance and Cook's Distance which were below *critical value* were observed and these assumptions were supported in Figure 10.2 above, which shows the normal P-P plot of the regression standardised residual on the observation (dependent variable). Figure 10.2 above shows that the regression standardised residual between the independent variable and dependent variable covered in the study looked normal. Figure 10.2 portrays the extent of normality that the impact of independence variable has on the dependent variable.

Table 10.2 Model Summary of Independent and Dependent Variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.328[a]	.108	.106	.506	.108	71.343	1	590	.000

a. Predictors: (Constant), How would you rate the overall experience of using information technologies for teaching and learning?

b. Dependent Variable: How critical is the integration of information technology to enhancing teaching and learning outcomes?

To further ensure that no violation of assumptions occurred, Table 10.2 performed the linear regression model summary of independent and dependent variables, which shows an R square of .108 and adjusted R square .106. This indicates that the variable 'overall experience' in the use of information technology for teaching and learning predicts 10.6% of the variation in the extent to which the integration of information technology is critical to enhancing teaching and learning outcomes. This is statistically significant at p = 0.000, where the p value when it is less than or equal to 0.05 ($p \leq 0.05$) is an indication that the test is statistically significant. In other words, significance was established in the relationship between the independent variable and the dependent variable.

Table 10.3 ANOVA Results of Independent and Dependent Variables

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.280	1	18.280	71.343	.000[a]
	Residual	151.177	590	.256		
	Total	169.458	591			

a. Predictors: (Constant), How would you rate the overall experience of using information technologies for teaching and learning?

b. Dependent Variable: How critical is the integration of information technology to enhancing teaching and learning outcomes?

**. Correlation is significant at p ≤ 0.05 level (2-tailed).

Table 10.3 equally shows the significant relationship between the independent variable of the overall experience of academics at the selected universities and the dependent variable (extent to which the integration of information technology is critical to enhancing teaching and learning outcomes), where the value of p is 0.000, which less than 0.05.

Table 10.4 Coefficient Results of Independent and Dependent Variables

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	2.058	.071		28.876	.000	1.918	2.198
How would you rate the overall experience of using information technologies for teaching and learning?	.162	.019	.328	8.446	.000	.124	.199

a. Dependent Variable: How critical is the integration of information technology to enhancing teaching and learning outcomes?

Table 10.4 above shows the coefficient results of the independent and dependent variables. It can be described that the unstandardized Beta (β) coefficients of the independent variable (overall experience) is 0.162 and standardized β coefficients is 0.328. The corresponding p value of the independent variable is 0.000, which is less than 0.05. This indicates that significant positive relationship was established between the two variables. The results show that overall experience of academics at the selected universities contributes to the regression model. It can be said that the overall experience (good or bad) serves as a predictor to the extent to which the integration of information technology is critical to enhancing teaching and learning outcomes. The independent variable has a statistically significant impact on the outcome (dependent) variable. This further supports the study's hypothesis, namely that alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes.

10.3 Discussion of findings in relation to research questions and objectives of the study

This section of the thesis presents the discussion of findings presented in the data analysis chapters (i.e. Six, Seven and Eight) in relation to the study's research questions as well as objectives formulated from the problem statement. The research questions and objectives in the study were expressed in such a way that they are linked to one another. The main aim of this section is to verify whether the objectives of the study have been met or not. This section also seeks to validate the findings and describe their correlation to the research questions in order to show that answers have been provided to the research questions. The discussion on the findings emanating from the tested hypotheses provide an explanation and confirmation and/or otherwise of the theoretical assumptions that alleviating higher education challenges through strategic integration of technology can enhance teaching and learning outcomes. The study also focused on the impact of using information technology in higher education in general. The overall impact on the use of information technology include but not limited to its impact to alleviate higher education challenges; enhance teaching and learning outcomes; promote technology integration and transformation success in higher education; and realise ICTs potential benefits to higher education.

The mediating variables put forward in the study are paths to discuss the link on the awareness of the rationale for the integration and use of information technologies at the selected universities in Africa at the selected higher education institution in Africa; the historiography and pedagogical underpinnings of the integration of information technology; the challenges and limitations that may hinder the successful integration of information technology as well as overcoming the challenges and limitations to technology integration in higher education at the selected universities in Africa. Alternative to mere acknowledgement that there is a positive correlation and statistically significant relationship between the links offered in the previous sections and chapters, this chapter offers explanations on how the strategic integration of technology can alleviate and overcome the challenges and limitations that hinder technology integration and transformation in higher education in order to enhance teaching and learning outcomes at the selected universities in Africa.

10.3.1 Establish awareness of the rationale for the integration and use of adopted information technologies at the selected higher education institutions

To provide answers to the first research question which sought to establish the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa, research questions were set for participants to gain insight on their level of information technology acceptance, resistance and awareness to change in the use of information technology for teaching and learning purposes. The achievement of the first research objective was accomplished by aligning the research questions to the first adopted theory (change management model) which sought to argue that managing changes in higher education does not necessarily impose the introduction of new technology. Rather, it is about encouraging and motivating the people involved in the delivery of instructions or education to change the way they do things and their views about their respective roles in the institution. The significance of this point derives from Kershaw's (1996) change management principles through which the researcher could understand the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa.

Accordingly, the first question began with individual (academic) understanding and acceptance that change is needed. In the quest to understand the rationale for the integration and use of adopted technologies at the selected universities, academics were requested to indicate their disposition to the proposition that it is the university's obligation to provide strategies for implementing change in the use of technology (which may include certain policies that potentially compel academics to change to use of information technology whenever new ones are rolled out). Responses to the proposition regarding the need of information technology for different/specific educational purposes implemented by the university were then tested to further address the first research objective. Lastly, the final question in this category pertains to academics' disposition to the proposition that the university is responsible for and/or should create a suitable institutional structure to provide adequate support for promoting technology use.

In relation to achieving this research objective, a portion of the literature review shows contributing factors, challenges and instances of information technology integration across different higher education institutions in Africa and the rest of the world. As was identified in the problem statement, institutions are investing substantial amount of resources in an effort to successfully integrate information technology into teaching and learning, yet they are not seeing the promised benefits of technology (Chaka & Govender, 2017; Govender & Chitanana, 2016; Pennarola & Caporarello, 2013). This suggests that there is a need to establish the awareness of the rationale for the integration and use of adopted information technologies at higher education institutions. The review of literature showed the overview and landscape of higher education in Africa in general and then narrowed down to the overview and landscape of higher education in both Nigeria and South Africa. Literature findings further showed that both countries have different infrastructural development in terms of information technology penetration. South Africa was identified as a richer country in terms of technology and infrastructure. Findings from academics at the three selected higher education institutions depicted their encouragement/motivations towards technology acceptance, resistant as well as awareness to change in the use of information technology for teaching and learning purposes. The study also sought to understand the position of academics in terms of personal motivation to use information technology to deliver instructions and how they viewed their respective roles as academics within the university as well as probing the construct about change management self-awareness.

In order to achieve this connection, the study established that over 90% of academics at the three selected universities in Africa agreed that change in the use of information technology begins with them. It was also identified that majority of academics agreed to accepting change in the use of technology in order to enhance technology integration in higher education. The follow up response shows that majority of the participants want their higher education institutions to provide strategies for implementing these change(s) in the use of information technology. The implication of this is that academics prefer the university management/leadership to provide various strategies that will aid their use of technology for teaching and learning purposes. Academics' agreement to these questions also shows that academics want their universities to clarify the need of a particular technology for specific educational and/or teaching and learning purposes. The final part of these questions shows that majority (over 90%) of academics at the three selected universities agree that their universities should create suitable institutional structure that will provide adequate support for them to promote information technology use. The implication of these findings is that academics from the three selected universities are conscious of change management and are aware of the need to strategically integrate information technology into higher education to enhance teaching and learning outcomes as well as to promote information technology use amongst academics who may be resistance to change in the use of technology. Hence, the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa was established using these principles to justify the need for the objective.

10.3.2 Understand the historical trends and pedagogical underpinnings of the integration of information technology in higher education

In order to fulfil the second research objective of the study, the corresponding main research question was answered through a set of developed questions. The results obtained show academics' familiarity with information technology based on their historical trends and pedagogical underpinnings of the integration of information technology in higher education. The historical trends of information technology integration in higher education were examined in the study by developing questions that indicate academics' level of computer competencies; identify academics' knowledge on information technology (current and past); identifying the types of computer systems they use/have used; and the period in which they have been using computer/information technologies for teaching, learning and research purposes. In the quest to establish the pedagogical underpinnings of the integration of information technology in higher education, the research question delved into academics' perceptions on the types of information technology platforms they found most important for integration and their dispositions and the university's disposition towards the use of information technology facilities.

This objective aligned with the second adopted theory (Model of Technology Adoption in the Classroom) of this study that uses five step-hierarchical principles in order to better understand both traditional and modern applications of technology in education. There are five phases in the model and they include: Familiarity, Utilisation, Integration, Reorientation and Evolution. Each phase has its own concerns and corresponding support needed to provide an understanding to a lecturer's location within the construct of technology adoption. However, the full potential/benefits of any information technology will only be realised once the educator/teacher progresses through all the five phases, otherwise the technology will probably be misused or quickly discarded from use (Hooper & Reiber, 1995).

In the questionnaire, academics were asked to indicate their level of computer competencies and to provide further information on any training and/or retraining in information technology that they held or have in related courses. This examines the familiarisation and/or reorientation of any form of IT training they have had or might have been exposed to in the past/present. Another section of the questionnaire focused on the types of computer systems and applications that academics use or are familiar with (familiarisation and utilisation). These computer systems/application included operating systems (computer and mobile operating systems) as well as computer and mobile application software they use. Further questions around the historical trends included the period (time) they have been using (utilisation and integration of) information technologies for teaching and learning activities. Academics were asked to indicate their involvement and experiences in the use of e-Learning for teaching as well as learning and research activities which address the pedagogical underpinnings of the integration of information technology in higher education. The pedagogical underpinnings sought to address the questions – What, How and Why integrate technology in higher education. The findings pertaining to the second research objective were split into two. The first instance discussed findings regarding the historical trends of information technology integration in higher education. The second instance focused on discussions around pedagogical underpinnings of the integration of information technology in higher education.

In the first instance, the results obtained from the study regarding historical trends of information technology integration in higher education indicate that 98% of participants from the selected universities in Africa have moderate to very experienced knowledge and competencies in the use of computer and information technology. Findings show that although participants may have certain level of competencies in the use of information technology for teaching and learning purposes, these competencies were acquired not from any formal IT training or certification but rather through self-teaching. Specifically, the research findings show that information technology knowledge and/or skills were acquired by academics (69.20%) through their own efforts without any formal instructions.

The study's second objective sought to establish academics' involvement and experiences with e-Learning for teaching, learning and research purposes. The study shows in section 8.4.4 the correlation between academics' involvement with e-Learning for their own work and for the purpose of integration into teaching and learning practices. Based on findings, the study established that there is no correlation between these two constructs. Although 85.30% of academics indicated yes in response to the proposition regarding the use of e-Learning activities for their own personal work, it is important to note that such use of technology can be located within the broader context of promoting technology integration into teaching and learning in higher education in order for technology to alleviate higher education challenges and achieve its promised benefits to higher education.

Academics' involvement and experiences identified in the study to be relevant for promoting technology integration involved their e-Learning activities in collaboration with departments at institutions other than their own. As the study established in Table 8.20, there is statistically significant correlation (where the value of $p < 0.05$) between academics' e-Learning activity collaboration with other departments at their institution and promoting technology integration in higher education for teaching and learning. To support the achievement of this objective, the study established that there is significant correlation between academics' favourable inclination to be involved in e-Learning activities in the future and the promotion of technology integration into teaching learning practices. The implication of this findings is that the promotion of technology integration into teaching and learning practices should be a continuous approach and process in order to ensure it alleviates higher education challenges and fulfils its potential benefits to higher education.

The second instance focused on achieving the pedagogical underpinnings of the integration of information technology in higher education. This objective can be viewed with the intention of answering the questions: Why integrate technology into teaching and learning? What types of information technology platforms are important for integration in higher education? What are the characteristics or attitudes of academics and the institutions towards the use of information technology platforms/facilities? Answers to these questions were mined and the results of the study show that there were various technology platforms/facilities (learning tools) available for institutions to integrate into teaching and learning practices. Literature review showed there were over 200 relevant learning tools mostly used for pedagogical activities (Hart, 2015). The study established that these learning tools enable learners to process learning and work through big ideas as well as concepts that will aid their thinking, planning and decision-making on methods of creating and executing learning activities (PCAE, 2016).

However, the integration of these learning tools is almost impossible without the institution and the academics to integrate it into their teaching and learning practices. Therefore, the study identified a category of information technologies that serves the purpose of e-Learning in higher education. Apart from academics from Nigeria who indicated they *do not know* the technologies, the majority of academics who participated in the study indicated that these e-Learning technologies are very important for integration purposes. The study further established that these learning tools can be integrated into higher education as academics satisfy their teaching and learning needs. Table 5.4 shows the category of information technology identified in the study and the significance of each to achieving the objective of the study. The findings show that the information technology platforms identified are statistically significant (where the value of $p < 0.05$) to test the important learning technologies to promote technology integration in higher education.

The last two sets of questions focused on academics and institutions' disposition towards the use of information technology tools/facilities. A review of literature was used to depict different learning technology tools to test institutional and academics' personal disposition towards the use of information technology in higher education at the selected universities in Africa. As was presented in Section 9.4, the results indicate that email facility was the information technology tool of choice amongst the three selected universities. This implies that email facility serves as the most convenient and the easiest to use form of communication to a large number of audience within the institutions and for personal use. This tool renders itself useful amongst the academics, faculty and the students. Apart from the email tool, the Nigerian institution (LASU) lags behind in terms of the varying levels of usage of other information technology tools. However, the two South African institutions (UKZN and UNISA) make substantial usage of other information technology tools which are not limited to discussion forum tools; Vodcast, online tests and quizzes tools, Calendar and Dropbox tools. Overall, the study established that a very low percentage of academics at LASU indicated that their institution enables the usage of these information technology tools and provides little or no training to support the facilities. This implies that a majority of participants from LASU do not make use of these technologies to promote information technology integration in higher education. In contrast to the findings from LASU, findings from UKZN and UNISA (with significant number of academics) show that their institutions enable the use of the facilities and provide moderate training and support for these facilities to promote information technology integration.

