AN EVALUATION OF THE IMPLEMENTATION OF THE INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) POLICY FOR EDUCATION IN THE FACULTY OF EDUCATION AT THE UNIVERSITY OF NAMIBIA

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Abstract

The purpose of this evaluation study was to determine the extent to which the teacher educators in the Faculty of Education at the University of Namibia implemented the Information and Communication Technology (ICT) Policy for Education. This study employed both the quantitative method in the form of questionnaires and the qualitative method in the form of interviews and classroom observations. From the 100 participants surveyed 73 respondent, which was a 73% response rate to the questionnaire. The data were analysed by using the Likert Scale, Pearson-Product Moment Correlation Coefficient, Kruskal-Wallis H Test, Eigenvalue: Factor Analysis and Eigenvalue: Cluster. A purposive sampling was then conducted on the teacher educators at each University of Namibia campus who were tasked to teach with ICTs. These teacher educators were interviewed and classroom observations were conducted.

The findings of the study indicated that the participants had a good understanding of the ICT Policy for Education. However, the findings further indicated that the respondents lacked training in ICT pedagogy, lacked technical know-how in ICT applications; lacked technical support at their campuses; lacked the time to learn and incorporate ICT skills and tools into lessons; and lastly exposed insufficient budget allocation in place for use in procurement of ICT tools such as hardware and software. The findings of the study may inform the teacher education institutions and the Ministry of Education on the extent to which the objectives identified in the ICT Policy for Education are being achieved. The findings may also inform stakeholders about factors that hinder effective implementation of the ICT Policy for Education in teacher training institutions. Finally, based on the findings of the study, the researcher proposed a model on how to implement the ICT Policy for Education at the tertiary level.

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List of Abbreviations

CECS	Community Education Computer Society
FOE	Faculty of Education
GRN	Government of the Republic of Namiba
GESCI	Global e-Schools and Communities Initiative
ICT	Information and Communications Technology
IPO	Input, Process, Output Model
MOE	Ministry of Education
NIED	National Institute for Educational Development
TAM	Technology Acceptance Model
TCP/IP	Transmission Control Protocol/Internet Protocol
UNAM	University of Namibia

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Dedications

This work is dedicated to my wife and children. It is dedicated to my beautiful wife Rezell Kazondovi. You shine a bright light in my life. You provide purpose and direction in my life.

It is further dedicated to my beautiful children, Jacqueline Nokokure Kazondovi, Xharia Nguviuta Kazondovi, and Abigail Njembo Kazondovi. You are always on my mind. You are the first thing I think about when I wake and the last thing on my mind before I go to sleep.

Declarations

I, Collins Mbatjiza Kazondovi, declare hereby that this study is a true reflection of my own research, and that this work, or part of thereof has not been submitted for a degree in any other institution of higher education.

I, C. M. Kazondovi grant the University of Namibia the right to reproduce this dissertation in whole or in part, in any manner or format which the University of Namibia may deem fit.

______________________________(Signature)   Date: ___________________

Collins Mbatjiza Kazondovi

CHAPTER 1

1.1 Introduction

Namibia gained its independence in 1990 from nearly a century of colonialism and decades of apartheid rule. During colonial rule, education was developed and modelled in a way that black Namibians be trained for semi-skilled and unskilled labour (Cohen, 1994). The fight for liberation was waged for nearly a century by the black Namibians. Namibia gained its independence in 1990. After independence, the Namibian Government started on a path of education reform. The Government embraced education as one of the pillars for the national development strategy in the hope of transforming the Namibian society (GRN, 2004). The disparity has necessitated the development of policies that would narrow the gap between the disadvantaged black majority and the advantaged white communities (MEC, 1993).

In 1993, the Ministry of Education and Culture (MEC) recognized the past history and identified a purpose for a nation that could now take responsibility for its future. The Ministry of Education produced an educational framework called: "Towards Education for All" to guide educational development in the country, in which three important goals were emphasized: access, equity and equality. Achieving these in education has been a challenge for the Namibian Government (MEC, 1993). In terms of access, all schools and the University of Namibia different campuses are required to have the same resources, including well-qualified teachers and lecturers, and well equipped laboratories (GRN, 2004). In terms of equity, the focus is on providing technology infrastructure, maintenance and support, and training to all teacher educators at tertiary institutions. In terms of equality, the focus is on providing the skills and competencies that are regarded as core elements of living in a knowledge based society (GRN, 2004).

In order to address the challenges of access, equity and equality, the Namibian Government developed a blueprint for its future in the form of "Vision 2030" which was launched in 2004 (GRN, 2004). The purpose of this "Vision 2030" document was to provide a framework that defines where Namibia is, where it has to go, and over what time frame (GRN, 2004). This Namibia Vision 2030 document would guide the Namibian government with deliberate efforts in order to improve the quality of life of Namibian people. It is designed as a broad and national unifying vision which would serve as a guide for development plans (GRN, 2004). This document would link short term national plans with long term national plans of the Namibian nation. It would provide a framework that would be used as a basis to build capacity of all the public and private sectors in Namibia (GRN, 2004).

In order to meet the developmental goals of Vision 2030, this Vision 2030 document has a sub-vision which is to provide a "fully integrated, unified and flexible education and training system, that prepares Namibian learners to take advantage of a rapidly changing environment and contributes to the economic, moral, cultural and social development of the citizens throughout their lives." (GRN, 2004, p.88)**.** This document proposed that the Ministry of Education should develop, implement and monitor a national ICT policy. This policy would be introduced from pre-primary education to tertiary education. The purpose of this ICT policy document is to prepare all Namibia's learners, students and teachers with the ICT skills needed in order to meet the challenges of the 21st century (MoE, 2005).

Educational institutions are expected to establish and utilize fully equipped media centres containing more than just printed materials and are required to provide access to global information by electronic means. The policy document describes what needs to be achieved with ICT in education and what must be put in place in order to achieve it (MoE, 2005).

A review of the National ICT Policy took place in 1995 at the National Institute for Educational Development (NIED) and after changes were made, the new national policy was adopted in 2005. In order to implement the ICT Policy successfully, the Ministry of Education appointed the National ICT Steering Committee, comprising of educational stakeholders and the private sector, to advise the Ministry of Education on the best practices of ICT provision and pedagogical usage. The ICT Policy for Education was developed in order to enhance the use and development of appropriate pedagogical ICT solutions. The document also stipulates pre-service and in-service teacher education institutions as priority areas for ICT deployment, followed by schools with secondary grades and lastly followed by schools with primary grades (MoE, 2005).

The adoption of the National ICT Policy was followed by the National ICT Implementation Plan Guide (MoE, 2006). The Ministry of Education created a National Budget from 2006 onwards, in order to ensure that the implementation plan would be implemented. In addition, other stakeholders such as Global e-School Initiative (GeSCI), SchoolNet Namibia, Namibia Education Training Academy (NETA) and Computer Education Community Service (CECS) have been supporting this activity by donating ICT resources to schools (MoE, 2007). The National Education Technology Service and

Support Centre (NETSS) in Windhoek, a refurbishment centre was established to assemble and deploy ICT in schools in 2006. To enhance efficiency, the XNET Development Trust was formed in 2003 to address the issue of providing reliable and cost effective Internet connectivity. The implementation plan lists parallel deployment of infrastructure readiness and platform deployment, with training and support, along with curriculum development and content availability. It is hoped that implementing all three strategies simultaneously would deliver a comprehensive implementation (MoE, 2007). The purpose of the education reform was to redress the inequity of the previous dispensation.

The response by the Ministry of Education (MoE) to the ICT Policy implementation, has led to the Education and Training Sector Improvement Program (ETSIP). The ETSIP was introduced to aid progress toward the goals outlined in Vision 2030. The programme aims to hasten development toward the Millennium Development Goals (MDG), while improving the current education system and increasing the supply of highly skilled individuals in Namibia. ICT is an integral part of the ETSIP manifesto. The ETSIP program started in 2007 when the project was approved by the World Bank with a loan amount of U$7.5 million for a period of three years (World Bank, 2008). The major goal of ETSIP is to contribute to the Government of Namibia's efforts to equitably increase the immediate supply of middle to high level skills required to meet current labour market demands and to lay a foundation for a sustainable supply of skills required for future equitable growth and for facilitating Namibia's transition to a knowledge-based economy (World Bank, 2008).Towards this end, Namibia also embarked on an aggressive plan to fully integrate information and communications technologies ((ICT) into its education system as part of the government's efforts to become a knowledge-based economy by the year 2030 (MoE, 2007).

The ICT policy document stipulates that it is essential to measure, evaluate and research the impact of this policy and issues relating to it, and to point out the effect and effectiveness of using ICT within the education community (MoE, 2005). It is important to evaluate the ICT Policy for Education because when it is implemented properly it can facilitate change, in the use and integration of ICTs in teaching and learning (Kozma, 2010; MoE, 2005; Watson, 2006). When the ICTs are used in innovative ways, knowledge is created, shared and communities of learning are established (Kozma, 2010; Lupu, 2011; Vandeyar, 2013). The ICT Policy for Education was evaluated at secondary school level (Boer, 2012; Ngololo, 2010), however, there were no studies found that evaluated the ICT Policy for Education in teacher education in Namibia. How the ICT Policy for Education is implemented in teacher education at the University of Namibia is not known. In addition, the factors that affect the implementation of the ICT Policy for Education are also not known.

In the absence of effective ICT Policy implementation at the tertiary level, some of the major challenges will be to transform teacher training into improved teacher practices in the classroom (Gichoya, 2005; Vandeyar, 2013). Many lecturers will have difficulties in finding meaningful pedagogical use for technology. This will hamper lecturers gaining digital skills, which will enable them to use a wide variety of technology-related tools and applications (Kozma, 2010). This will lead to few lecturers to use ICT regularly in their lessons, while others will use ICT on an ad-hoc basis (Bingimlas, 2009) . Lecturers will not access quality teaching materials from the internet, where they can share and establish communities of learning. When the lecturers do not see the relationship between ICTs to pedagogy, curriculum and assessment, they will not be motivated to use ICTs for teaching purposes (Lupu, 2011; Vandeyar, 2013). They will not use ICTs in innovative ways. Therefore, this study will focus on the evaluation of the implementation of the ICT Policy for Education in the Faculty of Education at the University of Namibia.

1.2 Statement of the Problem

Many countries face significant challenges in transforming the promises of technology into tangible benefits for learning (Kozma, 2010; UNESCO, 2010). Many of these challenges are related to infrastructural and technical issues, such as lack of access to technology or poor connectivity. This is particularly the case in low-income countries (UNESCO, 2010). In Namibia, the Faculty of Education at the University of Namibia is faced with challenges and demands in the use of ICTs in teaching and learning, maintenance of infrastructures and technical support (Magadza, 2010; University of Namibia, 2005), as required by the ICT Policy for Education. The use of ICTs for teaching and learning is seen as an 'add on', and not an integral part of teaching and learning at teacher training institutions (Bingimlas, 2009; Cameron, 2005; Hew & Brush, 2007; Iipinge, 2010; Richards, 2005). Other barriers include the lack of relevant content in a language understood by the lecturer and limited access to open education resources. However the main challenge, including for the most advanced education systems, lies in teachers' capacities to use technology effectively in the classroom (UNESCO, 2010).

A number of studies in the evaluation of the ICT Policy for Education were conducted in Namibia; Boer (2012) explored how the secondary school teachers in Namibia implemented the ICT Policy for Education; Ngololo (2010) focused on the evaluation of the implementation of ICT Policy for Education in rural Namibian schools; and Matengu (2006), on the other hand focused on the adoption of ICT at schools in the urban and rural area settings of Namibia.

In other studies, Iipinge (2010), concentrated on ICT integration at the former colleges of education; Kamerika (2006) determined the perception and challenges that contribute to the implementation of computer practice into schools in the Khomas, Omaheke and Otjozondjupa education regions; Chisholm (2004) investigated the use of ICTs in schools in Namibia, Botswana and Seychelles; Stork and Aochamub (2003) focused on ICTs use in Namibia in the public and private sector. None of these studies focused on the implementation of the ICT Policy for Education in teacher education in Namibia.

1.3 Research Questions

The main objective of this study will be to evaluate the implementation of the ICT Policy for Education in the Faculty of Education in the University of Namibia. Thus, the research questions are:

a) How is the ICT Policy for Education being implemented in the Faculty of Education?

b) What are the factors that hinder the implementation of the ICT Policy for Education in the Faculty of Education?

c) What recommendations can be provided in order to better implement the ICT Policy for Education in the Faculty of Education at the University of Namibia?

1.4 Significance of the Study

This study is the first in the evaluation of the ICT policy for education in teacher training institutions in Namibia. Therefore, the findings of the study may inform the teacher education institutions and the Ministry of Education on the extent to which the objectives identified in the ICT Policy for Education are being achieved. The findings may also inform stakeholders about factors that hinder effective implementation of the ICT Policy for Education in teacher training institutions. Finally, based on the findings of the study, the researcher will propose a model on how to implement the ICT Policy for Education at teacher training institutions.

1.5 Limitations of the Study

First, the study will be carried out at the University of Namibia, in particular the Faculty of Education and as such limited to that. Second, participants might not honestly answer the questions. For example, some teacher educators might overstate or understate the use of ICTs in teaching, therefore, making some data unreliable. The reason for this behaviour is social desirability. However, the triangulation of data will remedy this limitation. Third, some teacher educators may not want to be observed while teaching with ICTs, therefore making it difficult to collect data. To remedy this, the teacher educators who are willing to be observed will be used. Fourth, the researcher's bias may interfere in the process of gathering and analysing data. The peer review process will help remedy the researcher's bias.

1.6 Definition of Terms

ICT Policy for Education: It is a framework at the national level for the use and integration of ICT into the education system (Kozma, 2010), in this case the Namibian education system, in order to make successful use of ICT in enhancing the reach and quality of teaching and learning.

ICT: Information Communication Technology (ICT) is a generic name used to describe a range of technologies for gathering, storing, retrieving, processing, analysing, and transmitting information (Vandeyar, 2013).

Internet: The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to link several billion devices worldwide (Sanchez, Salinas & Harris, 2011).

Technology: ICT tools that lecturers can use to support teaching and learning.

Pedagogical use of ICT: It is the use of ICTs in the teaching and learning in order to successfully meet a learning objective.

Digital Learning Materials: These are teaching and learning materials in software form, and not in hard copy.

1.7 Summary

Chapter 1 focused on the orientation of the study which described how the ICT Policy for Education was developed as a call from stake holders, educational partners, private sector and technology advocates for the Namibian education institutions to produce knowledge based citizens who are competitive in the global economy. The problems identified with national ICT policy implementation were specified. The research questions were asked. The significance of the study, limitations of the study and the definition of terms were stated. Next, Chapter 2 will discuss the ICT Policy for Education in Namibia.

CHAPTER 2: LITERATURE REVIEW

In this chapter, the literature will be reviewed using the following two research questions:

1. How is the ICT Policy for Education being implemented in the Faculty of Education?
2. What are the factors encountered in the implementation of the ICT Policy for Education in the Faculty of Education?

In answering the first question, several issues where identified, namely: ICT policy evaluations at the global level, Systems theory, ICT pedagogical training, ICT infrastructure, ICT uses in the classroom, class size, learning management system (LMS), social media, ongoing professional training in ICT,Vision 2030 document, and ICT Policy for Education in Namibia.

In answering the second question: technical support, obstacles to ICT integration, ICT qualifications, community of practice, future training needs in ICTs were identified and evaluation models were discussed.

Next, the keywords used to search the information on ICT Policy evaluations in higher education are put in table format below.

Keywords used in various databases

Keywords	Scopus	Science Direct	A-Z Title Listing	Ebsco Publishing	Emerald Group Publishing	Hinari	Google Scholar	ERIC
ICT policy evaluation in higher education	X	X		X		X	X	X
ICT Policy evaluations		X	X	X	X	X	X	

Education Policy Evaluations	X	X	X		X		X	X
Educational Policy and ICT implementations	X	X		X		X	X	
ICT use in Education	X		X	X	X	X	X	X
ICT use in developing countries	X	X	X	X	X		X	X
ICT integration in teaching	X	X	X	X	X	X	X	X
ICT use in classrooms		X	X		X	X	X	X

2.1 ICT Policy Evaluations

In answering the first question, ICT policy evaluations around the world were discussed. Policies are strategic statements that provide a broader context for change and articulate a vision that motivates people to change and coordinate efforts within the system and across sectors (Hasan, 2016; Johnson & Hoba, 2015; Kozma, 2011; UNESCO, 2011; Vandeyar, 2013; Vanderlinde, van Braak & Dexter, 2012). Policies can also be operational: these are action plans, programmes, or projects that provide the mechanism and resources by which the vision can be realized (Tondeur, van Keer, van Braak & Valcke, 2008, UNESCO, 2011; Vanderlinde, van Braak & Dexter, 2012). With all policy implementations, there is a need to monitor and evaluate policy implementations on specified targets, in order to see if the targets are met (Blignaut, Hinostroza, Els & Brun, 2010; Vanderlinde, van Braak & Dexter, 2012; Winthrop, Anderson & Cruzalegui, 2015). If the targets are not met, then changes need to be made in order to meet the specified targets (Kozma, 2011; Kumar, 2016; UNESCO, 2011).

The analysis of ICT policy evaluations further identified key areas that were problematic regarding government ICT policy implementation. These are related to the understanding of ICT Policies, access and ICT use, ICT infrastructure, ICT pedagogical training, technical support (Cross & Adam, 2007; Czerniewicz & Brown, 2009; Martinovic & Zhang, 2012; Tongkaw, 2013; UNESCO, 2011; Wonglimpiyarat, 2014) and communities of practice (McGrath & Guglielmo, 2015; Tsiotakis & Jimoyiannis, 2016).

Regarding the understanding of ICT policies, the lack of transmission of the ICT policy to various policy stakeholders and how the ICT policy intent is shared or not shared is a policy impediment (Awidi & Cooper, 2015; Lye, 2013; Mtebe & Raisamo, 2014). When the ICT policy neglects to inform universities on how ICT might be used in classrooms is an obstacle. Universities are left to their own devices, they accrue meaning to their own policies that guide their actions and classroom practices, which may be faulty (Choung, Hameed & Ji, 2012; Kimmons, Miller, Amador, Desjardins & Hall, 2015; Vandeyal, 2013). As a result the teacher educators may be disillusioned by the lack of adequate policy guidelines.

The decision makers at the national level often do not understand the local level context regarding technology procurement, access and ICT use in the classroom (Bakir, 2016; Tongkaw, 2013; UNESCO, 2011). The complex organizational structure associated with the delivery and operation of ICTs require high levels of fast and good quality communications procedures, oriented to satisfy the needs for efficient delivery and coordination among the different groups, agencies and institutions (Drape, Rudd, Lopez, Radford, 2016; UNESCO, 2011).

The organizational structure is a critical issue that could negatively affect the delivery of ICTs on where they are needed in the classroom, if there is no clear understanding of the different participants roles from the national level to the classroom (Kizito, 2016; Liana & Ngeze, 2015; Singh, 2016). Generally, there is agreement that governments should facilitate, support the use of ICT for educational purposes and establish an enabling regulatory environment in order to achieve this goal (Chukwunyere, 2016; Kozma, 2011; UNESCO, 2011). There is also relative consensus that the potential of ICTs in higher education can be realized if a concerted effort is made by governments, the private sector and NGOs to lay the foundations for the access and delivery of ICTs (Choung, Hameed & Ji, 2012; Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013).

The processes of ICT Policy implementations are broken into three organisation levels. There are namely: macro, meso and micro levels (Pandolfini, 2016, UNESCO, 2016; Vandeyar, 2013).

The macro level refers to the policies and strategies at the national level, aimed at facilitating access to and use of ICT at publicly funded universities (Pandolfini, 2016, UNESCO, 2916; Vandeyar, 2013). At this level, there are indicators dealing with connectivity and the technology infrastructure provision. There is also the expectation to capture the degree of implementation in order to facilitate this process, e.g. the incorporation of ICT in the educational curriculum design at the country level, the actions aimed at promoting the production of new digital learning resources, the plans for technological support that can be implemented at the local level to encourage this process, and the incorporation of digital competencies in initial and ongoing training for teacher educators (Pandolfini, 2016, UNESCO, 2016).

The meso level is situated at the institutional level (Pandolfini, 2016, UNESCO, 2016; Vandeyar, 2013) , in this case the University of Namibia campuses which brings together indicators that shed light on the strategies and dynamics that follow the incorporation of technology into each University of Namibia campus. Here the attention is paid to aspects relating to leadership and the specific initiatives aimed at driving the digitization of campus activity and, especially, the way the internet, networks and software are incorporated into its organizational culture, both for internal use at each University of Namibia campuses and for participation in and establishment of links with the educational community in its broadest sense (UNESCO, 2016).

The micro level refers to the activity that takes place in the framework of pedagogical practice and contains indicators to identify the frequency and types of uses of technology in the teaching and learning processes (Pandolfini, 2016, UNESCO, 2016; Vandeyar, 2013). Here attention is paid to specific areas of knowledge, the diversity of digital resources that are incorporated here, teachers educators' digital skills, digital skills of the students and, ultimately, teacher educators beliefs regarding the role of technology at this level (Vandeyar, 2013). The prominence acquired by the Internet in the daily lives of teacher educators and students is crucial. This level also incorporates indicators on frequency and ways of using technology, specifically in the classroom.

In order to measure the progress at each level, organizations such as the World Bank, Organisation for Economic Co-operation and Development (OECD), and Eurostat set the conceptual domains reporting on key aspects that converge in ICT education policy implementations, which are: the commitments made by these policies in the international context, the characteristics of the technological infrastructure available, the place of ICT in teacher training, the integration of these technologies into the curriculum, the form and intensity of use of ICT at university campuses, the importance placed on these technologies when measuring competencies and, finally, the transformation in terms of results and the impact on the universities (UNESCO, 2016). The grouped indicators in these domains incorporate international norms that ensure standardized and consistent statistical data for use by policy makers, researchers and large organizations that operate globally (UNESCO, 2016; Vandeyar, 2013). The numerous international reports that utilize these data also help monitor, on a large scale, the process of ICT integration into education systems at the different levels (UNESCO, 2016, Vandeyar, 2013). Data collection, in this case, is performed following the procedures used in monitoring surveys, and thus focuses on the university digitization process (Pucciarelli & Kaplan, 2016; Hayden, Monson & Trask, 2016).

Digitization process is of crucial importance to data processing, storage and transmission (Pucciarelli & Kaplan, 2016), It allows information of all kinds in all formats to be carried with the same efficiency and in a combined format (Pucciarelli & Kaplan, 2016; Hayden, Monson & Trask, 2016). Unlike analog data, which typically suffers some loss of quality each time it is copied or transmitted, digital data can, in theory, be propagated indefinitely with absolutely no degradation (Hayden, Monson & Trask, 2016). This is why it is a favored way of preserving information for many organisations around the world (Pucciarelli & Kaplan, 2016).

The methodological and operational constraints that these indicators can have, as a result of the restrictions associated with obtaining information and, especially, of the difficulties of adapting to the rapid evolution of ICT, require continuous review procedures for updating and incorporating new indicators to achieve the changes experienced in data gathering (Choung, Hameed & Ji, 2012; Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013). Thus, it guarantees the sustainability of constructing indicators at different levels that would otherwise be difficult to maintain for many countries (Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013).

Additionally, it ensures the continuity and regularity of the procedure and ensures comparable ICT uses. Indicators at all levels provide indications that are essential to accurately interpret how universities and their main actors appropriate ICT in their daily activities and within their specific specializations. Obtaining indicators provide a unique vision for each of the levels. The range of perspectives becomes fundamental for a complex interpretation of the facilitating elements and the obstructions that, in practice, ICT brings to innovation (Choung, Hameed & Ji, 2012; Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013).

Another factor that hampers the ICT Policy implementation is the inadequate funding of ICT initiatives and the high cost of ICTs, which affects the effective use of ICTs in teaching and learning (Martinovic & Zhang, 2012; Tongkaw, 2013). The university budgets in developing countries do not have sufficient funds provided for the ICT procurement (Chukwunyere, 2016; Kozma, 2011; UNESCO, 2011). Due to inadequate financial resources, developing countries governments can hardly provide enough support for basic education to sustain quality teaching and learning process (Dotong, Castro, Dolot & Prenda, 2016). Many developing countries depend on donor agencies for the acquisitions of ICTs (Dotong, Castro, Dolot & Prenda, 2016). Technology in higher education in African countries as a whole is lagging behind compared to the developed world (River, Rivers, Hazell, 2015). In the developing countries, it is extremely difficult to balance the building of an information economy and society, generally driven by globalization pressures with the basic challenges of poverty alleviation, adequate health care, including HIV/AIDS epidemic, employment creation, and national, and regional security issues (Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

Contributors to this state of affairs include inadequate resources, the lack of technological infrastructure, and unreliable electricity provision, among other factors (Chukwunyere, 2016; Kozma, 2011). The inequality in access, distribution, and use of information and communication technologies between the developing and developed countries is known as the digital divide (Fuchs & Horak, 2008; River, Rivers, Hazell, 2015). This digital divide involves material access (physical access to ICTs), mental access (ICT experience), skill access (information and strategic skills in ICT use), and usage access (meaningful opportunities for using ICTs) (Kizito, 2016; Liana & Ngeze, 2015; River, Rivers, Hazell, 2015; Singh, 2016).

Many institutions of higher education in Africa continue to struggle to survive with only very limited technological capacity and basic resources (Kizito, 2016; Liana & Ngeze, 2015; River, Rivers, Hazell, 2015; Singh, 2016). African universities computer laboratories are typically infrequently accessed, housing old and broken computers, with few or no educational programs installed on them (Kizito, 2016; Liana & Ngeze, 2015). Such limited technological infrastructure in Africa is making it hard for institutions to achieve their educational objectives.

It is not possible for the technologies that exist in the developed world to have a place on the African continent in its present condition. There are approximately 1.1 billion people living in Africa with only about 200 million who own radios (Kizito, 2016; Liana & Ngeze, 2015; River, Rivers, Hazell, 2015; Singh, 2016; UNESCO, 2016), 24 million own cellular phones, 20 million have a fixed phone line, 5.9 million own personal computers, and 1 in 13 households have television (Kizito, 2016; Liana & Ngeze, 2015; River, Rivers, Hazell, 2015; Singh, 2016; UNESCO, 2016). Only 7% of the world's internet users live in Africa (River, Rivers, Hazell, 2015). Most technologies, electronic networks, computers, etc. are far beyond the reach of the majority of Africans. The digital divide has been referred to as the worldwide crisis in education.

In addition, Africa has limited material access to ICTs in higher education, because African institutions, educators, and students cannot afford it, and following from this, experience, skills, and opportunities to use ICTs are also lacking (River, Rivers, Hazell, 2015; Singh, 2016; UNESCO, 2016). The situation is severe that the digital divide has been called the "digital apartheid" in reference to Africa, due to this continent's systematic exclusion from technological progress and its accompanying benefits (Fuchs & Horak, 2008; River, Rivers, Hazell, 2015). The digital divide also exists domestically, with African cities having higher levels of ICT development and access than African rural areas (Gebremichael & Jackson, 2006; Singh, 2016).

Educational systems have also grown and changed more rapidly than ever before. The Africans are behind in this technological race related to both developing as well as applying technology to higher education. However, rapid progress in technology innovations, which is again revolutionizing the capacity to store, transmit, and use information, is imminent in nations across Africa. Extending access to, and strengthening the quality of technology in higher education in Africa is emerging as a key national priority of African governments, as is the case on national agendas throughout the developing world (Chapman & Austin, 2002; River, Rivers, Hazell, 2015). The current debate as to whether technology alone can strengthen African education remains to be seen (River, Rivers, Hazell, 2015)

With the advent of ICT, many researchers believe there is still hope for Africa in partnership with the developed world, in order to implement ICTs in teaching and learning (Liana & Ngeze, 2015; River, Rivers, Hazell, 2015; Singh, 2016; UNESCO, 2016). Fueling this hope, the statistics on Internet usage for the individual countries in Africa from 2000 to 2007 indicate enormous user growth across the board. A good example is the Democratic Republic of the Congo, where the number of internet users jumped from 500 to 180,000 between 2000 and 2007 (Kizito, 2016; UNESCO, 2016).

Global debates on ICT Policy evaluations have different positions. Some argue that global ICT policy goals are over ambitious or unrealistic for many developing countries (Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013; Winthrop, Anderson & Cruzalegui, 2015). As a result , the global ICT policy education goals, can have limited utility and little bearing on country level action (Chukwunyere, 2016; Liana & Ngeze, 2015; Winthrop, Anderson & Cruzalegui, 2015) . They can also restrict the policy space at country level to come up with the best ICT policy solutions for diverse and deeply contextual problems (Johnson & Hoba, 2015; Kozma, 2011; Vandeyar, 2013; Winthrop, Anderson & Cruzalegui, 2015).The strategy of using global ICT goals to influence country level policy, including decisions on where to direct foreign aid, is not one that enjoys universal support (Vandeyar, 2013; Winthrop, Anderson & Cruzalegui, 2015).

On the other hand, others argue (Cross & Adam, 2007; Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013) that global ICT goals are a useful way to harmonize efforts and make progress on particular issues, such as offering flexible and inexpensive ICT skills that have the potential to respond to skilled manpower shortages in developing countries by increasing access to education and serving as an equalizer in economic development and transformation (Cross & Adam, 2007; Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013). When used effectively, ICTs engage teacher educators in educational experimentation and innovation in collaboration with an extended network of colleagues (Kimmons, Miller, Amador, Desjardins & Hall, 2015; Tongkaw, 2013; UNESCO, 2011; Winthrop, Anderson & Cruzalegui, 2015).

This study is guided by the Systems Theory, which is described next. This theory provided the foundation on how the research for this study was conducted. This theory focuses on inputs, processes and outputs which are essential for the efficient implementation of the ICT Policy for Education in Namibia.

2.2 Systems Theory

The systems theory was formulated by Ludwig von Bertalanffy, Talcott Parsons and Norbert Wiener (Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). As a biologist, Von Bertalanffy argued that living organisms should be studied as a whole (Yurtseven & Buchanan, 2016; Zhou, 2016). This point of departure is contradictory to the traditional scientific notion of breaking entities into separate parts in order to understand how the parts are functioning. Since the 1930s all studies of living systems, i.e. organisms, parts of organisms, and communities of organisms, emphasise connectedness, relationships and context (Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016). The view of interrelated elements that function as a whole is also applicable to universities as organisations. The nucleus of the systems theory is that the whole is more than the sum of its parts, as emphasised in the Gestalt theory (Carayannis, Campbell, & Rehman, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Ludwig von Bertalanffy was strongly influenced in his thinking by the concept of homeostasis which led him to formulate the theory of "open systems" (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016) which is the foundation of the systems theory.

The concept of "open systems" involves the activities or transformation processes that are involved in the processing of the inputs, which leads to outputs which constitute the notion of management (Zhou, 2016; Raymond, Bawa & Dabari, 2016). An organisation can be a "closed" or "open" system (Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016). An open system, such as a university is a system that is dependent on the environment in which it operates. Open systems like universities constantly interact with their environments. They structure themselves to deal with forces in the world around them. These include: human, financial, physical and information resources (Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Human resources include administrative, staff talent, and labour resources. Financial resources are the capital the universities use to finance both ongoing and long-term operations. Physical resources include supplies, materials, facilities, and equipment (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Information resources are knowledge, curricula, data, and other kinds of information utilized by the university (Carayannis, Campbell, & Rehman, 2016; Raymond, Bawa & Dabari, 2016). The environment is also depending on the system; there is therefore an interaction between the system and environment. The "environment" of the system is what lies "outside" of the system (Zhou, 2016; Raymond, Bawa & Dabari, 2016). The composition of the environment should always be examined in which open systems operate. An organisation such as the university should therefore continuously conduct an environmental assessment (Evans & Lindsay, 2002) or "environment scan" (Yurtseven & Buchanan, 2016; Raymond, Bawa & Dabari, 2016).

However, a closed system is self-supporting and exists independently of a particular environment (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Closed systems are closed off from the outside environment, and all interaction and knowledge is transmitted within the closed system only (Raymond, Bawa & Dabari, 2016). Closed systems can hamper growth since the flow of information stays within the system and has no chance to interact with or build on knowledge from the outside environment. A closed system is a physical system which does not exchange any matter with its surroundings, and is not subject to any force whose source is external to the system (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

A closed system in classical mechanics would be considered an isolated system (Carayannis, Campbell, & Rehman, 2016; Raymond, Bawa & Dabari, 2016). A production line is an example of a closed system within an organization. The daily work that takes place on production or assembly lines can be insulated from outside factors such as day-to-day meetings between upper-level executives, or information from other similar, competing production lines. Instead, workers on an assembly line are generally only responsible for completing their tasks on the line, depending on what type of line it is (Raymond, Bawa & Dabari, 2016).

The programme criteria in organisations such as universities are clustered in terms of input, processes and output as well as its impact and review (Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Within the context of higher learning, the inputs with regard to programmes that are offered by universities are typical issues such as the university's teaching and learning strategy, its assessment policies and procedures, infrastructure, library resources, administrative services, postgraduate policies and procedures, programme design, etc. Resources such as infrastructure and people, can also be regarded as input into a system. Resources go through a process of transformation and become outputs (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

The processes are functions such as programme co-ordination, academic development and success, teaching and learning interactions, student assessment practices, co-ordination of work-based learning, delivery of postgraduate programmes. The output can be regarded as student retention and throughput rates and the impact of programmes. Quality assurance activities within a system, such as in a university, should include the assessment of all its dimensions with regard to its inputs, processes and outputs (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

While Ludwig von Bertalanffy worked on his general systems theory, attempts to develop self-guiding and self-regulating machines led to an entirely new field of investigation that had a major impact on the further development of the systems view of life (Becket & Brookes, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Drawing from several disciplines, the new science represented a unified approach to problems of communication and control, involving a whole complex of novel ideas, which inspired Norbert Wiener (1894–1964) to invent a special name for it – "cybernetics" (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016;

Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The word is derived from the Greek (kybernetes) meaning "governance", elaborated to mean " to steer, navigate or govern" (Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016), and Wiener (1948) defined cybernetics as the science of control and communication in the animal and the machine.

Cybernetics soon became a powerful intellectual movement, which developed independently of organismic biology and general systems theory (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The cyberneticists were neither biologists nor ecologists; they were mathematicians, neuroscientists, social scientists, and engineers. Cybernetics is relevant to the study of systems, such as mechanical, physical, biological, cognitive, and social systems (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Cybernetics were concerned with a different level of description, concentrating on patterns of communication, especially in closed loops and networks. Their investigations led them to the concepts of feedback and self-regulation, and then, later on, to self-organization (Becket & Brookes, 2006; Raymond, Bawa & Dabari, 2016). This attention to patterns of organization, which was implicit in organismic biology and Gestalt psychology, became the explicit focus of cybernetics. Wiener, especially, recognized that the new notions of message, control, and feedback referred to patterns of organizations – that is, to nonmaterial entities – that are crucial to a fully scientific description of life (Becket & Brookes, 2006; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Later on, Wiener expanded the concept of pattern, from the patterns of communication and control that are common to animals and machines to the general idea of pattern as a key characteristic of life. The cybernetics movement began during World War II, when a group of mathematicians, neuroscientists, and engineers – among them Norbert Wiener, John von Neumann, Claude Shannon, and Warren McCulloch formed an informal network to pursue common scientific interests (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Raymond, Bawa & Dabari, 2016). Their work was closely linked to military research that dealt with the problems of tracking and shooting down aircraft, and was funded by the military, as was most subsequent research in cybernetics.

Cybernetics is a broad field of study, but the essential goal of cybernetics is to understand and define the functions and processes of systems that have goals and that participate in circular, causal chains that move from action, to sensing, to comparison with desired goal, and again to action (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Studies in cybernetics provide a means for examining the design and function of any system, such as universities by making them more efficient and effective (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Another theorist who helped to develop the systems theory was Talcott Parsons, a sociologist (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Higgs &

Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Parsons developed a theory of sociology as a system (Higgs & Smith, 2006). According to Parsons, all human beings and human activity form part of a social system in which people constantly communicate with each other. Central to the systems approach is the notion of interaction of subunits or subsystems within a system and interaction of the system with its environment. Modern systems theory has a common perception of what constitutes the essentials of a system, i.e. the notion that all systems are sharing common or generic concepts. Systems theory declares that all systems are governed by the same logic laws (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Modern systems theory therefore has a quest for understanding the fundamental principles and operating logic of all systems (Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The systems theory is a conceptual framework and philosophy that claims that life is a system of which humans are part (Becket & Brookes, 2006; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). This way of thinking was underpinned by the discoveries in quantum physics with reference to atoms and subatomic particles. Atomism argues that components of a system cannot be studied or analysed in isolation (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Systems theory is regarded as a powerful analytical and conceptual tool that a researcher can use in the field of complex physical and non-physical phenomena (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

The systems theory is not a single theory, but an approach to a complex structure that abstracts away from the particular physical, chemical, or biological nature of its components and simply considers the structure that they together implement, in terms of the functional role of individual parts and their contribution to the functioning of the whole (Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Raymond, Bawa & Dabari, 2016). Higgs and Smith (2006) understood and described the systems theory in the following statements: The world we live in is complicated. The methods of the systems theory can be used to cope with this complexity. All systems work within a certain context. The context is usually so complex that any system has to select the data that it will incorporate to use in its overall working (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016).