In conclusion, the study established that majority of academics that participated in the study are aware of the different information technology facilities available and indicate a strong personal use of the facilities but no adequate training programmes and support were provided for the facilities. The findings correspond to the cross-tabulation of findings presented in Section 9.4.2 that shows *no significant* correlation between academic's involvement with e-Learning for their own work and for the purpose of integration into teaching and learning practices. The implication of this finding underscores the need for institutions to provide strategies and training programmes to enable the use of these facilities to promote information technology integration in higher education and to take full advantage of ICTs benefits. This findings still corroborates with findings gathered over 17 years ago by Gauci and Nwuke (2001), who in their study found that higher education institutions in African countries lag behind in terms of benefiting from the immense opportunities that ICTs has brought to their counterparts in developed nations. Efforts to overcome such challenges have yet not been successful but the recommendations offered in this study will assist in addressing some of higher education issues by alleviating technology integration challenges in higher education in order to enhance teaching and learning outcomes and to achieve ICTs promised benefits.

10.3.3 Identify the implications of challenges to information technology integration into higher education

In order to address the third research objective of the study, the research question aligned with the objective was answered. To unpack the statement of this objective, the study split the identification of challenges that may hinder the potential benefits of information technology in higher education into two categories. The first category established the various factors in determining the success of information technology integration in higher education. The second category used some of these factors as challenges and further established other challenges by requesting participants in the study to indicate the seriousness of the challenges in the use of information technology for teaching and learning purposes. Overall, the study was able to establish various challenges faced in the integration and use of information technology for teaching and learning purposes in higher education based on the overall experiences and perceptions of academics at the selected universities in Africa.

The results indicate that there is a positive relationship between technology integration challenges and the potential benefits of information technology to higher education. This is an indication that there is a correlation between these two constructs, which shows that the third objective of the study has been achieved. The findings in the first category confirm the relevance of the majority of the factors in determining the success of information technology integration in higher education identified in the study. These factors include time between introduction and adoption of technology, personal interest in the use of technology, availability of funds, availability of physical space, quality assurance, employment of skilled professionals, increased access to technology, institutional policies to support the use of IT, sufficient support from management level, availability of resources, adequate ICT infrastructure, adequate training facilities and government supports and intervention programmes. This is an indication that the identified factors (if available) will promote the success of technology integration in higher education and, if not available, technology integration may not prosper.

Amongst the 14 factors identified in this study to determine the successful integration of information technology, low student enrolment in higher education was considered of little importance to determining the successful integration of technology. This implies that low student enrolment in higher education does not really affect the integration of technology for teaching and learning purposes. However, the remaining 13 factors identified in the study have been established to be significant to determine the success of information technology in higher education as described in Section 9.3.

Overall, the implications of the factors identified in the study amount to 68% of total variance in the variables being tested to determine the successful integration of information technology in higher education. This shows the extent to which each of these factors is associated with successful integration of information technology in higher education.

The outcome of the second category of this objective established the various challenges faced in the use of information technology for teaching and learning in higher education. The implication of these challenges is that they are associated with hindering the realisation of the potential benefits of information technology in higher education. However, findings show that majority of the challenges identified are linked to lack of time to adopt information technology, insufficient funds, poor physical space, lack of IT skills by academic staff, lack of IT skills by students, inadequate access to technology, inadequate infrastructure, poor technical support by management, potential loss of personal revenue, lack of training facilities, excessive student enrolment and poor institutional policies. Survey results show that 43% of academics who participated in the study did not find potential loss of personal revenue a challenge in the use of information technology for teaching and learning. On the other hand, 57% of academics found it a challenge. This is an indication that majority of academics at the selected universities still use information technology at some personal financial cost (allocated grants or own finances) for teaching and learning. Discussion of findings associated with alleviating these challenges are presented in section 10.3.5 of the study.

10.3.4 Identify the limitations of information technology integration in higher education

This section of the study discusses the research findings associated with the fourth research question and objective. This question aimed at identifying limitations (if any) of information technology integration in higher education from the perspective of academics at the selected universities. Findings from the study provided answers to the fourth research question and objective and revealed how academics are able to describe the quality of support they received from their institution's administration/management in the integration of information technology. It also provided answers to how academics deal with unsatisfactory experiences in the integration of information technology. Indications on how often they report complaints to institution's management during the integration of information technology and the general academics' ratings of responses from the institution management to their complaints/queries were further discussed. The implication of these four constructs is that they were identified as limitations to technology integration in higher education. This study argues that unsatisfactory quality of support by university management limits technology integration in higher education. Academics require management support to integrate information technology for teaching and learning, and without adequate support from the university management, technology does not prosper (Sang and Tsai, 2009). However, the findings of the study show that about 76% of academics that participated in the study indicated that the quality of support they received from their institution's management was satisfactory.

In order to establish that the relationship between the 'quality of support' that academics received from university management is a dependent variable on the following three independent variables – unsatisfactory experience; complaint report and complaint response – a linear regression model was used to test the assumptions. This test was conducted by the researcher in order to ensure the accuracy of data entry, missing values, outliers and normality. Missing data were replaced with sample median value and a preliminary test of multivariate variables was performed to avoid the violation of the assumptions of normality, linearity, homoscedasticity and multicollinearity in the study. To ensure that there is no violation of assumptions, the following log was generated after the regression test was performed in SPSS, showing all the criteria and procedures followed in executing the regression model. Tables 10.5, 10.6 and 10.7 show the model summary, Anova and coefficient values of the observation respectively.

```
REGRESSION
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT Q20
/METHOD=ENTER Q21 Q22 Q23
/RESIDUALS NORMPROB(ZRESID).
```

Table 10.5 Model Summary of Independent and Dependent Variables

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.594[a]	.353	.349	.531	.353	105.506	3	581	.000

a. Predictors: (Constant), How would you rate the response of your institution administration to your complaints/queries? How often do you report complaints to your institution's administration? How do you deal with unsatisfactory experience in the integration of information technologies in your institution?

b. Dependent Variable: How would you describe the quality of support you received by your institution administration in the integration of information technologies?

Table 10.6 ANOVA Results of Independent and Dependent Variables

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	89.168	3	29.723	105.506	.000[a]
	Residual	163.677	581	.282		
	Total	252.844	584			

a. Predictors: (Constant), How would you rate the response of your institution administration to your complaints/queries? How often do you report complaints to your institution's administration? How do you deal with unsatisfactory experience in the integration of information technologies in your institution?

b. Dependent Variable: How would you describe the quality of support you received by your institution administration in the integration of information technologies?

Table 10.7 Coefficient Results of Independent and Dependent Variables

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.046	.094		11.088	.000	.861	1.231
	How do you deal with unsatisfactory experience in the integration of information technologies in your institution?	.312	.035	.345	8.992	.000	.244	.380
	How often do you report complaints to your institution's administration?	-.115	.028	-.144	-4.181	.000	-.170	-.061
	How would you rate the response of your institution administration to your complaints/queries?	.195	.020	.365	9.565	.000	.155	.235

a. Dependent Variable: How would you describe the quality of support you received by your institution administration in the integration of information technologies?

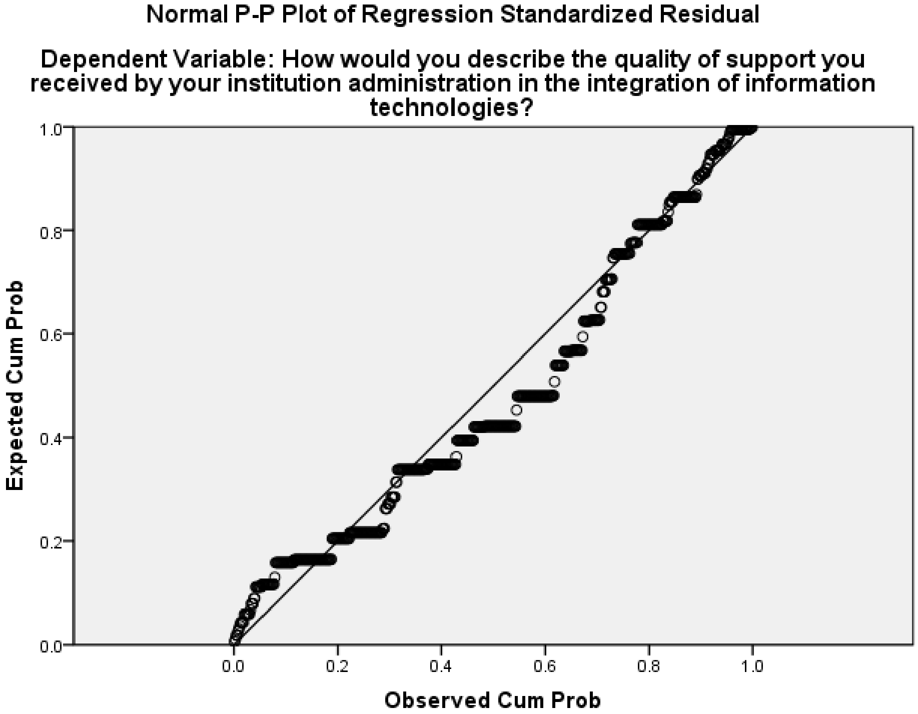


Figure 10.3 Normal P-P plot of Regression Standardized Residual

The researcher used three predictor variables (unsatisfactory experience; complaint report and complaint response) against one outcome variable (quality of support) to test the limitations of information technology integration in higher education. To ensure that no violation of assumptions occurred in the study, Table 10.5 performed the linear regression model summary of independent and dependent variables. The table shows that R square of .353 is adjusted to R square of .349 which indicates that the variables – unsatisfactory experience; complaint report; and complaint response – that academics undergo through their institutions' management in the integration of technology predicts 34.9% of the variation in the description of the 'quality of support' they received. The implication of the test is statistically significant at $p = .000$ ($p \leq 0.05$). In other words, significance was established in the relationship between the independent variables and the dependent variable.

Table 10.6 shows the ANOVA results of independent and dependent variables. The table also shows that a statistically significant relationship exists between the independent variables (unsatisfactory experience; complaint report; and complaint response) and the dependent variable ('quality of support'), where the value of p is .000, ($p \leq 0.05$). Table 10.7 shows the coefficient results of the independent and dependent variables. Table 10.7 indicates that the unstandardized Beta (β) coefficients of the independent variable unsatisfactory experience is .312 and standardized β coefficients is .345; unstandardized Beta (β) coefficients of the independent variable complaint report is -.115 and standardized β coefficients is -.144; and unstandardized Beta (β) coefficients of the independent variable complaint response is .195 and standardized β coefficients is .365 respectively. The corresponding p value of each of the independent variables is .000, which is less than 0.05. This indicates that significant positive relationship was established between the independent variables and dependent variable.

Figure 10.3 above shows the normal P-P plot of the regression standardised residual on the observation of the dependent variable. The study ensured that no violation of multicollinearity occurred by checking the outliers, normality, linearity, homoscedasticity and independence of residuals. The findings show that factors such as unsatisfactory experience in the integration of information technology; frequent complaint report to university management on technology integration challenges; and delayed and/or unsatisfactory response to academics complaints/queries affect the quality of support they receive from the university management in the integration of technology in higher education for teaching and learning purposes. These factors generally limit information technology integration in higher education. Having statistically established the relationships between these limitations, it can be said that the fourth research objective was achieved.

10.3.5 Solutions to alleviate the challenges and limitations that information technology may have on integration and transformation in higher education to enhance teaching and learning outcomes

The fifth research objective and question of the study were the last to be considered. Research objective five and research question five were formulated in order to propose solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education. To answer this research question and meet the research objective, the study applied a mixture of research methods (quantitative and qualitative). A mixture of quantitative and qualitative questions was formulated. The quantitative questions were closed-ended and the qualitative questions were open-ended. The intention was to have first-hand information and understanding on the types of drawbacks in terms of problems, issues, challenges and limitations that academics grapple with in their use and integration of information technology in higher education in relation to teaching and learning purposes.

Having identified the various types of drawbacks they experienced, the research question and supporting objective sought to establish the different types of support that academics feel their university management can/should provide to address the various drawbacks. Results gathered from the questions provided pointers as to the means for ensuring the sustainability of information technologies in higher education. The research objective can be said to have been met by establishing the different types of drawbacks and proposed solutions to alleviate the challenges that academics encounter in the use and integration of information technology in higher education in order to enhance teaching and learning outcomes. The following sub-sections present the opinions of academics with regards to the research questions and corresponding research objectives.

10.3.5.1 Establishing the types of drawbacks encountered in the use and integration of information technology in higher education

The outcome of the study with regards to academics' opinions on the types of drawbacks they encounter in the use and integration of information technology was linked to inadequate internet facilities; inconsistent power supply; lack of information technology skills by students and academics; irregular systems update; commercialization of information technology; insufficient facilities; and institutional policy. The findings obtained through the open-ended questions to achieve objective five can be associated with the challenges identified in the closed-ended questions to achieve objective three of the study. The results show that there is consistency in the findings and opinions of academics that participated in the study. The first-hand information provided by academics with regards to the types of drawbacks they encounter in the use and integration of information technology in higher education for teaching and learning purposes can decisively affect technology integration and transformation. Therefore, it can be said that the research objective five has been met.

10.3.5.2 Establishing the types of support to address the drawbacks in the use and integration of information technology to alleviate higher education challenges and limitations

This section of the study further discusses the types of support that academics suggested through their opinions that the university management can/should provide to address the drawbacks they encounter in the use and integration of information technology for teaching and learning purposes. Based on the qualitative analysis of findings, some of the support to address the drawbacks can be linked to the provision of adequate internet facilities; uninterrupted power supply; provision of IT skills training to students and academics; regular systems update, sufficient facilities and institutional policy. These supports form the basis of strategies that can be implemented to alleviate higher education challenges and enhance teaching and learning outcomes. The findings show that having these supports or strategies in place will alleviate technology integration challenges in higher education and the possible outcome of lifting this burden will enhance teaching and learning outcomes and ensure the realisation of the potential benefits of ICT to higher education.

The findings can be located in the context of the literature. Harrow and Oblinger (2015) noted that when there are appropriate strategies to support technology integration in higher education, the result will serve the purpose of successful technology integration and transformation. Therefore, information technology integration enhances learning outcomes and technology transformation allows learners to acquire knowledge in innovative ways. This is instructive, as the study has established and identified various challenges and/or limitations that may hinder the attainment of potential opportunities of information technology and transformation in higher education. Strategies identified in the study to propose solutions to technology integration will serve as appropriate tools to alleviate higher education challenges in order to enhance teaching and learning outcomes and achieve ICTs potential benefits to higher education. These strategies will not only alleviate higher education challenges but also provide means of sustaining the integrated technologies as noted in the discussion of the gaps that this study seeks to fill.

10.4 Discussion of Findings in relation to Institution's Management Support

This section of the thesis discusses the outcome of the study in relation to the follow-up responses presented in Section 8.6, gathered from university management in terms of their thoughts and opinions on the importance of technology integration in higher education. These responses were developed to further address the research problem by ensuring that the responses obtained from academics accurately reflect their thought/opinions. These findings were discussed to provide additional correlation over and above the statistical correlation that was carried out to validate academics' responses to the five main research questions. To validate the opinions of academics regarding the challenges and limitations in the use and integration of information technology for teaching and learning purposes, qualitative types of questions in the form of email interview were developed and sent out to university management at the selected universities in Africa. The types of questions developed were open-ended questions intended to seek greater understanding and opinions of institution's management regarding information technology integration in higher education.

These open-ended interview questions were asked to probe the quantitative research questions presented to academics. These open-ended questions were required to establish the challenges (if any) faced by management and/or academics as well as the challenges they are aware of that academics contend with in the use of information technology for teaching and learning purposes. This inquiry was necessary since university management provides IT support to the institution, including academics, faculties and students in general. The institutional and systemic challenges that university management identified as impediments to technology integration in higher education were validated through the open-ended questions. The open-ended questions further probed the drawbacks that exist within the higher education environment. Lastly, open-ended questions required university management to respond and give reasons as to why they considered technology integration to be critical for higher education.

After the review and analysis of findings using Nvivo 11 software to import, code, query and summarise data to thematic analysis of findings, the study identified five major themes which are discussed below. The themes, from the perspective of management, are management's understanding of technology integration in higher education; identification of information technology integration challenges; understanding of institutional and systemic challenges; drawbacks in the integration of information technology; and understanding of the significance of information technology in higher education.

10.4.1 Management's Understanding/Knowledge of Technology Integration in Higher Education

The study revealed that management at the selected universities in Africa has a clear understanding of what technology integration entails. The study further revealed that university management understands that technology integration generally solves and eases day-to-day usage of information technology for teaching and learning purposes. In addition, the study revealed that management described technology integration as means to solve institutional problems. These findings correlate to the quantitative results obtained from academics when the majority agreed to have used information technology for a minimum of two years as well as agreeing to have been involved in the use of technology for own work, collaboration with departments and for research, teaching and learning purposes. This shows a direct/positive correlation and understanding that academics' agreement to using information technology for the aforementioned purposes actually eases and solves specific teaching and learning problems. This was evidenced, for example, by the findings from the university management which mentioned that it substitutes the use of paper-based learning due to frequent change and evolution of technology within the university environment. Management further revealed that the integration of information technology in higher education ensures the effective use of educational resources towards achieving enhanced teaching and learning experiences and outcomes.

10.4.2 Information Technology Integration Challenges

In the quest of probing the kind of challenges that management are faced with and/or that management are aware of that academics are faced with in the use and integration of information technology in higher education, university management first alluded to the fact that not all academics are technology savvy. This implies that not all academics have the basic IT knowledge and skills. The study further revealed that academics' resistant to change in the use of information technology is one the challenges management are faced with in the integration process. It was noted that convincing academics who were comfortable with using the traditional way of teaching for several years was challenging. To this end, it is obvious that the need to conduct this type of research was necessary and relevant to the field of study. The adoption of change management model when developing the concepts of the study proves its relevance to this result. An understanding (Section 10.3.1) of academics' perception regarding their need for university management to provide strategies to implement changes in the use of information technology and to create suitable institutional structure to provide adequate support for promoting technology correlates to the findings gathered from the university management.

The study also revealed that the pace (time) of change in technology use for teaching and learning by academics was challenging. Academics may be slow to catch up with technology as it evolves. Another challenge established in the study involves students' access to technology. Despite the fact that the study focuses on academics' challenges and management support in the integration of technology processes, students are also an important part of the teaching and learning processes. Hence, their place and circumstances in the integration process cannot be ignored. The study revealed that management at the selected universities found that students do not have adequate access to information technology. This is due to poor infrastructure in the rural areas, cost of purchasing data and devices such as computers and smartphones. Unskilled educators (on contemporary learning methods), lack of technology integration visions (policies) by the institutions' management and unprepared students (in relation to evolving learning tools) are other challenges established in the study.

10.4.3 Institutional and Systemic Challenges

Discussions focusing on institutional and systemic challenges revealed that the university management found bureaucracy a challenge. This could be attributed to government interference in the running/management of the institution and influencing frequent changes in institution's policies. Top university's management positions (such as Chancellors and Vice Chancellors) are usually filled by political appointees, which could in a way create fractions/division in the university's management visions and/or goals. The presence of institutional management's leadership that has little or no interest and/or does not support technology usage and integration visions was also found to be challenging. Inadequate training and support programmes pose great challenges to technology integration in higher education. These findings correlate to the quantitative findings obtained from academics when majority revealed that their institution does not enable and does not provide training and support programmes for the information technology facilities (learning tools) identified in the study. Some of the learning tools included but not limited to discussion forums tool, podcast, Vodcast, IM, email and online tests. In addition to the established challenges in this theme, insufficient time to integrate technology, poor support, inadequate resources and poor access to technology were identified by the university management as institutional challenges that hinder technology integration in higher education. This list of results correlates to the identified challenges outlined in the quantitative results as very serious challenges in the use of information technology by academics for teaching and learning purposes at the selected universities in Africa.

In terms of systemic challenges, the study established that infrastructure delays constitute a main challenge that hinders the integration of information technology in higher education. The majority of the university's management found resistant to change a challenging factor in the integration of information technology in higher education. In addition, participants identified other impediments such as 'cost' in terms of expensive data rates and affordability of technology devices to support technology integration in higher education. This study finds that these identified challenges slow the pace of technology integration at the selected universities in Africa.

10.4.4 Drawbacks of Information Technology Integration

In terms of drawbacks in the integration of information technology in higher education, the study established that the university management identified inadequate technical experts in the use and integration of technology from management support role as a major challenge. This implies that the university management realises that there is a lack of skilled IT personnel that can provide adequate support to faculties and/or departments in order to enhance technology integration processes. Another challenge identified by the management pertains to lack in systems upgrade. This implies that most institutions lag behind in terms of systems upgrade. For example, at the time that the study was conducted, it was found that many of the computer systems at the selected institutions in Africa still ran Windows 7 Professional when they were supposed to be running most of the systems and applications in Windows 10 professional. This poses a great challenge to universities as cutting-edge applications used for teaching and learning purposes are required to run better on the latest Windows or other operating systems. This is so because technology is constantly evolving while most higher education institutions are left with obsolete technologies.

Inadequate support from heads of departments at the selected universities in Africa was found to be another challenge faced in the integration of information technology. This result may be attributed to the findings established under institutional and systemic challenges which indicated that intuitions' leadership showed little interest and provided inadequate support in technology usage and integration. In line with the foregoing, poor understanding as to why specific technology should be used for certain teaching and learning practices was established as a challenge. This implies that university management needs to clarify the need for information technology for different educational purposes. This finding correlates to the quantitative results obtained from academics when they were required to present their opinions on the imperative for the use of information technology in higher education. Almost all the academics that participated in the quantitative survey indicated that they wanted their respective institutions to clarify the need for information technology for different educational purposes. Furthermore, academics indicated that the institution should create suitable institutional structure to provide adequate support for the promotion of technology use and integration. Lastly, university management identified resistance to change as a challenge. The resistance was informed partly by the fear of the potential negative effect of technology, for example, that technology may take over the roles currently performed by humans such as replacing manpower with machine (automated systems) which will affect humans in the long run.

10.4.5 Significance of Information Technology Integration in Higher Education

The study established that both academics and management support that participated in the study agreed and considered the integration of information technology to be significant and/or critical for higher education. This is so because the study established that management support thought that information technology integration makes teaching and learning more interesting. The study further established that the university management found information technology integration to improve users' skills, increase collaboration and reduce paper-based textbooks. Adding to the significance of information technology integration in higher education, the study established that it makes data processing easier and faster to store and retrieve, creates platforms for frequent training and support programmes and improves the online presence of the institution which makes such institution highly competitive and most likely gives the institution an edge over others.

The study established that technology integration in higher education makes it easy for graduate students to integrate relatively easily into the work environment as they would have been exposed to a lot of contemporary technologies they might find useful at work. In view of the foregoing, the study established that technology speeds up teaching and learning, which allows more practical learning experience to be achieved (Ng'ambi et al., 2016). Therefore, teaching and learning labs can be offered online and practical sessions can be made available and viewed repeatedly online through live tutors and/or videos.

10.5 Discussion of findings in relation to the adopted models

This section discusses the findings of the study in relation to the three theoretical frameworks adopted to underpin the construct of the study's conceptual lenses. In terms of the link between the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa, the findings are discussed in relation to academic's resistance to change and change management awareness. Discussions on the link between historical trends and pedagogical underpinnings of the integration of information technology in higher education are based on the principles to better understand both traditional and modern applications of technology in education which included familiarization, utilization, integration, reorientation and evolution. Finally, findings on the link between challenges and limitations to technology integration are discussed in relation to factors contributing to the adoption of technology.

10.5.1 Relationship between the awareness of the rationale for the integration, use of adopted information technologies and change management awareness

The results of the study cohere with the assumptions of the change management model by Kershaw (1996). Managing changes and creating change management awareness in higher education do not necessarily impose the introduction of new technology. The core value is about encouraging and motivating the people involved in the delivery of instructions/education to change the way they do things and their views about their respective roles in the institution. The five dimensions adapted from Kershaw's change management model in higher education are applicable here. The first two of the dimensions were established as self-awareness initiatives (change begins with individual; and individual acceptance to change). The remaining three dimensions were established as institutional initiatives, which required the institution to include the provision of strategies to implementing change; clarifying the need of IT for specific educational purpose; and creating suitable institutional structure to provide adequate support for promoting technology use.

The outcomes of the study fit into the assumptions of the change management model and the five dimensions adapted. Academics at the three selected universities in Africa have positive perceptions towards the construct of the model. Academics' feelings about the imperative for the use of information technology in higher education show that they are aware of the need to change the way they do things and they feel they should be encouraged and motivated by their institution to use and integrate information technology into their teaching and learning practices. The outcomes also revealed that academics prefer their institutions to provide strategies for implementing change(s) in their use of information technology as well as clarify the need for a specific information technology for different educational purpose and/or task. Finally, it is understood that academics also want their universities to provide suitable institutional structure to provide adequate support for the promotion of information technology use and integration in higher education for teaching and learning purposes. The findings indicate that in general, academics are aware of change management and are willing to change should there be appropriate structure and support from their respective institution's management.

10.5.2 Relationship among historical trends, pedagogical underpinnings of the integration of information technology and the principles of traditional and modern application of technology

Discussions on the link among historical trends and pedagogical underpinnings of the integration of information technology in higher education based on the principles to better understand both traditional and modern applications of technology in education is presented in this section. These principles are based on Hooper and Reiber's (1995) model of technology adoption in the classroom. The model utilises five-step hierarchical principle which include *familiarization*, *utilization*, *integration*, *reorientation* and *evolution*. The findings of the study fit into the assumptions of the model. According to the model, each step has its own concerns and corresponding support needed to provide an understanding of an academic's location/role within the construct of technology adoption. In the context of the study and taking the first step (familiarization) into consideration, a considerable number of academics who participated in the study show a high level of competency in the use of computer/information technology. Almost 99% of academics indicated 'moderate' to 'very experienced' in response to the proposition on computer competency. This is an indication that there is a common historical trend amongst the participants and almost all the participants are aware of information technology in higher education.

Having established that academics are familiar with information technology, the study moved to the next step by testing academics' *utilization* of information technology in higher education. The study established that majority (86%) of academics have been utilizing information technology for more than 2 years. The implication of using information technology for teaching and learning purposes for a period over 2 years shows that users are relatively experienced and findings from such people will have strong elements of reliability in terms of opinions. Although the possibility of bias cannot be completely ruled out, the study undertakes statistical analysis of regression to manage and mitigate elements of bias in the analysis of findings. The results in this component of the research also support the pedagogical underpinnings that sought to address the questions – What, How and Why integrate technology in higher education. In relation to the forgoing, the study established that there is statistical correlation among academics' utilization and involvement in the use of information technology for research, teaching and learning purposes. The majority of academics at one stage in their experience of using information technology for research, teaching and learning purposes have been involved in e-Learning activities within their own work, collaboration with departments other than their own and are willing to be involved in e-Learning activities in the future.

The *integration* step of the model required academics to indicate specific information technology platforms they deemed important and adopted by their institutions for teaching and learning purposes. The results show that academics at the selected universities in Africa are aware of the different information technology platforms such as LMS/CMS, OER, ODL and MOOCs. The findings also show a high rating of academics' views as to the efficacy of the identified information technology platforms. Next, *reorientation* in the adoption of information technology was tested. The results show similarities and differences in the information technology facilities enabled at the selected universities, presented in Section 8.4 of the thesis. Some of the information technology facilities identified in the study include but are not limited to discussion forum, podcast, VODcast, IM, Bulletin board, email, Wiki and online test and quizzes tools.

The findings show that in terms of similarities, email facility was the information technology of choice across the selected universities. In terms of differences, there are varying levels of information technology enabled at the institutions due to unavailability, lack of orientation and training support programmes on the facilities. In general, a high number of participants indicated that they make use of the information technology facilities for their personal usage yet, the study shows that the universities did not enable the usage of many of the facilities identified in the literature. Moreover, the universities did not rank highly in terms of providing training and support for the facilities. The implication of institutions not enabling information technology facilities and not providing adequate training and support for information technology facilities will generally prevent or impede *evolution*. The assumptions of the model of technology adoption in the classroom offer some utility to this study. Therefore, for information technology to be successfully integrated/adopted, the institution's management needs to create strategies and/or policies that will encourage/motivate technology use amongst academics who are expected to introduce technology into the classrooms. The results on this thematic area correlate with Groff and Mouza's (2008) findings that encourage educators to use information technology resources through institutions' management support to promote technology integration in order to enhance teaching and learning outcomes.