Central to the systems approach is the notion of interaction of subunits or subsystems within a system and interaction of the system with its environment. The contemporary world is ruled by systems that are in conflict with each other; their functions are different and are evolved to solve different types of problems. The systems theory is about finding out why some systems operate efficiently whereas others disintegrate. The following are characteristic of the systems theory according to Higgs and Smith (2006): Parts of the system work together in some way to form a whole. All systems have goals/ purposes.

All systems have inputs and outputs. All systems take inputs and turn them into outputs. All systems absorb and generate some form of energy. Systems need to be controlled. Systems work in a certain order. Systems are specialised.

According to this thinking within the context of systems theory, there are fundamental structures, and then there are forces and mechanisms through which these interact which give rise to processes. Systems thinking is process thinking (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The inputs, processes and outputs of an organisation are all encompassed within the boundary of the environment (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Processes within a system, such as universities combine the input of people, equipment, method and environment to produce output (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; De Bruyn, 2002; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The typical inputs or resources of an organisation can be people in the form of labour, physical resources in the form of raw material, capital or financial resources, and information or knowledge. Universities should transform the environment's inputs to outputs in the form of products and services (Zhou, 2016; Raymond, Bawa & Dabari, 2016).

In a university environment the inputs, include purchase of ICTs, training in the use of ICTs for teaching purposes, ICT pedagogy, good technical know – how in ICT applications (Becket & Brookes, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). Processes would include, presenting interesting lectures, seeking, organizing and storing information, collaborating more with other lecturers and others within and outside their campus on the effective use of ICTs, self driven efforts in the use of ICTs, support for ICTs uses in the classroom by technical staff (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The output would include effective ICT integration in teaching (Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Therefore, if a university is operating under a fixed budget that it receives from a higher agency, for example, a national department of education or government, the budget itself is then a given and cannot be changed by the institution to fulfil different functions that it was not intended for. The budgetary constraints with regard to the latter are in this case in the environment of the system. If by some organisational change the system could influence the budget, the budgetary process then belongs partially inside the system (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016) . The environment will have an impact only to the extent that it causes changes to the elements of the system, namely the inputs, processes and the outputs. The environmental variables should have an influence on the actions of management within as well as outside the organisation (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). It is therefore imperative from a management point of view to examine, on a continuous basis, the composition of the environment in which a system operates (Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

The environment is not a constant entity but changeable and sometimes even unpredictable. Continuous assessment is imperative because complex factors can change the unstable environment which will have an effect on the system (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The changes in the environment should be identified and acted upon because they determine to a great extent how the system performs. Within the context of university, the demands for the products that university produces are determined by individual people or customers. These demands lie in the environment of the system or external to it, because they have the ability to influence the performance of the system. There are numerous environmental variables that have an impact on an organisation (Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Management of an organisation, such as the university has no or little control over the external environment, such as economic trends, social changes, political developments, etc. The political change in a country has its impact on the education landscape is an example of the impact that the external environment can have on the system. Universities should therefore be able not only to steer towards their own goals and priorities but also towards the goals and the national imperatives of the government (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Universities are operating within a competitive and highly technological global environment. The notion of constant awareness of the environment can save an institution from extinction. The management of an organisation should adopt a policy of organisational Darwinism to ensure that the organisation does not become extinct in a rapidly changing world in which only the fittest can survive (Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The evolution theory of Darwin testifies that species survive because they have the ability to adapt to a changing environment (Blackburn, 2005).

The micro-environment or internal environment refers to the organisation, such as the university in particular over which management has complete control. The vision, mission and goals of the university as well as objectives and strategies are variables of the micro-environment. These entail the university’s strategies that are controlled by management, including its management functions and the university's resources, employees and corporate culture (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The market environment or task environment's key variables are consumers, competitors and suppliers (especially within industry).

All these variables create certain threats as well as opportunities. Management should identify, evaluate and utilise the opportunities in the market environment and develop strategies that can meet competition. It is clear that management has little or no control over the components in the market environment (Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

The macro-environment exists outside the university as well as the market environment and includes the technological environment that is continuously responsible for change and innovation. An economic environment can influence factors such as inflation, recessions, fiscal policy of government and the wealth of the community. The social environment where people's lifestyles, habits and values are shaped by culture (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). The ecological environment comprises natural resources. The institutional environment with the government and its political involvement as the primary components. The international environment refer to the local and foreign political trends and events that influence the university and the market environment.

The components of the macro-environment are a given and the individual university has no control over them (Zhou, 2016; Raymond, Bawa & Dabari, 2016). The university should take cognisance of the market and macro-environment in order to adapt to them.

The concepts of entropy and synergy within the context of systems theory accentuate the importance of the interface between an organisation and its environment. "Synergy" and "entropy" are typical commonly used concepts in the systems theory. Synergy refers to the notion that the whole is greater than the sum of its parts. The individual subsystems are simultaneously applied in such a way that the result of their simultaneous application is greater than the sum of their individual efforts (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

Therefore, the various functions of an organisation, such as the university become more effective and productive as in the case where they function individually. All functions should therefore strive for synergy by means of complementing each other as interdependent components of a system. Entropy refers to the process of systems disintegration. It is therefore the opposite of synergy. If a system or a university fails to conduct environment assessments continuously or to make the necessary adjustments in order to ensure its continuous existence within an environment, the system or university is doomed to fail and to disintegrate. It is already mentioned that university, as open systems, are impacted by the environment. There is also a continuous interaction between the environment and the university. In order to ensure that a university does not become extinct, it should conduct environmental scans as a mechanism to align itself with the unstable external environment continuously (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

In summary, systems thinking or systems theory can be viewed as a way of thinking about total systems and their components (Becket & Brookes, 2006; Blackburn, 2005; Carayannis, Campbell, & Rehman, 2016; Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016). An understanding of processes that comprise three constituents, that is, inputs that are turned into outputs by means of certain processes. The inputs, processes and outputs process thinking emerged in the twentieth century science, which is the cornerstone of the systems theory (Higgs & Smith, 2006; Yurtseven & Buchanan, 2016; Zhou, 2016; Raymond, Bawa & Dabari, 2016).

2.3 ICT infrastructure

There is an identified digital gap between the developed and the developing world in terms of ICT infrastructure and maintenance (Awidi & Cooper, 2015; Echezona, 2010; Eyitayo, 2008; Kumar, 2016; Mavengere & Ruohonen, 2011; UNESCO, 2011). While the developed world use high speed, cost effective fibre optic technology for connectivity, most Africans Universities are still on satellite connectivity which is very costly and narrow bandwidth (Onwuagboke & Singh, 2016; Jegede, 2009, UNESCO, 2011). African universities face challenges in terms of lack of modern ICT infrastructure and low bandwidth (Echezona, 2010; Kizito, 2016; Tondeur, van Braak, Siddig & Scherer, 2016). Modern ICT require money for acquisition, installation, maintenance, training, and sustainability, which most African universities do not have (Drape, Rudd, Lopez & Radford, 2016; Eyitayo, 2008; Loisulie & Mselle, 2015).

The way in which information is produced, shared, and used is now heavily facilitated by information technology that a university depends on the quality of its connections of both the Internet and the global research network. Bandwidth determines the efficiency of internet connections, and equally important is the type of infrastructure used in the connectivity (Jegede, 2009; Gakio, 2006: UNESCO, 2011, Kozma, 2011, Kumar, 2016).

The effectiveness of internet connectivity depends on the speed of transmission across the networks. The greater the number of bandwidth per unit time, the greater the speed of data transmission and reception. Being part of the global information environment is an important aspect at African Universities (Drape, Rudd, Lopez & Radford, 2016; Olalude, 2007). African universities can be pivotal to development in Africa through research and education, when the ICT infrastructure is upgraded and maintained (Khodamoradi & Abedi, 2011; Loisulie & Mselle, 2015; Mugimu, 2010).

Current views on ICT infrastructure procurement in the developed countries are those who emphasize the role of government in facilitating the development of a networked, multimedia educational community in higher education through several strategies, including: (i) deregulation of electronic delivery to stimulate competition; (ii) removal of barriers for institutions operating on national and international scales; (iii) increase of information-consumer functions to inform choice and improve programmes; and (iv) support of public/private partnerships in support of ICT needs (Cross & Adam, 2007; Kozma, 2010; Kumar, 2016).

They emphasize issues of accountability, quality assurance, accreditation and consumer protection. For them, education is too important to exist without controls, without licensing, or without credentials (Drape, Rudd, Lopez & Radford, 2016; Loisulie & Mselle, 2015) . These issues have dominated debates on the role of government in European and North American context (Onwuagboke & Singh, 2016; Cross & Adam, 2007, Kozma, 2010; UNESCO, 2011).

In the developing countries, competition, inter-institutional cooperation, public/private partnerships, accountability, quality and consumer protection are directly linked to pressing challenges such as poverty, illiteracy, job creation, skills development and social inequality (Onwuagboke & Singh, 2016; Tondeur, van Braak, Siddig, Scherer, 2016). Compromises in choice and emphasis are needed in order to reconcile a national ICT strategy with these pressures. Researhers argue that national ICT policy cannot be limited to simply promoting the use of ICTs, but must also simultaneously address inequality and the distribution of information technology through the economy (Loisulie & Mselle, 2015; Kitizo, 2016).

2.4 ICT Pedagogical Training

The training in ICTs is often not focused and targeted to teacher educators, rather it is focused on acquiring basic ICT skills (Jegede, 2009; Mugimu, 2010; Tsai & Chai, 2012; Tondeur, van Braak, Siddig & Scherer, 2016). The training generally has no pedagogical content and the training involves non-academic staff (Bingimlas, 2009; John, 2015; Loisulie & Mselle, 2015). Therefore, it becomes difficult to develop a focused curriculum for ICT training for teacher educators as the audiences are heterogeneous in nature. This leads to a lack of confidence, and resistance to change by teacher educators (Johnson & Hoba, 2015; Singh, 2016).

The lack of ICT confidence makes teacher educators feel anxious about using ICTs in the classroom, and thus not confident to use them in their teaching. They are therefore not motivated to use ICT in the classroom (Bingimlas, 2009; Chitanana, Makaza & Madzima, 2008; Johnson & Hoba, 2015; Simcek, 2007). The resistance to change is caused by the lack of understanding on how ICTs will benefit their teaching and their students' learning. They also do not believe that they are being supported, guided, or rewarded in the integration of technology in their teaching (Ficek, & Segovia, 2006; John, 2015).

Teacher educators require extensive, on-going exposure to ICTs to be able to evaluate and select the most appropriate ICTs (Arkaitz, Martinez, Nere, 2010; Igari, 2014; Winthrop, Anderson & Cruzalegui, 2015). The development of appropriate pedagogical practices is seen as more important than technical mastery of ICTs by teacher educators (Winthrop, Anderson & Cruzalegui, 2015). Therefore, teacher educator training and professional development is seen as the key driver for the successful usage of ICTs in education. The most effective uses of ICT are those in which the teacher educator, aided by ICTs, challenge pupils' understanding and thinking, either through whole-class discussions or individual/small group work using ICTs (Awadi & Cooper, 2015; Igari, 2014; O'Sullivan & Samarawickrema, 2008). The way ICTs are used in lessons is influenced by the teacher educator mastery of his/her subjects, and how ICT resources are utilized to achieve those objectives. Research evidence shows that when teacher educators use their knowledge of both the subject and the way students understand the subject, their use of ICTs has a more direct effect on student achievement (Arkaitz; Martinez, Nere, 2010; Kumar, 2016; Rye, 2014; Trucano, 2005).

Teacher educators needed training in the areas of media and digital resource development, technology planning and evaluation, action learning and research, and specialized ICT in teaching and learning (Loisulie & Mselle, 2015; Singh, 2016). The above stated helps teacher educators to plan and organize their teaching materials which results in better content delivery. The curriculum should include information skills, thinking skills and creativity, communication skills, knowledge application skills, self-management skills, and character development (Chukwunyere & Ranjit, 2016; Kozma, 2010). In-service training programs provide teacher educators with the knowledge and skills needed to reform the pedagogical practices in their classrooms, especially with regard to collaborative teaching and learning, networking, and team work (Ali, Haolader & Muhammad, 2013; Kizito, 2016; Tondeur, van Braak, Siddig & Scherer, 2016).

Within the ICT pedagogical training there are various tools that are administered to gauge progress toward the goal (Drape, Rudd, Lopez & Radford, 2016; Winthrop, Anderson & Cruzalegui, 2015). The data from these measures can be reported on a scale of learning progression, called a metric. Within these metrics, different levels of learning or benchmarks are designed to make comparisons possible. Some multiple benchmarks measure different levels of learning. These benchmarks correspond to various levels of proficiency, such as basic, proficient and advanced. Indicators measure whether progress toward targets have been achieved or not (Kumar, 2016; Winthrop, Anderson & Cruzalegui, 2015). This is not done in developing countries (Winthrop, Anderson & Cruzalegui, 2015, UNESCO, 2011). These measures need to be put in place in order to gauge the ICT pedagogical uses at African universities.

2.5 ICT use in the classroom

Research points to two factors that affect ICT use, namely external and internal factors (Tsai & Chai, 2012) . External factors include issues, such as lack of adequate access to ICTs, time and institutional support. Low bandwidth, lack of digital resources and infrastructure are part of the external factors that hinder technology integration in teacher training institutions (Cross & Fatima, 2007; Tsai & Chai, 2012). Internal factors are more intrinsic to the teacher educator, such as the teacher educator's expertise in ICT pedagogical skills, beliefs, technology beliefs and the willingness to change (Igari, 2014; Tsai & Chai, 2012).

In addressing the external factors, the acquisition of cutting-edge technologies in teacher education institutions addresses the lack of digital resources and infrastructure (e.g., the unstable electricity support, low bandwidth, old and broken computers, and lack of education software) in many African universities. Such limited technological infrastructure in African teacher education institutions is making it hard to achieve their educational objectives (Kizito, 2016; Liana & Ngeze, 2015; Rivers, Rivers, Hazell, 2015; Singh, 2016). Material access to ICTs in African higher education is limited, because African institutions, educators, and students cannot afford them, and following from this, experience, skills, and opportunities to use ICTs are also lacking. The disparities in ICT infrastructure in African education institutions in rural areas is higher than in African education institutions in cities (Rivers, Rivers, Hazell, 2015; Gebremichael & Jackson, 2006).

In addressing the internal factors, teacher educators beliefs and how teacher educators overcome contextual challenges through creative re-structuring of classroom learning environment is a necessity (Tsai & Chai, 2012). The creation of knowledge and practice by teacher educators when they are confronted with the advancement of ICT and its associated pedagogical affordances is crucial (Kizito, 2016; Liana & Ngeze, 2015; Rivers, Rivers, Hazell, 2015; Singh, 2016; Tsai & Chai, 2012). It moves beyond the knowledge perspective, which tends to be associated with codified/justified true beliefs, into the design mode of knowing. This is termed as "design thinking” (Rivers, Rivers, Hazell, 2015, 2015; Singh, 2016; Tsai & Chai, 2012) Design thinking seeks to change and improve current situations and create what is desired (Kizito, 2016; Liana & Ngeze, 2015; Rivers, Rivers, Hazell, 2015; Singh, 2016; Tsai & Chai, 2012) . It may therefore tackle internal barriers as it treats barriers as problems that need to be tackled and resolved through human creative thinking. However, deeply rooted beliefs can prove to be hard to detect, and unless deep changes are effected, the programs may teach the skills and knowledge but still fail to produce the necessary shift in pedagogy (Kizito, 2016).

As classroom context and students are quite dynamic, the teacher educators should rely on some design thinking to re-organise or create learning materials and activities, adapting to the instructional needs for different contexts or varying groups of learners (Kizito, 2016; Liana & Ngeze, 2015). By achieving this, teacher educators can use technology for instruction at the right time and right place. Technology integration in education is not simply as a state of "technology", rather, it becomes a state of "art" (Rivers, Rivers, Hazell, 2015; Singh, 2016). Teacher educators need to be committed and skilled to implement technology integration in classrooms. In such stage, they may utilise technology at any time and at any place. As a result, teacher educators can undertake technology integration actively and fluently (Kizito, 2016).

In addition, the cultivation of design thinking should be an ongoing effort, regardless of whether or not one is in a technology rich or poor environment. Barriers will always exist in one form or another and design capacity is usually sharpened in a constrained environment (Loisulie & Mselle, 2015; Kitizo, 2016). Building teachers educators design capacity is therefore arguably the most crucial task for further integration of technology in education (Kizito, 2016; Liana & Ngeze, 2015; Rivers, Rivers & Hazell, 2015). This again calls for insightful design by teacher educators. The programs may teach the skills and knowledge but still fail to produce the necessary shift in pedagogy These factors often influence gaps between policies and the changes in classroom practice that they are intended to affect (Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

To achieve technology integration, internal factors need to be overcome. Some ideas are about highlighting the challenge of teacher educators attitude change towards instructional approaches. There is a need to try to link ICT competence and pedagogical consideration when using ICTs in teaching (Kizito, 2016; Liana & Ngeze, 2015). If a teacher educators have sufficient facility, rich digital instructional resources, positive attitudes or strong beliefs toward technology integration, they may have successful ICT implementation (Rivers, Rivers, Hazell, 2015; Singh, 2016; Tsai & Chai, 2012). This can be better achieved, if teacher educators strengthen the pedagogical foundation for technology integration (Kizito, 2016; Liana & Ngeze, 2015; Rivers, Rivers, Hazell, 2015; Singh, 2016).

Although current universities are aiming for innovative teaching and learning to gain global competitive advantage by adding value to traditional approaches, the integration of eLearning platforms has been problematic (Kizito, 2016; Liana & Ngeze, 2015; Singh, 2016), even though there are huge governments' investments in building ICT infrastructure. When teacher educators do not enjoy using eLearning platforms the way it was designed and planned to work, it becomes difficult to add value in the learning environment (River, Rivers, Hazell, 2015; Singh, 2016).

Another alarming factor that negatively affect ICT use in the classroom is changing subjects at the beginning of semesters which make the teacher educators to workup more numbers of subjects, leaving teacher educators to be “jack of all trades, and master of none” (Kitizo, 2016; Kumar, 2016). This has a negative impact on teaching and research, where the teacher educator can not explore new factors, dimensions and critical evaluation which could contribute to the existing mass of knowledge by either inductive or deductive reasoning and thereby brightening up the subject with a new outlook to the students (Kumar, 2016; Tondeur, van Braak, Siddig, Scherer, 2016).

2.6 Class Size

The Universities now face more challenges, and more complex issues, starting from an increase number of students enrolled in their educational programs up to the limitations imposed by the infrastructure available to accommodate the students and the curriculum classes (Sapelli & Illanes, 2016). Teacher educator to student ratio in developing countries is alarmingly high (Bai & Chang, 2016; Beattie & Thiele, 2016; Kumar, 2016, Kozma, 2011). In many developing countries government colleges and universities has observed a ratio of 1 teacher educator to 100 students or more at the undergraduate level (Egbenya, Halm, Eghenya & Quaye, 2016; Liana & Ngeze, 2015; Rivers, Rivers, Hazell, 2015; Singh, 2016). This high ratio of students to teacher educator makes the teaching difficult to handle the activities of the class and to allow personal attention to address the queries of the students (Igari, 2014; Tsai & Chai, 2012; Wadesango, Hove & Kurebwa, 2016).

In an era where large class sizes are becoming routine, their effects on student experiences have been examined (Liana & Ngeze, 2015; Lukwale, 2016; River, Rivers, Hazell, 2015; Singh, 2016). Researchers argue that larger classes can hinder a key type of beneficial student engagement—student interactions about academic and career matters with teacher educators and peers across campus (Sapelli & Illanes, 2016). While larger college classes are associated with lower student achievement, attendance, and participation (Beattie & Thiele, 2016; River, Rivers, Hazell, 2015; Singh, 2016; Tsai & Chai, 2012) studies have systematically examined the link between college class size and academic interactions (Beattie & Thiele, 2016; River, Rivers, Hazell, 2015; Singh, 2016; Tsai & Chai, 2012; Arias & Walker, 2004)

In the United States of America, it was found that minorities, such as African Americans and Latino students face particular challenges in college and universities, and there is evidence that larger classes particularly does not benefit disadvantaged students. Large class size negatively influence academic interactions for these student groups (Beattie & Thiele, 2016; Egbenya, Egbenya, Halm, Quaye, 2016; Lukwale, 2016; Sapelli & Illanes, 2016). Class size differences on a campus may influence academic interactions between students and their teacher educators. Organizational characteristics are known to shape social cohesion in the workplace (Adler & Kwon, 2002; Beattie & Thiele, 2016; Egbenya, Egbenya, Halm, Quaye, 2016; Lukwale, 2016; Sapelli & Illanes, 2016). Research evidence from focus groups and interview studies indicates that larger classes hinder student interactions (Arias & Walker, 2004; Giuseppe & Hubball, 2008).

One study on a campus that controlled for student- and classroom size found that grades declined as class size increased (Beattie & Thiele, 2016; Egbenya, Egbenya, Halm, Quaye, 2016; Johnson, 2010; Lukwale, 2016; Sapelli & Illanes, 2016). In addition to hindering academic performance, large classes have been negatively associated with other student behaviors. In a study where classes ranged in size from 3 to 50 students, students in larger classes reported lower levels of participation during class, including commenting, asking questions, and expressing personal opinions (Beattie & Thiele, 2016; Egbenya, Egbenya, Halm, Quaye, 2016). Further, larger classes have been linked to higher rates of student absenteeism and lower student evaluations of professors and courses (Beattie & Thiele, 2016; Bedard & Kuhn, 2008; Egbenya, Egbenya, Halm, Quaye, 2016; Johnson, 2010).

Student campus experiences are likely shaped by the average size of classes at the universities they attend (Beattie & Thiele, 2016; Egbenya, Egbenya, Halm, Lukwale, 2016; Sapelli & Illanes, 2016). Beattie and Thiele (2016) characterized the compartmentalization of student experiences as either “inside” or “outside” of class as an “artificial boundary” to be transcended. Universities best foster student success by helping students integrate ideas across different classes and by promoting discussions with professors and peers both inside and outside the classroom (Beattie & Thiele, 2016; Egbenya, Egbenya, Halm, Quaye, 2016). Students’ average class size influenced their academic interactions in a given semester, not only interactions confined to a single class (Egbenya, Egbenya, Halm, Quaye, 2016; Johnson, 2010; Lukwale, 2016; Sapelli & Illanes, 2016).

Classes serve as the institutional glue that solidifies academically-oriented network ties between students and teacher educators (Lukwale, 2016; Sapelli & Illanes, 2016). As they grow in size, however, student opportunities for socio-academic integrative moments may diminish (Giuseppe & Hubball, 2008). Further, the negative effects of large classes may be magnified for traditionally disadvantaged students, such as, African American and Latino students in the United States of America, since their experiences with marginalization may present unique challenges for developing academic relationships (Beattie & Thiele, 2016; Sapelli & Illanes, 2016).

The next topic is Learning Management Systems (LMS) which are used by universities for teaching purposes. These are electronic based learning systems.

2.7 Learning Management System

Learning Management Systems (LMS) have consolidated themselves as a flexible and dynamic tool for university-level learning worldwide in the last years (Cavus, 2015; Cigdem & Topcu, 2015; Dobre, 2015; Mtebe & Kondoro, 2016; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). They are defined as a working environment for supporting content management and academic processes to both on-site and online students and teacher educators (Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). The increasing use of this kind of environment provides improvement of learning quality and cost. (Munoz, Lasheras, Capel, Cantabella & Caballero, 2015).

The various types of LMSs could be split in three main families and these families are: open-source LMSs, proprietary LMSs, and cloud-based LMSs. (Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017) This involves the use of ICT technologies. Regardless of the type of LMS used at a university, the interfacing between teacher educators and students is done through electronic measures, (e.g. computer/tablet/mobile/smartphone/networks) and virtual means (Internet, Cloud computing, etc.). The purpose of the LMSs, regardless of the type category is the same. All LMSs from all main categories are believed to manage the educational cycle and the students' data at minimum (Munoz, Lasheras, Capel, Cantabella & Caballero, 2015).

Proprietary LMSs

The proprietary LMSs represent the beginning. These systems are called proprietary because they have been licensed by their developers under exclusivity of the legal rights belonging to the copyrights owner/s (Munoz, Lasheras, Capel, Cantabella & Caballero, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2016) . The proprietary LMSs require the existence of a developed infrastructure (buildings fitted with labs, networks, computers, etc.) and also involve the installation of the platforms on the universities servers and computers (Munoz, Lasheras, Capel, Cantabella & Caballero, 2015).

In case the universities do not have a sufficient developed infrastructure and the servers can not be accessed by teacher educators and students from external sources (for example using Juniper interface) than the LMS has to be interfaced through internal infrastructure which could be a disadvantage (Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Universities need to have fixed infrastructure and have well developed ICT network in order to use proprietary LMSs effectively. The most known and used at present proprietary LMS is Blackboard (Cavus, 2015; Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Some other important proprietary LMSs to be mentioned are: Design2Leran, ANGEL (property of Blackboard Inc.), Edmodo and Schoology (Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017).

The new trend in sales of proprietary LMSs is to cover the needs for training and development of the human resources of universities. However involved costs depend on the number of users, the number of licenses needed, the number of upgrades required, the level of maintenance necessary to be done, etc. In order to become cost effective, a proprietary LMS has to be purchased if the number of students is higher than 2,000 and the use of the LMS is targeted for at least three years. Recently, from many universities point of view, the proprietary LMSs are not anymore a viable and cost effective solution. Due to the strong competition of the open-source LMSs, and the Cloud-based LMSs, the proprietary LMS developers have looked to different possible customers including universities (Cavus, 2015; Cigdem & Topcu, 2015; Dobre, 2015).

Open-Source LMSs

Differently than the previous category, the open-source LMSs are learning management platforms which made available the source code under a public free license, this giving to the user the rights to use, to change, to study, to create and to distribute the results, free of charge, to anyone and for any purpose (Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). This is equal to a donation done by developer/s to the public for the public interest. The open-source LMSs were developed as an option to the proprietary ones being a better solution from financial point of view, involving less costs related to software licenses and maintenance/upgrades, requiring not a well developed infrastructure and, most important, offering the liberty to develop own LMS, based on own goals, own requirements and adapted to own necessities (Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017).

The major advantages offered by open-source LMSs are that in higher education, institutions are interested in selecting software they can modify to serve their particular needs and systems, and the university can make its own decision about whether or when to upgrade to a new version (Davis, Carmean, & Wagner, 2009). The present leader on the open-source LMSs market is Moodle (Edutechnica, 2014). According to Moodle statistics, Moodle had 69,559,411 users, from 229 countries (Moodle, 2014). Some other open-source LMSs considered are: Sakai, eFront LMS, Dokeos LMS (Cavus, 2015; Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). The open-source LMSs are considered a very good solution for small and medium size universities (Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017).

The disadvantage of open-source LMSs are that they can be less "user-friendly" and not as easy to use because less attention is paid to developing the user interface (Cavus, 2015; Cigdem & Topcu, 2015; Dobre, 2015). There may also be less support available for when things go wrong. Open source software tends to rely on its community of users to respond to and fix problems. Although the open-source LMSs are free, there may still be some indirect costs involved, such as paying for external support (Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Having an open-source LMS system means that there are many people identifying bugs and fixing them, it also means that malicious users can potentially view it and exploit any vulnerabilities (Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017).

Cloud-based LMSs

The Cloud-based LMS have emerged as an alternative that provide Internet available options, and use these to deliver the education online to any student, at anytime and anywhere around the world. The only requirement to be fulfilled is the existence of an Internet connection and of a tool (i.e., computer, tablet, smartphone) (Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). According to Bhatia (2014), the Cloud-based LMSs are a low cost solution which "*are able to take advantage of the convenience and flexible aspects of the technology*" (Bhatia, 2014, p4). Cloud-based LMS have the following advantages:

1. They do not require installation of LMS platform;
2. Could be accessed directly through an Internet connection:

3. The management (i.e., create, upload, change, communicate etc.) could be done through the internet browser;
4. Low cost solution, as are not required costly infrastructure, specialized software licenses, no maintenance involved from user side;
5. Extremely mobile solution as do not require a face-to-face interface;
6. Possible to personalize the education as required and as necessary and also capable to provide personalized and instant feedback to users (Dobre, 2015, p.319).

The above major advantages make the Cloud-based LMSs to be a suitable solution for universities and especially for those universities which do not have proper and sufficient infrastructure and also, facing an increase in the number of students enrollments (Cavus, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). The list of Cloud-based LMSs is long at present and is increasing and will increase even in the near future (Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). From most known cloud based LMSs are the following: DigitalChalk, Docebo SaaS LMS, TalentLMS, Firmwater LMS, Litmos LMS etc. (Cavus, 2015; Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017).

The disadvantage of Cloud-based LMS is that no cloud provider, even the very best, would claim immunity to service outages (Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Cloud computing systems are internet based, which means your access is fully dependent on your Internet connection. Like any hardware, cloud platforms themselves can fail for any one of a thousand reasons (; Cigdem & Topcu, 2015; Dobre, 2015). In cloud computing, every component is potentially accessible from the Internet. Nothing connected to the Internet is perfectly secure and even the best teams suffer severe attacks and security breaches (Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Cloud-based LMS, especially on a small scale and for short term projects, can be pricey. Though it can allow universities to reduce staff and hardware costs, the overall price tag could end up higher than the universities expected.

LMSs Trends

The present trends point out on the open-source LMSs (Davis, Carmean, & Wagner 2009). 20.1% of the responders were using Moodle, while 13.1% from the responders were using Blackboard LMS (Arenas-Gaitan & Alfaro-Perez, 2016; Davis, Carmean, & Wagner, 2009). There is a battle in progress, and that is carried out between the open-source LMSs versus the proprietary ones (Curran, 2011).

There is a high possibility that the battle between open-source and proprietary LMSs to be won by the Cloud-based systems (Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Other important trends are referring to the availability of a deployment system which could make things easier and faster for users being able to offer the possibility to interface the cloud based LMSs from any mobile device fitted with a Wi-Fi connection, a screen and a keyboard, and from any place where an Internet connection is available (Cigdem & Topcu, 2015; Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017). Another trend, is that in the future, the LMS developers will focus on the use of software as a service (SaaS) defined as the software which is not hosted by the user server but is stored in a third party (supplier) system. The software is being rented from the third party. The license of the software is retained by the third party (Dobre, 2015; Ramirez-Correa, Rondan-Cataluna, Arenas-Gaitan & Alfaro-Perez, 2017).

The next topic to be discussed is social media which is used by teacher educators for professional purposes, as well as for teaching purposes.

2.8 Social Media

The term Social Media has been object of several and contested definitions. Some authors use Social Media interchangeably with the term Web 2.0 (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016), others with social software (Ellison & Boyd, 2013; Ravenscroft, 2009), or with social web (Brown, 2012). Researchers have provided tentative definitions, such as that Social Media are a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content (Kaplan & Haenlein, 2010). The task of defining these devices is made more challenging by the fact that they are constantly in a state of change (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

Social networking sites, blogs, wikis, multimedia platforms, virtual game worlds, and virtual social worlds are among the applications typically included in the Social Media landscape (Tess, 2013). Despite the contested terminological differences, Social Media refer to a wide range of applications enabling users to create, share, comment and discuss digital contents (Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). They are also depicted as ‘dynamic’, ‘interactive’, ‘democratic’, ‘people centric’, ‘volatile’, ‘social’ and ‘adaptive’ (Brown, 2012, p.50). Due to these features, Social Media are often seen as means through which to deeply transform teaching and learning practices as more social, open and collaboration oriented (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

In particular, social networking tools are viewed as able to support a distributed and networked process of knowledge building through the connection and the promotion of networks and social interaction (Dron & Anderson, 2014; Siemens & Weller, 2011). Considering the academic context, some authors (Brown & Adler, 2008) have underlined that the adoption of these devices generates or requires a radical change of the pedagogical paradigm with ‘revolutionary’ consequences for academic institutions, or, at least, to reconsider teachers educators' e-learning and teaching practices. Others (e.g. Junco, 2014) have pointed out how an increased use of Social Media in higher education would lead to reconnecting academic institutions to the new generations of students (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

However, much of the literature in the field focuses on the potentials of Social Media for learning (Greenhow & Askari, 2015; Manca & Ranieri, 2016; Tess, 2013) or provides empirical evidence relating to their use in higher education by students (Bennett, Bishop, Dalgarno, Waycott, & Kennedy, 2012; Karvounidis, Chimos, Bersimis, & Douligeris, 2014). Teacher educators are increasingly adopting Social Media in their personal and professional lives (Moran, Seaman, & Tinti-Kane, 2012) with Facebook being the most visited Social Media site for personal use and LinkedIn the most used for professional purposes (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). However, frequency of personal use seems to be mostly associated with the frequency of professional use rather than with the frequency of teaching use (Manca & Ranieri, 2016). These results show a generally more favourable attitude towards personal sharing and professional development through online social networks rather than integrating these devices into teaching practices (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

From this point of view, more specific attention on how teacher educators actually use Social Media in their teaching practices, and a greater understanding of the perceptions they have of these devices, would allow researchers to overcome the generic analyses that often characterize reflections on the role of digital technologies for teaching in higher education, and to enhance knowledge about use of these tools in various geographical regions (Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). The uses of Social Media and the perceptions of teacher educators has about the potential and the barriers of these tools for teaching needs further investigation (Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

Several obstacles may prevent a full adoption of Facebook as a learning environment, such as declared and implicit institutional policies, teacher educators' and students' pedagogies, and several cultural issues (Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016). A number of challenges and opportunities offered by social network sites that would deserve further research investigation are: issues related to communication between teacher educators and students and their appropriate professional behaviours; pedagogical and technological challenges related to incorporating social networking practices into teaching and academic practices; and exploitation of social networking for teachers educators' professional training and development (Manca & Ranieri, 2016). A number of implications for policy and practices, such as questioning students' and teachers educators' vision of universities or of academia and their didactic agreements needs further investigation (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

A review study on the use of social network tools, Sobaih, Moustafa & Ghandforoush (2016) discussed the need to widen lines of research to include dimensions such as geographical and gender differences that could affect attitudes, resistance and actual uses of these sites. However, despite these suggestions, many teacher educators remain uncertain when they are requested to integrate Social Media tools or to assess their impact on students' learning (Greenhow & Askari, 2015; Simons, Ocepek & Barker, 2016). The potential of social networking sites are to increase interaction and networking between teacher educators, students and parents, as well as to co-create content in and out of the classroom (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011).

In the last decade, mostly failed in establishing the technology's effectiveness at improving student learning (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). These conclusions were pointed out by Simons, Ocepek & Barker (2016) who cautioned against the possible tensions that may arise when incorporating participatory practices associated with Social Media into formal contexts of learning (Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). These tensions are especially related to issues like the reshaping the traditional roles of teacher educators and students, the closed boundaries of university classes or lecture halls as opposed to the openness of Social Media, individual and collaborative learning and their implications for assessment and learning styles. The results reached so far suggest that there is the need to carry out further studies that focus on actual and intended use of Social Media, especially by large number of teacher educators (Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

Teacher educators attitudes towards Social Media for teaching are focused on students' usage and perceptions of Social Media use in learning (Bennett, Bishop, Dalgarno, Waycott & Kennedy, 2012; Karvounidis, Chimos, Bersimis, & Douligeris, 2014), very few explored teacher educators practices or teachers educators perceptions of Social Media benefits and constraints (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016;

Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). When exploring teaching practices based on the use of learning platforms that exploited Social Media affordances, issues such as teacher educators prior experiences with ICT in education, their attitudes towards digital media and their expectations, their pedagogical beliefs and current practices must be taken into consideration (Ajjan & Hartshorne, 2008; Brown, 2012; Ravenscroft, 2009; Rogers-Estable, 2014; Veletsianos, Kimmons, & French, 2013).

In a study on teachers educators awareness of pedagogical affordances, Rogers-Estable (2014) reported that most of the respondents showed positive attitudes towards integrating Social Media in their teaching. However, very few declared using these tools or planning to do so (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011). Scarcely perceived usefulness and low compatibility with current practices emerged as the most recurring reasons for low adoption (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Similarly, Rogers-Estable (2014) reported that declared uses of Social Media by teacher educators in higher education did not match the reported benefits, and concluded that extrinsic factors (e.g. time, training, and support), rather than intrinsic factors (e.g. beliefs, motivation, confidence), were the main barriers to teacher educators to use more these tools in education (Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

Brown (2012) explored teacher educators perceptions of the potential of Social Media for their teaching and any influences shaping those perceptions. The results of that study showed cautious attitudes towards these technologies, ranging from using of these tools in some contexts for promoting student-centred learning to the belief that ongoing experimentation with and discussion is the best way of reaching a deeper understanding of their potential. Veletsianos, Kimmons and French (2013) investigating how teacher educators lived experiences with social networking sites, pointed out that tensions exist between online social networks and teacher educators identity, as well as between personal connections and professional responsibility (Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

Research showed that while social networking sites can be positively used for professional purposes, the values embedded in such tools are the object of resistance or rejection when transferred to their teaching and research (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). At the same time, Manca & Ranieri, (2016) highlighted how social network sites and Social Media are usually framed by the ways other tools, such as Learning Management Systems, are understood and experienced.

Familiarity with existing tools and use of technology for specific functions may explain the ways that social network sites were experienced, thus contrasting starkly with the narrative of how Social Media might contribute benefits to educational practice (Farmer, Yue & Brooks, 2008; Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Ocepek & Barker (2016) stressed that teacher educators prefer those pedagogical and instructional practices that better utilize the potential of Social Media tools and, therefore, favour closed platforms such as Learning Management Systems that are more teacher-centred and rely less on students' contribution and their online social networking (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

There are several factors that could influence Social Media adoption for teaching (Buchanan, Sainter, & Saunders, 2013; Ajjan & Hartshorne, 2008; Dahlstrom & Bichsel, 2014; Greenhow & Gleason, 2014; Moran, Seaman, Tinti-Kane, 2011; Ulrich & Karvonen, 2011). Buchanan et al. (2013) investigated how a factor such as self-efficacy was associated with teacher educators use of learning technology and whether clearly identifiable barriers were associated with technology uptake among teacher educators. The results of the study showed that low perceived usefulness and negative conditions were associated with lower reported use. The findings also suggest that teacher educators use of learning technologies should be understood taking into account both individual and contextual factors (Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

The main factors affecting the educational outcome of Social Media use in university teaching are factors such as perceived usefulness, external pressure and compatibility of task-technology have positive effects on Social Media use (Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Moreover, the higher the perceived risk of using Social Media, the less likely teacher educators uses the technology to support in-class instructions frequently (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011). Another study (Ulrich & Karvonen, 2011) tested a number of predictors of the integration of Social Media tools into formal online learning environments, by investigating attitudes toward learner self-direction, instructional technology, and innovation; external facilitators and constraints; Web 2.0 knowledge and interest; and intended and actual use of Web 2.0 (Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

The results show that interest in these applications were partially predicted by prior knowledge of the technologies and perceived usefulness did not seem to be correlated to teacher educators interest, while interest predicted intended use (Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Factors such as gender, age and previous experiences influenced teacher educators' adoption of e-learning and new technologies like social network sites (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). The study also showed how crucial the role of the institutional support staff was when the teacher educarors started to use e-learning platforms and social networking tools, particularly in promoting their reflections on their unfulfilled expectations, nurturing dialogue and collaboration between peers and support staff, and involving teacher educators in the redesign of digital resources (Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016).

Similarly, Moran et al (2011) found that age plays an important role in the decision to adopt Social Media for teaching: according to their results, younger faculty use Social Media in their teaching more than older faculty do. This was confirmed by Greenhow and Askari (2015), who found that using Social Media more than their older colleagues. A further factor to be considered is the scientific discipline. As shown by Simmons, Ocepek & Barker (2016), teacher educators adoption of Social Media may vary depending on the subject matter whereby teacher educators in the humanities and arts, professions and applied sciences, and the social sciences are using Social Media more than those in natural sciences or mathematics and computer science (Kaplan & Haenlein, 2016; Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Similarly Moran et al (2011) confirmed that in the humanities and arts had higher rates of use when compared to natural sciences.

Most of these studies are reviews that produce findings on the use of Social Media tools, largely in higher education. With reference to microblogging services, microblogging has a potential to encourage participation, engagement, reflective thinking, collaborative learning, and to expand learning content in different formal and informal learning settings (Kaplan & Haenlein, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Several challenges, such as unfamiliarity with the tools, information overload, distraction, and prevailing lurking behaviours are reported (Manca & Ranieri, 2016; Moran, Seaman, Tinti-Kane, 2011; Simons, Ocepek & Barker, 2016; Sobaih, Moustafa & Ghandforoush, 2016). Similar challenges were also highlighted by Manca and Ranieri (2013) in their review study of Facebook as a technology-enhanced learning environment.

2.9 Ongoing Professional Development

Teacher educators professional development are an important component of ICT in education policy. Often policies that address teacher educators training will do so in the context of providing teacher educators with the skills needed to operate ICT equipments. But ICTs in education policy can address much larger issues related to professional development and do so in a broader context of educational change (Jimoyiannis, 2010; Marcial & de la Rama, 2015; UNESCO, 2016, 2008). In many developing countries, ICT are being used to extend access to education for teacher educators, particularly those in rural areas (Jimoyiannis, 2010; Marcial & de la Rama, 2015; UNESCO, 2016).

Policies are most effectively implemented in classrooms where the teacher educator had extended opportunities to learn policy related materials (Khodamoradi & Abedi, 2011; Loisulie & Mselle, 2015; Mugimu, 2010). The most effective teacher educator training experiences were concrete, content-specific, and instructionally useable practices directly connected to the policy (Igari, 2014; Kumar, 2016). Consequently, ICT policy implementation can best be assured when the teacher educator professional development includes specific skills and tasks that incorporated ICT into their everyday classroom practices and explicitly connect practices to ICT and broader education policies (Kozma, 2011). ICTs can support the development of literacy skills, access to information and communication, and combine pedagogy and technology to ensure effective teaching and learning at universities (Kumar, 2016; Loisulie & Mselle, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

ICT policies and programmes related to teacher educators training should be structured in a way that connects to specific classroom practices or engages teacher educators in a community of professional practice and ongoing development. The above stated have proven to be effective in universities reform (Igari, 2014; Marcial & de la Rama, 2015). In many developing countries, ICT-related teacher training policies spell out a specific set of skills that teacher educators are to acquire, as well as specify the duration of training (Kozma, 2011). In the early phases of ICT introduction, teacher educators need training in the operation of hardware, software, and, to some extent, networking. As ICT use by teacher educators becomes more common, professional development shifts to the pedagogical integration, the creation of content, and the development of shared knowledge and practice (Jimoyiannis, 2010; Marcial & de la Rama, 2015; UNESCO, 2016, 2008).

Given the fact that the teacher educators role have changed due to the present need of the learner, teacher educators require to ensure that their students are trained using the current technological processes and resources for them to meet up with the 21st century learning skills and expectations as regards the integration of current educational technologies (Kumar, 2016; Loisulie & Mselle, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). Tondeur, van Braak, Siddig and Scherer (2016) argues that the key to how ICTs are used depends on the teacher educator, notwithstanding the quantity and quality of technology available in the classroom. According to Marcial & de la Rama (2015), the teacher educator must have the competence and right attitude towards technology. Kumar (2016) identify the following as some major competences required of ICT competent teacher educators: making personal use of ICTs; mastery of a range of educational paradigms that make use of ICTs; making use of ICTs as minds tools; Use ICT as tools for teaching;

master a range of assessment paradigms which involves the use of ICTs and understanding the dimension of the use of ICT for teaching and learning.

According to Kumar (2016) the three ICTs competency standard for teacher educators ICTs integration are: technology literacy, knowledge deepening and knowledge creation. Technology literacy enables one to acquire technology skills as to learn effectively and efficiently using technology resource, the second which is knowledge deepening requires teacher educators to acquire an in-depth content knowledge of the university subjects as it relates to their real-world experiences and thirdly, knowledge creation that allows teacher educators to collaborate with colleagues and workforce they encounter, to create the new knowledge using technology-tools to bring more harmony and prosperity to the society (Kumar, 2016; Loisulie & Mselle, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

Additionally, UNSECO (2016) provided a yardstick for teacher educators in using technology based methods, teachers professional development in technology integration embrace proficiency in: use of word processing, presentation, graphics, record keeping software packages and digital resources to support instruction and record management. Secondly, to create and use an e-mail accounts for correspondence, common social networking communication and web based collaboration technologies to help students collaborate, access information and communicate with external experts and use of a search engines to access web or ICT resource to enhance productivity and acquisition.

After focusing on how ICT policies are implemented at the global level, the next focus is on how Namibia designed its ICT policy for Education. Vision 2030 document focused on the need to use ICTs in teaching and to create an ICT Policy document which will guide the ICT Policy implementations at tertiary level.

2.10 Vision 2030

The Government of the Republic of Namibia (GRN) in 2004 published the Vision 2030 document which advocated the use of Information and Communication Technologies (ICTs) in order to achieve social and economic transformation in Namibia, among other national goals. The document stated that ICTs are to be applied throughout all sectors of the economy and society to serve development goals. The document requires the implementation of the following strategies:

- Developing, implementing and monitoring a national ICT policy;
- IT training to be introduced from pre-primary education, and high financial support for students in applied sciences;
- Investments in electrical/electronic engineering and computer science education; establishment of a University of Applied Science and Technology, with high financial support; and virtual internet-based training facilities to be used to reach all Namibians;
- Support of co-operation of Namibian institutions with international research institutions;
- Provisions of benefits for PC purchase, and free broadband Internet access for the public;
- Support shown for ICT/Internet access centres in rural areas, and installation of wireless LAN implementations in identified centres of the country;
- Support of companies specialising in hardware design, in conjunction with mechatronics;

- Namibian and foreign entrepreneurs in the areas of ICT are supported, financially; and
- Investments in governmental ICT infrastructure and IT services. (p.67)

According to the document priority must be given to the development, implementation and monitoring of a comprehensive ICT policy for Namibia. After the successful implementation of the ICT policy, there must be support from all sections of the population, the industries and the government regarding the procurement and maintenance of ICTs as stipulated in the ICT policy for Education implementation.

2.11 ICT Policy for Education in Namibia

The ICT Policy for Education in Namibia is to support Vision 2030 call for constructive global partnerships founded on common interest, obligation, commitment, and equality premised on good governance, democracy, and human rights (Ministry of Education, 2005). The mission of this policy is to articulate the relevance, responsibility, and effectiveness of integrating ICT in education with a view to meeting the challenges of the 21st century. The purpose of this policy is to prepare all Namibia's learners, students, teachers, and communities of today for the world economy of tomorrow (Ministry of Education, 2005).

In order to address the goals of this policy and measure progress in the implementation of ICT in education, a series of specific development levels are identified (Ministry of Education, 2005). First, the overall goals of the ICT Policy will be described next, which are to:

- Produce ICT literate citizens;
- Produce people capable of working and participating in the new economies and societies arising from ICT and related developments;
- Leverage ICT to assist and facilitate learning for the benefit of all learners and teachers across the curriculum;
- Improve the efficiency of educational administration and management at every level, from the classroom, school library, through the school and on to the sector as a whole;
- Broaden access to quality educational services for learners at all levels of the education system;
- Set specific criteria and targets to help classify and categorize the different development levels of using ICT in education (p. 4).

The policy also has a set of specific educational goals, which are to:

- Emphasize pedagogical use of ICT as an integrated tool in the teaching-learning process;
- Monitor and evaluate curricular goals, indicating exactly what is expected of learners, students, and teachers;
- Provide clear objectives and competencies for learners, students, and teachers to achieve key ICT knowledge and skills;
- Provide guidance to teachers by clearly presenting the relevant assessment criteria to learners and students.
- Require curricula to be maintained which indicate exactly what is expected of learners, students, and teachers in regards to ICT in Education;
- Provide cross curricular opportunities in teaching (p.5).

In addition, the ICT Policy for Education in Namibia is divided into five developmental levels. These levels are described in order to provide the background to this study. Level One, focuses on pre primary and primary schools (kindergarten up to grade seven); Level Two, focuses on secondary schools (grade eight to grade twelve); Level Three, focuses on Vocational Training centres and Adult Education centers; Level Four, focuses on Tertiary

Institutions, which is the focus of this study, and Level Five, focuses on ICT departments in Higher Education, such as the Computer Science departments.

These levels are described below.

Level 1

The focus here is on the pre-primary phase, e.g. kindergartens and day care centers. At this level a small computer room should be available. This may be anything from two to a dozen computers. The computers are used for teaching ICT skills such as basic computer use, learning how to use a word processor, introduction to the Internet and finding knowledge. One or two staff will have a minimum basic ICT Literacy qualification. Students will spend about one hour a month using a computer. The site will have some audio/visual and broadcast facilities.

Level 2

All Level 1 attributes apply. The concentration here is on the primary and secondary phases, e.g. primary, junior secondary and secondary schools. In addition, all teaching and administrative staff should have reasonable access to a computer (at least one computer for every five staff and one to ten for learners/students) and are able to use the Internet and e-mail, as well as a word processor. The site is connected to the Internet. Learning materials are downloaded and occasionally created by teaching staff.

Level 3

The use of ICTs underpins significant proportions of the work. The focus here is on Vocational Training Colleges. The emphasis here is on adult education, libraries and community centers. All students have reasonable access to a computer (better than one computer per ten students), and all staff have access to a computer (better than one computer per three staff). The site has an Internet connection suitable for the number of users. All students are able to use a computer, communicate by e-mail, find information using web-based systems, create output using a word processor, e.g. assignments.

Level 4

This level focuses on Tertiary Institutions in Namibia. This level specifies that the use of ICTs would underpin much of the work at these institutions. There are a number of issues identified at this level, namely: ICT infrastructure at Tertiary Institutions; teacher educators and students use of ICTs and ICT qualifications of teacher educators.

ICT infrastructure: Each institution is expected to have a number of classrooms equipped with a computer and projector system and/or the ability to display audio/visual materials to students. Each teacher educator is expected to have a fully functional computer. The ratio should be one computer to five students or less. Each institution is expected to have a fixed internet connection.

ICTs use by teaching staff: Teacher educators will use the computer to prepare lessons, capture students' data and use it to conduct research. Learning materials are expected to be downloaded and created on computers by teaching staff. Over half of the communication and administrative tasks with the Ministry of Education should be done via e-mail and web services. Computer based Education materials will be used to support teaching. Computer based software will be used to assist in teaching.

ICTs use by students: All students are expected to use the computer to communicate via e-mail, find information using web-based systems, create output using a word processor, spread sheet and presentation software for assignments. Simulations and modelling software is expected to be available and used by students for experimentation and investigation. Students are expected to spend over one hour a day using a computer for learning purposes.

Qualifications: Over half of teacher educators will have ICT qualifications, such as the International Computer Driving Licence (ICDL).

Level 5

This is normally reserved for an educational facility with an ICT focus. The focus here is on the computer science departments, specializing in computer programming and networks. All students/learners and staff have good access to a computer. Most staff will have an ICT qualification. A significant number (more than 50%) of staff will have an advanced ICT qualification. ICT subjects such as programming, database design and usage, system configuration, etc. will be taught. (Ministry of Education, 2005).

In answering the second question, technical support, obstacles to ICT integration, ICT qualifications, community of practice, future training needs in ICTs were identified, and evaluation models were discussed.

2.12 Technical Support

ICT policies must address issues related to technical support regarding hardware, software and, networks support (Ali, Haolader & Muhammad, 2013; Tsai & Chai, 2012). Sufficient and effective technical support on infrastructure is a necessary condition for sustainable integration of ICTs and for the teacher educators to function effectively at universities (Blignaut, Hinostroza, Els & Brun, 2010; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

Another operational component is ongoing technical support, which teacher educators need not only in early phases of ICT use but as hardware and networking technologies become more sophisticated and educational applications become more complex. Assistance is needed not only to support teacher educators operation and connection of hardware and software, as well as help in integrating the use of ICT across the full range of curricular subjects (Kitizo, 2016; Kumar, 2016). There is a need for ongoing technical support and training for the ICT policy to be implemented successfully (Blignaut, Hinostroza, Els & Brun, 2010; Kozma, 2011; Kumar, 2016; Tondeur, van Braak, Siddig, Scherer, 2016).

Research findings indicate a lack of technical assistance in the maintenance of the ICT equipment at African universities (Blignaut, Hinostroza, Els & Brun, 2010; Kitizo, 2016; Kumar, 2016). The breakdown of ICTs causes interruptions if there is a lack of technical assistance, then the regular repairs of the ICTs are not carried out, which results in teacher educators not using ICTs effectively in their teaching. Therefore, if there is a lack of technical support to help teacher educators then, the teacher educators become frustrated resulting in their unwillingness to use ICT. Lack of technical support discourages teacher educators from adopting and integrating technology in classrooms (Ali, Haolader & Muhammad, 2013; Igari, 2014; Kumar, 2016). However, when there is sufficient technological support at universities, teacher educators are able to apply ICT in classrooms without wasting time troubleshooting hardware and software problems.

2.13 Obstacles to ICT Integration

Many developing countries, such as African and South American countries lack access to computers in working order, to lack of software, technical support, administrative support, sufficient teacher educator training, internet access, and sometimes lack of reliable supply of electricity (Kitizo, 2016; Kumar, 2016; UNESCO, 2011). In many developing countries, the use of a wide range of educational applications for ICT was somewhere between “never” and “sometimes” (UNESCO, 2011). These findings convey the limited extent to which the ICTs has been incorporated into educational systems in developing countries. Education systems in developing countries have yet to cross a threshold of significant ICT use, and as such, it is likely that ICT will have only a minimal impact on students by teacher educators (Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). The vast majority of educational systems, schools and universities around the world still participate in the mass production paradigm and technology is rarely used, even when it is available (Igari, 2014; Kumar, 2016; Tsai & Chai, 2012).

ICT policies also sometimes fail to impact classrooms when they do not have explicit connections to instructional practice, when they do not provide teacher educators with an opportunity to learn the ICT policies and their instructional implications, and when there is a lack of programmes or resources aligned with the intentions of the policies (Igari, 2014; Kumar, 2016; Tsai & Chai, 2012, UNESCO, 2011). In addition, often ICT policies fail because they do not address the changes that will make a difference in the education system. In many developing countries, ICT related policies focus on technology, such as hardware, software, networking, digital content, rather than its relationship to pedagogy, curriculum, or assessment (Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

Since the relationship between ICT policy and change is important but not sufficient, the challenge for policy-makers who are committed to transformational education change is not just to have an educational ICT policy, but to formulate ICT policies that have an impact at universities and classroom practices. To have a broad impact, these ICT policies need to be comprehensive, aligned with national needs and priorities, and do this within the nation's development context (UNESCO, 2016).

2.14 ICT Qualification of Teacher Educators

Many African teacher educators have little interest or experience in using ICTs (Ali, Haolader & Muhammad, 2013; Igari, 2014; Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016), therefore teacher educators need training in obtaining experience and skills with ICTs (Igari, 2014; Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). They need training particularly in the organization, ICT use and structuring of teacher educators teaching materials is needed to create their interest and educate them on the potential that ICTs hold for higher education. Such training will result in a mix of technical, professional, and content as a strategy for improving efforts to incorporate technology into African teacher education (Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016).

African teacher educators lack the knowledge and skills they need to maintain and modify ICTs (Johnson & Hoba, 2015), so that they can adapt the technology for different purposes and have the knowledge and skills to develop local ICT content that take into account the needs and culture of Africans (Igari, 2014; Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). They need training on the best practices in training to update the African teacher educators ICT skills (Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). Such best practices entail providing teacher educators with basic skills in ICT use, followed by fostering competencies in social and technical issues, pedagogy, collaboration, and networking (UNESCO, 2016), and incorporating the themes of "context and culture, leadership and vision, lifelong learning, planning and management of change" (Kumar, 2016).

The process of delivering teacher educator training to using ICTs is one of the strategies intended to increase teacher educator confidence, intention and competence (Ali, Haolader & Muhammad, 2013; Igari, 2014; Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). The degree of intention has a positive impact on the effective integration of ICT in education. This concept is also argued by Tondeur, van Braak, Siddig, Scherer (2016) who posits that teacher attitude towards using ICTs can be amplified by providing them with relevant support. Many African universities have been shifting from teacher-centered to student-centered learning in either blended or fully online and eLearning platforms are enabling this move (Ali, Haolader & Muhammad, 2013; Igari, 2014; Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). As the intention to use technology has been attributed to psychological belief, a number of researchers have been motivated by this direction for developing theoretical frameworks that are used to understand and measure user intention to use a range of technological tools.

It is believed that by providing teacher educators in Africa with ICT training and directly involving them in ICT initiatives, these initiatives may be more likely to succeed (Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016). There are too few African universities with technology, and there is even a shortage of staff who have been educated in its use and potential, limiting the opportunity for research and development of ICTs in higher education (Ali, Haolader & Muhammad, 2013; Igari, 2014; Kumar, 2016; Johnson & Hoba, 2015; Tondeur, van Braak, Siddig, Scherer, 2016) .

In order to remedy the lack of ICT qualifications by African teacher educators, communities of practice can help in this regard. Communities of practice is discussed next.

2.15 Communities of practice

Vandeyar (2013) argues that a community of practice should have an identity which is defined by a shared domain of interest. Members within a community of practice value their collective competence and learn from each other (Tsiokatis & Jimoyiannis, 2016; McGrath & Guglielmo, 2015; Al-ghamdi & Al-ghamdi, 2015). A community of practice must exist that pursues their interest in their domain. Members are bound as a social entity by mutual engagement and purpose. Members in a community must engage in joint activities and discussions with the intention to help each other and share information (Nistor, Trausan-Matu, Dascalu, Duttweiler, Chiru, Baltes & Smeaton, 2015; Liana &

Ngeze, 20415). The community that emerges builds relationships and an enabling and supportive environment. Members share a repertoire of resources: experiences, stories, tools and ways of addressing recurring problems. Members access content resources, discuss with others, and acquire relevant information, skills and knowledge (Garavaglia & Petti, 2015; Theodorakopoulos, Preciado & Bennett, 2012; Vandeyar, 2013) . To respond to the increased demands and the complexity of current instructional work, peer support and collaboration among teacher educator has become very important.

The traditional and popular approaches to teacher educator professional development appear to have low impact on teacher educator's ability to put innovative teaching approaches into practice, in the absence of communities of practice (McGrath & Guglielmo, 2015; Vandeyar, 2013). Among these obstacles are the difficulty of managing implied knowledge, the lack of novelty of information and knowledge, the absence of cooperation and collaboration in communities of practice (Nistor, Trausan-Matu, Dascalu, Duttweiler, Chiru, Baltes & Smeaton, 2015; Liana & Ngeze, 20415).

Communities of practice should include official and informal contacts, cooperation, and social networks. They should include processes of creating, sharing, and application of knowledge. The value of these communities grows, when knowledge is applied for achieving specific purposes such as improvement of specific skills, and delivery of content. There is strong emphasis on (1) knowledge creation, (2) knowledge organization, (3) knowledge storage, (4) knowledge dissemination, and (5) knowledge application (Tsiokatis & Jimoyiannis, 2016). For the above stated tasks to be disseminated there should be a strong ICT skills and technical support in place.

2.16 Future Training Needs of Teacher Educators

Innovative approaches into teacher educators training is to develop twenty first century teaching competencies in teacher educators skills sets. Thus, there is a need to reform and restructure teacher educator skills sets so that they can be in a position to develop the globally acknowledged teaching competencies (Cretchley, Edwards, O'Shea, Sheard, Hurst, Brookes, 2014; Hasan & Aslan, 2016; Kagaari, Munene, & Ntayi, 2010; Rivers, Rivers, Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016).

Both the quantitative and qualitative aspects of education plays crucial role in the advancement of ICTs in teaching (Hasan & Aslan, 2016; Kagaari, Munene, & Ntayi, 2010; Rivers, Rivers, & Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016). Rivers, Rivers & Hazell (2015) argues that when we think about the quality based education, we think about competent teacher educators who could impart knowledge effectively. Thus, to prepare competent teachers educators education programmes should be devised with the help of teaching technology. Organizations such as National Council for Teacher Education (NCTE) and National Council of Educational Research and Training (NCERT) in India, International Society for Technology in Education (ISTE) in the United States, Educational Technology Council Of the Alberta Teachers' Association (ETCATA) in Canada, Association for Learning Technology in Great Britain, and others focus on the improvement of teacher education system at national levels. They focus on new and efficient teaching competencies that could invite the contemporary issues of teaching at university level.

These agencies conduct relevant workshops and conferences concerning on how to deal with teaching competencies as a whole. Several commissions have also being constituted to discuss their views in terms of developing needed aspects of teaching competencies. Current and future teacher educators training can be defined in terms of teaching competencies in general and specific teaching competencies (Rivers, Rivers, Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016).

General Teaching Competencies

General teaching competencies include the basis of scientific methods of teaching with consideration to value and professional development. The main generic teaching competencies are comprised of Personal and Professional Values, Professional Development, Knowing the Student, Learning and Teaching Process, Monitoring and Evaluation of Learning and Development, Society Relationships, Knowledge of Curriculum and Content (Rivers, Rivers, Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016).

Specific Teaching Competencies

Specific teaching competency can be a subject based, as well as the level of education. But more commonly it can be defined as, teaching competency which includes the acquisition and demonstration of the composite skills required for classroom teaching like introducing a lesson, fluency in questioning, effective communication, explanation skills, pace of lesson, skills of linking the lesson to the daily life, reinforcement skills, understanding student behaviour, classroom mismanagement and evaluation skills (Cretchley, Edwards, O'Shea, Sheard, Hurst, Brookes, 2014; Hasan, 2016; Kagaari, Munene, & Ntayi, 2010; Rivers, Rivers, Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016). According to several researchers (Rivers, Rivers, Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016) teaching competency includes knowledge, attitude, skill and other teacher educators characteristics. A set of overt teacher educators classroom behaviours is a result of the interaction between the sign and the product variables of teaching within a social setting (Hasan, 2016; Kagaari, Munene, & Ntayi, 2010; Rivers, Rivers, Hazell, 2015; König, Blömeke, Klein, Suhl, Busse, & Kaiser 2014; UNESCO, 2016).

Area of Teaching Competency

Bakhru, Kanupriya, Sanghi and Medury (2013) identified fifteen management teaching competency areas; and were explained in terms of Analytical & Problem Solving, Conceptual Thinking, Mental Skills, Communication Skills, Knowledge and information orientation, Emotion Handling & Persistence, Self Dependence & Confidence, Adaptability, Concern For Standard & Achievement, Being open & receptive, Panning & Organizing, Interpersonal Management, Impact & influence, Discipline & Delegation and Occupational Attachment & Organizational Setting. The above stated promotes teacher educators ability to take the subject matter to the different relevant contexts including local, regional and global.

This study was guided by one model. An extensive search for evaluation models was conducted which are guided by the systems theory. Different evaluation models were considered, before one model was adopted for this study. The input, process and output model was adopted to help better implement the ICT Policy for Education in Namibia.

2.17 Evaluation models

Evaluation models describe what evaluators do or at least order what they should do (Bates, 2004; Cook, 2010; Patton, 2011; Posavac & Carey, 2007; Stufflebeam & Shinkfield, 2007). The evaluator’s responsibility is to provide information to management, in the Namibian case the Ministry of Education in order to help them in making decisions about programs and products. Evaluation models support learning about the dynamic processes within the programs, allowing an additional focus on program improvement (Bates, 2004; Cook, 2010; Patton, 2011; Stufflebeam & Shinkfield, 2007). Program success or lack of success in achieving those outcomes can be explained using a model.

Therefore, thoughtful selection of a specific evaluation model allows educators to structure their planning and to assure that important information is not overlooked. Generally, evaluators are concerned with determining the value or current status of programs or policies. The term ‘model’ is used in two general ways. (a) A prescriptive model, the most common type, is a set of rules, prescriptions, prohibitions, and guiding frameworks which specify what a good or proper evaluation is and how evaluation should be carried out. Such models serve as samples (Patton, 2011; Stufflebeam & Shinkfield, 2007). (b) A descriptive model is a set of statements and generalizations which describes, predicts, or explains evaluation activities (Cook, 2010; Patton, 2011; Stufflebeam &

Shinkfield, 2007). Such models are designed to offer a practical theory (Bates, 2004; Cook, 2010; Patton, 2011; Stufflebeam & Shinkfield, 2007).

The importance of studying evaluation models is shown in a number of ways. For example, Tyler's Model (1950, 1966) outlined the seven steps: 1. Establish broad goals or objectives; 2. Classify the goals or objectives; 3. Define objectives in behavioral terms; 4. Find situations in which achievement of objectives could be shown; 5. Develop or select measurement techniques; 6. Collect performance data; 7. Compare performance data with behaviorally stated objectives (Tyler, 1950, 1966). Evaluation was viewed as a cycle that involve not only clarifying and measuring objectives but adapting teaching methods and materials to make success more likely.

Most educational evaluation models deal with teaching, learning and curriculum (Bates, 2004; Cook, 2010; Patton, 2011; Stufflebeam & Shinkfield, 2007). Some educational evaluation models are designed to assess the practices and policies which facilitate them (Bates, 2004; Cook, 2010; Patton, 2011; Stufflebeam & Shinkfield, 2007). Educational evaluation models were not developed with education theories in mind; rather, the theories that informed thinking about science and knowledge in general underpinned the development of evaluation models (Patton, 2011; Stufflebeam & Shinkfield, 2007).

In any program evaluation assignment, it is reasonable for the evaluator to examine the extent to which program plans and operations are grounded in an appropriate theory or model. It can also be useful to engage in an effort to network the program and thereby seek out key variables and linkages. The evaluator can beneficially apply it in structuring the evaluation and in analyzing findings. An evaluation may be defined as the assessment of goal achievement through the collection and analysis of data useful in making decisions on the worth of a program (Bates, 2004; Cook, 2010; Patton, 2011; Stufflebeam & Shinkfield, 2007). Evaluation models are useful in guiding the management of data collection and analysis (Cook, 2010; Patton, 2011; Stufflebeam & Shinkfield, 2007).

The countenance model is described next. This model focused on the intended and observed outcomes of a program or policy evaluation.

Countenance Model

The countenance model was originally formulated for curriculum studies in the late 1960s by Robert Stake (1967). The countenance model aims to capture the complexity of an educational innovation or change by comparing intended and observed outcomes at varying levels of operation. The congruence between the intentional and the observational accounts provides the basis for judging the success, whilst at the same time allowing for the recording of unintended outcomes (Blyth & Davis, 2007; Stake, 1967, 2004).

This model emphasized on a full description of the educational program and the curriculum process. Three sources of information are taken into account (i) Antecedents (ii) Transactions and (iii) Out-comes (Stake, 1967, 2004). Antecedents refer to conditions existing prior to teaching and learning. Transactions are the encounters in the learning situation and Out-comes take into consideration the intended as well as the unintended, which arise during the implantation of a program (Stake, 1967, 2004).

This model recognizes that multiple standards operate depending on the educational setting, instructor and student. The recognitions of logical contingency between the antecedents, transactions and outcomes is an important feature of this model (Blyth & Davis, 2007; Stake, 1967, 2004). The evaluator is making judgements regarding the program based on the congruency between the intended and the observed aspects of the curriculum. (Bharvad, 2010)

Stake's (1967, 2004) responsive evaluation maybe suited to the evaluation of prototypes used in teaching. The nature of changing values and concerns of stakeholders can be difficult to account for, but Stake's model may be helpful in addressing such issues.

The greatest strength of Stake's model is the manner in which intents and actions are defined and observed, together with standards and judgements. Stake believes that the starting off point is to determine the "intents" of a particular curriculum or program (Bharvad, 2010; Blyth & Davis, 2007; Stake, 1967, 2004). These need to be described in terms of antecedents, transactions and outcomes. Antecedent intents relate to any conditions prior to the commencement of a curriculum or program and might include both students' and teacher educators' backgrounds and interests (Blyth & Davis, 2007; Stake, 1967, 2004). Transaction intents are the procedures and events which it is expected will transpire as the curriculum unfolds. They take place in the classroom or teaching learning environment. Outcome intents are the intended student outcomes in terms of achievements, together with the anticipated effects upon teacher educators, administrators and other parties.

Prior to any data collection, those involved in the performance and those involved in the evaluation must meet to establish a common frame of reference with respect to the three sets of intents. Not only does this clarify the purpose of the evaluation but it also allows for checks of what Stake refers to as logical consistencies between the intended antecedents, transactions and outcomes (Stake, 1967, 2004). In a similar fashion the intended standards which will be used to determine the appropriateness of the curriculum or program need also to be discussed and agreed upon. Again, logical consistency between the various elements can be monitored at this stage (Bharvad, 2010; Blyth & Davis, 2007; Stake, 1967, 2004). Once agreement has been reached the next step involves collecting observational data about the dynamics of a particular curriculum or program. As well as informal observations, Stake suggests that all kinds of empirical data collection should be employed, including instruments such as questionnaires and psychometric tests (Stake, 1967, 2004).

Such data needs to be collected to determine the extent of discrepancies between intents and observations, standards and judgements. If discrepancies do appear, they may be either discrepancies of empirical contingency, that is between antecedents, transactions and outcomes or discrepancies of congruence (between intents and observations or between standards and judgements) (Blyth & Davis, 2007; Stake, 1967, 2004). At this stage evaluation and interpretation of the data needs to be undertaken. This is almost inevitably a crucial time in any curriculum or program evaluation as the performers and the evaluators reassemble to discuss the information which has been collected (Bharvad, 2010; Blyth & Davis, 2007; Stake, 1967, 2004).

According to Stake (1967, 2004), the two major operations, or countenances, of any evaluation are complete description and judgement to aid an evaluator in collecting, organizing, and interpreting quantitative and qualitative data for these purposes. His scheme draws attention to the differences between descriptive and judgemental acts according to their phase in an educational program: antecedent, transaction, and outcome (Popham, 1993; Stake, 1967). Transactions are successive engagements or dynamic encounters constituting the process of instruction. Outcomes are the effects of the instructional experience (Popham, 1993. Stake, 1967).

Stake (1967, 2004) further divided descriptive acts according to whether they referred to what was intended or what was actually observed to occur. Judgemental acts were divided according to whether they refer to the standards used in making judgements or to the actual judgements (Stake, 1967, 2004). The evaluator records what the developer intented, what observers perceived, what patrons expect, and what value is placed on each aspect (Stake, 1967).

Stake's model is useful because it provides extensive evidence to support the success of a curriculum or policy (Bharvad, 2010; Blyth & Davis, 2007; Stake, 1967, 2004), by documenting possible links between all components of the curriculum or policy. The evaluator will next analyse information in the descriptive matrix by looking at congruence between intents and observations. Moving across the figure on the next page in a similar fashion, the evaluator will then apply standards to the descriptive data to form judgements. On the next page is the graphical representation of the Robert Stake's Countenance Model.

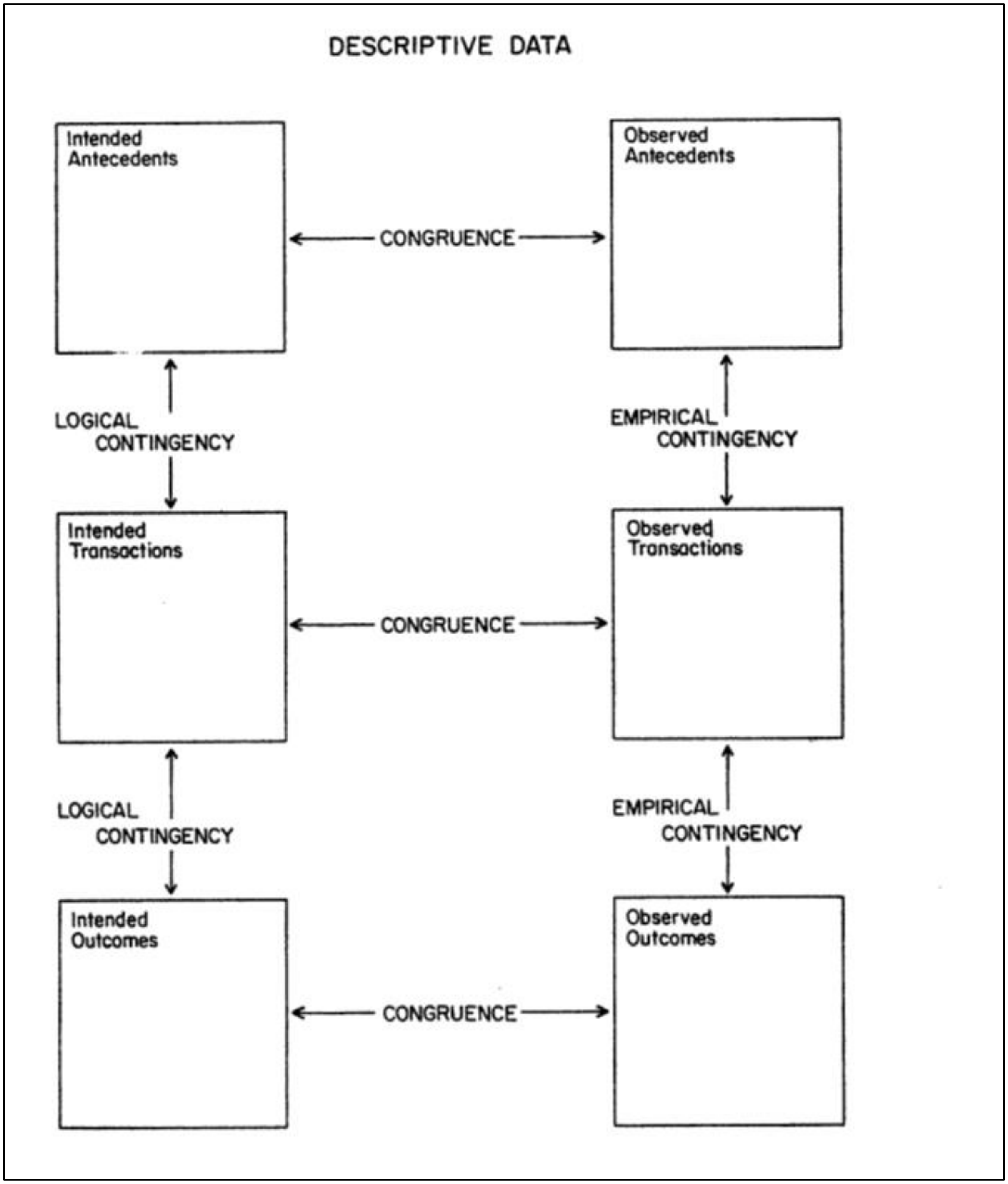


Figure 1: Robert Stake's Countenance Model. (Stufflebeam, 1966).