10.5.3 Relationship among challenges, limitations to technology integration and factors contributing to adoption of technology

This section of the study shows the link between challenges and limitations to technology integration in higher education which are discussed in relation to factors contributing to adoption of technology. Rogers' (2003) diffusion of innovation theory was adopted to underpin the concepts of this study. Diffusion process was described as a process in which innovation is being communicated through certain channels over time and within a particular social system. The construct of DoI offers great utility to the study. Specific construct and elements of the theory were integrated into the construct of the study. The first element adapted in the study focused on one of the diffusion process elements – ‘time’. According to DoI, time is an important element in the adoption process. Time is relevant in terms of the period it takes for the innovation/technology to be accepted; hence, it forms an important element in the factors and challenges identified in the study. The second element adapted was ‘social system’. Social system in the diffusion process refers to individual, organisation, groups, people and subsystems associated with the adoption stages. In the context of the study, the social system includes academics and university management that make up the study’s sample. Another construct adapted in the study was the categories of adopters. DoI identified five different categories of adopters in the diffusion process. These included innovators, early adopters, early majority, late adopters and laggards. The study identified and described the categories that the participants of this study belong to (Section 8.7.1) in terms of adoption.

Lastly, the assumptions of DoI state that for innovation to be successfully adopted or have a rapid adoption rate, it should have a greater relative advantage over the existing practices, compatibility to user’s needs perceiving the innovation as being reliable or dependable, trialability, observability and be less complex in the use of technology. These assumptions were used to develop several factors that determine the successful integration of technology in higher education. As mentioned earlier in section 10.3.3, some of the factors the study established through DoI assumptions as contributing factors can be linked to time between introduction and adoption of technology, personal interest in the use of technology, availability of funds, availability of physical space, quality assurance, employment of skilled professionals, increased access to technology, institutional policies to support the use of IT, sufficient support from management level, availability of resources, adequate ICT infrastructure, adequate training facilities and government supports and intervention programmes. Successful placement and/or alignment of these factors will lead to evolution or IS implementation success (adoption) as described by Rogers (2003).

The same assumptions helped the study to establish some of the challenges and limitations that affect information technology integration in higher education. In the dimensions of *technical complexity* (ease of use) of the technology integrated and used in higher education for teaching and learning purposes at the selected universities in Africa, the study was able to establish that unsatisfactory experience in the use of technology for teaching and learning, increased complaint report in the integration process and delayed complaint response by university management to academics’ need cause unsatisfactory quality of support which in turn limit information technology integration in higher education.

This study has found that the adoption of the assumptions of the three theories highlighted in the study guided the study towards achieving its objectives. The similarities in the adopted theories such as individual perceptions to innovation, information technology familiarity/use, change in social systems and support, time, technical compatibility and complexity – ease of use (training and retraining), all offer immense utility to the concepts/constructs of the study. These assumptions are important forerunners to information technology implementation success (Agarwal & Prassad, 2003; Bradford & Florin, 2003, Cooper & Zmud, 1990; Crum et al., 1996) and their applicability to the study contributes towards finding answers to the research questions

10.6 Chapter Summary

This chapter extensively discussed the study's findings in relation to the research questions and the research objectives formulated to address the problems of the study. The findings discussed in this chapter revealed that statistically significant relationship exists between the alleviation of higher education challenges through strategic integration of technology and its impact to enhance teaching and learning outcomes at the selected universities in Africa. In order to answer the research questions and meet the research objectives of the study, research hypotheses were formulated and statistically tested. The study confirmed the existence of widely held perceptions amongst academics at the selected universities in Africa that alleviating higher education challenges through strategic integration of technology has a direct impact on enhancing teaching and learning outcomes. Further into the discussions, the study established the existence of a relationship between overall experience of academics in the use and integration of technology and the extent to which technology integration is critical to enhancing teaching and learning outcomes. The study established that academics' satisfactory experience in the use of technology feeds into the extent to which the integration of information technology is critical to enhancing teaching and learning. However, unsatisfactory experience by academics at the selected universities in Africa may undermine the success of technology integration and the extent to which it enhances teaching and learning outcomes.

The outcome of the study offered insights on academics' level of information technology acceptance, resistance and awareness to change in the use of information technology for teaching and learning purposes. Through these insights, the study was able to establish the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa. Some of the outcomes established that academics prefer the university management to provide various strategies that will aid their technology use for teaching and learning purposes. Academics also want their respective universities to clarify the need of a particular technology for specific educational and/or teaching and learning purpose(s). Finally, academics at the three selected universities agree that their respective universities should create suitable institutional structure(s) that will provide adequate support for them to promote information technology use which would enhance sustainability of the technologies. The study established that almost all the academics who participated in the study have moderate to very experienced knowledge and competencies in the use of computers and information technology. The results of the study show there were various technology platforms/facilities (learning tools) available for institutions to integrate into teaching and learning practices. Therefore, the study established that these learning tools enable learners to process learning and work through big ideas as well as concepts that will aid their thinking, planning and decision-making on methods of creating and executing learning activities.

Moreover, the study further established the factors that determine the success of technology integration in higher education and factors that hinder the integration of technology (i.e. challenging and limiting factors). These factors were considered part of the overall experience of academics in the use of information technology. Therefore, the study established that academics at the selected universities were able to identify different challenges that hinder the success of technology integration in higher education. The results obtained from academics indicate that there is a positive relationship between technology integration challenges and the potential benefits of information technology to higher education.

The following chapter presents the summary of the research findings in relation to the quantitative and qualitative results obtained from the selected universities. It also presents recommendations and concludes the study by highlighting suggestions for further research.

CHAPTER ELEVEN

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

11.1 Introduction

This chapter presents the overall summary of findings, recommendations and concludes the thesis. The chapter rounds off the discussion and analysis of academics' perceptions on the impact of integrating information technology to alleviate higher education challenges in order to enhance teaching and learning outcomes at the selected universities in Africa. It then offers a number of recommendations drawn from observations and deductions established on the views and opinions expressed and implied in the responses of participants (both academic and management staff).

The overall objective of the study was to interrogate the alleviation of higher education challenges through strategic integration of technology in order to enhance teaching and learning outcomes at selected universities in Africa. This objective was assessed against the backdrop of potential and actual benefits of ICTs to higher education. The objectives of the study were further evaluated from a cognitive perspective using change management model, model of technology adoption in the classroom and diffusion of innovation theory to mediate variables linking strategic information technology integration to alleviating higher education challenges and its implications for teaching and learning outcomes. The mediating variables led to the expansion of the usage, factors, challenges and limitations of information technology on the interplay between strategic integration of information technology to alleviate higher education challenges and its impact to enhance teaching and learning outcomes at the selected universities. The summary of the major findings with regards to literature review Chapters (Two, Three and Four), quantitative and qualitative data analysis are presented in the chapter. However, the conclusions of this study are based on the five major research objectives highlighted as follows:

- To investigate the awareness of the rationale for the integration and use of information technologies at the selected universities in Africa;

- To examine the historiography and pedagogical underpinnings of the integration of information technology in higher education;

- To identify the challenges to information technology integration into higher education;

- To identify the limitations of information technology integration in higher education; and

- To propose solutions to alleviate the challenges and limitations of information technology integration to enhance teaching, and learning, and transformation in higher education.

It can be stated that the research objectives of this study were realised based on the empirical evidence and the overall conclusion of the study.

11.2 Summary of Major Findings from Literature Review and the Contribution of the Study

The literature review presented in Chapters Two, Three and Four in relation to the adopted theoretical framework of the study and the context of information technology integration in higher education and its impact to enhance teaching and learning showed that much research has been conducted on the direct link between the variables across the world. In contrast, there is scarcity of research activities on the alternative route proposed in the study, through strategies to integrate information technology into higher education by alleviating higher education challenges in order to enhance teaching and learning outcomes and allow ICTs to achieve its promised benefits to higher education. The findings of the study consequently extend the frontiers of knowledge, especially on the mediating impact of strategic information technology integration to alleviate higher education challenges in order to enhance teaching and learning outcomes at the selected universities in Africa.

Research conducted in the past decades on the link between strategies to integrate information technology into higher education by alleviating higher education challenges in order to enhance teaching and learning outcomes and allow ICTs to achieve its promised benefits to higher education have not been adequately explained across the globe. In addition, there has been a paucity of studies on these variables in African contexts. Hence, this study offers an explanation on the link between strategically integrating information technology into higher education to alleviating higher education challenges in order to enhance teaching and learning outcomes. Strategically integrating information technology into higher education had full mediating effect on the interplay between alleviating higher education challenges and enhancing teaching and learning outcomes which will in turn allow ICTs to achieve its promised benefits to higher education.

The construct 'successful strategic integration of technology' was measured with factors revealed through statistical reliability (using Cronbach's Alpha) and validity (factor analysis). The factors include time between introduction and adoption of technology, personal interest in the use of technology, availability of funds, availability of physical space, quality assurance, employment of skilled professionals, increased access to technology, institutional policies to support the use of IT, sufficient support from management level, availability of resources, adequate ICT infrastructure, adequate training facilities and government supports and intervention programmes. Therefore, successful strategic integration of technology offered constructive explanation of the link between alleviating higher education challenges and enhancing teaching and learning outcomes for ICTs to achieve its promised benefits to higher education at the selected universities in Africa.

The secondary sources of data gathered through review of literature across Africa and the rest of the world on the link between information technology integration in higher education and its impact to enhance teaching and learning showed that information technology integration in higher education has brought changes to the teaching and learning process. These changes have been associated with new challenges that require adequate review for information technology to achieve its promised benefits to higher education. In addition, the secondary sources of data showed that successful technology integration in higher education is positively associated with the mitigation of higher education challenges and motivates both academics and students in the use of technology. Furthermore, technology integration has the capability of allowing educators to apply technology in teaching curriculum and facilitate collaboration and co-operation within learning environment as well as the capability of engaging students to learn at a high level, which enhances teaching and learning outcomes in the long run.

11.3 Summary of Findings from the Quantitative Data (Questionnaire)

The major findings of the research from the tested hypotheses provided reliable answers to the research questions through which all the objectives of the study were met. The study's finding in relation to the first research question and corresponding objective revealed that the understanding of the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa would create a platform for other higher education institutions in Africa to examine their academic personnel's level of information technology acceptance, resistance, as well as their awareness to change in the use of information technology for teaching and learning purposes. It was established that managing changes in higher education does not necessarily impose the introduction of new technology. It is relatively about encouraging and motivating academics involved in the delivery of instructions or teaching to change the way they do things and their views about their respective roles in the institution. The findings show that majority of academics want their higher education institutions to provide strategies for implementing these change(s) in the use of information technology. The implication of this finding is that academics prefer the university management/leadership to provide various strategies that will aid their technology use and integration for teaching and learning purposes. This emerged as the starting point of the alternative route to integrating information technology into higher education at the selected universities in Africa.

Academics at the selected universities in Africa may have certain level of competencies in the use of information technology for teaching and learning purposes. The study established that the competencies were not acquired from any formal IT training or certification but rather through self-taught. This implies that information technology knowledge and/or skills were acquired by academics through their own efforts without any formal instructions or training organized by the institutions. The study revealed academics and institutions' disposition towards the use of information technology tools for teaching and learning purposes. The findings show that academics at UKZN and UNISA utilise similar learning tools in contrast to their LASU counterparts. The tools used at UKZN and UNISA include but not limited to blogs, discussion forums, Vodcast, online tests and quizzes tools, IM and Dropbox tools. It was established that email was the common technology tool of choice mostly used amongst the three selected universities. The implication of the findings shows that learning tools do not have similar popularity and usage at the same level across the selected universities.

Time between introduction and adoption of technology, personal interest in the use of technology, availability of funds, availability of physical space, quality assurance, employment of skilled professionals, increased access to technology, institutional policies to support the use of IT, sufficient support from management level, availability of resources, adequate ICT infrastructure, adequate training facilities and government supports and intervention programmes were factors significantly related to successful integration of information technology in higher education. These factors alleviate higher education challenges, promote technology integration, and enhance teaching and learning outcomes in higher education.

It was established that various challenges are associated with achieving the promised benefits of information technology to higher education. Challenges such as lack of time to adopt information technology, insufficient funds, poor physical space, lack of IT skills by academic staff, lack of IT skills by students, inadequate access to technology, inadequate infrastructure, poor technical support by management, potential loss of personal revenue, lack of training facilities, excessive students enrolment and poor institutional policies were associated to limiting teaching and learning outcomes and hindering the promised benefits of information technology to higher education.

Unsatisfactory quality of support by university management limits technology integration in higher education. The study established that there is a significant relationship between the 'quality of support' academics received from university management which is a dependent variable on the following three independent variables – unsatisfactory experience; complaint report and complaint response. This implies that unsatisfactory experience in the integration of information technology; frequent complaint report to university management on technology integration challenges; and delayed and/or unsatisfactory response to academics' complaints/queries affect the quality of support they receive from the university management in the integration of technology in higher education for teaching and learning purposes.

Overall, the study established that inadequate internet facilities; inconsistent power supply; lack of information technology skills by students and academics; irregular systems update; commercialization of information technology; insufficient facilities; and institutional policy were the major drawbacks academics encountered in their use and integration of information technology in higher education.

In order to provide appropriate support to mitigate these challenges, academics suggested that the provision of adequate internet facilities; uninterrupted power supply; provision of IT skills training to students and academics; regular systems update, sufficient facilities and institutional policy would provide solutions to alleviate the challenges and limitations that information technology may have on integration and transformation in higher education in order to enhance teaching and learning outcomes at the selected universities.

11.4 Summary of Findings from the Qualitative Data (Interviews)

The following themes emerged from the qualitative data gathered from management at the selected universities in Africa: management's understanding of technology integration in higher education; identification of information technology integration challenges; understanding of institutional and systemic challenges; drawbacks in the integration of information technology; and understanding of the significance of information technology for higher education from management viewpoints. These themes can be categorised into management's opinions and thoughts with regards to significance of information technology integration into higher education and challenges management faced or are aware of that academics face in the use and integration of information technology for teaching and learning practices.

The qualitative findings revealed that management at the selected universities in Africa understand and were able to address the question what, how and why integrate information technology in higher education. This generally described the purpose of integrating information technology in higher education. Typically, management expressed their opinions and revealed that technology integration generally solves and eases day-to-day usage of information technology for teaching and learning purposes. This was further expressed as a means to solve institutional problems. In the quest for answers to the research questions, management at the selected universities noted that not all academics were technology savvy, hence; they experienced technology integration resistance from specific academics which makes it difficult to integrate technology across board. This was identified as a major challenge to successful technology integration procedures. Another factor was time, which the university management thought was a challenge with regards to the pace of change in the use and mastery of information technology for teaching and learning practices. This speaks to the reality that some academics are slow to catch up with technology as it evolves.