The Countenance Model was not adopted for this study, because the focus of this model is on curriculum or policy evaluation. The model does not extensively focus on the information and communication technology (ICT) implementation, which is the focus of this study.

The next evaluation model to be discussed is the Erhmann's triad model. This model is used to evaluate ICT programs.

Erhmann's triad model

Ehrmann (1999) developed a comprehensive "Tool Kit" to guide evaluators of distance education programs. Using the metaphor of a flashlight, a tool for illuminating a small area brightly, he advised evaluators to begin with a vague, sometimes "almost incoherent," question of interest and then transform it from formless "blob" to focused evaluative "triad." (Ehrmann, 1999, 2000; de Freitas & Oliver, 2006; Mayrath, Traphagan, Heikes & Trivedi, 2011; Thompson, 2004).

For Ehrmann, the term "triad" refers to a focused question or set of questions devised to examine (a) a specific technology or method (e.g., e-mail, youtube, facebook, etc.) in relation to (b) a particular activity enabled by that technology or method and (c) a desired program outcome. The next step in the process is to ask questions in five related areas: (a) about the technology, (b) about the use of the technology for the activity, (c) about the activity, (d) about whether and how the activity is contributing to the desired outcome, and (e) about the outcome (Ehrmann, 1997a, 1997b, 1999, 2000).

The Flashlight Project has developed a number of services and tools to help evaluators implement their own focused evaluation studies. This model has a 500-item Current

Student Inventory. It has a set of questions that relates to different areas: (a) about the technology, (b) about the activity, and (c) about the outcome. It is linked to a number of teaching and learning issues, such as: Active learning; Collaborative learning; Using time productively; Rich and rapid feedback; Engagement in learning; Faculty-student interaction; High expectations for all students; Cognitive and creative outcomes; Accessibility; Positive addition to technology; Pre-requisites for using technology; Time on task; Respect for diversity; and application to the real world regardless of learning style (Ehrmann, 1997a, 1997b, 1999, 2000)

Erhmann’s (2000) triad approach to evaluating the effectiveness of educational technology is presented on the following page.

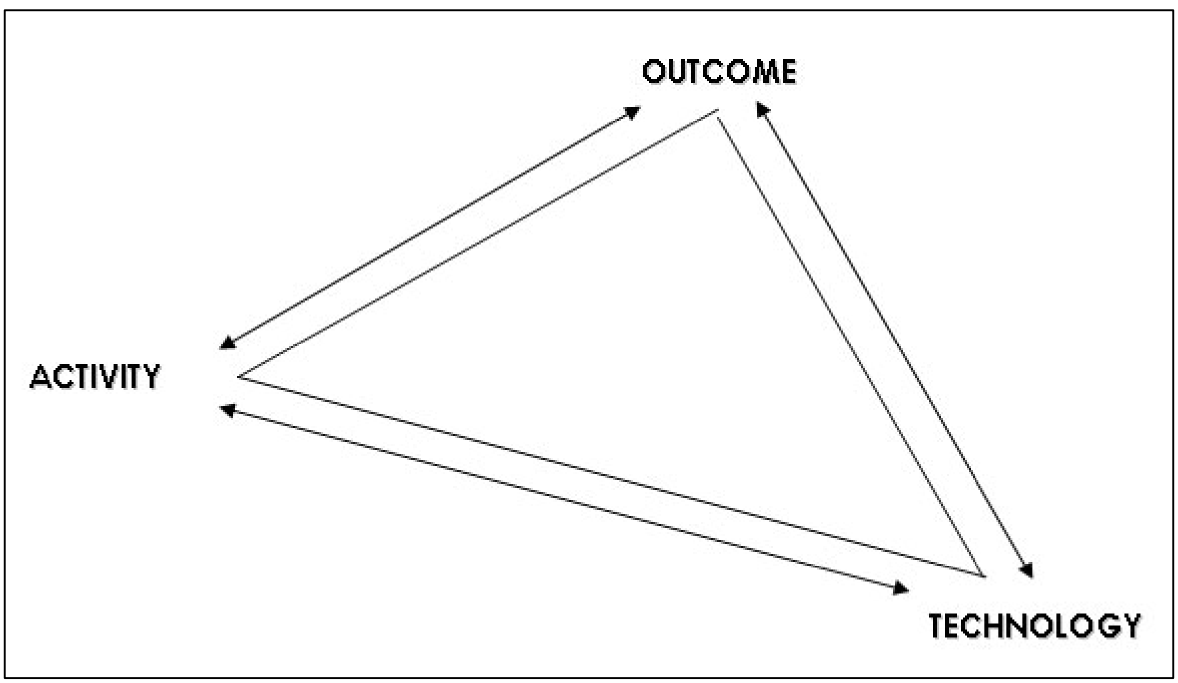


Figure 2: Erhmann's triad model (Parker &Wills, 2009).

This triad approach begins by clearly defining the intended student learning outcomes within a particular course, meaning what is to be learned, for what purpose and use (Ehrmann, 1999, 2000; de Freitas & Oliver, 2006; Mayrath, Traphagan, Heikes & Trivedi, 2011; Thompson, 2004). Activities are then designed to support the successful achievement of these outcomes. Finally, technology tools and methods are selected which appropriately support the learning activities and associated learning outcomes. Figure 2 outlines the proposed schedule of activities which are developed as a result of the needs assessment process and the triad approach.

With regard to Erhmann's triad model and its relation to this study, the technology aspect illustrated in the model would be in the use of Web logs or Web lectures, discussion forums, Learning Management System (LMS), social media, etc. The activities in using web logs would be related in the form of self-expression such as the individual's feelings, stories and testimonies through the motion of blogging. At the end, an outcome would be generated, focusing on empowering the individuals.

Using web lectures students will have the ability to stop, fast forward, or rewind playback and to navigate to any point in a web lecture using the table of contents navigation bar are examples of technological affordances already provided by web lecture delivery software. The web lectures allows students to study at own pace (Ehrmann, 1997a, 1997b, 1999, 2000). Other research projects may include, online communities, and web forums which make use of a variety of ICTs to support collaboration, engagement, and understanding. It may include links to external resources, and integrated interactive activities.

This model was not adopted, because it did not focus on how other stake holders, such as the Ministry of Education, private sector should be incorporated in this model. The next model to be described is Stufflebeam's CIPP Model.

Stufflebeam's CIPP Model

Daniel Stufflebeam intended CIPP (context/input/process/product) model evaluations to focus on program improvement instead of proving something about the program (Stufflebeam & Shinkfield, 1985, 2007). The usefulness of the CIPP model across a variety of educational and non-educational evaluation settings has been thoroughly documented (Stufflebeam & Shinkfield, 1985, 2007). Its elements share labels with the Logic Model, but the CIPP model is not hampered by the assumption of linear relationships that constrains the Logic Model (Stufflebeam, 1966; Stufflebeam & Shinkfield, 1985, 2007). An evaluator who understands an educational program in terms of its complex, dynamic and often nonlinear relationships elements will find the CIPP model a powerful approach to evaluation (Stufflebeam & Shinkfield, 1985, 2007).

The CIPP approach consists of four complementary sets of evaluation components that allow evaluators to consider important but easily overlooked program dimensions. Taken together, CIPP components accommodate the ever-changing nature of most educational programs as well as educators' enthusiasm for program-improvement data (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). By alternately focusing on program Context, Inputs, Process, and Products (CIPP), the CIPP model addresses all phases of an education program: planning, implementation, and a summative or final retrospective assessment if desired (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The first three elements of the CIPP model are useful for improvement-focused (formative) evaluation studies, while the Product approach, the fourth element, is very appropriate for summative (final) studies (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

Context evaluation study. A CIPP Context evaluation component is typically conducted when a new program is being planned (Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The associated evaluation questions are also useful when an established program is undergoing planned change or must adapt to changed circumstances. Explicit attention to an educational program's context is essential to effective evaluation and aligns well with complexity theory's emphasis on context (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). A new leader taking over an existing program, for example, may find thinking through a Context evaluation study helpful. Context studies can also be conducted when decisions about cutting existing programs are necessary (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

A CIPP Context evaluation component identifies and defines program goals and priorities by assessing needs, problems, assets, and opportunities relevant to the program or policy

(Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The Context study findings provide a useful baseline for evaluating later outcomes (Products). When preparing a request for external funding, a program's planning or leadership team can use a good Context study to strengthen the proposal (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). Questions about potential impediments and assets are included, a context evaluation is more inclusive than a conventional ''needs assessment'', though it does include that essential element (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

A number of data collection and analysis methods lend themselves well to a Context study. The evaluator might select from among the following methods, for example, depending on what the situation demands: document review; demographic data analysis; interviews; surveys; records analysis (e.g. test results, learner performance data); and focus groups (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

<u>Input evaluation study</u>. A CIPP model Input evaluation study is useful when resource allocation (e.g. staff, budget, time) is part of planning an educational program or writing an educational proposal (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). An Input evaluation study assesses the feasibility or cost-effectiveness of alternative or competing approaches to the educational need, including various staffing

plans and ways to allocate other relevant resources (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

Incorporating the Input evaluation approach into program development helps to maintain maximum responsiveness to unfolding program needs (context) (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). Building on the associated Context evaluation study, a CIPP model Input evaluation study focuses on how best to bring about the needed changes. A well-conducted Input evaluation study prepares educators to explain clearly why and how a given approach was selected and what alternatives were considered (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

A CIPP Input evaluation study formalizes a scholarly approach to program design (Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). When used to plan a new program, an Input evaluation study can also set up clear justification for assigning grant funding or other critical resources to a new program (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). When applied to a program already in place, an Input evaluation study can help the educator to assess current educational practices against other potential practices (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). Its focus on feasibility and effectiveness allows a developing program to remain sensitive to the practices most likely to work well (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

Identifying and assessing potential approaches to an educational need in an Input study might involve any of the following methods: literature review; visiting exemplary programs; consulting experts; inviting proposals from persons interested in addressing the identified needs (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

Process evaluation study. A CIPP Process evaluation study is typically used to assess a program's implementation (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). This type of study also prepares the evaluator to interpret the program's outcomes by focusing attention on the program elements associated with those outcomes (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). A Process evaluation study can be conducted one or more times as a program runs to provide formative information for guiding in-process revisions (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). For programs operating in the complex environment typical of medical education programs, this attention to process issues allows an ongoing data flow useful for program management and ongoing effective change (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

This kind of evaluation study can also be conducted after a program concludes to help the educator understand how the program actually worked. A CIPP Process study explicitly recognizes that an educational model or program adopted from one site can rarely be implemented with fidelity in a new site: contextual differences usually dictate minor to major adaptations to assure effectiveness (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The Process evaluation study elicits information about the program as actually implemented. Retrospective Process evaluation studies can also be used to examine often-overlooked but very important program aspects (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

The CIPP model's Process evaluation study is invaluable for supporting accountability to program stakeholders (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). It also allows for the data collection necessary for a program's continual improvement. The lessons learned about programmatic processes documented in a Process study are often useful to other educators, even when communication of program outcomes alone may not be all that useful (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

An evaluator designing a CIPP Process evaluation study would typically want to use the least-obtrusive methods possible while the program is running. The evaluator might choose from among these methods: Observation; Document review; Participant interviews (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

<u>Product evaluation study</u>. The CIPP model's Product evaluation study will seem familiar to most educators because of its focus on program outcomes. What may be more surprising is the breadth of that focus (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The CIPP Product evaluation study is the one most closely aligned to the traditional ‘‘summative’’ program evaluation found in other models, but it is more expansive (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). This type of evaluation study aims to identify and assess the program outcomes, including both positive and negative outcomes, intended and unintended outcomes, short-term and long-term outcomes (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). It also assesses, where relevant, the impact, the effectiveness, the sustainability of the program and/or its outcomes, and the transportability of the program (Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

A CIPP model Product evaluation study also examines the degree to which the targeted educational needs were met (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). A Product evaluation study may be conducted while a project is running, as interim reports of such a study will be useful for accountability purposes and for considering alternative processes, if warranted by less than desirable findings (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). A well-conducted CIPP model Product evaluation study allows the evaluator to examine the program's outcomes across all participants as well as within relevant sub-groups or even for individual participants (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

Program outcomes (Products) are best interpreted with the findings of the Process evaluation studies, it is possible, for example, that poor implementation (a process issue) might cause poor or unintended outcomes (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The art of the Product evaluation study is in designing a systematic search for unanticipated outcomes, positive or negative (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). To encompass the breadth of a good Product evaluation study, the evaluator might choose from these methods and data sources: Stakeholders' judgments of the project or program; Comparative studies of outcomes with those of similar projects or programs; Assessment of achievement of program objectives; Group interviews about the full range of program outcomes; Case studies of selected participants' experiences; Surveys; Participant reports of project effects (Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

CIPP model studies can be used both formatively (during program’s processes) and summatively (retrospectively) (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). Careful attention to the educational context of program is supported, including what comes before, after, or concurrently for learners and others involved in the program, how ‘‘mature’’ the program is (first run versus a program of long standing, etc.), and the program’s dependence or independence on other educational elements (Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

The CIPP model incorporates attention to multiple ‘‘inputs’’: learners’ characteristics, variability, and preparation for learning; faculty’s preparation in terms of content expertise and relevant teaching skills, the number of teacher educator available at the right time for the program; learning opportunities, including participant characteristics and other resources; adequacy of funding to support program needs and leadership support (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). The CIPP model allows educators to consider the processes involved in the program or to understand why the program’s products or outcomes are what they are (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). It incorporates the necessary focus on program products or outcomes, informed by what was learned in the preceding studies of the program but focuses on improvement rather than proving something about the program

(Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

It can provide multiple stakeholders information about the program's improvement areas, interpretation of program outcomes, and continuous information for accountability (Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). When choosing the CIPP model, educators should be aware that using it effectively requires careful planning (Stufflebeam & Shinkfield, 1985, 2007). It is most useful if taken up during the planning phases of a new program but may be usefully adopted for retrospective evaluation of a completed program (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016). Multiple data collection methods are usually required to do a good job with CIPP studies, and each data set must be analyzed with methods appropriate to the data and to the evaluation questions being addressed (Hamzah, Abdullah, Muhammad, 2016; Özer, Gelen, Alkan, Çınar, Duran, 2016; Stufflebeam & Shinkfield, 1985, 2007; Yıldız, Gözükara, Yıldırım, 2016).

Below is the graphical representation of the CIPP Model.

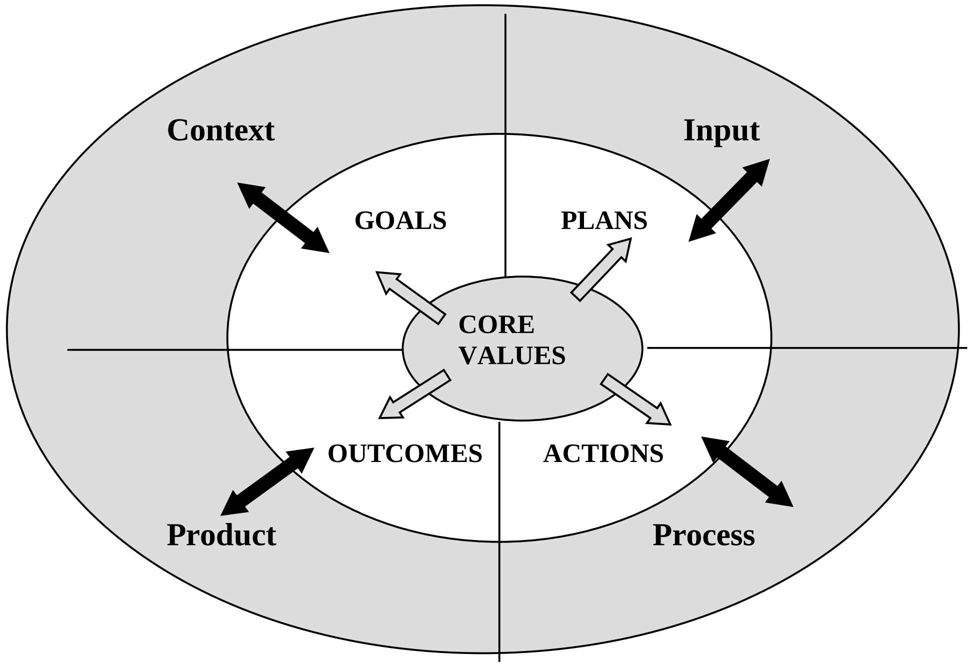


Figure 3. CIPP evaluation model (Stufflebeam, 1966).

The CIPP Model was not adopted for this study, because the focus of this model does not extensively focus on the information and communication technology (ICT) implementation, which is the focus of this study. The next model that was considered for this study was the ASSURE Model.

ASSURE Model

The ASSURE Model is based on learning necessities, and it aims to improve material selection. It stresses the interaction between learners and teacher educators during the design process and the realization of learning targets at the end of the process (Baran, 2010; Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016). The ASSURE Model has six phases: analyze learner (i.e., demographical features, learning styles and life styles of the target group), state objectives, select media and materials, utilize media and materials, require learner participation, evaluate and revise (Baran, 2010; Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016).

The ASSURE model is a methodological guide used for planning and realizing education, and it includes the use of classroom media and technology. The ASSURE model describes processes such as needs analysis, product design and development and prototype experiments (Baran, 2010; Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016). The ASSURE model consists of six stages (Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016):

1. **Analyze Learners:** Planning is to identify the learners in terms of demographic characteristics, learning styles, lifestyles, entry competencies, etc.
2. **State Objectives:** To state the objectives in terms of what the learner will be able to do as a result of instruction.
3. **Select Instructional Methods, Media and Materials:** Select available materials, modify existing materials or design new materials for implementation.
4. **Utilize Media and Materials:** To plan how the material will be used to implement, after selecting appropriate material.
5. **Require Learner Participation:** To be effective, instruction should require active \ mental engagement by learners.
6. **Evaluate and Revise:** To evaluate impact and effectiveness of instruction and to assess student Learning (Dickenson & Jaurez, 2016).

This model is based on learners’ needs and aims to increase productivity by selecting appropriate environments and materials (Baran, 2010; Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016). In the design process, the model emphasizes the interaction between the learner and teacher educator and achieving learning outcomes. Dickenson & Jaurez (2016) stated that in successful online course design, efficient communication and interaction are key factors. Using multimedia materials promoted students with different learning styles and learning interests and using blogs for student reflections increased their motivation and promoted their critical thinking (Baran, 2010; Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016). Baran (2010) stated the two most difficult steps in the ASSURE model are “selecting methods, media, and materials” along with “utilizing media and materials”, because developing new media and materials is a very demanding task; therefore, designers need to have access to educational materials.

The first stage of the ASSURE model is learner analysis. It is important that the method, media and materials are compatible with the characteristics of the learners for the effective use of educational media and technology. The learners’ general characteristics, specific introductory competencies (information, skills, and attitudes) and learning styles should be determined to select instructional methods and media (Baran, 2010; Dickenson & Jaurez, 2016; Ibrahim, 2015; Karakış, Karamete, & Okçu, 2016; Min, Mansor, & Samsudin, 2016). Thus, the researchers observed the students during classroom lessons to do learner analysis. In addition, the researchers held interviews with their instructors and the director of the school to collect data about their teaching styles, technical capabilities and course materials and the students' ages and academic achievement and using them for teaching purposes.

The focus of this model was on planning, selecting instructional methods, media and materials. The Namibian ICT Policy incorporated other stake holders such as the Ministry of Education and other interest groups, such as the private sector which are not included in this model, therefore this model was not adopted in this study.

Technology Acceptance Model

Technology Acceptance Model (TAM) models how users come to accept and use a technology (Abu-Dalbouh, 2016; Amornkitpinyo & Wannapiroon, 2015; Chuttur, 2009; Gupta, Zaidi, Udo, & Bagchi, 2015; Moon, Kang, Choi & Kim, 2015; Tang & Hsiao, 2016; Wirtz & Göttel, 2016). This model was developed to study the acceptance of the technology by an individual taking into account, both the perceived ease of use and the usefulness of the technology (Abu-Dalbouh, 2016; Amornkitpinyo & Wannapiroon, 2015; Chuttur, 2009; Gupta, Zaidi, Udo, & Bagchi, 2015; Moon, Kang, Choi & Kim, 2015; Tang & Hsiao, 2016; Wirtz & Göttel, 2016). The TAM was initially proposed by Fred Davis in 1989 (Davis, 1993). It comprises two beliefs, the perceived utilities and the perceived ease of application, which determine attitudes to adopt new technologies. The attitude toward adoption will decide about the adopter's positive or negative behavior in the future concerning new technology (Abu-Dalbouh, 2016; Davis, 1993; Amornkitpinyo & Wannapiroon, 2015; Chuttur, 2009; Gupta, Zaidi, Udo, & Bagchi, 2015; Moon, Kang, Choi & Kim, 2015; Tang & Hsiao, 2016; Wirtz & Göttel, 2016).

The TAM suggests that when users are presented with a new technology, a number of factors determine their decision about how and when they will use it (Abu-Dalbouh, 2016; Davis, 1993; Amornkitpinyo & Wannapiroon, 2015; Chuttur, 2009; Gupta, Zaidi, Udo, & Bagchi, 2015; Moon, Kang, Choi & Kim, 2015; Tang & Hsiao, 2016; Wirtz & Göttel, 2016). First, the perceived usefulness reflects the expected benefits from using a certain technology. Second, the perceived ease of use reflects the perceived behavioral control in the theory of planned behavior (Abu-Dalbouh, 2016; Davis, 1993; Amornkitpinyo & Wannapiroon, 2015; Chuttur, 2009; Gupta, Zaidi, Udo, & Bagchi, 2015; Moon, Kang, Choi & Kim, 2015; Tang & Hsiao, 2016; Wirtz & Göttel, 2016).

Abu-Dalbouh (2016) proposed a novel evaluation model to evaluate user acceptance of software and system technology by modifying the dimensions of the Technology Acceptance Model (TAM). Below is the description of the Technology Acceptance Model.

<u>External Variables</u> - include years of computer experience, system familiarity (length of elapsed timesince first using that application), and organizational job category (staff support, programmer, analyst, or manager).

<u>Perceived usefulness (PU)</u> – is defined the degree to which a person believes that using a particular system would enhance his or her job performance.

<u>Perceived ease-of-use (PEOU)</u> – is the the degree to which a person believes that using a particular system would be free from effort.

Attitude Toward Using – is the attitude toward using the system which is the most important determinant of behavioral intention to use the system.

Behavioral Intention to Use – is the strength of the attitude toward using the system, is the behavioral intention to use the system.

Actual System Usage – the perceived usefulness and perceived ease of use are major beliefs that influence attitude toward system use and eventually lead to actual system use. (Davis, 1993).

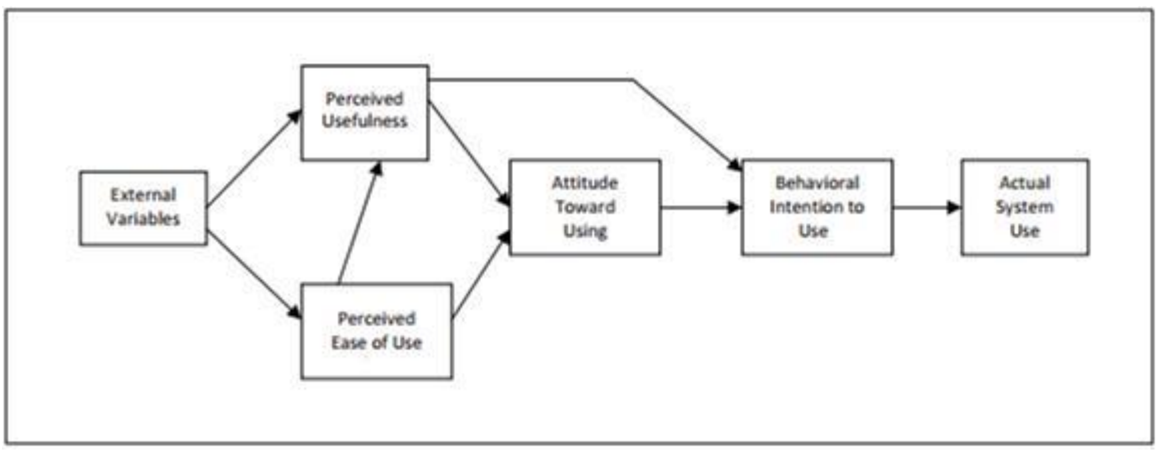


Figure 4. Technology Acceptance Model (Davis, 1993).

The Technology Acceptance Model was not adopted for this study, because the focus on the individual's intention and actual use of an ICT application. There is not much emphasis on other stake holders, such as the Ministry of Education and the private sector.

ADDIE Model

The five-phase ADDIE Model – Analysis, Design, Development, Implement, and Evaluate was developed in 1975 at Florida State University. The U.S. Armed Services adopted ADDIE, as a valid Instructional Systems Design approach for training development. ADDIE has also become the framework for the Department of Defense Instructional Systems Design and Standards Approach to Training (Branch, 2009; Durak & Ataiz, 2016; Khalil & Elkhider, 2016; Lee & Jang, 2014; O'Connor, 2005; Prammanee, 2016; Reinbold, 2013; Türker, 2016).

As a discipline, instructional system design is based upon a set of values, specialized knowledge, intellectual skills, and methodologies that pinpoint performance problems and provide a means of solving them through training and other human performance solutions (Branch, 2009; Durak & Ataiz, 2016; Khalil & Elkhider, 2016; Lee & Jang, 2014; O'Connor, 2005; Prammanee, 2016; Reinbold, 2013; Türker, 2016). The ADDIE model has become the most widely used model for describing and directing courseware development. Most other models contain phases that correspond closely to the five ADDIE model (Branch, 2009; Durak & Ataiz, 2016; Khalil & Elkhider, 2016; Lee & Jang, 2014; Prammanee, 2016; Reinbold, 2013; Türker, 2016).

Government institutions and contractors in the United States of America often share the responsibility for completing the tasks and deliverables included in each phase of the ADDIE Model (Branch, 2009; Durak & Ataiz, 2016; Khalil & Elkhider, 2016; Lee & Jang, 2014; O'Connor, 2005; Prammanee, 2016; Reinbold, 2013; Türker, 2016). For example, government personnel or independent specialists developing a Statement of

Objectives (SOO) or Statement of Work (SOW) may conduct a preliminary training needs analysis, part of the ADDIE analysis phase. When this occurs, the contractor's entry point into the ADDIE Model and decision points within each phase change to reflect this new scope and schedule (Durak & Ataiz, 2016; Khalil & Elkhider, 2016; Lee & Jang, 2014; Prammanee, 2016; Reinbold, 2013; Türker, 2016).

The model is linear in fashion (Khalil & Elkhider, 2016; Lee & Jang, 2014; Prammanee, 2016; Reinbold, 2013; Türker, 2016). Instructional design is evaluated at the end of the process. Each function is divided into a set of specific activities. For example, when moving from the Analysis to the Design phase, Evaluation should occur, then, from the Design phase, Evaluation and Revision should reoccur (Branch, 2009; Durak & Ataiz, 2016; Khalil & Elkhider, 2016; Lee & Jang, 2014; O'Connor, 2005; Prammanee, 2016; Reinbold, 2013; Türker, 2016). Finally, prior to the Production phase, authoring and pre-production examples should be reevaluated. Revisions should take place at this time. During actual the Production (which includes Pro-and Post Production) phase, a final Analysis and Usability study should occur prior to creating the master product.

Next is the table that illustrate the different phases of the ADDIE model. Different questions are asked to help understand what is expected at each phase.

Table 1 – The Interactive-Addie Matrix **Phase**	**Questions**
Analysis	What are the prerequisite skills of the student?

	What technologies are the available? What environment will be used by the student in accessing the software? How will the student use the software to support their learning? What are the educational possibilities of the use of software?
Design	Is the software design consistent with the approach of learning in the classroom? How complex are the materials to be presented? What are the levels of learner control? What methods and approaches are used to provide learners with a challenge? What design will be used to accommodate teaching methods? What can be done to match explicit and implicit curriculum aims to perceived specific curriculum requirements?
Development	What development skills are needed; is there a need for outsourcing? How will the software be delivered? What is the best interface design given the learning goals and objectives?
Implementation	Are there any implications for the student and/or teacher in the implementation of the software? If so, what student and/or teacher support mechanisms have been implemented?

Evaluation	Can the teacher use the software to improve and/or extend their teaching? Does the learning environment provide adequate teacher/student interaction? Does the software improve the student learning experience? Does the software identify implicit curriculum aims?

Table. 1. ADDIE model (O'Connor, 2005).

Input, Process and Output Model

This study used the Input, Process and Output Model. This model was a good fit for this study. In the IPO model, a process is viewed as a series of boxes (processing elements) connected by inputs and outputs (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). Information or material objects flow through a series of tasks or activities based on a set of rules or decision points (Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). Flow charts and process diagrams are often used to represent the process. (Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). What goes in is the input; what causes the change is the process; what comes out is the output (Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005).

Not only is the input, process, and output model of communication applied in human communication, but it can be applied in the class room setting (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). The way teacher educators educate students influences how they will apply that what they learn in class in the real world. There are two types of teacher educators in education (Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). The teacher educator who give challenging assessment tasks and the teacher educator who can let the students get away with little to no effort (Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). Teacher educators need to understand the input, process, and output model because it demonstrates new ideas, challenging material, and the ability for growth. With this understanding comes quality teacher educators who can prepare the students for the knowledge based society of tomorrow (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005).

When using this education model, the teacher educator is the socio-emotional leader of the group and their students are there to learn new ideas (Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). A teacher educator usually starts the class by discussing the material they want to cover and what is due. This brings out the topic of discussion in class. Students continually share their values and knowledge about what is discussed.

Conversation begins to occur in the class room, this being the input. When conversation occurs, learning takes place and perception may be altered (Severson & Tomlinson, 2013; Sloane & Dilger, 2005). Input is important in this model, without it, the classroom will be lethargic and not interesting. Few students want to enter a class room and the teacher educator just lectures and talks. Students begin to lose interest and thus not motivated to do the assignments and participate in classroom discussion (Pandolfini, 2016; Severson & Tomlinson, 2013).

During the input phase, stake holders such as the Ministry of Education in Namibia and the private sector have an input in terms of teaching and learning strategy, assessment policy and procedures strategies, staffing, training in using ICTs, and ICT infrastructure provision.

Teacher educators that stand out to student are the ones that take their course material to the next level, challenging the students (Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). The assignments teacher educators give to the students is the process. The assignments, tests, and projects get the students through the class. Variety of assessment tasks give the teacher educator an idea of the strength and weakness of the students. Classes should not only be test based because it does not sufficiently demonstrate the application of the topic. Material should be flexible, which will result in a well rounded student. In the process phase, it is known as the “action” part of the model. The assignments being given out and the students completing them is the process. Process can occur in short and long term periods. Short term process can be the completing of an assignment. Long term process is the completing of the course, in which the student will receive a grade (Sloane & Dilger, 2005). What is being measured can vary depending on the goals of the course. Teacher educators use the assignments to measure the understanding of a class.

The better the grade in students assignments, the more understanding is in the class room. This, demonstrating understanding about how the teacher educator should set up the course. The assignments teacher educators give to the students demonstrates understanding about the knowledge they have about the topic. Teacher educators use the grades they give to students to show what needs to be improved. Teacher educators stride for their students to complete the tasks and achieve good grades. Each assessment task given allows feedback on student progression (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). When students are challenged with material, it gives the teacher educator a motivation value. This is an output. Output allows for students to improve themselves. When a teacher educator gives a grade back with feedback, students can learn if their method of studying is working. Improvement can be made to get a better grade. Output allows for new input, this is known as feedback. Students grow and learn in each class they take. Output measures the students dedication to the course.

The more dedication the student has, the higher output they will have. Teacher educators can use the student output to change the direction of the course. Teacher educators might have to re teach certain topics or concepts in order to get a better understanding of the topics being discussed in the course. Output is very important in education for that reason.

Teacher educators and students both want to succeed in learning new things. The teacher educator to student relationship gets stronger over the duration of the course, when they spend months together. Each challenging each other to grow in knowledge.

The input, process, and output in education give teacher educators a model to challenge students and their ability to grow. It not only creates conversation in a class room but measure the success of the teacher educator (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). Many things are measured in a class room such as tests, projects, presentation, activities. Students evaluate teacher educators at the end a semester.

This model is developed to describe the implementation process and then used for engaging stakeholders in dialog and subsequent data analysis throughout the program cycle.

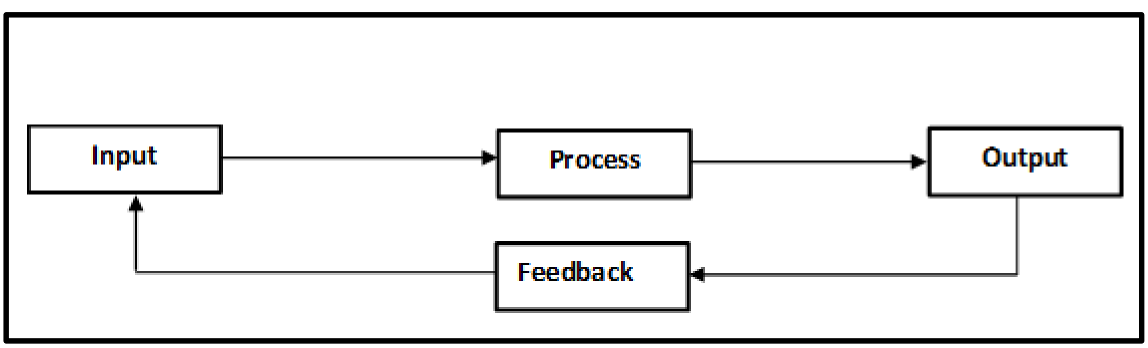


Figure 5. The Input, Process and Output Model (Littlejohn & Foss, 2008).

Inputs: the Inputs with regard to programs that are offered by universities are typical issues such as the university's teaching and learning strategy, its assessment policies and procedures, infrastructure, library resources, administrative services, postgraduate policies and procedures, program design, etc. (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). Resources can also be regarded as input into a system, such as personal computers, laptops, tablets, Local Area Network (LAN) and Wide Area Network (WAN), and broad band internet (Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005).

Processes: The processes are functions such as program co-ordination, academic development and success, teaching and learning interactions, student assessment practices, co-ordination of work-based learning, delivery of postgraduate program (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). It can be attendance of learners over the e-learning module, interaction with other learners and teacher educator over the e-learning module, and training of teacher educators on better teaching methods and practices (Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005).

Outputs The output can be regarded as student retention and throughput rates and the impact of program (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016;

Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005). It can be performance scores, documentation converted to monetary value, benefits or attitude change. Quality assurance activities within a system, which should include the assessment of all its dimensions with regard to its inputs, processes and outputs (Becket & Brookes, 2006; Gessler & Herrera, 2015; Holub, 2016; Lubaale, 2015; Mater & Ibrahim, 2015; Nieminen & Lehtoranta, 2015; Pandolfini, 2016; Severson & Tomlinson, 2013; Sloane & Dilger, 2005).

The IPO model provided the general structure and guide for the direction of this study. Substituting the variables of this study on the IPO model, the researcher came up with the model in chapter 5. The conceptual map developed for conducting this research served as the blueprint for the model provided in chapter 5, as part of the recommendation for this study.

Summary

Chapter 2 focused on ICT policy evaluations at the global level, Systems Theory, ICT pedagogical training, ICT infrastructure, ICT uses in the classroom, class size, Learning Management System (LMS), social media, ongoing professional training in ICT,Vision 2030 document, and ICT Policy for Education in Namibia. There was also a further focus on technical support, obstacles to ICT integration, ICT qualifications, community of practice, future training needs in ICTs, and evaluation models. Chapter 3 will focus on the methodology for this study. The methods and procedures used in this study are explained in chapter 3.

CHAPTER 3: METHODOLGY

The methods and procedures used in this study are explained in this chapter. This chapter will discuss the research design, population and sampling procedures, research instruments, pilot study, data collection procedures, and data analysis procedures.

3.1 Research Design

This study used the mixed-method approach. It used both the quantitative and qualitative methods. The quantitative method used was in the form of questionnaires, which collected data with regards to the knowledge about the ICT Policy for Education in the Faculty of Education, on the categories of ICT uses in the classroom, installed software on PCs, speed to download teaching materials from the internet or network, frequency of ICT applications uses, hours per week of teaching with PCs, hours per week of internet use for teaching purposes, ICT qualifications, different ways of acquiring ICTs skills, community of practice, division of labour, obstacles encountered during the ICT implementation, and future training needs in ICTs were identified. The quantitative research method is discussed next, which was used in this study.

In social sciences, quantitative research is widely used in education, psychology, economics, demography, sociology, marketing, community health, health & human development, gender and political science, and less frequently in anthropology and history (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Quantitative research is the systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The objective of quantitative research is to develop and employ mathematical models, theories and/or hypotheses pertaining to phenomena (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003).

Quantitative methods provide standardized data on which inferential statistics are drawn (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003). It presume to have an objective approach to studying research problems, where data is controlled and measured, to address the accumulation of facts, and to determine the causes of behaviour (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). As a consequence, the results of quantitative research may be statistically significant (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The overarching aim of a quantitative research study is to classify features, count them, and construct statistical models in an attempt to explain what is observed (Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). The data is usually gathered using structured research instruments. The results are based on large sample sizes that are representative of the population. The research study can usually be replicated or repeated, given its high reliability (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

A researcher has a clearly defined research question(s) to which objective answers are sought. All aspects of the study are carefully designed before data is collected. Data is in the form of numbers and statistics, often arranged in tables, charts, figures, or other non-textual forms (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The study can be used to generalize concepts more widely, predict future results, or investigate causal relationships (Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). A researcher uses tools, such as questionnaires or computer software, to collect, manipulate and analyze numerical data.

Quantitative researchers attempt to remain detached from the study, and from the sample (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015). They strive to maintain objectivity, where they try to not influence the findings with their own personal values, feelings, and experiences (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). This is because quantitative researchers believe that the researcher involvement in the study could create bias. They do not want to sway the study towards the perceptions and values of the researcher, rather than allowing the hard scientific facts to take hold (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Biasing a research study is considered by scientists as being poor scientific technique (Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

In quantitative research, the investigator identifies a research problem based on trends in the field or on the need to explain why something occurs (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Describing a trend means that the research problem can be answered best by a study in which the researcher seeks to establish the overall tendency of responses from individuals and to note how this tendency varies among people (Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). In the case of this study, it was determined that there was need to determine the extent to which ICTs are used in teaching in teacher education. The present and future use of ICTs in teaching will determine whether Namibia will become an industrialized country by 2030, as described in the Namibia’s Vision 2030 document and the Namibia’s ICT Policy for Education document.

Before designing a quantitative research study, the researcher must decide whether it will be descriptive or experimental study, because this will dictate how the researcher will gather, analyze, and interpret the results (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). A descriptive study is governed by the following rules: subjects are generally measured once; the intention is to establish associations between variables; and, the study may include a sample population of hundreds or thousands of subjects to ensure that a valid estimate of a generalized relationship between variables has been obtained (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). The present study is descriptive in nature, where the questionnaires were administered to the participants. The opinions of the participants were gathered about their knowledge of the ICT Policy for Education, and their uses of ICTs for teaching and learning purposes.

Regarding experimental studies, in its simplest form, an experiment aims at predicting the outcome by introducing a change of the preconditions, which is reflected in a variable called the predictor (independent). The change in the predictor is generally hypothesized to result in a change in the second variable, called the outcome (dependent) variable (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Experimental design includes subjects who are measured before and after a particular treatment, or a control group and the experimental group. The sample population may be very small and purposefully chosen, and it is intended to establish causality between variables (Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The experiments are carefully planned in advance so that the results are both objective and valid (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015).

Experimental studies aim to describe or explain the variation of information under conditions that are hypothesized to reflect the variation (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It is generally associated with true experiments in which the design introduces conditions that directly affect the variation, but may also refer to the design of quasi-experiments, in which natural conditions that influence the variation are selected for observation (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

The different types of experimental design are: between subjects design; completely randomized design; factorial design; matched-pairs design; observational study; longitudinal research; cross sectional research; pretest-posttest design; quasi-experimental design; randomized block design; randomized controlled trial and within subjects design (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

In reviewing the literature in quantitative research, the researcher will typically see a substantial literature review at the beginning of the study (Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Thus, the literature plays a major role in two ways: justifying the need for the research problem and suggesting potential purposes and research questions for the study (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Justifying the research problem means that the researher use the literature to document the importance of the issue examined in the study (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). To accomplish this, the researcher will search the literature, locate studies that identify the problem as important to examine, and then cite this literature in the research report (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

The literature also creates a need for the study, as expressed specifically in the purpose statement and the research questions or hypotheses (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). The researcher identify in the literature key variables, relations, and trends, and use these to provide direction for the research questions and hypotheses (Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). A literature review on ICT policy evaluation, may show that there is limited knowledge about ICT policy evaluation in teacher education (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Existing literature, however, may identify the importance of ICT access and ICT use among teacher educators. Thus, important research questions might address ICT training and ICT access influence on ICT use in the classroom. In this way, the literature in a quantitative study both documents the need to study the problem and provides direction for the research questions (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007).

In quantitative research questions, researchers ask specific, narrow questions in order to obtain measurable and observable data on variables (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The major statements and questions of direction in a study, such as the purpose statement, the research questions, and the hypotheses are specific and narrow because the researcher wants to identify only a few variables to study (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). From a study of these variables, the researcher obtain measures or assessments on an instrument or record scores on a scale from observations (Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The researcher indicate what they will examine and then identify the factors that they predict will influence this involvement (Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Thus, their research questions are specific, and later in the method section, they explain how they will measure these factors (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

In quantitative data collection, the researcher use an instrument to measure the variables in the study (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). An instrument is a tool for measuring, observing, or documenting quantitative data (Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It contains specific questions and response possibilities that the researcher establish or develop in advance of the study. Examples of instruments are survey, questionnaires, standardized tests, and checklists that the researcher might use to observe the participants behaviors (Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The types of questions included in the questionnaire are yes or no answers (Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). For example, participants in this study where asked whether they received professional training in the use of ICTs during the past two years. The participants were expected to give a yes or no answer on the question asked. These type of questions have a definite yes or no answer. Questions on a questionnaire can also be Likert style questions (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). The Likert style questions included the knowledge about the ICT policy for Education, where the participants were asked to respond on a five-point scale (e.g. strongly agree, agree, undecided, disagree, and strongly disagree). The participants were asked to tick one of the options they agreed with. The participants were asked tick all statements that apply to how they used ICTs in their classes, e.g. to organize and store information, to manipulate and analyse data, to support individualized learning, etc.

The questionnaire questions can have fill in the blanks options. The participants for this study were asked to fill in the blanks, by specifying the reasons why they have not received training in the last two years. The questionnaire had the skip logic, where the participants where asked whether they had access to a computer for teaching purposes. If they did not have access to a computer, they were asked to proceed to the next section, because the questions that followed had to do with the number of hours they used the computer to prepare their lessons, hours per week of internet use for research and teaching related activities, speed to download teaching materials, etc. The researcher also collected responses based on checking boxes, or from checklists the participants completed on the questionnaire.

The purpose of collecting data is to apply the results (called generalizing the results) from a small number of people to a large number (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The larger the number of individuals studied, the stronger the case for applying the results to a large number of people (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015).

After collecting and analyzing the data, the researcher will draw conclusions based on the representative sample studied (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De

Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). In quantitative data analysis, the researcher analyze the data using mathematical procedures, called statistics. Results need to be calculated using Excel, Access, or data analysis software, such as SPSS (Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). This study used SPSS for its data analysis. These analyses consist of breaking down the data into parts to answer the research questions. Statistical procedures such as comparing groups or relating scores for individuals provide information to address the research questions or hypotheses (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The researcher then interpret the results of this analysis in light of initial predictions or prior studies (Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). This interpretation is an explanation as to why the results turned out the way they did, and often the researcher will explain how the results either support or refute the expected predictions in the study (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The researcher can use a statistical program (i.e., factor analysis) to help them identify the most important questions for each of the items (or factors) in the study (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015). With this reduced set of questions for each of the factors in the study, the researcher can then conduct descriptive analysis, such as means and standard deviations, and use the statistical program of regression statistical analysis to predict whether the control of predictors best explain the variation in scores for the study (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). In short, the researcher use statistical analysis consisting of three phases: factor analysis, descriptive analysis, and regression analysis (Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

The ultimate goal is to relate variables to see what predictors (demographics or factors) best explain the findings (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). The researchers can discuss the main results of the study and compare their results with those found in other studies in the literature (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

In reporting and evaluating quantitative research, the overall format for a study follows a predictable pattern: introduction, review of the literature, methods, results, and discussion (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Watkins & Gioia, 2015). This form creates a standardized structure for quantitative studies. In addition, it also leads to specific criteria that the researcher might use to judge the quality of a quantitative research report (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015) .

The researcher can examine a quantitative study to see if it has an extensive literature review; tests good research questions and hypotheses; uses rigorous, impartial data collection procedures; applies appropriate statistical procedures; and forms interpretations that naturally follow from the data (Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The entire study conveys an impersonal, objective tone, and they do not bring either their biases or their personal opinions into the study (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The specific strengths of using quantitative methods to study social science research problems are described next. It allows for a broader study, involving a greater number of subjects, and enhancing the generalization of the results (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It allows for greater objectivity and accuracy of results (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Quantitative methods are designed to provide summaries of data that support generalizations about the phenomenon under study (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

In order to accomplish this, quantitative research usually involves few variables and many cases, and employs prescribed procedures to ensure validity and reliability (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It applies well established standards so that the research can be replicated, and then analyzed and compared with similar studies (Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The researcher can summarize vast sources of information and make comparisons across categories and over time. Personal bias can be avoided by keeping a distance from participating subjects and using accepted computational techniques (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

On the other hand, some specific limitations associated with using quantitative methods to study research problems in the social sciences are described next. Quantitative data is more efficient and able to test hypotheses, but may miss contextual detail (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Uses a static and rigid approach and employs an inflexible process of discovery (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008). The development of standard questions by researchers can lead to "structural bias" and false representation, where the data actually reflects the view of the researcher instead of the participating subject (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

Results provide less detail on behavior, attitudes, and motivation. Researcher may collect a much narrower and sometimes superficial dataset. Results are limited as they provide numerical descriptions rather than detailed narrative and generally provide less elaborate accounts of human perception (Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). The research is often carried out in an unnatural, artificial environment so that a level of control can be applied to the exercise. This level of control might not normally be in place in the real world thus yielding "laboratory results" as opposed to "real world results" (Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Preset answers will not necessarily reflect how people really feel about a subject and, in some cases, might just be the closest match to the preconceived hypothesis (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

This study also used the qualitative methods to collect the data. Qualitative research asks broad questions and collects word data from phenomena or participants (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The qualitative research method used both the interviews and observation procedures (Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003). Interpretive researchers believe human actions result from choices based on constructed interpretations of the social setting (Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

It involves the collection, analysis, and interpretation of data that are not easily reduced to numbers (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). These data relate to the social world and the concepts and behaviors of people within it. Qualitative research can be found in all social sciences and in the applied fields that derive from them, for example, research in education, psychology, sociology, health services, nursing, pharmacy, etc. (Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003)

Qualitative research is an inquiry process of understanding, based on a methodological tradition of inquiry that explores a problem, which enables construction of a complex, holistic picture, analyses words, reports detailed views of informants and conducts the study in a natural setting (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It usually involves many variables and few cases, versus many cases and few variables as in quantitative research (Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

Qualitative research goes beyond counting and ranking. It records and analyzes feelings, behaviors and attitudes, thus covering the issue in depth and detail (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016). Research data is collected through interviews, enabling the researcher to interact with the research subjects in their own language and terms (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). This enables the researcher to collect more accurate data because the answers are first hand and there is room for clarification (Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

It creates openness during research, by encouraging people to expand on their answers, responses can bring up new topics not initially considered, but as equally important (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008)). The objective of research can change with the emergence of new data. Qualitative research can sometimes provide a better understanding of the nature of educational problems and thus add to insights into teaching and learning in a number of contexts (Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015).

Qualitative research employs different designs, namely: grounded theory design, ethnographic design, narrative design, and case studies.

Grounded Theory Designs

Instead of studying a single group, the researcher might examine a number of individuals who have all experienced an action, interaction, or process (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015). Grounded theory designs are systematic, and employ qualitative procedures that researchers use to generate a general explanation, grounded in the views of participants, called a grounded theory (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016).

It explains a process, action, or interaction among people. The procedures for developing this theory include primarily collecting interview data, developing and relating categories (or themes) of information, and composing a figure or visual model that portrays the general explanation (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015). In this way, the explanation is "grounded" in the data from participants. From this explanation, the researcher construct predictive statements about the experiences of individuals (Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016). This study used the grounded theory design, where the participants were interviewed and observed during classroom experiences and teachings.

Ethnographic Designs

The researcher may be interested in studying one group of individuals, in examining them in the setting where the participants live and work, and in developing a portrait of how they interact (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). An ethnographic study is well suited for this purpose. Ethnographic designs are qualitative procedures for describing, analyzing, and interpreting a cultural group's shared patterns of behavior, beliefs, and language that develop over time (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

In ethnography, the researcher provides a detailed picture of the culture-sharing group, drawing on various sources of information (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The ethnographer also describes the group within its setting, explores themes or issues that develop over time as the group interacts, and details a portrait of the group (Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015).

Narrative Research Designs

The researcher may not be interested in describing and interpreting group behavior or ideas, or in developing an explanation grounded in the experiences of many individuals (Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016). Instead, the researcher wish to tell the stories of one or two individuals. Narrative research designs are qualitative procedures in which researchers describe the lives of individuals, collect and tell stories about these individuals' lives, and write narratives about their experiences (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). In education, these stories often relate to school classroom experiences or activities in schools (Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003).

Case study

In doing case study research, the "case" being studied may be an individual, organization, event, or action, existing in a specific time and place (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016;

Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Case studies explore and investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships (Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). Data is collected through interview and observations.

Case studies allow a researcher to investigate a topic in far more detail than might be possible if they were trying to deal with a large number of research participants (e.g. surveys) with the aim of averaging the responses (Bales, 2002; Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). Researchers select methods of data collection and analysis that will generate material suitable for case studies such as qualitative techniques (semi-structured interviews, participant observation, diaries), personal notes (e.g. letters, photographs, notes) or official document (e.g. case notes, clinical notes, appraisal reports) (Brown, 2014; Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). This study collected data through structured interviews, participant observations, photographs and field notes from the different University of Namibia campuses.

The data collected can be analysed using different theories (e.g. grounded theory, interpretative phenomenological analysis, text interpretation (e.g. thematic coding) etc. (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015). This study used the grounded theory to analyse the data.

Case study research has long had a prominent place in many disciplines and professions, ranging from education, psychology, anthropology, sociology, and political science (Bryman, 2012; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). Case studies may involve both qualitative and quantitative research methods, such as in the case of this study.

The lack of empirical research in the evaluation of ICT policy in Namibia in higher education, justifies the use of mixed-methods procedures. The mixed-method approach is a step in the right direction towards utilizing the strengths of both qualitative and quantitative research (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The problems addressed by social, such as in education and health science researchers are complex, and the use of either quantitative or qualitative approaches by themselves is inadequate to address this complexity (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015;

Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The interdisciplinary nature of research, as well, contributes to the formation of research teams with individuals with diverse methodological interests and approaches.

There is more insight to be gained from the combination of both qualitative and quantitative research than either form by itself (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The combined use provides an expanded understanding of research problems (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

One of the most advantageous characteristics of conducting mixed-methods research is the possibility of triangulation, i.e., the use of several means (methods, data sources and researchers) to examine the same phenomenon (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). Triangulation allows one to identify aspects of a phenomenon more accurately by approaching it from different vantage points using different methods and techniques (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). Successful triangulation requires careful analysis of the type of information provided by each method, including its strengths and weaknesses (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015).

The use of mixed-method research provides a number of advantages, namely: provides strengths that offset the weaknesses of both quantitative and qualitative research. For instance, quantitative research is weak in understanding the context or setting in which people behave, something that qualitative research makes up for (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). On the other hand, qualitative research is seen as deficient because of the potential for biased interpretations made by the researcher and the difficulty in generalizing findings to a large group (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Quantitative research does not have these weaknesses.

Using both types of research, the strengths of each approach can make up for the weaknesses of the other (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It provides a more complete and comprehensive understanding of the research problem than either quantitative or qualitative approaches alone (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

It provides an approach for developing better, more context specific instruments. For instance, by using qualitative research it is possible to gather information about a certain topic or construct in order to develop an instrument with greater construct validity, i.e., that measures the construct that it intends to measure (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). It helps to explain findings or how causal processes work (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

This study used the concurrent triangulation design to collect and analyse the data. Below is the graphical representation of the concurrent triangulation design.

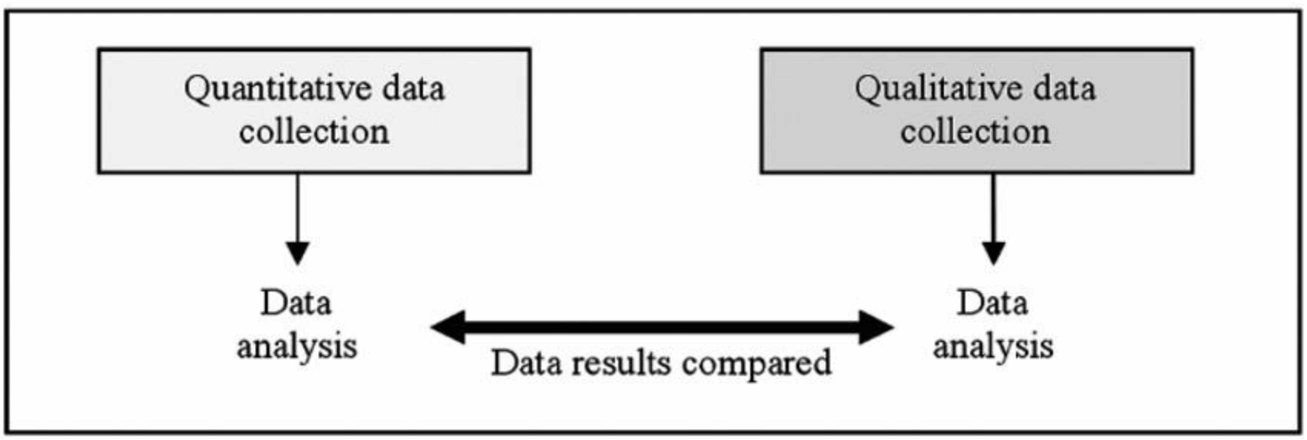


Figure 6. Concurrent triangulation design (Creswell, 2009).

The purpose of this design is to obtain different but complementary data on the same topic (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015) to best understand the research problem. The intent in using this design is to bring together the differing strengths and non-overlapping weaknesses of quantitative methods (large sample size, trends, generalization) with those of qualitative methods (small sample size, details, in depth) (Patton, 2011).

This design and its underlying purpose of converging different methods has been discussed extensively in the literature (e.g., Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). This design is used when a researcher wants to directly compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data.

The researchers implement the quantitative and qualitative methods during the same timeframe and with equal weight (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). The single-phase timing of this design is the reason it has also been referred to as the "concurrent triangulation design" (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007). It generally involves the concurrent, but separate, collection and analysis of quantitative and qualitative data so that the researcher may best understand the research problem. The researcher attempts to merge the two data sets, typically by bringing the separate results together in the interpretation or by transforming data to facilitate integrating the two data types during the analysis.

There are variants of the Triangulation Design. The four variants are the convergence model, the data transformation model, the validating quantitative data model, and the multilevel model. The first two models differ in terms of how the researcher attempts to merge the two data types (either during interpretation or during analysis), the third model is used to enhance findings from a questionnaire, and the fourth is used to investigate different levels of analysis (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The convergence model represents the traditional model of a mixed-methods triangulation design (Creswell, 1999). In this model, the researcher collects and analyzes quantitative and qualitative data separately on the same phenomenon and then the different results are converged, by comparing and contrasting the different results during the interpretation (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Researchers use this model when they want to compare results or to validate, confirm, or corroborate quantitative results with qualitative findings. The purpose of this model is to end up with valid and well-substantiated conclusions about a single phenomenon (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

The study on e-Learning in Nursing Education (Harerimana, Mtshali, Hewing, Maniriho, Kyamusoke, Mukankaka, Rukundo, Gasurira, Mukamana, Mugarura, 2016) is an example of this model. In their study, they derived qualitative themes from the qualitative data. These qualitative data findings was then analyzed with the quantitative data, using correlations and logistical regression to identify relationships between categories

(Harerimana, Mtshali, Hewing, Maniriho, Kyamusoke, Mukankaka, Rukundo, Gasurira, Mukamana, Mugarura, 2016). This study adopted this research design.

Researchers may choose to use the data transformation model (Creswell, 2009). This model also involves the separate collection and analysis of quantitative and qualitative data sets. However, after the initial analysis, the researcher uses procedures to transform one data type into the other data type. This is accomplished by either quantifying qualitative findings or qualifying quantitative results (Creswell, 2009; Creswell & Clark, 2011). This transformation allows the data to be mixed during the analysis stage and facilitates the comparison, interrelation, and further analysis of the two data sets.

Researchers use the validating quantitative data model when they want to validate and expand on the quantitative findings from a survey by including a few open-ended qualitative questions. In this model, the researcher collects both types of data within one survey instrument (Ndanu & Syombua, 2015). The qualitative items are an add-on to a quantitative survey, the items generally do not result in a rigorous qualitative data set. However, they provide the researcher with interesting quotes that can be used to validate and enhance the quantitative survey findings (Creswell, 2009; Creswell & Clark, 2011; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

For example, the research by Thomas & Whitten (2012) used the Validating Quantitative Data Model (VQDM) to collect both quantitative and qualitative data, merge and validate the data, and use the results to understand a research problem on learning support for students with learning difficulties in India and Australia. The study highlights the importance of context to practice when providing support for children who have learning difficulties (Thomas & Whitten, 2012). Qualitative data, which used in-depth observations provided detail that was lacking in quantitative data alone. They were also used to clarify the meaning of ambiguous or inconsistent responses (Thomas & Whitten, 2012).

The fourth variant of the Triangulation Design is what referred to as multilevel research (Creswell, 2009; Creswell & Clark, 2011; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). In a multilevel model different methods (quantitative and qualitative) are used to address different levels within a system. The findings from each level are merged together into one overall interpretation. For example, Elliott and Williams (2002) studied an employee counseling service using qualitative data at the client level, qualitative data at the counselor level, qualitative data with the directors, and quantitative data for the organizational level.

The Concurrent Triangulation Design has a number of strengths and advantages, including the following: The design makes intuitive sense. Researchers new to mixed-methods often choose this design. It was the design first discussed in the literature ((Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015), and it has become a framework for thinking about mixed-methods research.

It is an efficient design, in which both types of data are collected during one phase of the research at roughly the same time. Each type of data can be collected and analyzed separately and independently, using the techniques traditionally associated with each data type (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015 . This lends itself to team research, in which the team can include individuals with both quantitative and qualitative expertise (Creswell, 2009; Creswell & Clark, 2011; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

Challenges in using the Triangulation Design are that much effort and expertise is required, particularly because of the concurrent data collection and the fact that equal weight is usually given to each data type (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015) . This can be addressed by forming a research team that includes members who have quantitative and qualitative expertise, by including researchers who have quantitative and qualitative expertise on graduate committees, or by training single researchers in both quantitative and qualitative research. Researchers may face the question of what to do if the quantitative and qualitative results do not agree (Bazeley, 2003; Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). These differences can be difficult to resolve and may require the collection of additional data. The question then develops as to what type of additional data to collect, quantitative data, qualitative data, or both? There may be the need for the collection of additional data or the re-examination of existing data to address this challenge.

For the convergence model, researchers need to consider the consequences of having different samples and different sample sizes when converging the two data sets (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). Different sample sizes are inherent in the design because quantitative and qualitative data are usually collected for different purposes (generalization vs. in-depth description, respectively). Researchers can consider collecting large qualitative samples or weighting the cases (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009).

It can be very challenging to converge (integrate) two sets of very different data and their results in a meaningful way (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009). In addition, researchers need to design their studies so that the quantitative and qualitative data address the same concepts. This strategy facilitates merging the data. For the data transformation model, researchers need to develop procedures for transforming data and make decisions about how the data will be transformed (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Patton, 2011). In general, it is easier for researchers to quantify their qualitative data by transforming qualitative codes or themes into counts or ratings (Creswell, 2009; Creswell & Clark, 2011; Patton, 2011).

3.2 Population

The population consisted of all teacher educators in the Faculty of Education (N = 207) at the different campuses of the University of Namibia. The different campuses were the Main (Windhoek), Khomasdal (Windhoek), Hifikepunye (Oshakati), Rundu and Katima Campus.

3.3 Sampling Procedures and Sample Size

Two sampling methods were used in this study, namely: purposeful and random sampling methods. In purposeful sampling, participants are selected because of some unique characteristics or that they meet a specific criterion (Cama, Jorge, Andrades, 2016; Fraenkel & Wallen, 1993; Nind, Curtin & Hall, 2016). In this case, all teacher educators who taught Integrated Media and Technology (IMTE) were selected, because they met the criteria set by the researcher. Seven teacher educators were tasked to teach with ICTs. These teacher educators were located at different University of Namibia campuses.

The second sampling method used was the random sampling method, in which each and every member of the population has an equal and independent chance of being selected (Bales, 2002; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016). The participants included all the teacher educators at the different University of Namibia campuses.

The formula to determine the random sample size was determined by:

$$n = \frac{[\, 4\,(r)\,(1\text{-}r)\,(f)\,(1.1)\,]}{[\,(0.12r)^2\,(p)\,(n_h)\,]}$$

Where

n is the required sample size, expressed as number of teacher educators

4 is a factor to achieve the 95 per cent level of confidence

r is the predicted or anticipated prevalence (coverage rate) of the indicator

f is the shortened symbol for deff (design effect)

1.1 is the factor necessary to raise the sample size by 10 per cent for non-response

0.12r is the margin of error to be tolerated at the 95 per cent level of confidence, defined as 12 percent of r (relative sampling error of r)

p is the proportion of the total population upon which the indicator, r, is based

nh is the average teacher educators size (ILO, 2012; UNICEF, 2008).

This formula is used by various organizations to determine the random sample size from a population. Several organizations such as the International Labour Organization (ILO) and the The United Nations Children's Emergency Fund (UNICEF) use this formula when determining random sample size from a population.

The Main campus had (43 teacher educators), therefore 14 teacher educators were chosen from that campus.

The Katima Mulilo campus had (34 teacher educators), therefore 11 were chosen.

The Khomasdal campus had (34 teacher educators), therefore 11 were chosen.

The Rundu campus had (34 teacher educators), therefore 11 were chosen.

The Hifikepunye Pohamba campus had (61 teacher educators), therefore 20 were chosen.

3.4 Research Instruments

This study used three instruments for data collections purposes, namely: questionnaire, interviews and an observation checklist.

Questionnaire

The questionnaire sought to answer the first research question of this study, which focused on the knowledge about the ICT Policy for Education in the Faculty of Education, the categories of ICT uses in the classroom, installed software on PCs, speed to download teaching materials from the internet or network, frequency of ICT applications uses, hours per week of teaching with PCs, hours per week of internet use for teaching purposes, ICT qualifications, different ways of acquiring ICTs skills, community of practice, division of labour, obstacles encountered during the ICT implementation, and future training needs in ICTs were identified.

The advantages of questionnaires are that the results are based on large sample sizes that are representative of the population. The research study can usually be replicated or repeated, given its high reliability when questionnaires are used (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008;

Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

Questionnaires provide standardized data on which inferential statistics are drawn (Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003). It presume to have an objective approach to studying research problems, where data is controlled and measured, to address the accumulation of facts, and to determine the causes of behaviour (Brown, 2014; Creswell, 2009; Creswell & Clark, 2011; De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015). As a consequence, the results of research may be statistically significant (De Lisle, 2011; Early, 2007; Hall & Howard, 2008; Shulha, & Wilson, 2003; Stockman, 2015; Teddlie & Tashakkori, 2009; Watkins & Gioia, 2015).

Interviews

The interviews sought to answer the second research question, which gathered in depth knowledge about the factors encountered in the implementation of the ICT Policy for Education in the Faculty of Education. The advantages of interviews are that particular questions can be pursued in depth, items that are unclear can be explained and they provide opportunities for follow-up questions to check for accuracy from what was observed (Bales, 2002; Gall, Gall, & Borg, 2007; Nind, Curtin & Hall, 2016). All IMTE teacher educators where interviewed, because they are tasked to teach with ICTs and would provide rich information about ICT use in teaching. The interviews were conducted on a one-to-one basis at a location of their choice at each campus and lasted for about thirty minutes. Interviews were formal and fully structured.

Observation Checklist

The researcher observed a minimum of twenty lessons at each campus with two or three teacher educators in order to get a complete picture on how ICTs are used as per policy guidelines at the different University of Namibia campuses. All IMTE teacher educators were observed. The observations provided an opportunity to see for an extended period of time how ICTs are used for teaching and learning activities. This allowed the researcher to see whether these activities are in line with the ICT policy for education objectives.

3.5 Pilot Study

Some of the advantages of conducting a pilot study is that it can give advance warnings about proposed methods or instruments that are inappropriate or too complicated (Dash, 2008; Gall, Gall, & Borg, 2007). It permits preliminary testing of the research instruments that leads to testing more precise research problem of the study (Bryman, 2012; Bales, 2002; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Welman, Kruger, & Mitchell, 2005). Nind, Curtin and Hall (2016) suggested that this may lead to changing some questions, dropping some, or developing new questions. It often provides the researcher with ideas, approaches, and clues that may not have been detected before conducting the main study. Such ideas and clues increase the chances of getting clearer findings in the main study (Porter, Graham, Bodily & Sandberg, 2016).

Twelve teacher educators were used to pilot test the questionnaire. Two teacher educators were used to pilot test the interview and observation checklist. The participants recommended changes to the wording of some of the questions on the questionnaire. Some follow up questions where added to the questionnaire to provide better clarity on some issues. Some changes were also added to the interview questionnaires and observation checklist. After the necessary changes and adjustments were made resulting from the pilot study, the researcher embarked on the main study.

3.6 Data Collection Procedures

Permission to carry out this study was sought from the Post Graduate Studies Committee. The following schedule was created in order to identify the key tasks with regards to the collection of data:

March 2015- the Pilot study was conducted at the Khomasdal campus.

April 2015– the questionnaire was administered to the randomly selected sample of the teacher educators at the Main campus.

April 2015 – interviews and observation of the teacher educators at the Main campus were conducted who are tasked to teach with ICTs.

August 2015 - the questionnaire was administered to the randomly selected teacher educators at the University of Namibia, Hifikepunye Pohamba campus. Interviews with the teacher educators tasked with teaching with ICTs at the Hifikepunye Pohamba campus was conducted. Observation was made of teacher educators using ICTs for teaching and learning purposes at the Hifikepunye Pohamba campus.

September 2015 - the questionnaire was administered to the randomly selected teacher educators at the University of Namibia, Rundu campus. Interviews with the teacher educators tasked with teaching with ICTs at the Rundu campus was conducted. Observation was made of teacher educators using ICTs for teaching and learning purposes at the Rundu campus.

October 2015 - the questionnaire was administered to the randomly selected teacher educators at the University of Namibia, Katima Mulilo campus. Interviews with the teacher educators tasked with teaching with ICTs at the Katima Mulilo campus was conducted. Observation was made of teacher educators using ICTs for teaching and learning purposes at the Katima Mulilo campus.

3.7 Data Analysis Procedures

To allow for comparison of variables to the ICT policy for education, the knowledge about the ICT Policy for Education in the Faculty of Education was analysed, the categories of ICT uses in the classroom, installed software on PCs, speed to download teaching materials from the internet or network, frequency of ICT applications uses, hours per week of teaching with PCs, hours per week of internet use for teaching purposes were asked, ICT qualifications, different ways of acquiring ICTs skills, community of practice, division of labour, obstacles encountered during the ICT implementation, and future training needs in ICTs were identified and conclusions were drawn from the results, using the Statistical Package for Social Science (SPSS). The software drew descriptive statistics on close ended questions such as qualifications in ICTs, experience in using ICTs, and subjects taught using ICTs, among others and was compared to the criteria specified in the ICT Policy for Education.

The various statistical procedures used in this study are provided below:

- The **Cronbach's Alpha** was used to test the internal consistency of the answers provided on the questionnaire.
- The **Likert Scale** was used to group similar responses on the questionnaire.
- The **Pearson product-moment correlation coefficient (PPMCC)** was used to check the correlation between: ICT policy understanding and gender; ICT policy understanding and age groups; ICT policy understanding and participants qualifications; ICT policy understanding and rank; ICT policy understanding between the campuses; ICT policy understanding between the different departments.

  Further correlations were made on ICT use and gender; ICT use and age groups; ICT use and participants qualifications; ICT use and rank; ICT use between the different campuses; and ICT use and the different departments.

  Another correlation was made between the community of practice and gender; community of practice and age groups; community of practice and participants qualifications; community of practice and rank; community of practice and the different campuses; and community of practice and the different departments.

- The **Kruskal-Wallis H Test** was used to compare the different campuses (Main, Khomasdal, Hifikepunye, Rundu and Katima) on ICTs use, Professional Development, Division of Labour, Community of Practice and Infrastructure.

- The **Eigenvalue: Factor Analysis** was used to reduce the original variables into a smaller set of composite dimensions or factors, e.g. if the questions on ICTs use had 19 questions it was reduced to 6 or less variables.

- The **Eigenvalue: Cluster** was used to cluster responses on each construct such as Community of Practice into clusters that are homogeneous.

Individual responses to open-ended questions were collated, classified under common themes, patterns identified and included selectively for illustrative purposes in the discussion of the results for the interviews. The same criteria used to analyse the interviews, was used in the observations, in order to identify themes and patterns. This helped to validate data collected using different sources, such as questionnaires, interviews and observation.

3.8 Ethical Considerations

Ethical concerns involve protection against possible harm against participants, confidentiality of the research data, and deception (Dash, 2008; Nind, Curtin & Hall, 2016). Permission to carry out this study was sought from the Post Graduate Studies Committee. The purpose of the study was explained to the participants. The researcher sought informed consent from the participants, before participating in the study. Before any audio recording was done, permission was sought from the participants. Participation in the study was voluntary and participants could leave the study at any time. Participants were assured that the information received from them will be kept confidential and would only be used for the purpose of the study. Fictitious names or codes was assigned to all participants. Objectivity was preserved through relying on multiple sources, such as the questionnaire, interview and observations. The researcher did not deliberately take participants responses out of context.

The data collected will be kept in a locked cabinet in the researcher's office for a period of five years. The data will then be destroyed after five years.

3.9 Summary

The methods and procedures used in this study were explained in this chapter. This chapter discussed the research design, population and sampling procedures, research instruments, pilot study, data collection procedures, and data analysis procedures.

Chapter 4: Data Analysis

In this chapter, data will be analyzed using the following two research questions:

3. How is the ICT Policy for Education being implemented in the Faculty of Education?

4. What are the factors encountered in the implementation of the ICT Policy for Education in the Faculty of Education?

In answering the first question, various sub-questions were asked and included, namely: knowledge about the ICT Policy for Education?, categories of ICT uses in the classroom?, installed software on PCs?, speed taken to download teaching materials from the internet or network?, frequency of ICT applications uses?, hours per week of teaching with PCs?, and hours per week of internet use for teaching purposes?.