It was also revealed by the management at the selected universities that students do not have adequate access to information technology. This is due to poor infrastructure in the rural areas, cost of purchasing data and devices such as computers and smartphones. This was identified as another major challenge in the integration of information technology procedures. As noted above in section 10.4.2 "students are also important part of the teaching and learning processes;" therefore, it is important to take cognisance of this challenge in order to be able to propose adequate solutions to address technology integration strategies proposed in this study.

Other challenges identified by university management include but are not limited to bureaucracy, poor leadership interest in technology integration goals/visions, inadequate training and support programmes to both academics and students, inadequate resources, unskilled educators on contemporary learning methods, lack of technology integration visions (policies) by the institutions' management and unprepared students to evolving learning technologies. These challenges hinder technology integration in higher education, based on the experience and perceptions of university management in the integration of technology procedures.

In the attempt to identify the major drawbacks in the integration of information technology in higher education at the selected universities in Africa, the university management revealed that inadequacy and shortage of skilled IT personnel to provide adequate support to academics and faculty were a drawback. Poor and/or irregular systems upgrade (as identified by academics in the quantitative data) were also identified as drawbacks encountered in the integration of information technology in higher education.

Overall, university management showed a clear understanding of the construct technology integration in higher education and were able to identify its specific significance to higher education. The study established that the university management takes note that integrating information technology into higher education makes teaching and learning a more interesting practice. Another significance identified in the study showed that information technology integration improves users' skills, increases collaboration and reduces the use of paper-based textbooks. Lastly, the study established that information technology integration makes data processing easier and faster to store and retrieve. Information technology integration makes it easy and fun to create teaching and learning platforms (such as LMSs, CMS, Blogs and Discussion Forums) as well as for frequent training and support programmes and improves the online presence of the institution.

11.5 Summary of each Chapter

Chapter One presented the basic introduction of the study, based on the background, problem statement, research objectives, research questions and statement of research hypotheses. A summary of research methodology was presented which aligns with the research settings and reason for comparison. Motivation, relevance, and gaps to be filled in the study were presented. The chapter further presented the research limitations, the research output of the study and layout of the thesis.

Chapter Two began the literature review chapters by first presenting the adopted theoretical frameworks of the study. It then presented literature review in the context of information and communication technologies. Some aspects presented included the historical background of information technology integration in higher education and pedagogical underpinnings of the integration of technology, which was reviewed to provide answers to the need of integrating technology into higher education. The chapter further reviewed the role and importance of technology integration, impact of integrating technology in higher education, and overview of the history of ICTs in Nigeria and South African higher education sector where the study was conducted. Finally, the chapter dealt with ICT for development solutions leading to the discussion of modern educational ICTs and the top-rated learning tools available for technology integration purposes in higher education.

Chapter Three presented modern educational information and communications technologies. This presentation was followed with discussions on e-Learning concepts, merits, components and facilities within higher education context. The chapter also discussed other modern and emerging information and communications technologies in detail. The technologies included Learning Management Systems (LMS), Open and Distance Learning (ODL), Massive Open Online Courses (MOOCs), Mobile Learning, Web 2.0, Internet of Things (IoT) and Cloud Computing that were utilised in the study instrument to measure academics' disposition towards the use of the technologies. The last section of the chapter presented the top-rated learning tools that higher education institutions may find useful and integrate to enhance teaching and learning processes. Arguments regarding successful integration of learning tools in higher education were presented to close off the chapter.

Chapter Four presented literature review on the profile and landscape of higher education as well as the technical background of information technology integration in higher education and the challenges posed in its integration at the selected universities. This was done in the context of Africa in general and the rest of the world. The roles academic and management staff play in technology integration were reviewed. Instances of various technology integration strategies at the selected countries (Nigeria and South Africa) and other part of the world were also reviewed in order to identify what was considered successful and not successful technology integration strategies.

Chapter Five presented the research methodology as it provided detailed instruments used in the research. It also presented administrative and implementation processes carried out in the research and related approaches and techniques to the research objectives in more detail than presented in Section 1.7 of Chapter One. The chapter discussed the research philosophy adopted, including its strengths and limitations. The study adopted pragmatism as the appropriate philosophical stand for this study and further justified its use. An explanatory research design was adopted. This was necessary in order to adequately describe and explain the relationship between alleviating higher education challenges through strategic technology integration and its impact on enhancing teaching and learning outcomes at the selected universities in Africa. The analysis was executed by adopting a simple random sampling technique. A cross-institutional analysis approach was adopted to collect data using the principles of contemporary mixed methods design, where priority was given to quantitative data collection technique and analysis procedures. Chapter Five further presented the administrative procedure of the research design, population of the study, sampling techniques, methods of analysis linking models, and statistical concepts.

Chapter Six delved into data presentations and analysis of findings within the construct of change management, familiarity, and technology integration across the three selected institutions. Data were presented and analysed in relation to the collected data during the field work. Presentation of data was analysed using two major statistical software, IBM SPSS 24 and Nvivo 11. Chapter Six targeted findings from Lagos State University, Nigeria. The chapter presented the background information of respondents, change management self-awareness, familiarity and important information technologies for higher education at LASU. In addition, LASU respondents' institutional and personal dispositions towards the use of information technology, predisposing factors and challenges inherent in the adoption of new technologies were presented. The drawbacks experienced in the use of information technology at LASU were presented. Lastly, presentation of the utility of information technology to higher education at LASU was analysed and interpreted.

Chapters Seven and Eight were also presented in line with Chapter Six. The only difference was that each institution's findings were presented in separate chapters. Hence, Chapter Seven and Eight presented analysis of findings from UKZN and UNISA respectively.

Chapter Seven presented analysis of findings within the construct of change management, familiarity and technology integration across the three selected institutions. Chapter Seven targeted findings from the University of KwaZulu-Natal, South Africa. Chapter Seven presented the background information of respondents, change management self-awareness, familiarity and important information technologies for higher education at UKZN. In addition, UKZN respondents' institutional and personal dispositions towards the use of information technology, predisposing factors and challenges inherent in the adoption of new technologies were presented. The drawbacks experienced in the use of information technology at UKZN were presented. Lastly, presentation of the utility of information technology to higher education at UKZN was analysed and interpreted.

Comparatively, Chapter Eight presented analysis of findings within the construct of change management, familiarity and technology integration across the three selected institutions. Chapter Eight targeted findings from University of South Africa, South Africa. Chapter Eight presented the background information of respondents, change management self-awareness, familiarity and important information technologies for higher education at UNISA. In addition, UNISA respondents' institutional and personal dispositions towards the use of information technology, predisposing factors and challenges inherent in the adoption of new technologies were presented. The drawbacks experienced in the use of information technology at UNISA were presented. Lastly, presentation of the utility of information technology to higher education at UNISA was analysed and interpreted.

Chapter Nine evaluated research findings and presented the comparative framings and statistical analysis of findings from LASU, UKZN and UNISA by means of cross-institutional approach. Inferential statistics are presented through Factor Analysis and Validity tests using regression and Anova. Evaluation of identified issues in data collected in terms of the test ran was discussed. Some of the evaluations included suggested institutional support to address drawbacks, academics' involvement and experiences with e-Learning technologies for teaching and learning, evaluation of findings from institutional administrators to alleviate technology integration challenges and enhance teaching and learning outcomes in higher education. The quality of administrative support in correlation with technology integration in higher education was presented. Lastly, the chapter evaluated the relationship between early adopter and late adopters of technology in the context of the study's locations (Nigeria and South Africa).

Chapter Ten discussed the findings of the study based on the empirical evidence presented in Chapters Six, Seven and Eight of the thesis. The discussion was presented with regards to the research objectives, research questions and tested hypotheses. The findings of the study are discussed in order to provide a holistic understanding of the aim of the study. It was noted that expanding the boundaries of knowledge with regards to alleviating higher education challenges through strategic integration of information technology in order to enhance teaching and learning outcomes was crucial, as this contributes to the achievement of the promised benefits of information technology to higher education. The formulated hypotheses were tested using inferential statistics such as correlations and multiple regressions.

Chapter Eleven summarised the findings of the study, proffered recommendations and presented the concluding remarks of the study. This chapter also proposed a strategic framework for technology integration into higher education in order to alleviate higher education challenges and enhance teaching and learning outcomes at the selected universities in Africa. The chapter concluded the entire study by presenting suggestions for future research.

11.6 Recommendations

This section of the study first makes a number of recommendations based on the problems, issues and challenges identified in the findings of the study. It then suggested a proposed Strategic Integration of Technology Framework that can be used for future research.

11.6.1 Change Management Awareness

The study found that some academics showed resistance to change in the use of information technology for teaching and learning purposes. This was one of the major challenges identified in the study. However, it was established that majority of academics understand that change in the use of information technology begins with individual understanding and acceptance to change. The university management action should be geared towards implementing strategies that will facilitate and improve technology integration in higher education institutions. The first strategy should be directed towards creating suitable change management awareness. Adequate communication and strategies that will encourage and motivate academics towards accepting new technology should be implemented. This will mitigate the level of technology resistance when new/old technologies are required. The university management should also clarify the need for new learning tools and strategize the methods through which the tool(s) will be integrated into teaching and learning practices to meet both teachers and learners' needs. Change management awareness will generally enhance the integration as well as the introduction of technology into the teaching and learning processes/environment. Change management awareness could serve as a motivational programme to assist higher education institutions in obtaining external funds to acquire more technology to enhance teaching and learning outcomes. In the long run, change management awareness could alleviate higher education challenges, enhance teaching and learning outcomes as well as allowing ICTs to achieve its promised benefits to higher education. This programme is essential at the beginning stage of integrating new technology into the higher education environment.

11.6.2 Orientation of New Employees

Although academics are using information technology for teaching and learning practices, such use is self-defined or at the discretion of the academics. The study further established that academics at the selected universities in Africa may have certain level of competencies in the use of information technology for teaching and learning purposes, but the competencies were understood to not have been acquired through any formal IT training or certifications. The competencies were acquired through self-teaching. In other words, the information technology knowledge and/or skills were acquired by academics through their own efforts without any formal instruction or training. Therefore, it can be noted and recommended that the use of information technology and teaching tools before taking over teaching is important. Institutions need to orientate, train and teach new academics/employees before allowing them to commence teaching duties irrespective of whether they know the technology or not. The way they have been using the technology and teaching tools in previous work environments may not be the same way such technology is used in the current institutional environment. Therefore, the orientation of new employees will provide easy access to all the necessary basic information, training, technology and services and it will provide them with clarification on how to take an active role in the institution. It is expected that taking an active role in teaching practices may enhance teaching and learning outcomes.

11.6.3 Training and Retraining of Staff

Research findings suggest that many academics find training and retraining capacity a challenge. Therefore, universities need to look at why this is identified as a challenge. Institutions should be enthusiastic in training staff. It is understandable that some institutions may be enthusiastic in training staff but may not have the facilities while some may have the facilities, but the corporate culture does not emphasize training. Staff need to be trained and retrained in order to acquire new skills, and especially to respond to change in the use of information technology to promote the prosperity of technology integration in higher education. Training and retraining of staff do not only support acquiring new skills but have the capability to modify knowledge and attitudes through learning for an improved performance, which may alleviate some of the higher education challenges. Training and retraining of staff are a significant part of the strategies that will enhance the sustainability of the integrated information technology in higher education. Training and retraining efforts make the use and integration of information technology easier and fun to integrate into teaching and learning practices, which sustain the information technology in the long run. Such technologies will not be easily discarded after a period due to its ease of use and interest.

11.6.4 Students' Orientation Programmes and Access to Information Technology

Similar to the orientation given to new employees, the study identified lack of IT skills by students as one of the serious challenges in the use of information technology for teaching and learning purposes by academics. Similar to this result, university management also found that students do not have adequate access to information technology. This is attributable to poor infrastructure in the rural areas, cost of purchasing data and devices such as computers and smartphones. Apart from inadequate students' access to information technology, the study found that unprepared students to evolving learning tools is another challenge that negatively impacts information technology integration in higher education. Therefore, it is imperative for universities to orientate first-year and new postgraduate students to the use of information technology available within the university environment. Both the research findings and the literature findings suggest that there should be students' technology training in order to promote technology use and integration in higher education (Oyelere, Suhonen, & Sutinen, 2016).

Such orientation may include introducing students to the information technology platforms available for learning, the use of library and the use of Local Area Network (LAN). As noted earlier, the limited use of information technology for teaching and learning purposes is symptomatic of the general trend in both Nigerian and South African Universities. This problem is not solely due to the ignorance or unwillingness on the part of learners to use information technology, but to institutional factors such as the lack of orientation programmes and inadequate access to information technology and platforms available for learning (Chaka & Govender, 2017). To this end, it is suggested that universities should create systems and implement procedures suitable for the effective use of information technology tools and platforms for learning. All first-year students should take information technology courses regardless of the course/programme they may be registered for. Universities should endeavour to implement programmes that will give students access to basic information technology tools such as free internet facilities (Wi-Fi), tablet phones, laptops and/or desktop computers. These initiatives and strategies will prepare students for their technological future. The outcome of such strategies will increase pass rates, enhance students' retention by reducing dropout from higher education. Students will also find learning processes more interesting.

11.6.5 Integration of Information Technology into Culture

The study recommends that university management should endeavour to implement strategies to integrate information technology into higher education culture. Culture in the sense that most homes, work places, institutions and now objects (such as vehicles) have connected computers and/or internet-enabled devices. The connectivity has integrated into people's lives in such a way that the world is at their fingertips (Hawkins, 1997). Therefore, it is now a norm and necessity for both teachers and students to possess twenty-first century skills. The integration of information technology into culture within the university environment will fulfil the obligation of the twenty-first century information technology skills, which promises to promote personal and social responsibilities of academics and students. University management should make it a norm for academics to find means to integrate technology into curriculum development. The approach will revolutionize teaching and learning practices.

To achieve this, staff development and orientation programmes should be regularly made available and updated in order to meet the need of current/future evolution of technologies. Moreover, integration of information technology into higher education culture may not only change academics' behavioural approach to computers as problem-solving tools but to a more constructive approach. The implication of this is that academics become more constructive in their thinking and teaching approaches. Academics become better guides and facilitators of learning. Technology integration into culture also has its benefits on students, which may include the ability for students to become better planners, critical thinkers and creators. It will also aid strong communication skills both for interpersonal relationships and presentation needs. Technology integration into higher education culture for economically disadvantaged students will afford such students not to only find the institution a place where they will have the opportunity to use computer but to integrate technology into their learning which could bridge the digital divide.