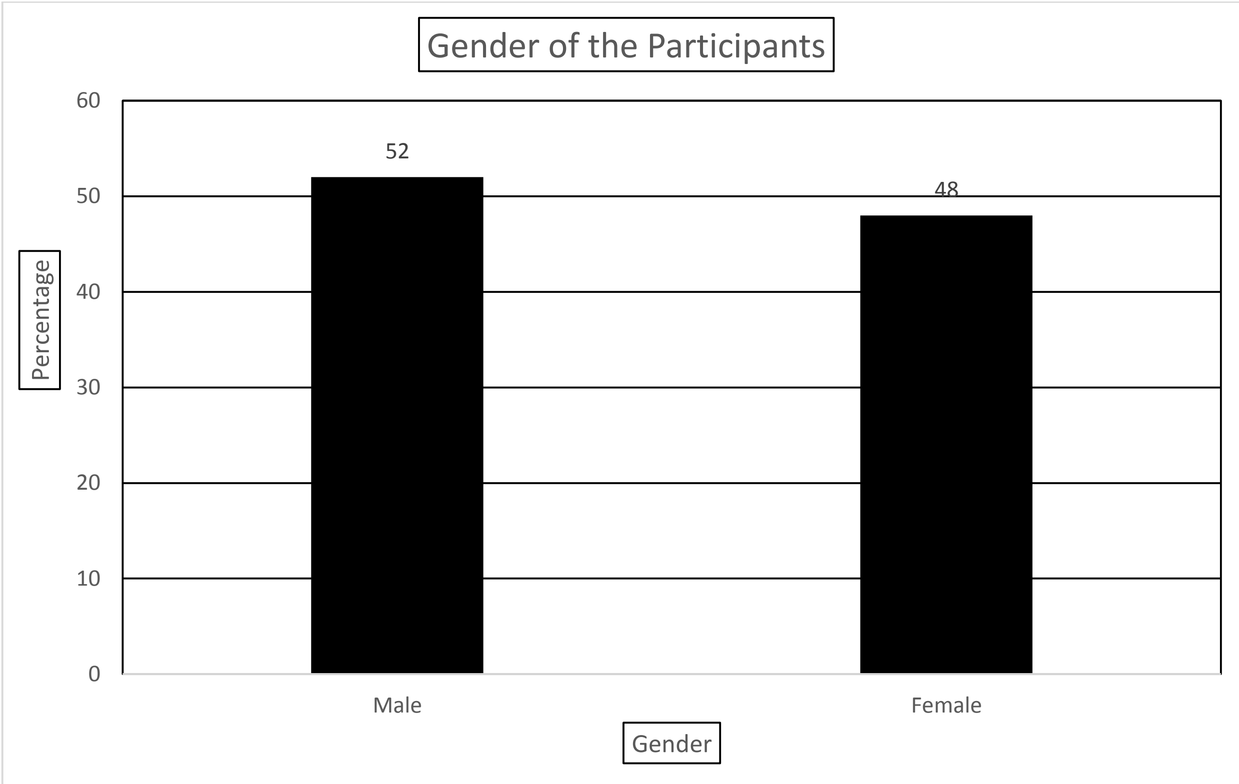
In answering the second question, ICT qualifications, different ways of acquiring ICTs skills, community of practice, technical support, obstacles encountered during the ICT implementation, and future training needs in ICTs were asked.

On the next two pages, Figure 7 and Figure 8 presents the demographic information about the participants of the study.

Figure 7 on the next page presents the gender of the participants. 38 out of 73 respondents (52%) indicated to be male, while 35 out of 73 respondents (48%) indicated to be female. The respondents were randomly selected.

4.1 Gender of the participants in the study.

Figure 7: Gender of the participants in the study.

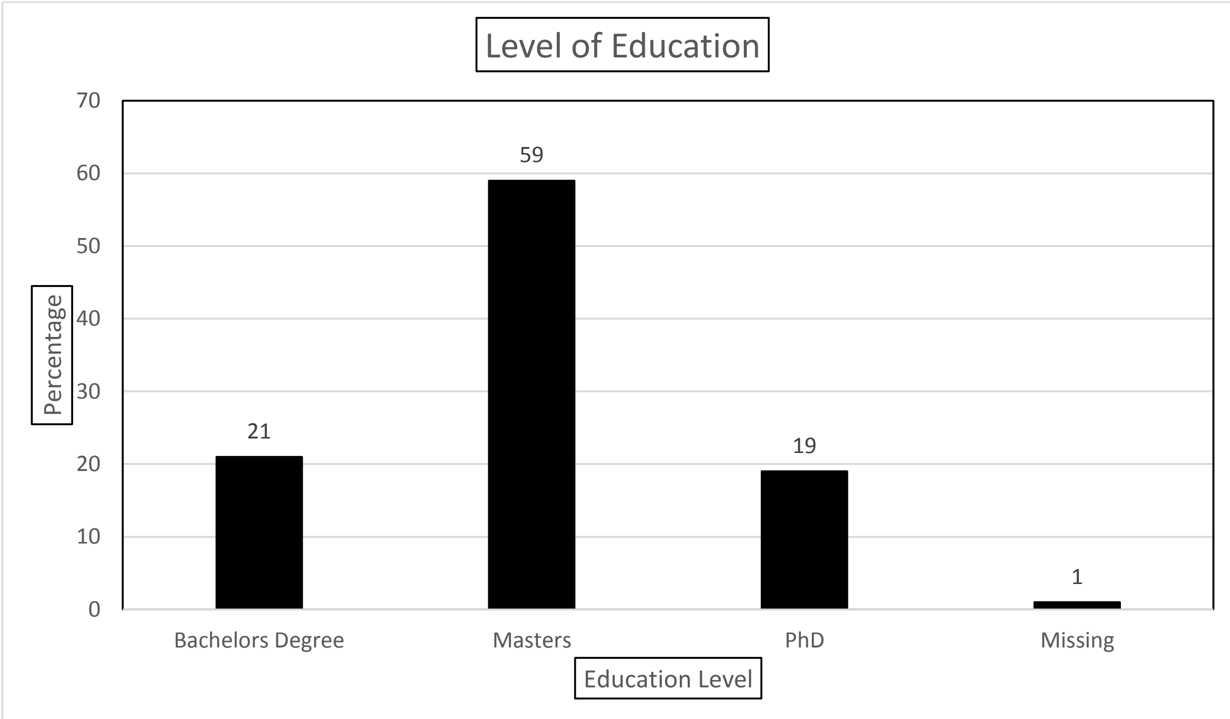


Analysis of data was performed using SPSS (v.24)

Figure 8 on the next page presents the level of education of the participants. 15 out of 73 (20.5%) respondents indicated having completed a bachelors degree; 43 out of 73 (58.9%) respondents indicated having completed a Masters degree; 14 out of 73 (19.2%) respondents indicated having completed a PhD degree; 1 out 73 (1.4%) respondents did not specify their level of education.

4.2. Level of education of the participants in the study

Figure 8: Level of education of the participants in the study.



Analysis of data was performed using SPSS (v.24)

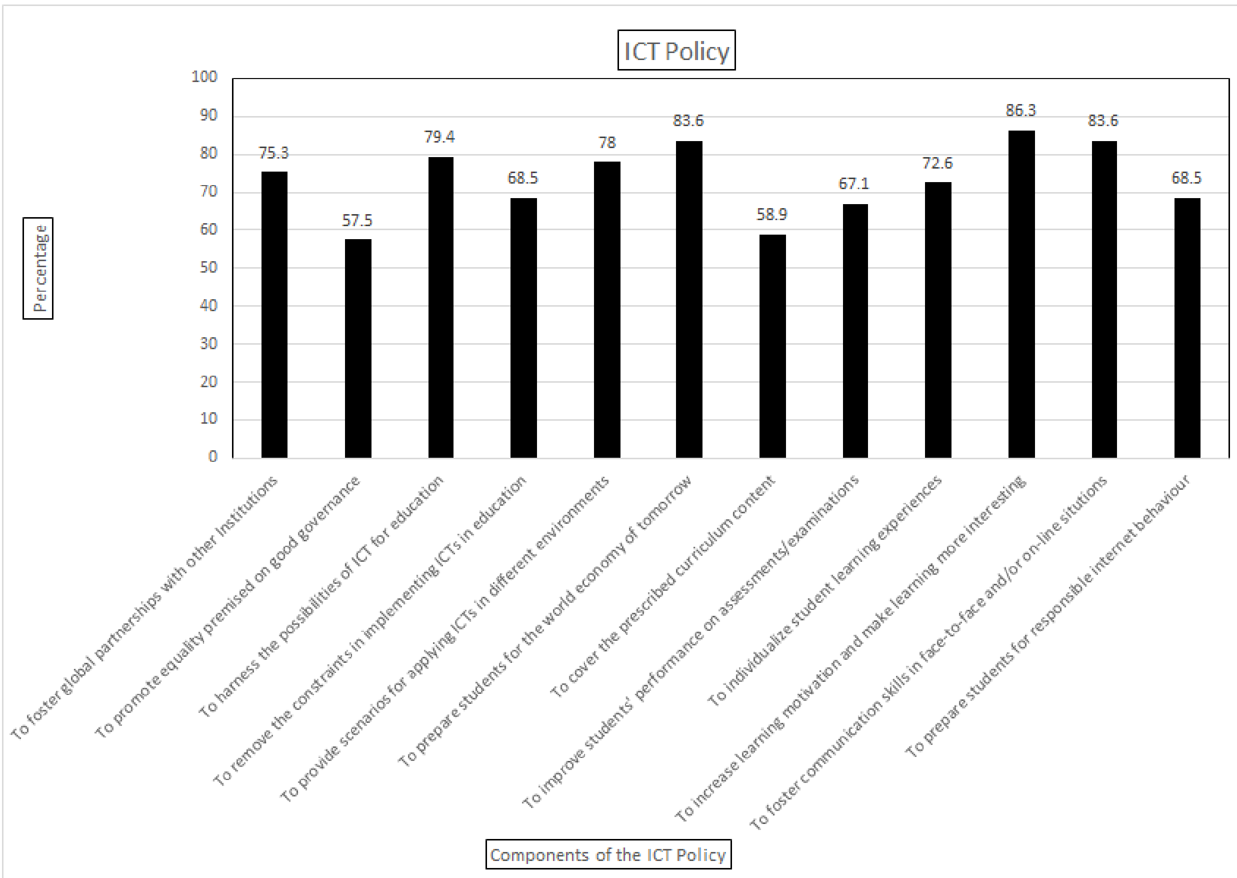
Addressing the first research question, on the next page, Figure 9 presents the knowledge of the respondents about the different components of the ICT Policy for Education.

The components of the ICT Policy that scored high, were to increase learning motivation and to make learning more interesting, which was 86.3% (63 out of 73 respondents); to foster communication skills in face-to-face and/or on-line situations, was 83.6% (62 out of 73 respondents); to prepare students for the world economy of tomorrow, was 83.6% (62 out of 73 respondents; to harness the possibilities of ICTs in education, was 79.4 %

(58 out of 73 respondents); to foster global partnership with other institutions, was 75.3% (55 out of 73 respondents), among others.

4.3 Respondents knowledge about the ICT Policy for Education objectives

Figure 9: Respondents knowledge about the ICT Policy for Education objectives



Analysis of data was performed using SPSS (v.24)

The least known components of the ICT Policy for Education was to promote equality premised on good governance, which was 57.5% (42 out of 73 respondents); to cover the prescribed curriculum content was 58.9% (43 out of 73 respondents); to improve students' performance on assessment or examinations was 67.1% (49 out of 73 respondents); and to prepare students for responsible internet behavior was 68.5% (50 out of 73 respondents).

The reliability of the data was assessed through the Cronbach's Alpha analyses, which determines whether the instruments and the scales have internal consistency and reliability (Bryman, 2012; Welman, Kruger, & Mitchell, 2005). Cronbach's Alpha reliability coefficient normally ranges between 0 and 1 with no lower limit to the coefficient. The more the Cronbach's alpha coefficient is close to 1.0, the greater the internal consistency of the items in the scale (Nind, Curtin & Hall, 2016). The Cronbach Alpha for this category was determined to be at (α = .978). The questions for this category showed a strong internal consistently and reliability.

A factor analysis of the twelve components as identified in Figure 1, shows a strong correlation and can be reduced to one principal component, with Eigenvalue of 9.957, and the percentage of variance was 82.971. Two other measures were used to examine the factor analysis, namely Kaiser-Meyer-Olkin (KMO) and the Bartlett's Test of sphericity. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was (.945). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index used to examine the appropriateness of factor analysis (Aspfor & Fransson, 2015; Park, Yu & Jo, 2016). High values (between 0.5 and 1.0) indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate.

The Bartlett's Test of sphericity had a Chi-square value of (X^2 =2585.948) at significant level (p = .000). Bartlett's test is used to test if *k* samples are from populations with equal variances (Bales, 2002; Bryman, 2012; Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016). Equal variances across samples is called homoscedasticity or homogeneity of variances (Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016; Welman, Kruger, & Mitchell, 2005). Some statistical tests, for example the analysis of variance, assume that variances are equal across groups or samples. The Bartlett test can be used to verify that assumption. Bartlett's test is sensitive to departures from normality. That is, if the samples come from non-normal distributions, then Bartlett's test may simply be testing for non-normality. This test confirmed the equal variances across the groups.

Table 2 below summarizes the total Eigenvalue for each of the twelve components. The significance of the findings will be discussed in the next chapter, which will focus on the discussion of the results. Next is the table describing the analysis of variance using the Eigenvalue factor analysis.

Table 2. Knowledge about ICT Policy for Education: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.957	82.971	82.971	9.957	82.971	82.971
2	.727	6.055	89.026			
3	.325	2.705	91.731			
4	.320	2.665	94.396			
5	.236	1.965	96.361			
6	.215	1.788	98.149			

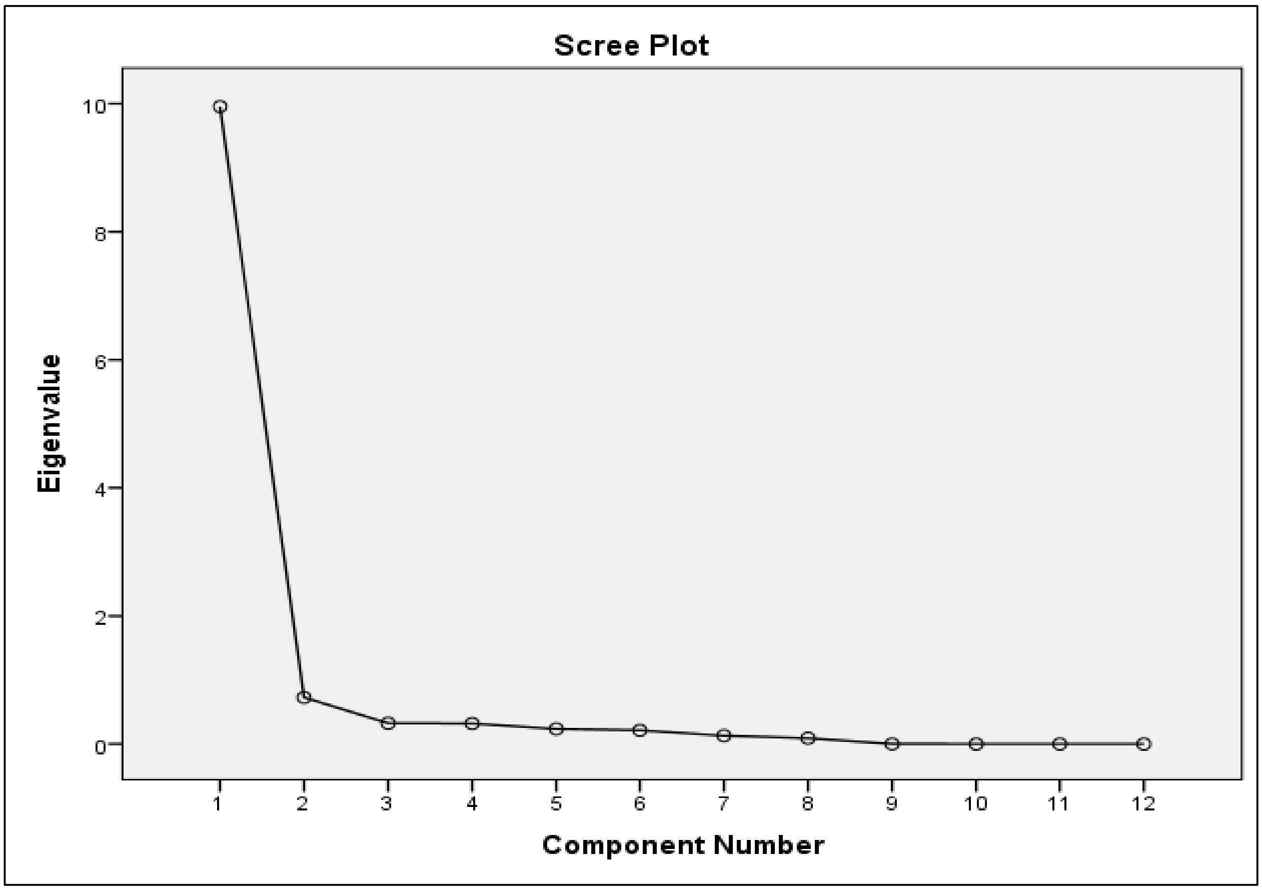
7	.130	1.085	99.234			
8	.090	.749	99.983			
9	.001	.007	99.990			
10	.000	.004	99.994			
11	.000	.003	99.998			
12	.000	.002	100.000			

Extraction Method: Principal Component Analysis.

Analysis of data was performed using SPSS (v.24)

Figure 10 gives a scree plot results confirming results in Table 1 below. The scree plot provides a visual presentation of Table 2.

Figure 10: Scree Plot providing a visual representation of Table 2



Analysis of data was performed using SPSS (v.24)

To determine the understanding of the ICT Policy at the different University of Namibia campuses, the Kruskal-Wallis Test was conducted. The Kruskal-Wallis H test (sometimes also called the "one-way **ANOVA** on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable (Nind, Curtin & Hall, 2016; Porter, Graham, Bodily & Sandberg, 2016). Below are the different campuses mean rank scores about their knowledge of the ICT Policy for Education.

Table 3: Knowledge about ICT Policy for Education between Campuses

	Campus	N	Mean Rank
ICT Policy for Education - 9a (To foster global partnership)	Khomasdal	12	40.00
	Main	15	42.67
	Hifikepunye Pohamba	20	34.98
	Rundu	15	34.37
	Katima Mulilo	11	33.27
	Total	73	
ICT Policy for Education - 9b (To promote equality premised on good governance)	Khomasdal	12	37.58
	Main	15	35.97
	Hifikepunye Pohamba	20	35.68
	Rundu	15	40.30
	Katima Mulilo	11	35.68
	Total	73	
ICT Policy for Education - 9c (To harness the possibilities of ICT in education)	Khomasdal	12	34.04
	Main	15	38.33
	Hifikepunye Pohamba	20	36.75
	Rundu	15	38.67
	Katima Mulilo	11	36.59
	Total	73	
ICT Policy for Education - 9d	Khomasdal	12	32.79
	Main	15	39.70
	Hifikepunye Pohamba	20	34.30

(To remove the constraints in implementing ICTs in education)	Rundu	15	38.70
	Katima Mulilo	11	40.50
	Total	73	
ICT Policy for Education - 9e (To provide scenarios for applying ICTs in different environments)	Khomasdal	12	41.08
	Main	15	34.00
	Hifikepunye Pohamba	20	36.63
	Rundu	15	36.50
	Katima Mulilo	11	38.00
	Total	73	
ICT Policy for Education - 9f (To prepare students for the world economy of tomorrow)	Khomasdal	12	38.71
	Main	15	41.17
	Hifikepunye Pohamba	20	32.73
	Rundu	15	37.77
	Katima Mulilo	11	36.18
	Total	73	
ICT Policy for Education - 9g (To cover the prescribed curriculum content)	Khomasdal	12	40.25
	Main	15	36.27
	Hifikepunye Pohamba	20	32.95
	Rundu	15	42.50
	Katima Mulilo	11	34.32
	Total	73	
ICT Policy for Education - 9h (To improve students' performance on assessment/examinations)	Khomasdal	12	37.88
	Main	15	36.93
	Hifikepunye Pohamba	20	32.70
	Rundu	15	38.60
	Katima Mulilo	11	41.77
	Total	73	
ICT Policy for Education - 9i (To individualize student learning experiences)	Khomasdal	12	42.79
	Main	15	41.57
	Hifikepunye Pohamba	20	33.88
	Rundu	15	39.27
	Katima Mulilo	11	27.05
	Total	73	
ICT Policy for Education - 9j (To increase learning motivation and make learning more interesting)	Khomasdal	12	46.17
	Main	15	41.20
	Hifikepunye Pohamba	20	32.65
	Rundu	15	32.43
	Katima Mulilo	11	35.41

	Total	73	
ICT Policy for Education - 9k (To foster communication skills in face-to-face and/or on-line situations)	Khomasdal	12	39.17
	Main	15	39.13
	Hifikepunye Pohamba	20	35.58
	Rundu	15	39.27
	Katima Mulilo	11	31.23
	Total	73	
ICT Policy for Education - 9l (To prepare students for responsible internet behavior)	Khomasdal	12	44.54
	Main	15	44.20
	Hifikepunye Pohamba	20	29.85
	Rundu	15	36.30
	Katima Mulilo	11	32.91
	Total	73	

Analysis of data was performed using SPSS (v.24)

The mean rank scores fluctuated between different campuses. The Khomasdal Campus consistently scored higher than the other campuses, on the different components of the ICT Policy, but not with big margins. The Main campus scored second, followed by the Hifikepunye Pohamba campus, followed by Rundu Campus, and last the Katima Mulilo Campus. The results indicate that the Khomasdal Campus had a better knowledge of the ICT Policy for Education objectives.

Interviews were conducted with the participants at each campus with lecturers tasked to teach with ICTs, in order to determine their understanding of the ICT Policy, among other issues. The comment that best describes the participants knowledge of the ICT Policy during the interview was, "It is a good policy. It is well thought out. It was trying to address the ICT literacy to achieve the goals of Vision 2030. It is intended for Namibia to be a knowledge based society" (Participant 6, 2015).

An analysis was conducted on SPSS on the correlation between the gender of the participants and their understanding of the ICT Policy for Education. The table below shows the statistics on the understanding of the ICT Policy and gender.

Table 4: Knowledge about ICT Policy for Education between the sexes.

Crosstab						
			ICT Policy For Education			Total
			Disagree	Undecided	Agree	
Gender of respondent	male	Count	7	9	15	31
		% within Sex of respondent	22.6%	29.0%	48.4%	100.0%
	female	Count	9	8	8	25
		% within Sex of respondent	36.0%	32.0%	32.0%	100.0%
Total		Count	16	17	23	56
		% within Sex of respondent	28.6%	30.4%	41.1%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of (X^2 =1.817), the degrees of freedom (df) = 2 at significant level (p = .403). It was determined that there was no significant difference between the sexes on their understanding of the ICT Policy for Education, because (p = .403) which was greater than 0.05.

Table 5: Chi-Square test results: Knowledge about ICT Policy for Education between the sexes

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.817[a]	2	.403
Likelihood Ratio	1.830	2	.401
Linear-by-Linear Association	1.774	1	.183
N of Valid Cases	56		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.14.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the age of the participants and their understanding of the ICT Policy for Education. The table below shows the statistics on the understanding of the ICT Policy between the different ages.

Table 6: Knowledge about ICT Policy for Education between the different age groups

Crosstab						
			ICT Policy For Education			Total
			Disagree	Undecided	Agree	
Age of the respondent	<30 yrs	Count	0	1	0	1
		% within Age of the respondent	0.0%	100.0%	0.0%	100.0%
	30-39 yrs	Count	3	2	4	9
		% within Age of the respondent	33.3%	22.2%	44.4%	100.0%
	40-49 yrs	Count	6	4	10	20
		% within Age of the respondent	30.0%	20.0%	50.0%	100.0%

	50+ yrs	Count	10	10	9	29
		% within Age of the respondent	34.5%	34.5%	31.0%	100.0%
Total		Count	19	17	23	59
		% within Age of the respondent	32.2%	28.8%	39.0%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of (X^2 =4.711), the degrees of freedom (df) = 6 at significant level (p = .581). It was determined that there was no significant difference between age and their understanding of the ICT Policy for Education, because (p = .581) which was greater than 0.05.

Table 7: Chi-Square test results: Knowledge about ICT Policy for Education between the different age groups.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.711[a]	6	.581
Likelihood Ratio	4.767	6	.574
Linear-by-Linear Association	.395	1	.530
N of Valid Cases	59		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .29.

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the qualification of the participants and their understanding of the ICT Policy for Education. The table below shows the statistics on the understanding of the ICT Policy and the qualification of the participants.

Table 8: Knowledge about ICT Policy for Education between the different qualifications.

Crosstab

			ICT Policy For Education			
			Disagree	Undecided	Agree	Total
Highest Qualification	Bachelors degree	Count	5	2	7	14
		% within Highest Qualification	35.7%	14.3%	50.0%	100.0%
	Masters	Count	11	12	10	33
		% within Highest Qualification	33.3%	36.4%	30.3%	100.0%
	PhD	Count	3	3	5	11
		% within Highest Qualification	27.3%	27.3%	45.5%	100.0%
Total		Count	19	17	22	58
		% within Highest Qualification	32.8%	29.3%	37.9%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of ($X^2 = 3.004$), the degrees of freedom (df) = 4 at significant level ($p = .557$). It was determined that there was no significant difference between the qualification of the participants and their understanding of the ICT Policy for Education, because ($p = .557$) which was greater than 0.05.

Table 9: Chi-square test results: Knowledge about ICT Policy for Education between the different qualifications.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.004[a]	4	.557
Likelihood Ratio	3.201	4	.525
Linear-by-Linear Association	.001	1	.971
N of Valid Cases	58		
a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is 3.22.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the rank of the participants and their understanding of the ICT Policy for Education. The table below shows the statistics on the understanding of the ICT Policy and the rank of the participants.

Table 10: Knowledge about ICT Policy for Education between the different qualifications.

Crosstab						
			ICT Policy For Education			Total
			Disagree	Undecided	Agree	
Rank	Tutor	Count	0	0	1	1
		% within Rank	0.0%	0.0%	100.0%	100.0%
	Lecturer	Count	19	16	17	52
		% within Rank	36.5%	30.8%	32.7%	100.0%
	Senior Lecturer	Count	0	0	4	4
		% within Rank	0.0%	0.0%	100.0%	100.0%
	Associate Professor	Count	0	1	0	1
		% within Rank	0.0%	100.0%	0.0%	100.0%
	Missing	Count	0	0	1	1
		% within Rank	0.0%	0.0%	100.0%	100.0%
Total		Count	19	17	23	59

	% within Rank	32.2%	28.8%	39.0%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of ($X^2 = 12.762$), the degrees of freedom (df) = 8 at significant level (p = .120). It was determined that there was no significant difference between the rank of the participants and their understanding of the ICT Policy for Education, because (p = .120) which was greater than 0.05.

Table 11: Chi-Square test results: Knowledge about ICT Policy for Education between the different qualifications.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.762[a]	8	.120
Likelihood Ratio	14.710	8	.065
Linear-by-Linear Association	1.303	1	.254
N of Valid Cases	59		
a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .29.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the campuses and their understanding of the ICT Policy for Education. The table on the next page shows the statistics on the understanding of the ICT Policy and the campuses.

Table 12: Knowledge about ICT Policy for Education between the different campuses.

Crosstab						
			ICT Policy For Education			Total
			Disagree	Undecided	Agree	
Campus	Khomasdal	Count	2	3	3	8
		% within Campus	25.0%	37.5%	37.5%	100.0%
	Main	Count	4	4	4	12
		% within Campus	33.3%	33.3%	33.3%	100.0%
	Hifikepunye Pohamba	Count	7	5	4	16
		% within Campus	43.8%	31.3%	25.0%	100.0%
	Rundu	Count	3	3	9	15
		% within Campus	20.0%	20.0%	60.0%	100.0%
	Katima Mulilo	Count	3	2	3	8
		% within Campus	37.5%	25.0%	37.5%	100.0%
Total		Count	19	17	23	59
		% within Campus	32.2%	28.8%	39.0%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of ($X^2 = 4.941$), the degrees of freedom (df) = 8 at significant level ($p = .764$). It was determined that there was no significant difference between the campuses and their understanding of the ICT Policy for Education, because ($p = .764$) which was greater than 0.05.

Table 13: Chi-square test results: Knowledge about ICT Policy for Education between the different campuses.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.941[a]	8	.764
Likelihood Ratio	4.898	8	.768
Linear-by-Linear Association	.221	1	.639
N of Valid Cases	59		
a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is 2.31.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the different departments and their understanding of the ICT Policy for Education. The table below shows the statistics on the understanding of the ICT Policy and the campuses.

Table 14: Knowledge about ICT Policy for Education between the different departments.

Crosstab						
			ICT Policy For Education			Total
			Disagree	Undecided	Agree	
Department	Missing	Count	1	0	0	1
		% within Department	100.0%	0.0%	0.0%	100.0%
	Anim	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	CIAS	Count	3	5	6	14
		% within Department	21.4%	35.7%	42.9%	100.0%
	Dean	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	Earl	Count	2	1	0	3

		% within Department	66.7%	33.3%	0.0%	100.0%
	ECDL	Count	1	1	1	3
		% within Department	33.3%	33.3%	33.3%	100.0%
	Econ	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	Educ	Count	3	4	4	11
		% within Department	27.3%	36.4%	36.4%	100.0%
	EFM	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	ELCH	Count	0	1	3	4
		% within Department	0.0%	25.0%	75.0%	100.0%
	Envi	Count	1	0	0	1
		% within Department	100.0%	0.0%	0.0%	100.0%
	EPIE	Count	1	1	0	2
		% within Department	50.0%	50.0%	0.0%	100.0%
	Life	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	LPE	Count	1	0	0	1
		% within Department	100.0%	0.0%	0.0%	100.0%
	Math	Count	5	2	0	7
		% within Department	71.4%	28.6%	0.0%	100.0%
	MSSE	Count	1	2	3	6
		% within Department	16.7%	33.3%	50.0%	100.0%
	Wild	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
Total		Count	19	17	23	59
		% within Department	32.2%	28.8%	39.0%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of (X^2 = 29.841), the degrees of freedom (df) = 32 at significant level (p = .576). It was determined that there was no significant difference between the different departments and their understanding of the ICT Policy for Education, because (p = .576) which was greater than 0.05.

Table 15: Chi-Square test results: Knowledge about ICT Policy for Education between the different qualifications.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	29.841[a]	32	.576
Likelihood Ratio	36.816	32	.256
N of Valid Cases	59		
a. 50 cells (98.0%) have expected count less than 5. The minimum expected count is .29.			

Analysis of data was performed using SPSS (v.24)

The next category that was examined was the different categories of ICT uses in the classroom. Figure 11 on page 188 describes the different categories of ICT uses in the classroom by the respondents.

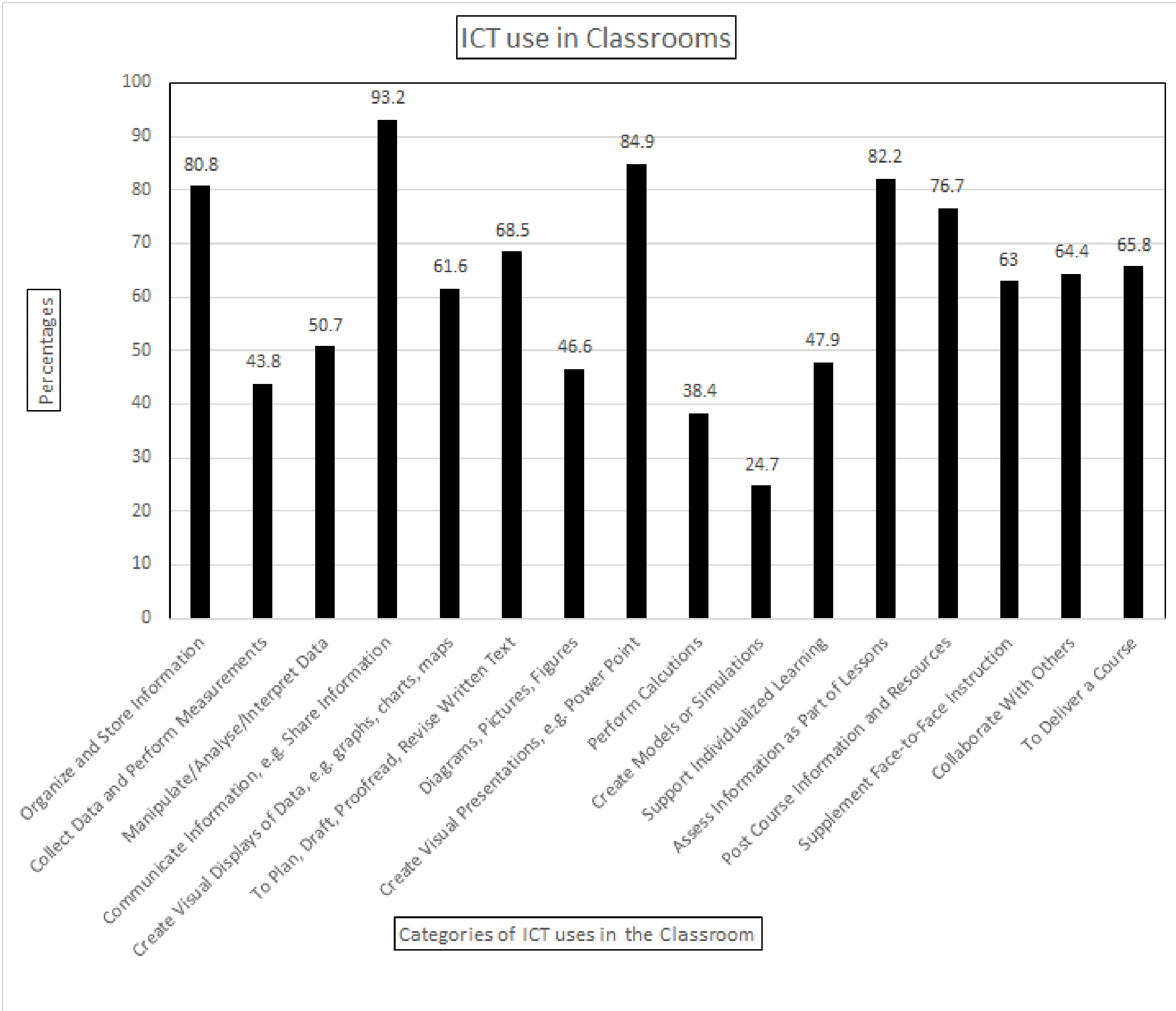
4.4 Categories of ICT use in the classrooms

The respondents who indicated that they used ICTs to share information with students was 93.2% (68 out of 73 respondents); 84.9% (62 out of 73 respondents) indicated that they used ICTs to create visual presentations, such as in Power Point presentations; 82.2% (60 out of 73 respondents) indicated that they used ICTs to assess information as part of lessons; 80.8% (59 out of 73 respondents) indicated that they used ICTs to organize and store information; 76.7% (56 out of 73 respondents) indicated that they used ICTs to post course information and resources to students, among other categories.

The categories of least use of ICT in classrooms were to create models or simulations which was 24.7% (18 out of 73 respondents); to perform calculations was 38.4% (28 out of 73 respondents); to collect data and perform measurements was 43.8% (32 out of 73 respondents); to create diagrams, pictures and figures was 46.6% (34 out of 73 respondents); and to support individualized learning was 47.9% (35 out of 73 respondents).

The Cronbach Alpha for this category was determined to be at (α = 1). An analysis of variance using the Eigenvalue factor analysis yielded one factor greater than 1, which was 15.983, and the percentage of variance was 99.895. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was (.972). The Bartlett's Test of sphericity had a Chi-square value of (X^2 = 6709.801) at significant level (p = .000).

Figure 11: Categories of ICT use in the classrooms



Analysis of data was performed using SPSS (v.24)

Table 16 below describes the analysis of variance using the Eigenvalue factor analysis.