11.6.6 Provision of Adequate Technical Support

It was established in the study that inadequate technical support in the integration of information technology was a major challenge in higher education. It is therefore recommended that university management should endeavour to implement strategies to provide adequate technical support to academics in the integration of information technology procedures. The provision of adequate technical support in the integration of information technology in higher education should include swift responses by management to academics' queries and complaints; satisfactory quality of services provided by management support team; and provision of adequate information technology tools and devices such as computers, internet facilities, LMSs and other learning tools to meet both academics and students' needs. Other learning tools are referred to the list of over 200 online tools highlighted in the literature Chapter 3, Section 3.16 of the thesis. Some of these online learning tools may require subscription that individual academic may not have sufficient funds to acquire, but university management are therefore encouraged to subscribe to such learning tools in order for academics to achieve their teaching and learning obligations. This kind of support will not only positively affect academics' performance in their teaching practices but will also positively affect students' learning outcomes. It will also support the sustainability of the integrated information technologies. Adequate technical support could also alleviate higher education challenges and fulfil ICTs' promised benefits to higher education.

11.6.7 Sustainability of Integrated Technologies

University management should continuously review adopted information technology to see if it still meets the needs of the teachers and learners. The review and introduction of new technologies will determine the utility, relevance and sustainability of the current technologies, thereby highlighting the necessity (or otherwise) of a switch or change. This continuous review advances technologies in the society. The field of information systems and technology is dynamic and not static, so the need to review emerging technologies is necessary. The constant review of information technology offers great benefits to the sustainability of the current technologies. Management at the selected universities should ensure that there are dedicated research team(s) to look into emerging technologies that will continuously meet the needs of the teachers and learners. This aspect of the study's recommendations has the potential to enhance the sustainability of integrated information technologies at the selected universities in Africa.

11.7 General Observations and Recommendations

The study identified that poor leadership interest in technology integration goals and visons limits technology integration in higher education. The study recommends that management at the selected universities should endeavour to include futuristic technology integration strategies into their vision statements and/or goals in order to help fulfil the promised benefits of ICTs to higher education. The inclusion of information technology integration strategies into their visions/goals may also contribute to alleviate higher education challenges and enhance teaching and learning outcomes. When technology integration is implemented in leadership visions/goals that aimed at improving the university through technology planning, information technology integration can be positively effective in content area learning amongst academics, promote students' higher-order thinking and problem solving skills as well as to prepare students for the labour force.

Having identified through the academics that challenges such as inadequate internet facilities, inconsistent power supply, lack of IT skills both by academics themselves and students, irregular systems updates and unfriendly institutional policies were the major drawbacks encountered in the integration of information technology in higher education, university leadership (management) should look into the complaints raised by the respondents presented in Section 5.8.1; 6.8.1 and 7.8.1 respectively. It is recommended that the university management should avoid paying too much emphasis on bureaucratic principles. This could be corrected by implementing adaptive or dynamic principles which will allow flexibility whenever necessary. The proposed framework in Section 10.8 could serve as useful tool when planning and integrating information technology in higher education.

University management at the selected institutions should also seek government interventions in order to address systemic challenges such as inconsistent power supply, inadequate infrastructure, poor physical space and insufficient funds allocated to promote the integration of information technology in higher education. Apart from the systemic challenges that is somewhat above the capacity of the universities, management should also seek to address any form of institutional challenges such as inadequate internet facilities, poor IT skills by academics and students, insufficient training programmes, poor technical support by management as well as unsuitable institutional policies. It is usually within the capacity of the institutions to address the institutional challenges. Therefore, management at the selected universities should implement strategies that would be adopted to address academics' unsatisfactory experience in the integration of technology procedures.

In doing so, there will be reduced complaint report to IT support management on technology integration challenges experienced by academics. This should be done by swiftly responding to academics' complaints/queries which would enhance the quality of support academics receive from the university management in the integration of technology in higher education for teaching and learning purposes. The timeous response(s) should also be supported by allocating resources to cater for academics' needs in the process of using and integrating information technology in higher education. Continuous support and allocation of resources will not only enhance teaching and learning outcomes but will also lead to the sustainability of the integrated information technologies. Providing adequate support for academics will guarantee the alleviation of information technology integration challenges in higher education, enhance teaching and learning outcomes, promote sustainability of the technologies and guarantee ICTs promised benefits to higher education.

Lastly, it was observed in the study's findings that management at the selected universities have inadequate IT experts and/or personnel to support the needs of academics. This inadequacy has a negative effect on the effort university management put in place to support academics in the integration of technology processes. Therefore, management need to employ more IT experts in order to provide adequate technical support to meet both academics and students' needs in the integration of technology processes. Boosted IT workforce will alleviate higher education challenges in higher education and promote technology integration in higher education which could eventually enhance teaching and learning outcomes.

11.8 Proposed Framework: Strategic Integration of Technology into Higher Education

Figure 11.1 depicts the strategic framework that this study proposes for facilitating information technology integration into higher education based on this study's identified issues, challenges and limitations in the integration processes in order to

- Alleviate higher education challenges;
- Enhance teaching and learning outcomes; and
- Achieve ICTs promised benefits to higher education.

This model forms a part of the study's recommendations and it may be suggested for future research in a similar study of information systems and technology, and/or a different field of research depending on the objectives of the study and the need of the researcher. It should be noted that the application and/or adoption of the theory in a different study may produce different results from those presented in this study.

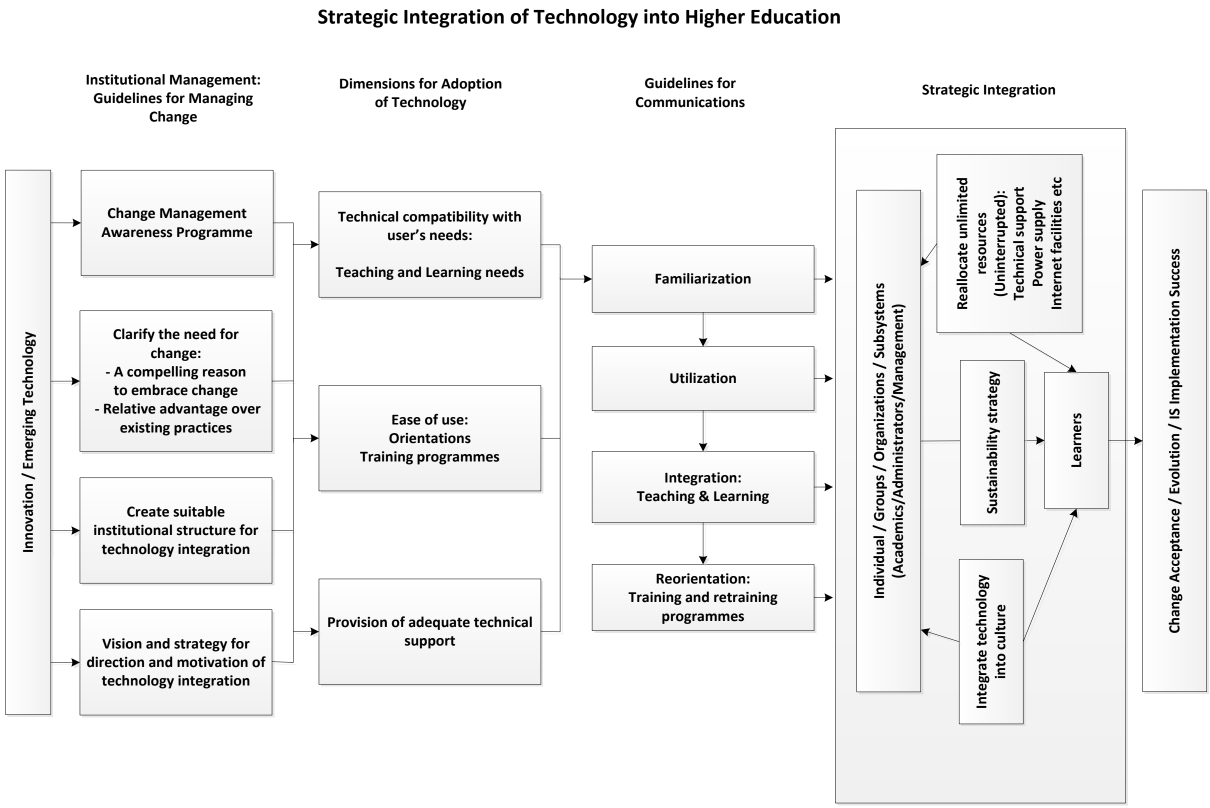


Figure 11.1 Framework on Strategic Integration of Technology (Developed by researcher from a synthesis of findings)

There are four (4) phases in the strategic integration of technology into higher education framework.

Phase One

Phase one (1) is the Institutional Management phase, which was adopted from Kershaw's (1996) change management model integrated to conceptualise the first research objective of the study. It suggests that the university management should provide guidelines for managing change (Change Management). In this case, for any innovation and/or emerging information technology developed and introduced to higher education environment, university management should implement strategies for change management awareness. The change management awareness programmes will allow adequate communication channel that will encourage and motivate academics towards accepting new technology. This programme and/or strategy could mitigate the level of technology resistance when new/old technologies are required for teaching and learning to fulfil both academics and students' needs.

This proposed strategy relates to the study's findings as management at the selected universities in Africa indicated that some academics were not IT compliant, technology savvy, difficult to convince to use technology for teaching, as well as being unskilled in the use and integration of emerging learning tools. These findings constitute some of the major challenges encountered by management when providing supports to academics in the integration processes. Overall, the qualitative findings from management were meant to support the quantitative findings obtained from academics in order to ensure that academics clearly and truly understand their difficulties in the integration of information technology processes. The study further established from management's response that both educators and their institution (management) lack the vision, determination and technological know-how to achieve rich media and technology for teaching and learning. The findings suggest that the integration of technology is more challenging when academics are not aware of contemporary teaching and learning tools/systems that are already replacing and/or succeeding the existing ones.

To this end, the study recommends in the framework that the institutional management should be responsible for clarifying the need for change to users or stakeholders (i.e. academics, learners and faculty), by providing compelling reasons/importance to embrace change. Management at this stage also need to explain the relative advantage that the new technology has over existing ones. The institutional management is also responsible for creating a suitable institutional structure (such as goals, policies and vision statements) that will support and enhance change management and integration of information technology. The last stage of this phase involves the creation or development of strategies for implementing the policies to accomplish the vision, mission and mandate of the institution, as well as accommodating stakeholders' requirements and needs in order to create direction and motivation for technology use and integration. The framework suggests that it is the responsibility of the institution to create change management awareness for stakeholders. By doing so, it will be easy to manage both the stakeholders and the emerging technology. In addition, technology integration in higher education will be meaningful and its impact will alleviate academics' resistance to technology use and enhance acceptance, performance as well as teaching and learning outcomes. The proposed phase one was attributed to the findings of the study which can be referenced in Sections 6.3; 7.3; and 8.3 respectively. Further references to this suggestion can be referenced in Section 9.6 and Section 10.3.1. The associated recommendations can be found in Chapter Eleven, section 11.6.1.

Phase Two

Phase two (2) of the framework is an adaptation of the Diffusion of Innovation Theory (Rogers, 2003). The theory was adopted to develop strategies to conceptualise the construct of the research objectives. This phase presents the dimension for adoption of technology. It communicates messages about Innovation/Emerging technology. The first stage of the phase requires the need for innovation/emerging technology to present the technical compatibility with users' (academics and students) needs. Technology users at this stage would be able to establish the reliability of the technology. Reliability in terms of the compatibility of the new technology with existing technology or existing teaching and learning procedures without issues/challenges. Once reliability and/or dependability is established in the use of the integrated technology into teaching and learning practices, technology becomes easy to use. The innovation/emerging technology should be easy to use (i.e. user friendly) in order to be successfully adopted or integrated. The process of making the new technology easy to use/user friendly will include orientation and training programmes that could get users familiar with the technology and give them confidence to integrate into teaching and learning practices. These recommendations were associated with the research findings that indicated that academics showed resistance to embrace new technology and were not IT compliant. This was further supported when management thought that academics' resistance to embrace technology was associated with being technophobic and lack of confidence in the use of new technology. Hence, the recommendation became suitable to address such issues or problems.

Another instance was established in the study which indicated that students have no access to technology and may be unprepared for the modern learning tools. Therefore, orientation of new students on the use of different technology platforms available for learning within the university environment will be appropriate to address such challenges. The orientation of students will allow students to easily transition into the higher education environment and ready to integrate into the higher education system. This strategy will not only promote students use of technology for planning, critical thinking, creativity and learning, but also will prepare students for the labour force.

The final stage of this phase involves the provision of adequate technical support. This stage is very important in the adoption of technology phase because the findings of the study suggested that inadequate technical support would hinder the success of information technology integration in higher education. The study noted that both academics and management indicated the need to provide adequate technical support to promote and encourage technology integration in higher education. This form of support should include the deployment of more IT experts (IT personnel) at higher education institutions to support both academics and students' teaching and learning technology needs, swift responses to complaints/queries, regular systems update, and technology ready lecture rooms.

Apart from the adaptation of the Diffusion of Innovation Theory used for the conceptualisation of the second phase of the framework, the proposed phase two were attributed to the findings of the study which can be referenced in Sections 6.7; 7.7; and 8.7 respectively and references in Chapter 9, section 9.6.

Phase Three

Phase three (3) of the framework presents the guidelines for communicating innovation/emerging technology to users. This stage is an adaptation of the model of technology adoption using five hierarchical principles by Hooper & Reiber, (1995). Having made necessary provision for adequate technical support in the previous phase, the innovation/emerging technology can then be familiarized or introduced to users. This phase sought to address the challenges identified in Phases One and Two (with regards to the study's findings). *Familiarization* requires a light exposure to the technology to users. This familiarization include purpose, functions and methods of integrating the new technology into teaching and learning practices. This exposure is required to address stakeholders' teaching and learning needs. *Utilization* is what follows, where users make use of the technology at least one or more times for minor routine tasks within the teaching and learning sessions. The next stage is *integration*, and it requires users to select technology based on its relevance to the instructional tasks and not just for the sake of using the technology.

Integration in the proposed theory requires integrating information technology into curriculum and revolutionising the teaching and learning process. The use and integration of technology into curriculum will help change academics/students' roles and relationships. In this case, integration of technology lends itself as the multidimensional teaching and learning tool that transforms the roles and relationships of academics and students. Academics become better guides and facilitators and students take more responsibility for their learning outcomes. Integration would offer positive impact on academic performance and positively affect student achievement and learning outcomes. In a way or another, integration of technology renders itself available to address some of the higher education challenges and it will also alleviate some of the challenges, provided there is sufficient technical support throughout the process. However, adoption usually stops at the integration stage, but *reorientation* (which includes re-training) is the stage where the use of technology is emphasized as part of teaching and learning processes. Technology is usually considered as part of the learning framework in the reorientation stage rather than being a distinct application.

Phase Four

Phase four (4) is the strategic integration of technology phase where technology is integrated into culture. This phase of the framework was informed by the synthesis of findings in the study. The integration of technology into cultures means presenting and emphasizing the need for technology in everyday activities. Technology is presented as a way of life as it is integrated into both academic and social endeavours in the university community. Technology renders itself available to be used and to solve/ease the day-to-day operations in the university environment. This phase should first include academics, management and or faculty as they are usually the first group to adopt technology and later disseminated and integrated into instructional tasks or administrative procedures. Thereafter, learners (students) tend to be involved in the integration and adoption process. Reallocation of resources is another important factor in the strategic integration of the technology phase. *Reallocation of unlimited resources* will encourage the *continual and uninterrupted* usage of technology in order to enhance teaching and learning outcomes and to alleviate potential higher education challenges such as inadequate internet facilities, inconsistent power supply, lack of information technology skills by students and academics, irregular systems update and insufficient facilities.

During the fourth phase procedures, information technology sustainability strategies should be kept in place to ensure frequent review of information technology available within the university environment. This strategy may offer prolonged technology usage and technology may not be easily discarded after utilising it for a while. The sustainability strategy should include continuous review of adopted information technology to ensure it still meets both academics and students' needs. Adequate technical support will also enhance the sustainability of the adopted information technologies. *Change acceptance, evolution and/or information systems implementation success* is achieved provided all phases of the framework have been adhered to or met.

The proposed *phase four* is attributed to the findings of the study which can be referenced in Sections 6.8; 7.8; and 8.8 respectively. The proposed strategic technology integration is attributed to the findings from the open-ended questions on the drawbacks that academics experienced in the use of information technology in higher education. The interview findings from the university management also informed the development of the phase four of the framework.

11.9 Significance of Findings

The study extends the boundaries of knowledge in the field of information systems and technology and higher education systems. This contribution is based on the strategies proposed in the study to alleviate higher education challenges. The study notes that the alleviation of higher education challenges is statistically significant to enhance teaching and learning outcomes. The study identified academics' positions in terms of personal motivation to use information technology to deliver instructions and how they viewed their respective roles as academics within higher education, probing the construct about change management self-awareness. This shows that academics prefer the university management/leadership to provide various strategies that will aid their use of technology for teaching and learning purposes. Also, academics want their universities to clarify the need of a particular technology for specific educational and/or teaching and learning purposes.

This study shows the characteristics or attitudes of academics and the institutions towards the use of information technology platforms/facilities. The study further revealed there were over 200 relevant learning tools available for pedagogical activities. The study established that these learning tools enable learners to process learning and work through big ideas as well as concepts that will aid their thinking, planning and decision-making on methods of creating and executing learning activities. In addition, the study noted that academics are aware of the different information technology facilities available and indicate a strong personal use of the facilities, but no adequate training programmes and support were provided for the facilities. The implication of this finding underscores the need for institutions to provide strategies and training programmes to enable the use of these facilities to promote information technology integration in higher education.

The study confirms the relevance of most of the factors that determine the success of information technology integration in higher education. Some these factors included time between introduction and adoption of technology, personal interest in the use of technology, availability of funds, availability of physical space, quality assurance, employment of skilled professionals, increased access to technology, institutional policies to support the use of IT, sufficient support from management level, availability of resources, adequate ICT infrastructure, adequate training facilities and government supports and intervention programmes. This shows that access or availability to these factors will promote the success of information technology integration in higher education.

In the same light, the study established the various challenges faced in the use of information technology for teaching and learning purposes in higher education. Some of the challenges included: lack of time to adopt information technology, insufficient funds, poor physical space, lack of IT skills by academic staff, lack of IT skills by students, inadequate access to technology, inadequate infrastructure, poor technical support by management, potential loss of personal revenue, lack of training facilities, excessive student enrolment and poor institutional policies. The implication of these challenges is that they are associated with hindering the realisation of the potential benefits of information technology in higher education.

However, strategies identified and explained in this study to propose solutions to technology integration will serve as appropriate tools to alleviate higher education challenges in order to enhance teaching and learning outcomes and achieve ICTs promised benefits to higher education. These strategies will not only alleviate higher education challenges but also provide means of sustaining the integrated technologies for teaching and learning process.

11.10 Limitations and Suggestions for Further Studies

The findings and discussion of this study acknowledged that there is a limitation on the validity of the research findings that deal solely with the opinions of academics and a few management staff. Another limitation worth taking into consideration could be linked to the fact that students were not involved in this research to further gain insights into their opinions regarding information technology processes and outcomes for learning purposes. However, the study suggests that future investigation on a study of this nature may also include students' perceptions on technology integration processes.

The scope of the study is limited to alleviating higher education challenges through strategic information technology integration and to making recommendations to enhance teaching and learning outcomes at selected universities in Africa. These outcomes serve as the mediating variables to achieve the objectives of this study. Hence, the discussions offered in this study are limited to these two constructs to play a major role in the realisation of ICTs promised benefits to higher education. For that reason, future studies may consider the utilisation of other constructs through these links and focus on other countries in Africa or similar constructs in other parts of the world.

This study helps to understand the opinions and challenges of academics towards the use and integration of information technology into higher education. For further research, the opinions and nuances presented in this study may not necessarily apply to academics in other parts of Africa or the world. This calls for scholarly examination and inquiry into how institutional and systemic challenges may affect teaching learning outcomes or academic performance in other parts of the world. Such research endeavour is likely to yield insights that may help to further interrogate and determine the relative weight that can be given to the influence of technology on academic outcomes.

11.11 Thesis Conclusion

To this end, all the objectives of the study were fully met through the tested hypothesis and statistical tests such as Chi-Square, ANOVA, Factor analysis and Regression. The most valuable outcomes of the study has been demonstrated through the recommendations proffered by the researcher.

Conclusion 1

The study established an understanding of the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa by gaining insights on academics' level of information technology acceptance, resistance and awareness to change in the use of information technology for teaching and learning purposes. This was accomplished through change management model which was adapted to identify the core values of change management awareness amongst academics. While the first stages formulated the core values to understand academics' individual acceptance to change and that change is required to enhance technology integration in higher education, the second stages linked the core values to the university management's responsibilities to provide strategies to implement change in the use of technology by academics. These values were further linked to university management's responsibility to clarify the need for change by providing compelling reasons to embrace change. More so, the core values are associated with management role to create suitable institutional structure for technology integration and include strategic technology integration directives in their vison statement and/or goals. This met objective one of the study. Based on the empirical evidence, all the participants strongly agreed to the core values associated with their level of information technology acceptance, resistance and awareness to change in the use of information technology for teaching and learning purposes at the selected universities in Africa.

Conclusion 2

The second objective sought to understand the historical trends and pedagogical underpinnings of the integration of information technology in higher education. This objective was achieved by indicating academics' level of computer competencies; identify academics' knowledge on information technology (current and past); identify the types of computer systems they use/have used; and the period in which they have been using computer/information technologies for teaching, learning and research purposes.

Academics' perceptions on the types of information technology platforms they found most important for integration and their dispositions and the university's disposition towards the use of information technology facilities were also queried. This was achieved by adopting model of technology adoption in the classroom which uses five-hierarchical principles. These principles were used to better understand both traditional and modern applications of technology in higher education. The five principles were Familiarity, Utilisation, Integration, Reorientation and Evolution.

Analysis associated with these principles showed that majority of academics who participated in the study had moderate to very experienced knowledge and competency in the use of computers and information technology. Although the second objective was met when the study established that majority of academics have certain level of competencies in the use of information technology for teaching and learning purposes, it was found that these competencies were acquired not from any formal IT training or certification but rather through self-teaching. The information technology skills were acquired by academics through their own efforts without any formal instructions or training. It was also established through objective two that academics' involvement and experience identified in the study to be relevant for promoting technology integration involved their e-Learning activities in collaboration with departments at institutions other than their own. The study further established that there is significant correlation between academics' e-Learning activity collaboration with other departments at their institution and promoting technology integration in higher education for teaching and learning. The study established that there is significant correlation between academics' indication to be involved in e-Learning activities in the future and the promotion of technology integration into teaching learning practices.

The study examined the pedagogical underpinnings of the integration of information technology in higher education through various technology platforms/facilities (learning tools) available for institutions to integrate into teaching and learning practices. Some of the learning tools include but are not limited to blogging tools, discussion forums tools, email technology, podcast, and IM. Literature review chapter 2, section 2.15 also identified about 200 learning tools which could be useful for educational purposes. However, the study concludes that integrating these learning technologies into teaching and learning practices does not only make academics better guides and/or facilitators of learning but also makes students more responsible for their learning outcomes. Integration of these learning technologies positively affects academics' teaching performance and students' learning achievements. These outcomes fulfilled research objective two of the study.

Conclusion 3

The third objective of the study sought to identify the challenges that may hinder the realisation of the potential benefits of information technology in higher education. The first aspect of this objective established the factors in determining the success of information technology integration in higher education and the second component identified various challenges by requesting academics at the selected universities to indicate the seriousness of the challenges in the use of information technology for teaching and learning purposes. The outcome of the findings in the first aspect was that majority of the factors in determining the success of information technology integration in higher education identified in the study has been linked to time between introduction and adoption of technology, personal interest in the use of technology, availability of funds, availability of physical space, quality assurance, employment of skilled professionals, increased access to technology, institutional policies to support the use of IT, sufficient support from management level, availability of resources, adequate ICT infrastructure, adequate training facilities and government supports and intervention programmes. This is an indication that the identified factors (if available) will promote the success of technology integration in higher education and, if not available, technology integration may not prosper. The study also found that these factors were statistically significant to determine the success of information technology in higher education.

The second component of objective three of the study found that the identified challenges were linked to lack of time to adopt information technology, insufficient funds, poor physical space, lack of IT skills by academic staff, lack of IT skills by students, inadequate access to technology, inadequate infrastructure, poor technical support by management, potential loss of personal revenue, lack of training facilities, excessive students enrolment and poor institutional policies. However, the implication of these challenges was associated to hindering the potential benefits of information technology in higher education. This two-fold explanation – factors in determining the success of information technology integration in higher education and the various challenges hindering the potential benefits of information technology in higher education – fulfilled research objective three of the study.

Conclusion 4

The fourth research objective identified limitations of information technology integration in higher education. The outcome of the findings revealed how academics are able to describe the quality of support they received from their institution's administration/management in the integration of information technology. It also provided answers to how academics dealt with unsatisfactory experiences in the integration of information technology. Findings on how often academics reported complaints to institution's management during the integration of information technology and academics' ratings of responses from the institution management to their complaints/queries were further discussed. The research found that there is statistically significant correlation that exists between the independent variables and the dependent variable. The independent variables were unsatisfactory experience; complaint report; and complaint response and the dependent variable was 'quality of support'.

In conclusion, the results of the findings of research objective four showed that factors such as unsatisfactory experience in the integration of information technology; frequent complaint report to university management on technology integration challenges; and delayed and/or unsatisfactory responses to academics' complaints/queries affect the quality of support they received from the university management in the integration of technology in higher education for teaching and learning purposes. These factors were established to generally limit information technology integration in higher education. These findings fulfilled the fourth research objective.

Conclusion 5

The last conclusion which addressed the research objective five of the study sought to perform analysis in order to propose adequate solutions to alleviate the challenges and limitations that information technology may have on integration and transformation in higher education to enhance teaching and learning outcomes. The objective first established the types of drawbacks that academics encountered in the use and integration of information technology in higher education. Secondly, the objective established the types of support to address the drawbacks in the use and integration of information technology to alleviate higher education challenges and limitations that will lead to transformation.

Drawbacks encountered in the use and integration of information technology were linked to inadequate internet facilities; inconsistent power supply; lack of information technology skills by students and academics; irregular systems update; commercialization of information technology; insufficient facilities; and institutional policy. Based on the qualitative analysis of findings, some of the support to address the drawbacks were linked to the provision of adequate internet facilities; uninterrupted power supply; provision of IT skills training to students and academics; regular systems update, adequate facilities and institutional policy. The study established that the provision of these supports/strategies may alleviate technology integration challenges in higher education and the possible outcome of reducing these drawbacks will enhance teaching and learning outcomes. Alleviating these drawbacks will also guarantee ICTs promised benefits to higher education and eventually positively transforms the entire teaching and learning experience for both academics and students at the selected universities in Africa. This fulfils the fifth objective of the study.

11.12 Overall Conclusion

There are varying degrees of similarities and differences in the research findings from LASU, UKZN and UNISA. A significant part of the research finding is that academics are aware of the importance and usefulness of integrating information technology into higher education, especially for research purposes and for teaching and learning activities. The recommendations of the study should improve the appreciation of the significance of technology and the integration of information technology to alleviate higher education challenges and enhance teaching and learning outcomes in order for ICTs to achieve its promised benefits to higher education.

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APPENDICES

Appendix 1: Ethical Clearance Letter

UNIVERSITY OF KWAZULU-NATAL™
INYUVESI YAKWAZULU-NATALI

16 February 2015

Mr Omotayo Kayode Abatan 208529163
School of Management, Information Systems and Governance
Westville Campus

Protocol reference number: HSS/1076/014D
Project title: Strategic Integration of Technology towards Alleviating Higher Education Challenges in Africa

Dear Mr Abatan

Full Approval – Expedited

This letter serves to notify you that your application in connection with the above has now been granted full approval.

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach/Methods must be reviewed and approved through an amendment /modification prior to its implementation. Please quote the above reference number for all queries relating to this study. Please note: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

Best wishes for the successful completion of your research protocol.