Table 16. ICT use in the classroom

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

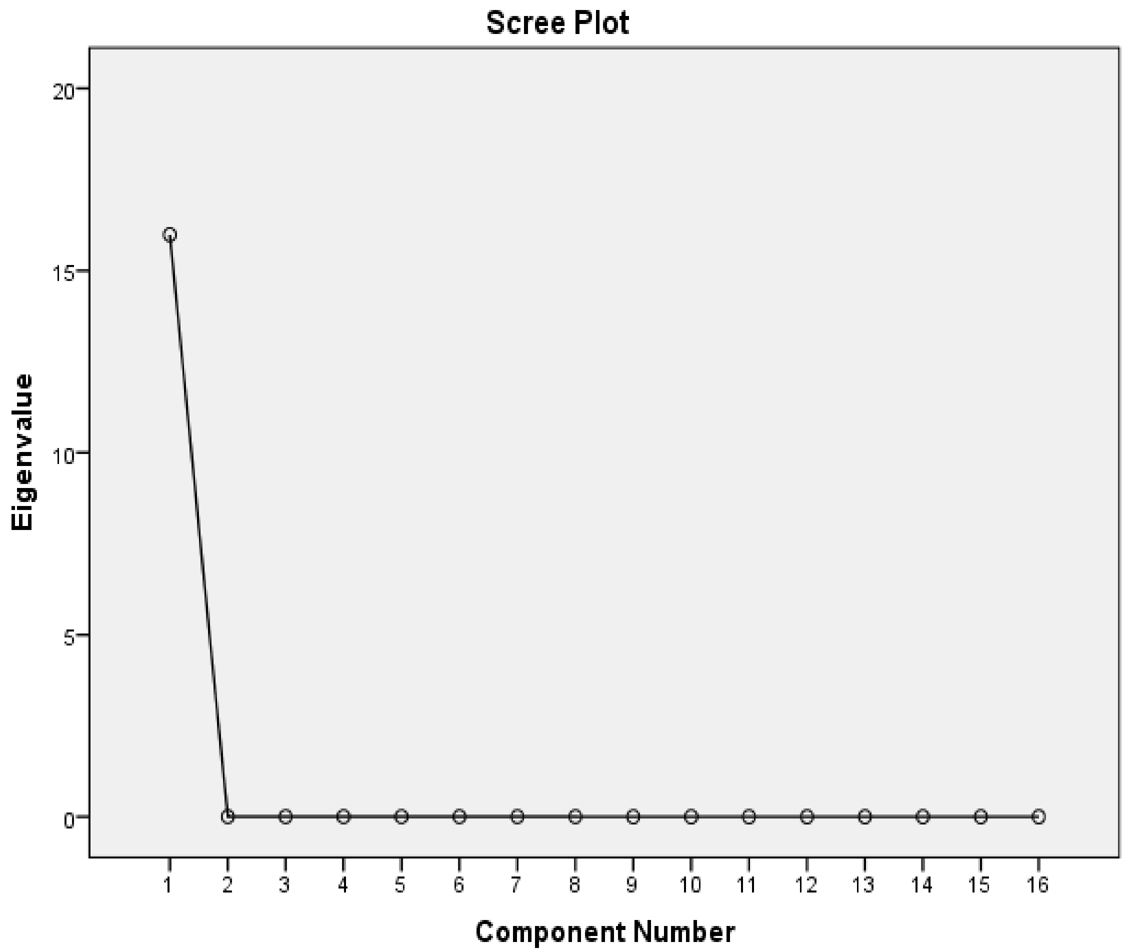
1	15.983	99.895	99.895	15.983	99.895	99.895
2	.003	.016	99.911			
3	.002	.014	99.925			
4	.002	.011	99.936			
5	.001	.009	99.945			
6	.001	.008	99.954			
7	.001	.008	99.961			
8	.001	.007	99.969			
9	.001	.006	99.975			
10	.001	.006	99.980			
11	.001	.005	99.986			
12	.001	.004	99.990			
13	.001	.003	99.993			
14	.000	.003	99.996			
15	.000	.002	99.998			
16	.000	.002	100.000			

Extraction Method: Principal Component Analysis.

Analysis of data was performed using SPSS (v.24)

Figure 12 gives a scree plot results confirming results in Table 16 on the next page. The scree plot provides a visual presentation of Table 16.

Figure 12: Scree Plot providing a visual representation of Table 16.



Analysis of data was performed using SPSS (v.24)

During interviews with some participants, anonymous 3, indicated, that he predominately used the computer to create his term plan, and to distribute to his students. He predominately used the internet, e.g. course blog called word press for class work discussion and social media to create groups. Anonymous 7 used Edmodo for testing and discussion, Moodle as a Learning Management System (LMS), and Social Media for discussion.

During observation, at Campus 1 anonymous 1 tasked students to create Facebook, Twitter and Skype accounts. Anonymous 2 at Campus 1 gave lectures using the Microsoft PowerPoint software. Anonymous 3 at Campus 1 gave activities where the students had to access applications online.

At Campus 2, anonymous 4 used the internet to search for pedagogical approaches. Anonymous 4 also tasked the students to join e-portfolio communities online. Anonymous 5 at Campus 2 tasked the students to create accounts on EDMODO, a learning management system (LMS).

At Campus 3, anonymous 6 gave activities to students in Microsoft Word and gave his lectures using PowerPoint. At Campus 4, anonymous 7 gave activities to students in PowerPoint. Anonymous 7 also gave an activity on how to create a school website. Anonymous 7 also introduced the students to social media, to be used for classroom discussion. At Campus 5, anonymous 8 gave lectures and activities to students in PowerPoint.

On the questionnaire, the participants were asked about their opinions about the infrastructure, their views about ICTs impact on teaching, which ICTs they used and frequency of use, and years of teaching with ICTs. In terms of Infrastructure, 98.6% (72 out of 73 respondents) indicated that they had an assigned computer at their campus. The respondents who believed that ICTs greatly changed the way they delivered lessons, was 68.5% (50 out of 73 respondents). The respondents who indicated that they downloaded teaching materials from the internet or network was 80.8% (59 out of 73 respondents).

The respondents who indicated that they upload teaching materials to the network or internet was 72.2% (52 out of 73 respondents).

The participants responses to the frequency of ICT applications used for teaching are displayed in Table 17. Table 17 below describes the percentages of ICT applications used for teaching.

Table 17. Frequency of ICT use in the classroom

	Daily %	Weekly %	Monthly %	Once or Twice a Year %	Never %	Not Available %	Missing %	Percent Total
Website	35.6	17.8	5.5	6.8	15.1	4.1	15.1	100
Word Processing	67.1	11	5.5	4.1	2.7	1.4	8.2	100
Spread Sheets	6.8	24.7	20.5	23.3	17.8	0	6.8	100
Databases	8.2	12.3	12.3	16.4	35.6	0	15.1	100
Online Discussion Forum	12.3	15.1	12.3	15.1	39.7	1.4	4.1	100
Presentation Software	74	17.8	1.4	2.7	1.4	1.4	1.4	100
Email	87.7	8.2	4.1	0	0	0	0	100
Search Engines	86.3	11	1.4	0	0	0	1.4	100
Drill/Practice Programmes	6.8	24.7	17.8	11	27.4	4.1	8.2	100

Analysis of data was performed using SPSS (v.24)

The Kruskal-Wallis Test was conducted about the categories of ICT uses at the different University of Namibia campuses. Table 18 below presents the differences in the Mean Rank scores between the campuses.

Table 18. Frequency of ICT use in the classroom per campus

Ranks

	Campus	N	Mean Rank
Web site	Khomasdal	12	39.25
	Main	15	35.97
	Hifikepunye Pohamba	20	37.43
	Rundu	15	28.13
	Katima Mulilo	11	47.27
	Total	73	
Word Processing	Khomasdal	12	30.75
	Main	15	37.30
	Hifikepunye Pohamba	20	38.60
	Rundu	15	33.40
	Katima Mulilo	11	45.41
	Total	73	
Spread Sheets	Khomasdal	12	43.33
	Main	15	28.43
	Hifikepunye Pohamba	20	41.00
	Rundu	15	30.80
	Katima Mulilo	11	42.95
	Total	73	
Databases	Khomasdal	12	49.38
	Main	15	25.20
	Hifikepunye Pohamba	20	42.70
	Rundu	15	25.53
	Katima Mulilo	11	44.86
	Total	73	
Online discussion forum	Khomasdal	12	39.75
	Main	15	33.00
	Hifikepunye Pohamba	20	38.60
	Rundu	15	28.33
	Katima Mulilo	11	48.36
	Total	73	
Presentation software	Khomasdal	12	36.58
	Main	15	36.90
	Hifikepunye Pohamba	20	36.98
	Rundu	15	42.20

	Katima Mulilo	11	30.55
	Total	73	
E-mail	Khomasdal	12	35.42
	Main	15	37.47
	Hifikepunye Pohamba	20	34.48
	Rundu	15	37.17
	Katima Mulilo	11	42.45
	Total	73	
Search Engines	Khomasdal	12	32.00
	Main	15	41.47
	Hifikepunye Pohamba	20	33.78
	Rundu	15	39.10
	Katima Mulilo	11	39.36
	Total	73	
Drill/Practice Programmes	Khomasdal	12	42.71
	Main	15	31.87
	Hifikepunye Pohamba	20	42.53
	Rundu	15	22.37
	Katima Mulilo	11	47.68
	Total	73	

Analysis of data was performed using SPSS (v.24)

The mean rank scores fluctuated between different campuses about the frequency of ICT uses between campuses. The Katima Mulilo campus scored higher on most categories such as on the use of websites, word processing, online discussion forum, e-mail use, and drill and practice programs. The Katima Mulilo campus scores on the category of the frequency of ICT use was consisted with the ICT policy for Education objectives which encourages ICT use in teaching in tertiary education.

An analysis of variance using the Eigenvalue factor analysis yielded three components greater than 1, which were 2.982 total and percentage of variance was 33.130 for component 1; 1.532 total and percentage of variance was 17.022 for component 2; and 1.024 total and percentage of variance was 11.373 for component3. The significance of the results will be discussed in the next chapter, which will focus on the discussion of the results.

The Cronbach Alpha for this category was determined to be at (α = .703). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was (.699). The Bartlett's Test of sphericity had a Chi-square value of (X^2 = 152.855) at significant level (p = .000).

Table 19. below describes the components identified about the frequency of ICT use in the classrooms.

Table 19. Frequency of ICT use in the classroom per campus: Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.982	33.130	33.130	2.982	33.130	33.130	2.681	29.785	29.785
2	1.532	17.022	50.152	1.532	17.022	50.152	1.826	20.293	50.077
3	1.024	11.373	61.525	1.024	11.373	61.525	1.030	11.447	61.525
4	.990	10.999	72.524						
5	.737	8.189	80.713						
6	.555	6.162	86.875						
7	.528	5.863	92.738						
8	.347	3.851	96.589						
9	.307	3.411	100.000						

Extraction Method: Principal Component Analysis.

Analysis of data was performed using SPSS (v.24)

Below is the component matrix for the categories of ICT applications used for teaching.

Table 20. Component Matrix of ICT use in the classroom per campus

Component Matrix[a]

	Component		
	1	2	3
Online discussion forum	.758	-.302	.041
Drill/Practice Programmes	.746	.167	-.055
Spread Sheets	.706	-.328	-.110
Search Engines	.668	-.430	.124
Web site	.572	.277	.320
Databases	.529	-.101	-.031
Presentation software	.294	.792	.064
Word Processing	.436	.635	-.091
E-mail	-.151	-.049	.936

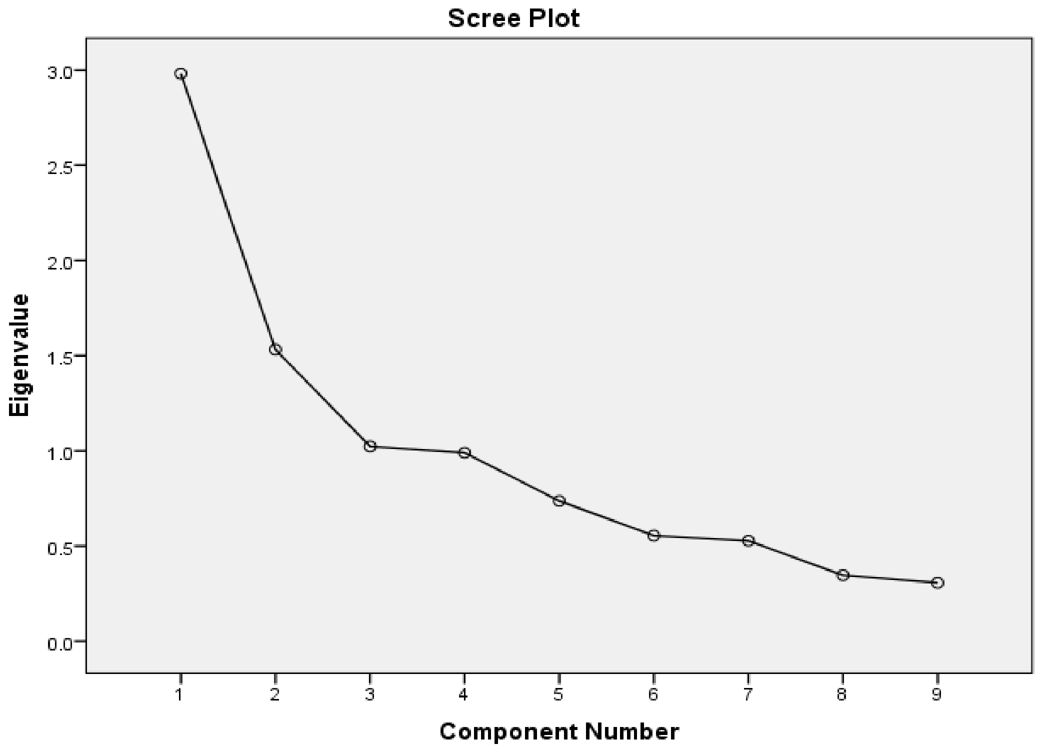
Extraction Method: Principal Component Analysis.

a. 3 components extracted.

Analysis of data was performed using SPSS (v.24)

Figure 13 on the next page gives a scree plot results confirming results in Table 20. The scree plot provides a visual presentation of Table 20.

Figure 13: Scree Plot providing a visual representation of Table 20.



Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between gender and ICT usage. The table below shows the statistics on the ICT usage and gender.

Table 21: Knowledge about ICT usage for Education between the different sexes.

Crosstab						
			ICT Usage			Total
			Frequent	Moderate	Seldom	
Gender of respondent	male	Count	14	12	12	38
		% within Sex of respondent	36.8%	31.6%	31.6%	100.0%
	female	Count	10	11	11	32
		% within Sex of respondent	31.3%	34.4%	34.4%	100.0%
Total		Count	24	23	23	70
		% within Sex of respondent	34.3%	32.9%	32.9%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of ($X^2 = .241$), the degrees of freedom (df) = 2 at significant level (p = .886). It was determined that there was no significant difference between gender and ICT usage, because (p = .886) which was greater than 0.05.

Table 22: Chi-square test results: Knowledge about ICT usage for Education between the different sexes.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.241[a]	2	.886
Likelihood Ratio	.242	2	.886
Linear-by-Linear Association	.179	1	.672
N of Valid Cases	70		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.51.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between gender and ICT usage. The table on the next page shows the statistics on the ICT usage and gender.

Table 23: Knowledge about ICT usage for Education between the different age groups.

Crosstab						
			ICT Usage			Total
			Frequent	Moderate	Seldom	
Age of the respondent	<30 yrs	Count	1	0	0	1
		% within Age of the respondent	100.0%	0.0%	0.0%	100.0%
	30-39 yrs	Count	4	5	3	12
		% within Age of the respondent	33.3%	41.7%	25.0%	100.0%
	40-49 yrs	Count	13	7	3	23
		% within Age of the respondent	56.5%	30.4%	13.0%	100.0%
	50+ yrs	Count	6	13	18	37
		% within Age of the respondent	16.2%	35.1%	48.6%	100.0%
Total		Count	24	25	24	73
		% within Age of the respondent	32.9%	34.2%	32.9%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of (X^2 = 15.154), the degrees of freedom (df) = 6 at significant level (p = .019). It was determined that there was a significant difference between gender and ICT usage, because (p = .019) which was less than 0.05. The results confirm a correlation between age and ICT usage.

Table 24: Knowledge about ICT usage for Education between the different sexes.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.154[a]	6	.019
Likelihood Ratio	15.834	6	.015
Linear-by-Linear Association	7.376	1	.007
N of Valid Cases	73		
a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .33.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between qualification and ICT usage. The table below shows the statistics on the ICT usage and qualification.

Table 25: Knowledge about ICT usage for Education between the different qualifications.

Crosstab						
			ICT Usage			Total
			Frequent	Moderate	Seldom	
Highest Qualification	Bachelors degree	Count	2	9	4	15
		% within Highest Qualification	13.3%	60.0%	26.7%	100.0%
	Masters	Count	17	11	15	43
		% within Highest Qualification	39.5%	25.6%	34.9%	100.0%
	PhD	Count	4	5	5	14
		% within Highest Qualification	28.6%	35.7%	35.7%	100.0%
Total		Count	23	25	24	72
		% within Highest Qualification	31.9%	34.7%	33.3%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of ($X^2 = 6.506$), the degrees of freedom (df) = 4 at significant level (p = .164). It was determined that there was no significant difference between qualification and ICT usage, because (p = .164) which was greater than 0.05.

Table 26: Chi-square test results: Knowledge about ICT usage for Education between the different sexes.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.506[a]	4	.164
Likelihood Ratio	6.535	4	.163
Linear-by-Linear Association	.051	1	.822
N of Valid Cases	72		

a. 4 cells (44.4%) have expected count less than 5. The minimum expected count is 4.47.

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between rank and ICT usage. The table on the next page shows the statistics on the ICT usage and rank.

Table 27: Knowledge about ICT usage for Education between the different ranks.

Crosstab						
			ICT Usage			Total
			Frequent	Moderate	Seldom	
Rank	Tutor	Count	0	1	0	1
		% within Rank	0.0%	100.0%	0.0%	100.0%
	Lecturer	Count	21	22	22	65
		% within Rank	32.3%	33.8%	33.8%	100.0%
	Senior Lecturer	Count	3	0	2	5
		% within Rank	60.0%	0.0%	40.0%	100.0%
	Associate Professor	Count	0	1	0	1
		% within Rank	0.0%	100.0%	0.0%	100.0%
	Missing	Count	0	1	0	1
		% within Rank	0.0%	100.0%	0.0%	100.0%
Total		Count	24	25	24	73
		% within Rank	32.9%	34.2%	32.9%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of ($X^2 = 8.696$), the degrees of freedom (df) = 8 at significant level ($p = .369$) was found. It was determined that there was no significant difference between rank and ICT usage, because ($p = .369$) which was greater than 0.05.

Table 28: Chi-square test results: Knowledge about ICT usage for Education and rank.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.696[a]	8	.369
Likelihood Ratio	10.851	8	.210
Linear-by-Linear Association	.000	1	.990
N of Valid Cases	73		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .33.

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between campus and ICT usage. The table below shows the statistics on the ICT usage and campus.

Table 29: Knowledge about ICT usage for Education between the different campuses.

Crosstab						
			ICT Usage			Total
			Frequent	Moderate	Seldom	
Campus	Khomasdal	Count	3	4	5	12
		% within Campus	25.0%	33.3%	41.7%	100.0%
	Main	Count	6	6	3	15
		% within Campus	40.0%	40.0%	20.0%	100.0%
	Hifikepunye Pohamba	Count	6	7	7	20
		% within Campus	30.0%	35.0%	35.0%	100.0%
	Rundu	Count	8	5	2	15
		% within Campus	53.3%	33.3%	13.3%	100.0%
	Katima Mulilo	Count	1	3	7	11
		% within Campus	9.1%	27.3%	63.6%	100.0%
Total		Count	24	25	24	73
		% within Campus	32.9%	34.2%	32.9%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of ($X^2 = 10.596$), the degrees of freedom (df) = 8 at significant level (p = .226). It was determined that there was no significant difference between campus and ICT usage, because (p = .226) which was greater than 0.05.

Table 30: Chi-square test results: Knowledge about ICT usage for Education and the different campuses.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.596[a]	8	.226
Likelihood Ratio	10.996	8	.202
Linear-by-Linear Association	.308	1	.579
N of Valid Cases	73		
a. 10 cells (66.7%) have expected count less than 5. The minimum expected count is 3.62.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between departments and ICT usage. The table below shows the statistics on the ICT usage and departments.

Table 31: Knowledge about ICT usage for Education between the different departments.

Crosstab						
			ICT Usage			Total
			Frequent	Moderate	Seldom	
Department	Missing	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	Agri	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	Anim	Count	0	1	0	1
		% within Department	0.0%	100.0%	0.0%	100.0%
	CIAS	Count	6	7	4	17
		% within Department	35.3%	41.2%	23.5%	100.0%
	Dean	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%

	Earl	Count	0	4	2	6
		% within Department	0.0%	66.7%	33.3%	100.0%
	ECDL	Count	1	1	1	3
		% within Department	33.3%	33.3%	33.3%	100.0%
	Econ	Count	0	1	0	1
		% within Department	0.0%	100.0%	0.0%	100.0%
	Educ	Count	5	3	6	14
		% within Department	35.7%	21.4%	42.9%	100.0%
	EFM	Count	0	1	0	1
		% within Department	0.0%	100.0%	0.0%	100.0%
	ELCH	Count	1	3	1	5
		% within Department	20.0%	60.0%	20.0%	100.0%
	Envi	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	EPIE	Count	0	1	1	2
		% within Department	0.0%	50.0%	50.0%	100.0%
	Lang	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
	Life	Count	1	0	1	2
		% within Department	50.0%	0.0%	50.0%	100.0%
	LPE	Count	1	0	0	1
		% within Department	100.0%	0.0%	0.0%	100.0%
	Math	Count	4	3	1	8
		% within Department	50.0%	37.5%	12.5%	100.0%
	MSSE	Count	5	0	1	6
		% within Department	83.3%	0.0%	16.7%	100.0%
	Wild	Count	0	0	1	1
		% within Department	0.0%	0.0%	100.0%	100.0%
Total		Count	24	25	24	73
		% within Department	32.9%	34.2%	32.9%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of ($X^2 = 38.142$), the degrees of freedom (df) = 36 at significant level ($p = .372$). It was determined that there was no significant difference between departments and ICT usage, because ($p = .372$) which was greater than 0.05.

Table 32: Chi-square test results: Knowledge about ICT usage for Education between the different departments.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	38.142[a]	36	.372
Likelihood Ratio	43.895	36	.172
N of Valid Cases	73		
a. 54 cells (94.7%) have expected count less than 5. The minimum expected count is .33.			

Analysis of data was performed using SPSS (v.24)

4.5 Years of teaching with ICT

Next, the participants were asked to respond to a question about to the number of years of teaching with ICTs. The respondents who indicated 5 years of teaching with ICTs, was 17.8% (13 out of 73 respondents); The respondents who indicated 4 years of teaching with ICTs, was 16.4% (12 out of 73 respondents), the remaining years of teaching with ICTs was below 10%. On the next page table 8 describes the years of teaching with ICTs.

Table 33. Years of teaching with ICT

Years teaching with ICT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	5	6.8	6.8	6.8
	1.00	5	6.8	6.8	13.7
	2.00	2	2.7	2.7	16.4
	3.00	6	8.2	8.2	24.7
	4.00	12	16.4	16.4	41.1

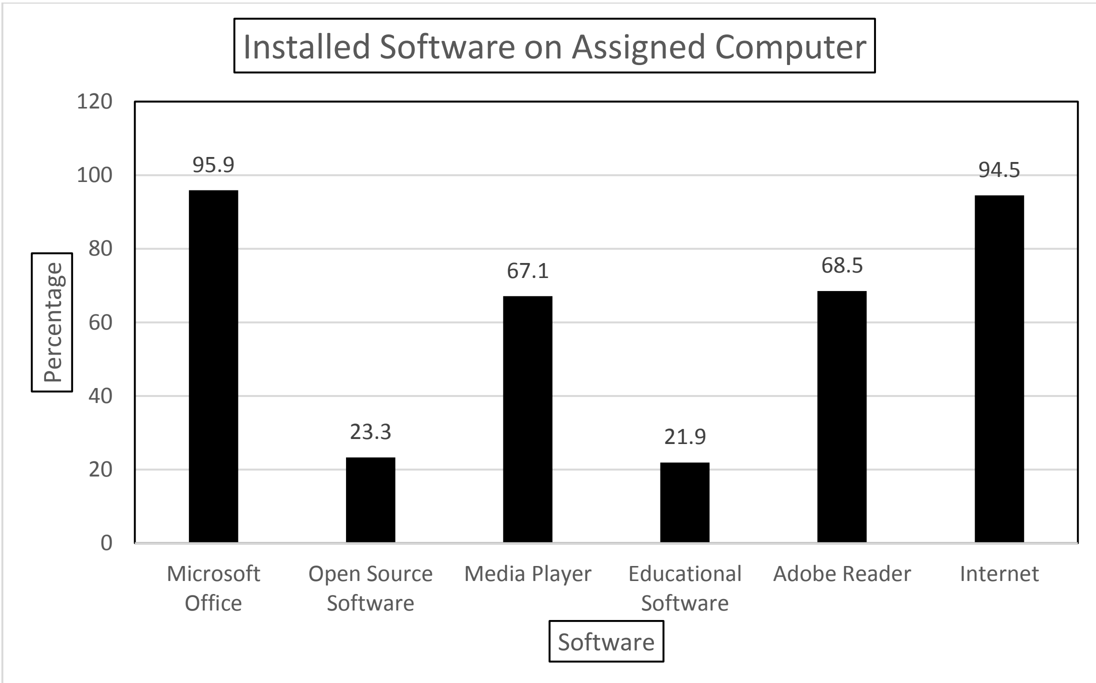
	5.00	13	17.8	17.8	58.9
	6.00	2	2.7	2.7	61.6
	7.00	1	1.4	1.4	63.0
	8.00	3	4.1	4.1	67.1
	9.00	2	2.7	2.7	69.9
	10.00	6	8.2	8.2	78.1
	12.00	2	2.7	2.7	80.8
	14.00	1	1.4	1.4	82.2
	15.00	5	6.8	6.8	89.0
	99.00	8	11.0	11.0	100.0
	Total	73	100.0	100.0	

Analysis of data was performed using SPSS (v.24)

4.6 Installed Software on Assigned Computer

Firstly, the respondents were asked whether they had an assigned computer, 98.6% indicated that they had an assigned computer. Secondly, the respondents were asked about the software installed on their computers. The respondents who indicated that they used Microsoft Office software for teaching purposes was 95.9% (70 out of 73 respondents); Open Source software was 23.3% (17 out of 73 respondents); Media Player was 67.1% (49 out of 73 respondents); Education software was 21.9% (16 out of 73 respondents); Adobe Reader was 68.5% (50 out of 73 respondents); and Internet use was 94.5% (69 out of 73 respondents). Next is the graphic presentation of the applications installed on teacher educators computers.

Figure 14: Installed Software on Assigned Computer

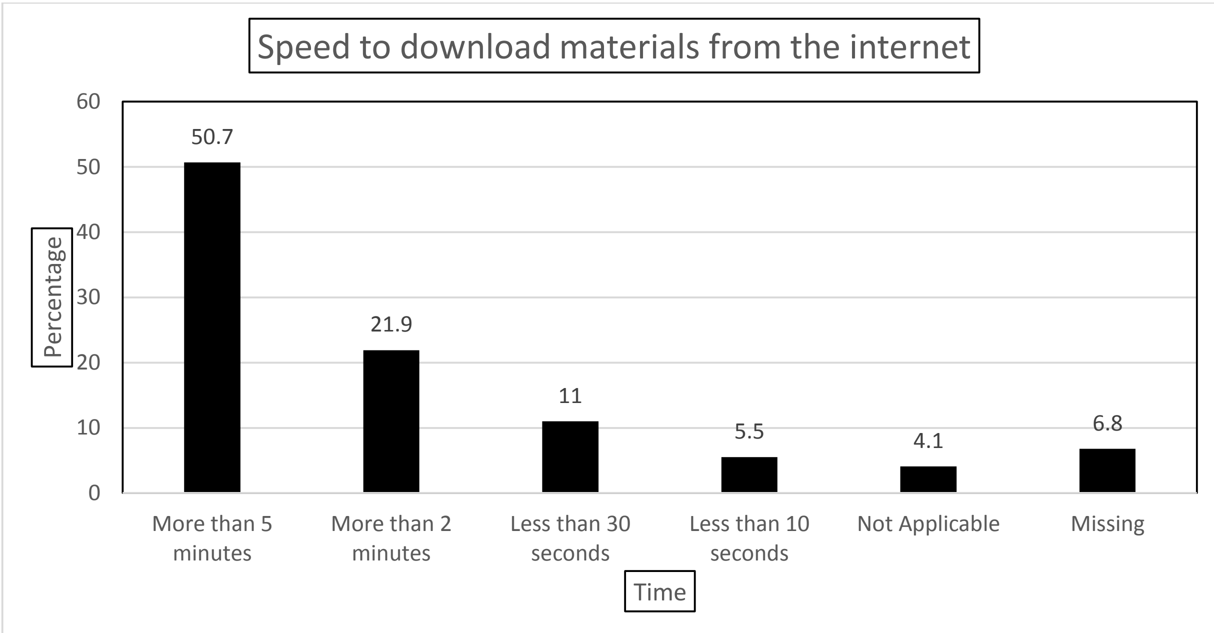


Analysis of data was performed using SPSS (v.24)

4.7 Speed to Download Materials from the Internet

Subsequent, the respondents were asked about the speed at which they downloaded the teaching materials from the internet. The respondents who indicated that the speed at which they downloaded materials from the internet was more than 5 minutes for teaching purposes was 50.7% (37 out of 73 respondents); The respondents who indicated that it took more than 2 minutes to download teaching materials was 21.9% (16 out of 73 respondents); those who indicated less than 30 seconds was 11% (8 out of 73 respondents); those who indicated less than 10 seconds was 5.5% (4 out of 73 respondents); 11% (8 out of 73 respondents) did not respond to this question.

Figure 15: Speed to download materials from the internet



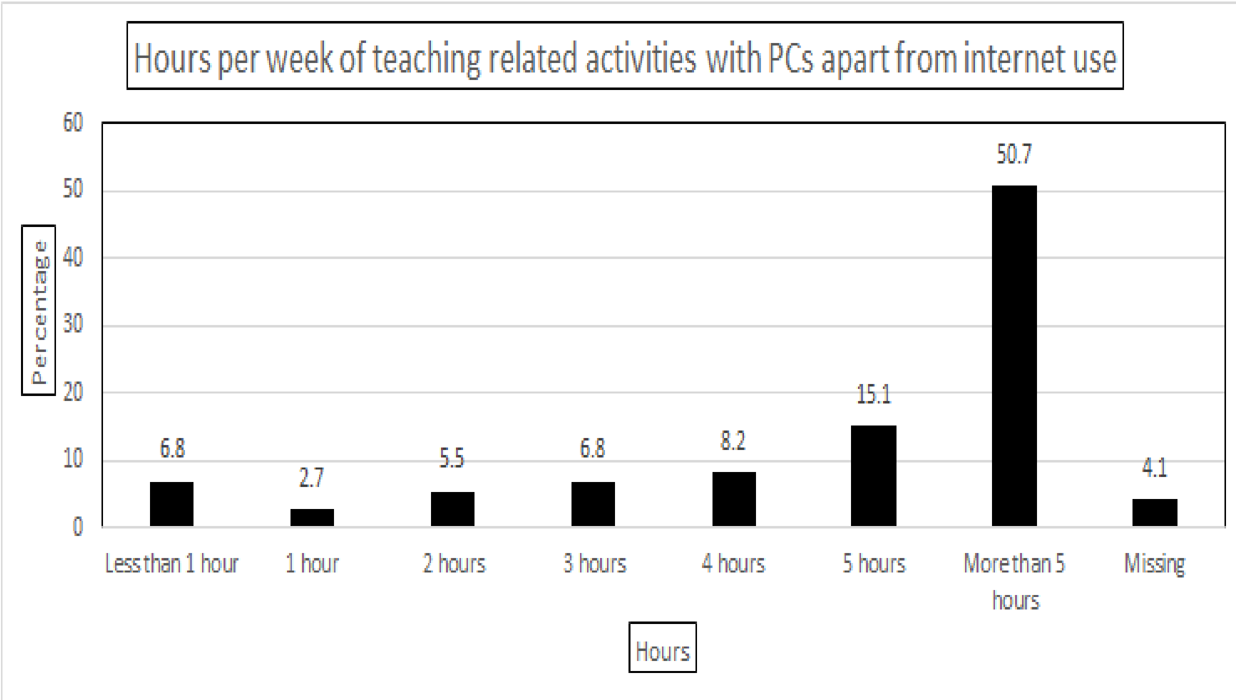
Analysis of data was performed using SPSS (v.24)

During the interview with some participants, anonymous 2, indicated that the speed to download information from the internet as "Very, very slow". Anonymous 5 described it as "Very slow. It is frustrating. The network is on and off"

4.8 Hours per Week of Teaching Related Activities with PCs apart from Internet use

On the next page is Figure 16 which shows the hours per week of teaching with PCs

Figure 16: Hours per week of teaching related activities with PCs apart from internet use

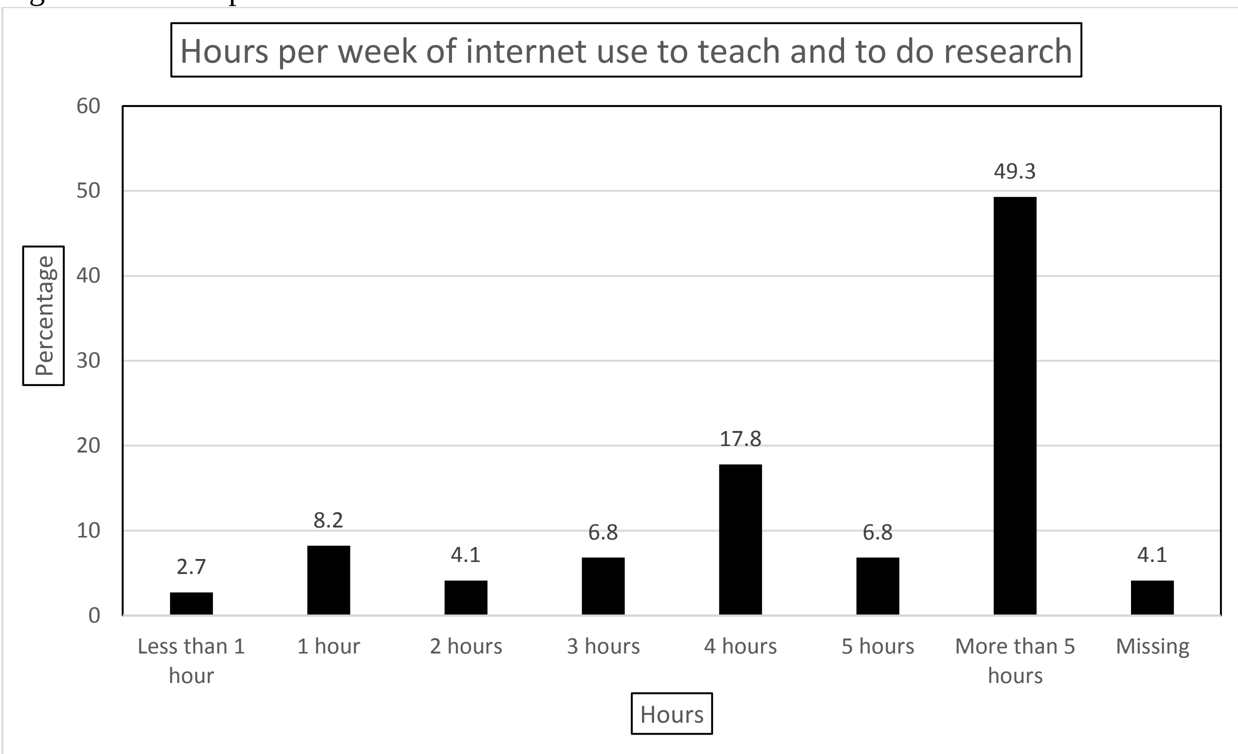


Analysis of data was performed using SPSS (v.24)

The respondents who indicated that they use the PCs more than 5 hours per week for teaching purposes were 50.7% (37 out of 73 respondents); 5 hours per week was 15.1% (11 out of 73 respondents); 4 hours per week was 8.2% (6 out of 73 respondents); 3 hours per week was 6.8% (5 out of 73 respondents); 2 hours per week was 5.5% (4 out of 73 respondents); 1 hour per week was 2.7% (2 out of 73 respondents); and less than 1 hour per week was 6.8% (5 out of 73 respondents); 4.1% (3 out of 73 respondents) did not respond to this question. The results show that the majority of the respondents used their assigned PCs for more than 5 hours per week for teaching purposes.

4.9 Hours per Week of Internet use to Teach and to do Research

Figure 17: Hours per week of internet use to teach and to do research



Analysis of data was performed using SPSS (v.24)

The respondents who indicated that they use the internet more than 5 hours per week for teaching purposes were 49.3% (36 out of 73 respondents); 5 hours per week was 6.8% (5 out of 73 respondents); 4 hours per week was 17.8% (13 out of 73 respondents); 3 hours per week was 6.8% (5 out of 73 respondents); 2 hours per week was 4.1% (3 out of 73 respondents); 1 hour per week was 8.2% (6 out of 73 respondents); and less than 1 hour per week was 2.7% (2 out of 73 respondents); 4.1% (3 out of 73 respondents) did not respond to this question. The ICT Policy for Education stipulates that the teaching staff should have fixed internet connectivity which can be used to search, do research and download teaching materials.

In answering the second research question, ICT qualifications, different ways of acquiring ICTs skills, community of practice, technical support, obstacles encountered during the ICT implementation, and future training needs in ICTs were identified.