Yours faithfully

....
Dr Shenuka Singh (Chair)

/px

cc Supervisor: Professor Manoj Maharaj
cc Academic Leader Research: Professor Brian McArthur
cc School Administrator: Ms Angela Pearce

Humanities & Social Sciences Research Ethics Committee
Dr Shenuka Singh (Chair)
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Website: www.ukzn.ac.za

Appendix 2: Informed Consent Letter

UNIVERSITY OF KWAZULU-NATAL
Discipline of Information Systems & Technology

Dear Respondent,

Ph.D. Research Project

Researcher: Omotayo Abatan (+27 78 728 1235)

Supervisor: Prof. Manoj Maharaj (+27 31 260 8003)

Research Office: Ms P Ximba (+27 31 260 3587)

I am Omotayo Abatan, a doctoral student in the Discipline of Information Systems & Technology, at the University of KwaZulu-Natal. You are invited to participate in a research project entitled "Alleviating Higher Education Challenges in Africa through the Strategic Integration of Technology." The aim of this study is to:

- To investigate the awareness of the rationale for the integration and use of adopted information technologies at the selected universities in Africa;
- To examine the historiography and pedagogical underpinnings of the integration of information technology in higher education in Africa;
- To perform an exploratory analysis in order;
- To identify the challenges that may hinder the potential opportunities of information technology in higher education;
- To identify the limitations of information technology integration in higher education; and
- To perform analysis in order to propose solutions to mitigate and overcome the challenges and limitations that information technology may have on integration and transformation in higher education.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this research project. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Discipline of Information Systems & Technology, UKZN.

If you have any questions or concerns about participating in this study, please contact me or my supervisor at the numbers listed above.

It should take you about 15 minutes to complete the questionnaire. I hope you will take the time to complete the questionnaire.

Sincerely,

Investigators' signature________________________________ Date________________________

Appendix 3: Questionnaire

Topic: Alleviating Higher Education Challenges through Strategic Integration of Technology: A case of Selected Universities in Africa

Ph.D. Research Project
Discipline of Information Systems & Technology
School of Management, IT and Governance (MIG)
University of KwaZulu-Natal
Researcher: Omotayo Abatan (+27 78 728 1235)
Supervisor: Prof. Manoj Maharaj (+27 31 260 8003)

Introduction

The purpose of this questionnaire is to gather information from you on your experiences and perceptions of information technology implemented in your institution. The information gathered will be used to propose and provide strategic ways in which information technology can be integrated towards alleviating higher education challenges in Africa.

In this questionnaire, the following keywords are used: Information technology and e-learning. As used in this research, each keyword can briefly be described as:

Information Technology: it is the application of both computers and telecommunications equipment to store, retrieve, transmit and manipulate data.

E-Learning: it is an interactive learning method in which the learning material or content is available electronically and it provides some sort of feedback to the users.

- *Please sign the letter of informed consent, giving me permission to use your responses for this research project.*
- *Please rate the statements in each section by placing a check in the appropriate box.*
- *The questionnaire should take about 20mins.*

CONSENT

I hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

____________________ ____________________

Signature of Participant Date

Your response to this questionnaire will be treated with confidentiality.

Section A: Background

This section of the questionnaire refers to your background information. The information will allow me compare groups of respondents. Once again, I assure you that your responses will remain confidential.

1. Gender?
☐ Male ☐ Female

2. Age?
☐☐

3. Highest qualification?
☐ Diploma ☐ Degree ☐ Honours ☐ Masters ☐ Ph.D.

4. Occupation (Academic) level?
☐ Tutor/Teaching Assistant ☐ Junior Lecturer ☐ Lecturer
☐ Senior lecturer ☐ Associate professor ☐ Professor
Another group (please specify): ______________________

Section B: Change in management (Self-awareness)

5. Please select the number that best represent how you feel about the imperative need for use of information technology.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
1.1 Changes in the use of information technology begin with your individual understanding that change is actually needed.	1	2	3	4
1.2 You understand and accept that you must change to enhance integration of technology into higher education.	1	2	3	4
1.3 A University should provide strategies for implementing changes in the use of information technology.	1	2	3	4
1.4 A University should clarify the need for information technology for different educational purposes.	1	2	3	4
1.5 A University should create a suitable institutional structure to provide adequate support for promoting technology use.	1	2	3	4

Section C: Background: Familiarity with Information Technology (IT) platforms

6. Indicate what you regard to be your level of computer competency
☐ Very inexperienced ☐ Inexperienced ☐ Moderate
☐ Experienced ☐ Very experienced

7. Do you have any certification(s) in information technology (IT) or IT-related courses?
☐ Yes ☐ No

a. If yes, please indicate which qualifications____
b. Have you had any further training or retraining programs in the IT field identified in Q7a?
☐ Yes ☐ No

c. Have you acquired competency in any other/a different IT field?
☐ Yes ☐ No

d. If yes, please indicate which programs ____

8. Which of these computer system(s) do you use? *Please select* *__all__* *applicable option(s)*

☐ Operating Systems (OS): Computer ☐ Operating Systems (OS): Mobile

☐ Computer Hardware: Physical elements of a computer ☐ Mobile Applications Software

☐ Computer Application Software

9. How long have you been using computer/information technologies for teaching and learning purposes? *Please select one option.*

☐ Less than 6 months ☐ More than 6 months but less than 1 year

☐ More than 1 year but less than 2 years ☐ More than 2 years but less than 3 years

☐ More than 3 years but less than 4 years ☐ More than 4 years but less than 5 years

☐ More than 5 years

10. a. Please select *all* the options that apply to your involvement and experiences with e-learning for **teaching** and **learning** purposes (e.g. curriculum delivery/course delivery/online instruction/seminars/assessment).

☐ I am involved in e-learning activities within my own work

☐ I am involved in e-learning activities in collaboration with departments at my institution, other than my own

☐ I am involved in e-learning activities in collaboration with other institutions in my country

☐ I am involved in e-learning activities in collaboration with other institutions in Africa

☐ I am involved in e-learning activities in collaboration with institutions outside of Africa

☐ I would like to be involved in e-learning activities in the future

☐ I am aware of colleagues using e-learning on a regular basis

b. Please select *all* the options that apply to your involvement and experiences with e-learning for **research** purposes.

☐ I am involved in e-learning activities within research fields

☐ I am involved in e-learning activities in collaboration with Departments at my institution, other than my own

☐ I am involved in e-learning activities in collaboration with other institutions in my country

☐ I am involved in e-learning activities in collaboration with other institutions in Africa

☐ I am involved in e-learning activities in collaboration with institutions outside of Africa

☐ I would like to be involved in e-learning activities in the future

☐ I am aware of colleagues using e-learning on a regular basis

11. On a scale of 1 – 4, which of these technologies do you think are most important for technology integration into higher education? If you do not know of the technology please enter 0. *Tips: 0 is on the left column before the technologies.*

I don't know	Information Technology (e-Learning)	**Not important**	**Less important**	**Somewhat important**	**Very important**
0	11.1 Learning Management Systems or Course Management Systems (CMS)	1	2	3	4
0	11.2 Open Education Resources (OER)	1	2	3	4
0	11.3 Open and Distance Learning	1	2	3	4
0	11.4 Mobile Learning	1	2	3	4
0	11.5 Smarthistory Technology	1	2	3	4
0	11.6 Virtual Learning Environment (VLE)	1	2	3	4
0	11.7 Massive Open Online Courses (MOOCs)	1	2	3	4
0	11.8 Collaborative Education Network (CEN)	1	2	3	4
0	Other:	1	2	3	4

12. On a scale 1 – 4, rate the efficacy of the following information technologies adopted by your institution. If your institution does not use a specific information technology, please enter 0 for Not available.
Tips: 0 is on the left column before the technologies. Other, please specify and rate accordingly.

Not available	Information Technology (e-Learning)	**Not important**	**Less important**	**Somewhat important**	**Very important**
0	12.1 Learning Management Systems or Course Management Systems (CMS)	1	2	3	4
0	12.2 Open Education Resources (OER)	1	2	3	4
0	12.3 Open and Distance Learning	1	2	3	4
0	12.4 Mobile Learning	1	2	3	4
0	12.5 Smarthistory Technology	1	2	3	4
0	12.6 Virtual Learning Environment (VLE)	1	2	3	4
0	12.7 Massive Open Online Courses (MOOCs)	1	2	3	4
0	12.8 Collaborative Education Network (CEN)	1	2	3	4
0	Other:	1	2	3	4

13. Please indicate your institution's disposition towards and your personal use of the following facilities. *(Mark X)*

Information Technology Facilities	My institution enables use of this facility	My institution provides training & support for this facility	I use the facility
Discussion forums			
Audio Learning			
Video Learning (Podcasting)			
Instant Messaging (IM)			
Content Management			
Bulletin Boards			
Chatrooms			
Games and Leisure			
Online tests and quizzes(self-assessment)			
Blogs			
Email			
Online IT Lab (e.g. Pearson's MyLabsPlus)			
FAQs – Frequently Asked Questions			
Questions and Answers (Q&A)			
Statistics			
Wiki			
Calendar (Schedule tool)			
Dropbox			

14. On a scale of 1 – 4, please rate the necessity of the following items for integration of information technology.

	Not important	**Less important**	**Somewhat important**	**Very important**
14.1 Use of projector	1	2	3	4
14.2 Use of Interactive Whiteboards for Face-to-face lectures	1	2	3	4
14.3 Train learners how to use IT systems before they start courses	1	2	3	4
14.4 IT should only be used for lectures and assignments	1	2	3	4
14.5 IT should be used for assessments (tests and exams)	1	2	3	4
14.6 The use of videos to improve long distance students learning experiences	1	2	3	4

Section D: Information Technology Integration

15 Please indicate your motivations regarding the adoption of new technology.

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
15.1 I like to experiment with new technology	1	2	3	4
15.2 I have always tried to obtain the latest information technology	1	2	3	4
15.3 Among my colleagues, I am usually the first to try out new IT	1	2	3	4
15.4 I would more likely use information technology if someone else used it	1	2	3	4
15.5 I intend to use information technology in the future	1	2	3	4

16. How important are the following factors in determining the success of information technology integration in higher education?

Factors	**Of no importance**	**Of little importance**	**Somewhat important**	**Important**	**Very important**
Time between introduction and adopting					
Personal interest in the use of technology					
Availability of Funds					
Availability of physical space					
Quality assurance					
Employment of Skilled professionals					
Low student enrolment into higher institution					
Increasing access to technology					
Institutional policies to support the use of IT					
Sufficient support from management level					
Availability of resources					
Adequate ICT infrastructures					
Adequate training facilities					
Government support and interventions					

17. On a scale of 1 – 4, please rate how serious the following challenges are in your use of information technology for teaching and learning?

Challenges	**Not serious**	**Less serious**	**Somewhat serious**	**Very serious**
Lack of time for adoption	1	2	3	4
Insufficient funds	1	2	3	4
Poor physical space	1	2	3	4
Lack of IT skills by academic staff	1	2	3	4
Lack of IT skills by students	1	2	3	4
Inadequate access to technology	1	2	3	4
Inadequate infrastructure	1	2	3	4
Poor technical support by management	1	2	3	4
Potential loss of personal revenue	1	2	3	4
Lack of training facilities	1	2	3	4
Excessive students' enrolment	1	2	3	4
Poor institutional policies	1	2	3	4

18. How would you rate the overall experience of using information technologies for teaching and learning?
☐ Very Poor ☐ Poor ☐ Average ☐ Good ☐ Very Good

19. How would you rate the overall experience of using information technologies for research?
☐ Very Poor ☐ Poor ☐ Average ☐ Good ☐ Very Good

20. How would you describe the quality of support you received by your institution administration in the integration of information technologies?
☐ Not satisfactory ☐ Somewhat satisfactory ☐ Very satisfactory

21. How do you deal with unsatisfactory experience in the integration of information technologies in your institution?
☐ Ignore the problem ☐ Complain to colleagues and others ☐ Call support centre/ICT

Other (please specify) ______________________________

22. How often do you report complaints to your institution's administration?
☐ Never ☐ Rarely ☐ Occasionally ☐ Frequently ☐ Very Frequently

23. How would you rate the response of your institution administration to your complaints/queries?
☐ Not Prompt nor Satisfactory ☐ Not Prompt but Satisfactory

☐ Prompt but not Satisfactory ☐ Prompt and Satisfactory

24. Would you consider the integration of information technology to be critical for higher education?
☐ Not critical at all ☐ Somewhat critical ☐ Very critical

25. How critical is the integration of information technology to enhancing teaching and learning outcomes?
☐ Not critical at all ☐ Somewhat critical ☐ Very critical

26. a. Have you experienced any drawback(s) in your use of information technology at your institution?
☐ Yes ☐ No

b. If yes, please indicate the drawbacks ____

27. What support can/should the institution provide to address the drawback(s)?

____

28. What impact does the use of Information technology have on higher education?
☐ Negative ☐ Somewhat Negative ☐ Somewhat Positive ☐ Positive

Thank you for your time - it is highly appreciated!

Appendix 4: Interview

Topic: Alleviating Higher Education Challenges through Strategic Integration of Technology: A case of Selected Universities in Africa

Ph.D. Research Project

Discipline of Information Systems and Technology

School of Management, IT and Governance (MIG)

University of KwaZulu-Natal

Researcher: Omotayo Abatan (+27 78 728 1235)

Supervisor: Manoj Maharaj (+27 31 260 8003)

Introduction:

The purpose of this interview is to gather information from you based on the results obtained from academics at your institution with regard to technology integration and the possible challenges they face in the integration process.

Teaching using ICT in higher education presents many challenges and the problems academics commonly face in the integration of technology into teaching and learning practices may include but are not limited to the lack of time to adopt technology; insufficient support from management; inadequate infrastructure; inadequate development programmes; funding issues and many more.

Due to the fact that you, the management, have to implement and maintain the systems, and that without management support, innovation does not prosper, your responses to the questions that will be put to you will be regarded as highly significant.

CONSENT

I hereby confirm that I understand the nature of the research project and I consent to participate in this project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

I understand that my responses will be regarded as confidential and that my identity will be safeguarded throughout the lifecycle of this study.

______________ ______________

Signature Date

SECTION 1: BIOGRAPHICAL INFORMATION

Institution? (Please mark “x” where applicable):

LASU ☐ UKZN ☐ UNISA ☐

a. How long have you been in your present position in this organisation?

b. Briefly describe your role and its relationship to management/ICT support

SECTION 2: TECHNOLOGY INTEGRATION QUESTIONS

Questions 1:
What is your understanding of technology integration in the higher education environment?

Question 2:
What kind of challenges have you faced or are you aware of that academics face in their use of technology for teaching and learning practices?

Question 3:
As a technology user yourself, what kind of institutional and systemic challenges do you think hinder the integration of technology in higher education?

Question 4:
What are the drawbacks of technology integration in higher education?

Question 5:
Would you consider information technology integration to be critical for higher education and why?

Thank you for your time.