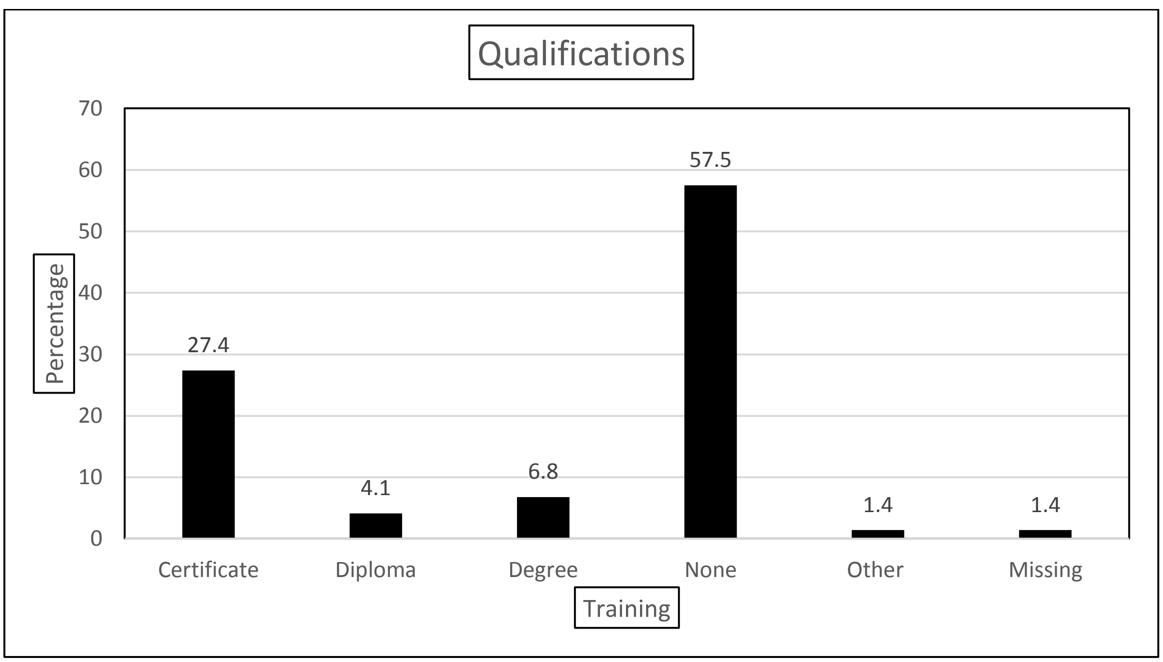
Question Two states:

What are the factors encountered in the implementation of the ICT Policy for Education in the Faculty of Education?

4.10 ICT Qualifications of the Teaching Staff

Figure 18 on the next page presents the ICT qualifications of the respondents.

Figure 18. ICT qualifications of the teaching staff.



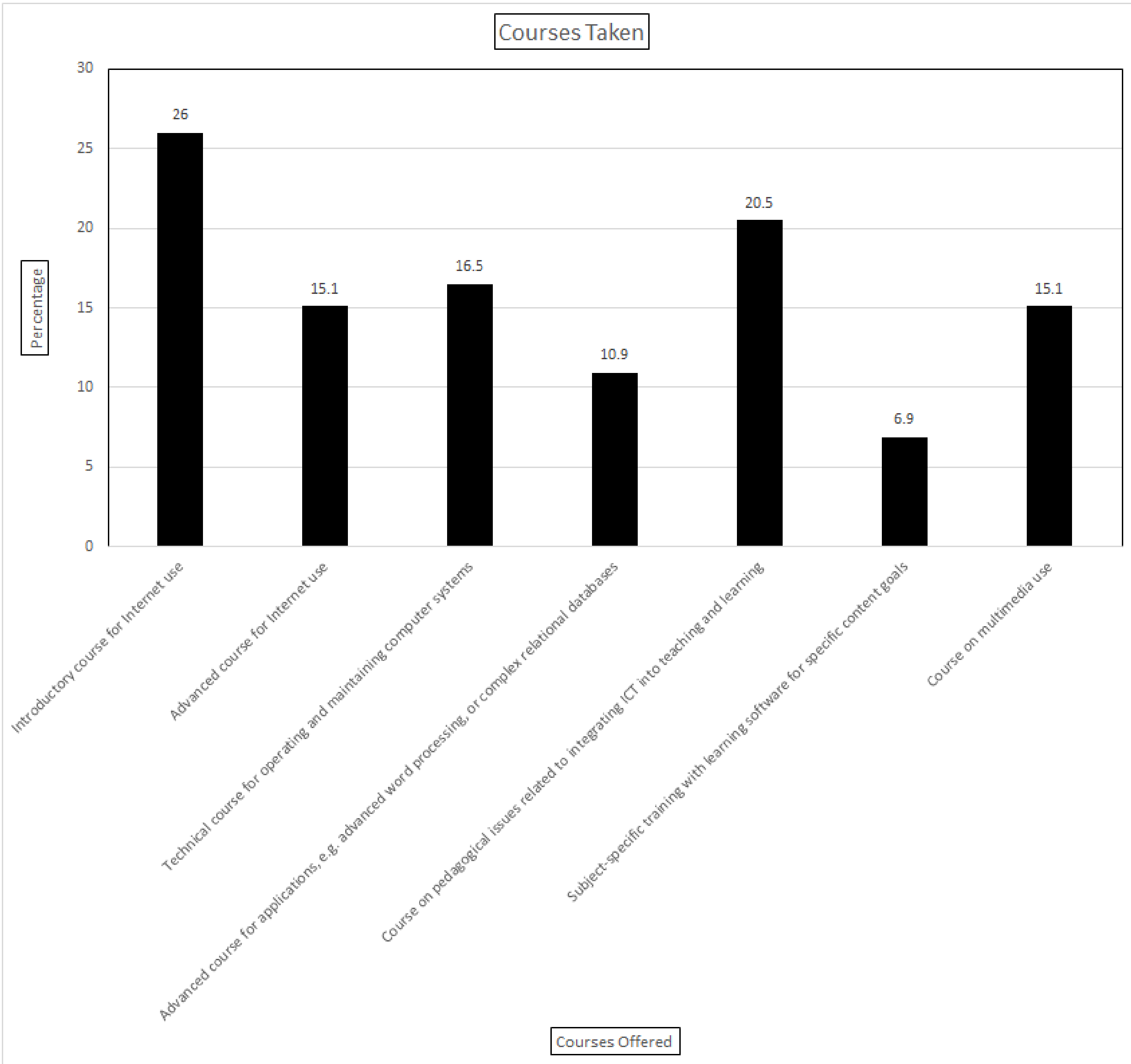
Analysis of data was performed using SPSS (v.24)

The respondents who indicated that they do not have any qualifications in ICTs were 57.5% (42 out of 73 respondents); 27.4% (20 out of 73 respondents) indicated that they had a certificate in ICTs; 6.8% (5 out of 73 respondents) indicated that they had a degree in ICTs; 4.1% (3 out of 73 respondents) indicated that they had a diploma in ICTs; 2.4% (2 out of 73 respondents) did not respond to this question.

4.11 Training taken in ICTs

On the next page is the graphic representation about the various ways in which the respondents acquired knowledge and skills in using ICTs.

Figure 19. Training taken in ICTs



Analysis of data was performed using SPSS (v.24)

The respondents who indicated that they took an introductory course in internet use was 26% (19 out of 73 respondents); 15.1% (11 out of 73 respondents) indicated having taken an advanced course in internet use; 20.5% (15 out of 73 respondents) indicated having taken a course in pedagogical issues related to integrating ICT into teaching and learning;

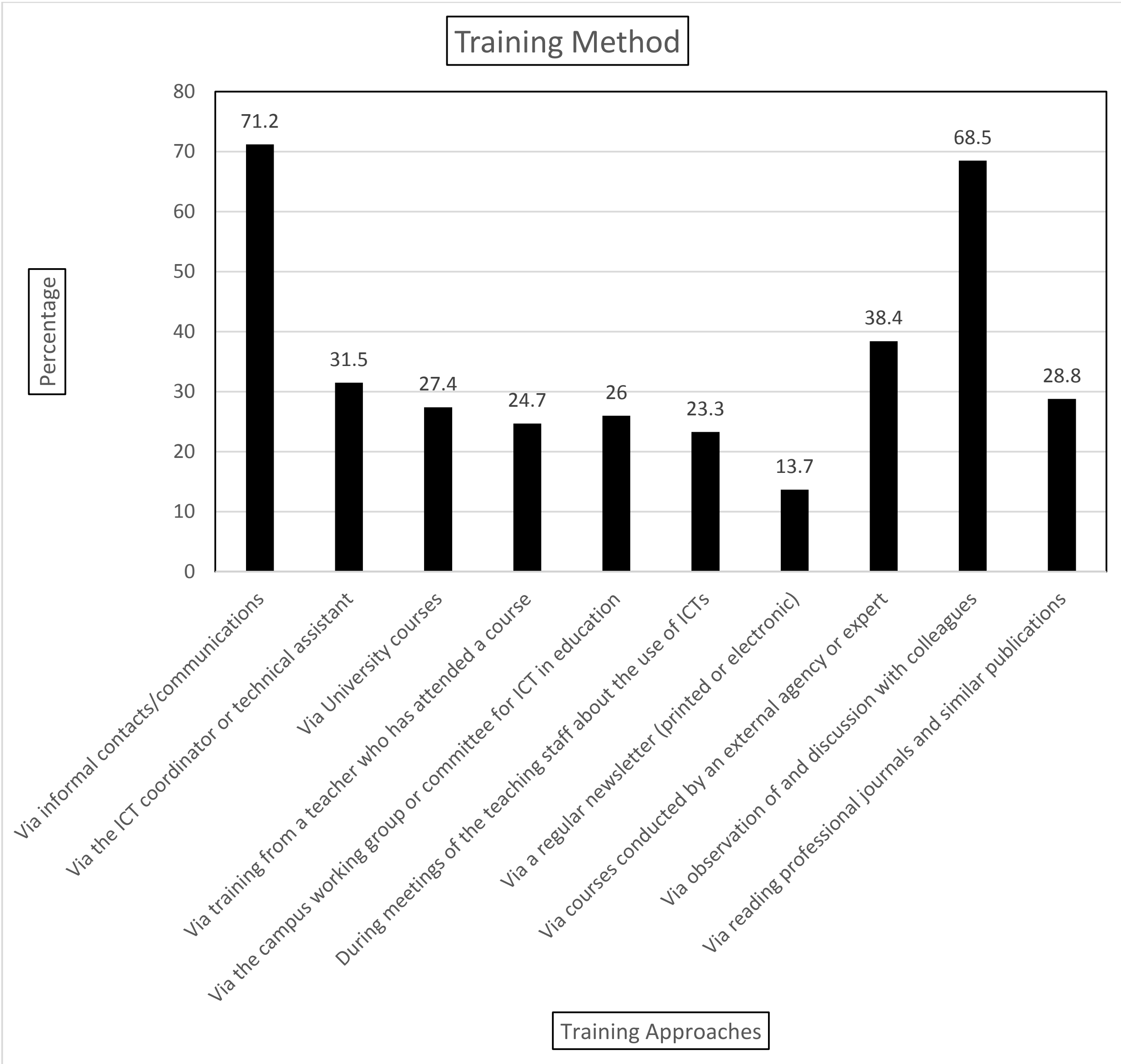
16.5% (12 out of 73 respondents) indicated having taken a technical course in operating and maintaining computer systems; 15.1% (11 out of 73 respondents) indicated having taken a course on the use of multimedia; 10.9% (9 out of 73 respondents) indicated having taken an advanced course in applications such as advanced word processing, or complex relational databases; and 6.9% (5 out of 73 respondents) indicated having taken subject specific training with learning software for specific content goals, e.g. tutorials, simulation, etc.

4.12 Training Methods in ICTs

Next, the respondents who indicated that they acquired ICT skills via informal contacts where 71.2% (52 out of 73 respondents); 68.5% (50 out of 73 respondents) indicated that they acquired ICT skills via observation of and discussion with colleagues; 38.4% (28 out of 73 respondents) indicated that they acquired ICTs skills via courses conducted by an external agency or expert from outside the University; 31.5% (23 out of 73 respondents) indicated that they acquired ICTs skills via ICT coordinator or technical assistant at their campuses. The remaining methods of acquiring ICTs skills was below 30%.

On the next page is Figure 20 which presents the methods in which the respondents acquired their ICT skills.

Figure 20. Training methods



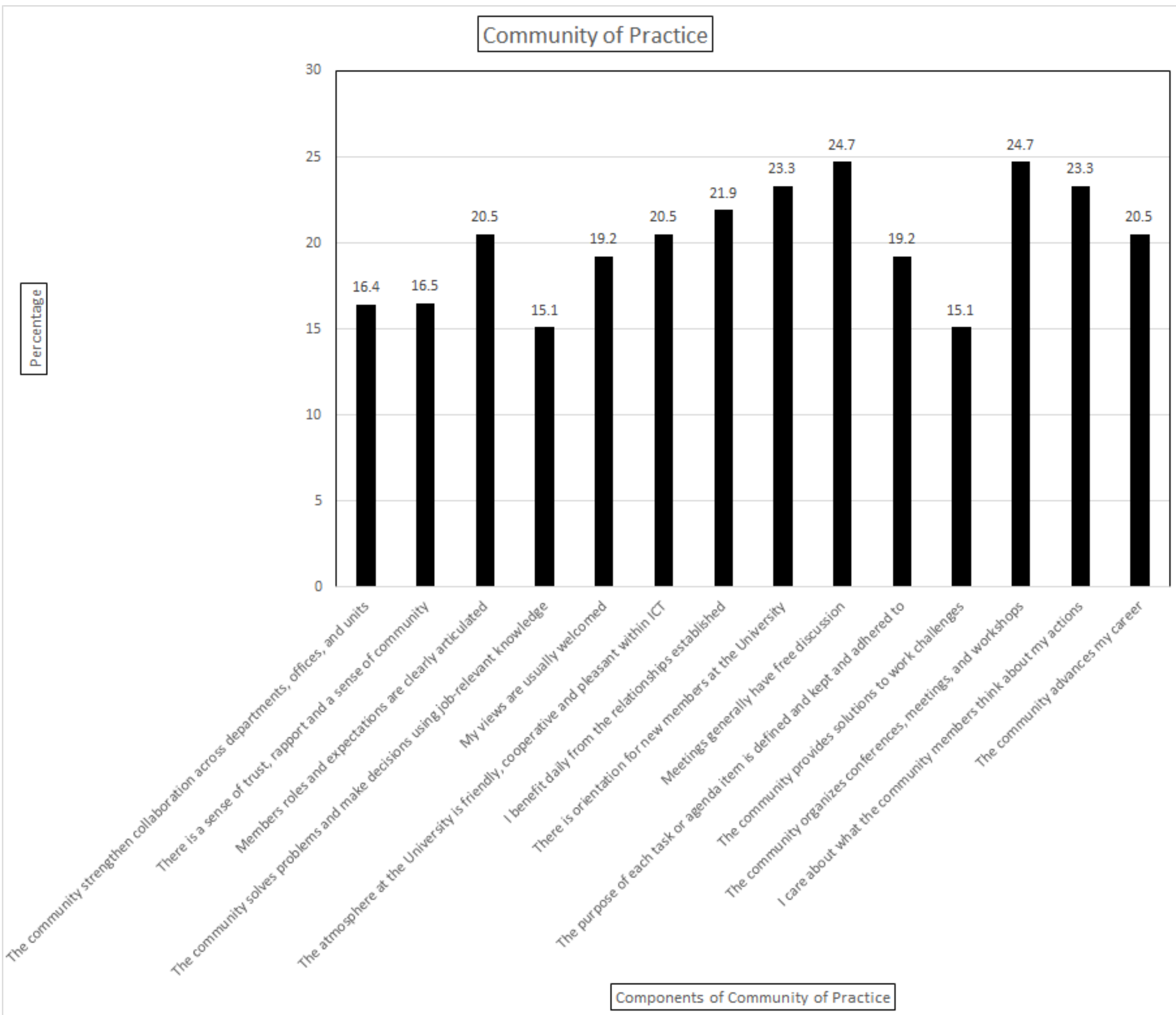
Analysis of data was performed using SPSS (v.24)

During the interview, anonymous 2 indicated that he acquired ICT skills through “self exploration. Through friends and colleagues within the Faculty at the University”. Anonymous 4 indicated that she acquired skills through personal initiative. She searched the internet. She reads journals and attend conferences.

4.13 Communities of Practice

Below is the description of Community of Practice as stipulated in the ICT Policy document, that specifies that linkages and partnerships should be established, in order to speed up the implementation of the ICT Policy for education.

Figure 21. Communities of practice



Analysis of data was performed using SPSS (v.24)

The respondents who indicated that they had meetings that have free discussion on issues to better teach their courses was 24.7% (18 out of 73 respondents); while 24.7% (18 out of 73 respondents) indicated that they used the community to organize conferences, meetings, and workshops; 23.3% (17 out of 73 respondents) indicated that they felt that they cared about what the community members thought about their actions; 21.9 (16 out of 73 respondents) indicated that they benefitted daily from the relationships established; 20.5% (15 out of 73 respondents) indicated that they felt that the members roles and expectations were clearly articulated; 20.5% (15 out of 73 respondents) indicated that the atmosphere at the University is friendly, cooperative and pleasant within ICT; 20.5% (15 out of 73 respondents) indicated that the community advances their careers.

The least communities of practice factors identified was that the community provides solutions to work challenges, which was 15.1% (11 out of 73 respondents); 15.1% (11 out of 73 respondents) indicated that the community solved problems and made decisions using job-relevant knowledge; 16.4% (12 out of 73 respondents) indicated that the community strengthened collaboration across departments and offices; 16.5% (12 out of 73 respondents) indicated that there was a sense of trust, rapport and a sense of community, among others.

An analysis of variance using the Eigenvalue factor analysis yielded one factor greater than 1, which was 12.767, and the percentage of variance was 91.193. On the next page is table 33 which describes the analysis of variance using the Eigenvalue factor analysis.

Table 33. Factor analysis on the community of practice

Total Variance Explained

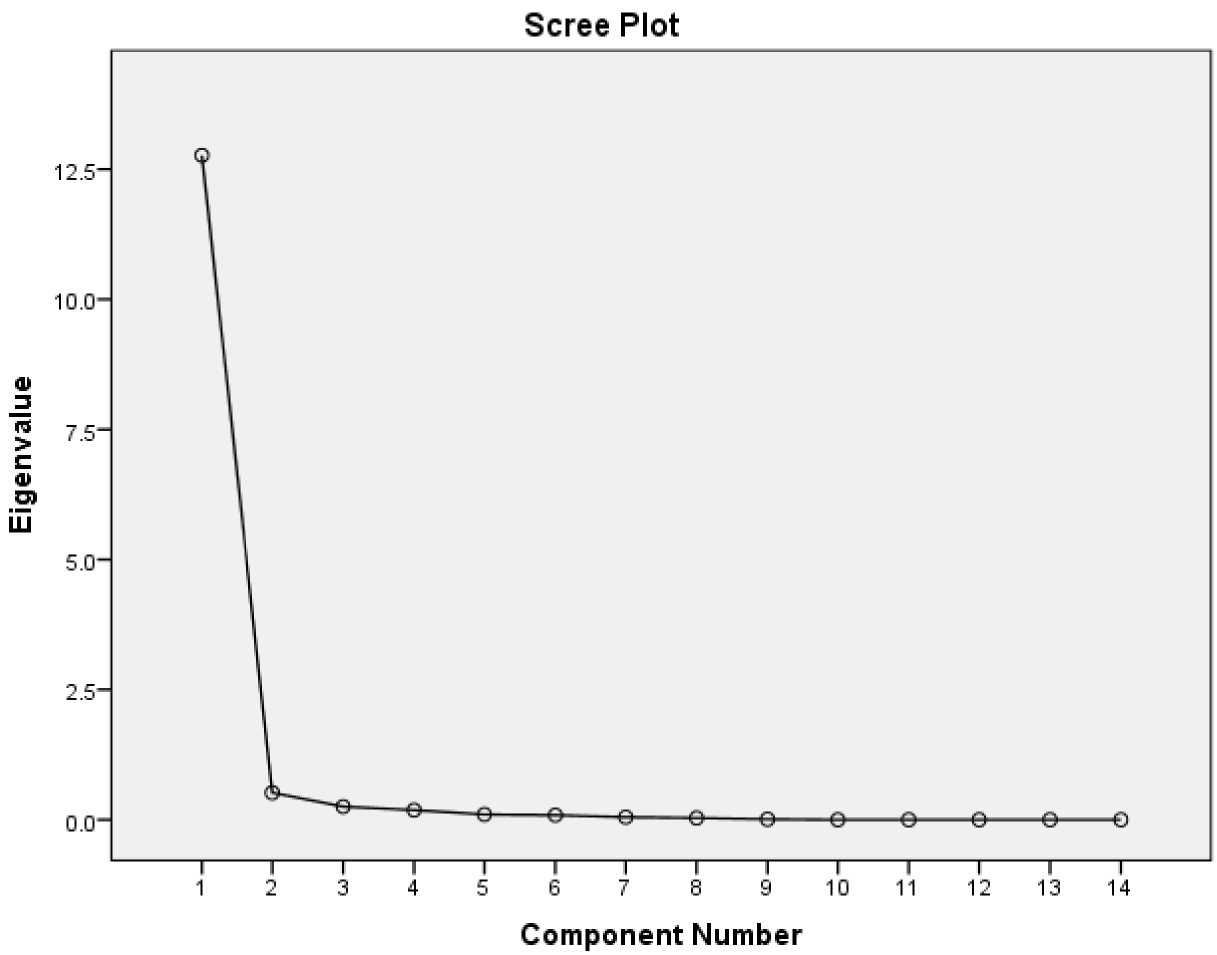
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.767	91.193	91.193	12.767	91.193	91.193
2	.516	3.688	94.880			
3	.251	1.796	96.677			
4	.185	1.321	97.998			
5	.100	.718	98.715			
6	.087	.625	99.340			
7	.050	.357	99.697			
8	.033	.234	99.931			
9	.009	.068	99.999			
10	5.628E-5	.000	99.999			
11	4.377E-5	.000	100.000			
12	2.655E-5	.000	100.000			
13	1.345E-5	9.604E-5	100.000			
14	1.104E-5	7.884E-5	100.000			

Extraction Method: Principal Component Analysis.

Analysis of data was performed using SPSS (v.24)

Below is the scree plot representing table 33 above.

Figure 22. Scree Plot representing table 33



Analysis of data was performed using SPSS (v.24)

The Kruskal-Wallis Test was conducted about the communities of practice at the different campuses. On the next page is the table describing differences in the Mean Rank scores between the campuses.

Table 34. Communities of Practice

Ranks

	Campus	N	Mean Rank
Community of Practice - 36a (The community strengthen collaboration across departments, offices, and units)	Khomasdal	12	16.58
	Main	15	39.63
	Hifikepunye Pohamba	20	37.98
	Rundu	15	42.30
	Katima Mulilo	11	46.68
	Total	73	
Community of Practice - 36b (There is a sense of trust, rapport and a sense of community)	Khomasdal	12	12.83
	Main	15	40.93
	Hifikepunye Pohamba	20	38.93
	Rundu	15	42.93
	Katima Mulilo	11	46.41
	Total	73	
Community of Practice - 36c (Members roles and expectations are clearly articulated)	Khomasdal	12	17.21
	Main	15	40.00
	Hifikepunye Pohamba	20	37.60
	Rundu	15	42.03
	Katima Mulilo	11	46.55
	Total	73	
Community of Practice - 36d (The community solves problems and make decisions using job-relevant knowledge)	Khomasdal	12	15.33
	Main	15	41.03
	Hifikepunye Pohamba	20	38.98
	Rundu	15	41.30
	Katima Mulilo	11	45.68
	Total	73	
Community of Practice - 36e (My views are usually welcomed)	Khomasdal	12	17.75
	Main	15	41.27
	Hifikepunye Pohamba	20	37.45
	Rundu	15	41.27
	Katima Mulilo	11	45.55
	Total	73	
Community of Practice - 36f (The atmosphere at the University is friendly,	Khomasdal	12	13.63
	Main	15	40.20
	Hifikepunye Pohamba	20	38.13
	Rundu	15	43.60

cooperative and pleasant within ICT)	Katima Mulilo	11	47.09
	Total	73	
Community of Practice - 36g (I benefit daily from the relationships established)	Khomasdal	12	17.00
	Main	15	40.73
	Hifikepunye Pohamba	20	37.20
	Rundu	15	42.53
	Katima Mulilo	11	45.82
	Total	73	
Community of Practice - 36h (There is orientation for new members at the University)	Khomasdal	12	15.00
	Main	15	41.17
	Hifikepunye Pohamba	20	37.50
	Rundu	15	42.97
	Katima Mulilo	11	46.27
	Total	73	
Community of Practice - 36i (Meetings generally have free discussion)	Khomasdal	12	11.08
	Main	15	42.50
	Hifikepunye Pohamba	20	40.03
	Rundu	15	41.77
	Katima Mulilo	11	45.77
	Total	73	
Community of Practice - 36j (The purpose of each task or agenda item is defined, kept and adhered to)	Khomasdal	12	12.67
	Main	15	43.20
	Hifikepunye Pohamba	20	37.70
	Rundu	15	42.27
	Katima Mulilo	11	46.64
	Total	73	
Community of Practice - 36k (The community provides solutions to work challenges)	Khomasdal	12	13.58
	Main	15	41.93
	Hifikepunye Pohamba	20	39.48
	Rundu	15	41.20
	Katima Mulilo	11	45.59
	Total	73	
Community of Practice - 36l (The community organizes conferences, meetings, and workshops)	Khomasdal	12	14.42
	Main	15	40.73
	Hifikepunye Pohamba	20	41.18
	Rundu	15	40.13
	Katima Mulilo	11	44.68
	Total	73	

Community of Practice – 36m (I care about what the community members think about my actions)	Khomasdal	12	12.96
	Main	15	41.47
	Hifikepunye Pohamba	20	40.88
	Rundu	15	40.90
	Katima Mulilo	11	44.77
	Total	73	
Community of Practice - 36n (The community advances my career)	Khomasdal	12	14.71
	Main	15	40.90
	Hifikepunye Pohamba	20	40.55
	Rundu	15	40.40
	Katima Mulilo	11	44.91
	Total	73	

Analysis of data was performed using SPSS (v.24)

The Katima Mulilo campus scored higher on all categories about the community of practice between campuses. The Rundu Campus scored second highest, followed by the Main Campus, then Hifikepunye Campus, and last Khomasdal Campus. The Katima Mulilo campus appeared to have practiced communities of practice better than the other campuses on this category, based on the questionnaire results. The ICT Policy for Education specifies that linkages and partnerships should be established, in order to speed up the implementation of the ICT Policy for education.

An analysis was conducted on SPSS on the correlation between the gender of the participants and their reported understanding of community of practice. The table on the next page shows the statistics on the reported use of community of practice and gender.

Table 35: Knowledge about the community of practice between the different sexes.

Crosstab					
			Community of Practice		Total
			Disagree	Agree	
Gender of respondent	male	Count	5	27	32
		% within Sex of respondent	15.6%	84.4%	100.0%
	female	Count	10	16	26
		% within Sex of respondent	38.5%	61.5%	100.0%
Total		Count	15	43	58
		% within Sex of respondent	25.9%	74.1%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of (X^2 = 3.902), the degrees of freedom (df) = 1 at significant level (p = .048). It was determined that there was a significant difference between gender and community of practice, because (p = .048) which was less than 0.05. The results confirm a correlation between gender and community of practice.

Table 36: Chi-square test results: Knowledge about the community of practice between the different sexes.

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.902[a]	1	.048		
Continuity Correction[b]	2.802	1	.094		
Likelihood Ratio	3.923	1	.048		
Fisher's Exact Test				.071	.047
Linear-by-Linear Association	3.834	1	.050		
N of Valid Cases	58				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.72.
b. Computed only for a 2x2 table

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the age of the participants and their implementation of community of practice. The table below shows the statistics on the implementation of community of practice and age.

Table 37: Knowledge about the community of practice between the different age groups.

Crosstab					
			Community of Practice		Total
			Disagree	Agree	
Age of the respondent	<30 yrs	Count	0	1	1
		% within Age of the respondent	0.0%	100.0%	100.0%
	30-39 yrs	Count	3	6	9
		% within Age of the respondent	33.3%	66.7%	100.0%
	40-49 yrs	Count	6	14	20
		% within Age of the respondent	30.0%	70.0%	100.0%
	50+ yrs	Count	6	25	31
		% within Age of the respondent	19.4%	80.6%	100.0%
Total		Count	15	46	61
		% within Age of the respondent	24.6%	75.4%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of (X^2 = 1.471), the degrees of freedom (df) = 3 at significant level (p = .689) was found. It was determined that there was no significant difference between age and community of practice, because ($p = .689$) which was greater than 0.05.

Table 38: Chi-square test results: Knowledge about the community of practice between the different age groups.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.471[a]	3	.689
Likelihood Ratio	1.696	3	.638
Linear-by-Linear Association	.521	1	.470
N of Valid Cases	61		
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .25.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the highest qualification of the participants and their reported implementation of community of practice. The table on the next page shows the statistics on the reported implementation of community of practice and highest qualification.

Table 39: Knowledge about the community of practice between the different qualifications.

Crosstab					
			Community of Practice		
			Disagree	Agree	Total
Highest Qualification	Bachelors degree	Count	3	8	11

		% within Highest Qualification	27.3%	72.7%	100.0%
	Masters	Count	7	29	36
		% within Highest Qualification	19.4%	80.6%	100.0%
	PhD	Count	5	8	13
		% within Highest Qualification	38.5%	61.5%	100.0%
Total		Count	15	45	60
		% within Highest Qualification	25.0%	75.0%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of (X^2 = 1.879), the degrees of freedom (df) = 2, at significant level (p = .391). It was determined that there was no significant difference between highest qualification and community of practice, because (p = .391) which was greater than 0.05.

Table 40: Chi-square test results: Knowledge about the community of practice and qualifications

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.879[a]	2	.391
Likelihood Ratio	1.799	2	.407
Linear-by-Linear Association	.493	1	.483
N of Valid Cases	60		
a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.75.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the rank of the participants and their reported implementation of community of practice. The table below shows the statistics on the reported implementation of community of practice and rank.

Table 41: Knowledge about the community of practice between the different ranks.

Crosstab					
			Community of Practice		Total
			Disagree	Agree	
Rank	Lecturer	Count	12	42	54
		% within Rank	22.2%	77.8%	100.0%
	Senior Lecturer	Count	3	2	5
		% within Rank	60.0%	40.0%	100.0%
	Associate Professor	Count	0	1	1
		% within Rank	0.0%	100.0%	100.0%
	Missing	Count	0	1	1
		% within Rank	0.0%	100.0%	100.0%
Total		Count	15	46	61
		% within Rank	24.6%	75.4%	100.0%

Analysis of data was performed using SPSS (v.24)

On the next page is the chi square results, where the chi-square value of ($X^2 = 4.196$), the degrees of freedom (df) = 3, at significant level ($p = .241$). It was determined that there was no significant difference between rank and community of practice, because ($p = .241$) which was greater than 0.05.

Table 42: Chi-square test results: Knowledge about the community of practice and rank.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.196[a]	3	.241
Likelihood Ratio	4.112	3	.250
Linear-by-Linear Association	.293	1	.589
N of Valid Cases	61		
a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is .25.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the campus of the participants and their reported implementation of community of practice. The table below shows the statistics on the reported implementation of community of practice and campus.

Table 43: Knowledge about the community of practice between the different campuses.

Crosstab					
			Community of Practice		Total
			Disagree	Agree	
Campus	Main	Count	5	10	15
		% within Campus	33.3%	66.7%	100.0%
	Hifikepunye Pohamba	Count	6	14	20
		% within Campus	30.0%	70.0%	100.0%
	Rundu	Count	3	12	15
		% within Campus	20.0%	80.0%	100.0%
	Katima Mulilo	Count	1	10	11
		% within Campus	9.1%	90.9%	100.0%
Total		Count	15	46	61
		% within Campus	24.6%	75.4%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of (X^2 = 2.529), the degrees of freedom (df) = 3, at significant level (p = .470). It was determined that there was no significant difference between campus and community of practice, because (p = .470) which was greater than 0.05.

Table 44: Chi-square test results: Knowledge about the community of practice and different campuses.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.529[a]	3	.470
Likelihood Ratio	2.806	3	.423
Linear-by-Linear Association	2.350	1	.125
N of Valid Cases	61		
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 2.70.			

Analysis of data was performed using SPSS (v.24)

An analysis was conducted on SPSS on the correlation between the departments of the participants and their reported implementation of community of practice. The table on the next page shows the statistics on the reported implementation of community of practice and department.

Table 45: Knowledge about the community of practice between the different departments.

Crosstab

			Community of Practice		
			Disagree	Agree	Total
Department	Missing	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	Agri	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	Anim	Count	1	0	1
		% within Department	100.0%	0.0%	100.0%
	CIAS	Count	1	14	15
		% within Department	6.7%	93.3%	100.0%
	Dean	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	Earl	Count	2	3	5
		% within Department	40.0%	60.0%	100.0%
	ECDL	Count	1	0	1
		% within Department	100.0%	0.0%	100.0%
	Econ	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	Educ	Count	5	8	13
		% within Department	38.5%	61.5%	100.0%
	EFM	Count	1	0	1
		% within Department	100.0%	0.0%	100.0%
	ELCH	Count	1	2	3
		% within Department	33.3%	66.7%	100.0%
	Envi	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	EPIE	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	Lang	Count	1	0	1
		% within Department	100.0%	0.0%	100.0%
	Life	Count	2	0	2
		% within Department	100.0%	0.0%	100.0%
	LPE	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
	Math	Count	0	6	6

		% within Department	0.0%	100.0%	100.0%
	MSSE	Count	0	5	5
		% within Department	0.0%	100.0%	100.0%
	Wild	Count	0	1	1
		% within Department	0.0%	100.0%	100.0%
Total		Count	15	46	61
		% within Department	24.6%	75.4%	100.0%

Analysis of data was performed using SPSS (v.24)

Below is the chi square results, where the chi-square value of (X^2 = 29.307), the degrees of freedom (df) = 18, at significant level (p = .045) was found. It was determined that there was a significant difference between department and community of practice, because (p = .045) which was less than 0.05. The results confirm a correlation between department and community of practice.

Table 46: Chi-square test results: Knowledge about the community of practice and the different departments.

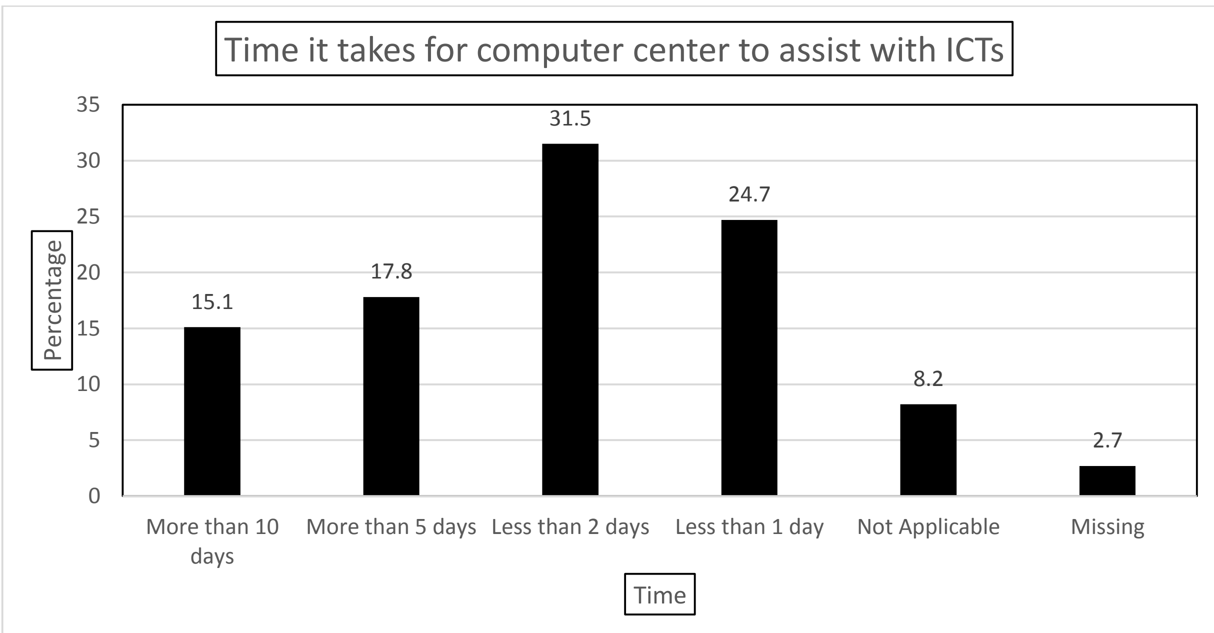
Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	29.307[a]	18	.045
Likelihood Ratio	32.830	18	.017
N of Valid Cases	61		
a. 36 cells (94.7%) have expected count less than 5. The minimum expected count is .25.			

Analysis of data was performed using SPSS (v.24)

4.14 Technical Support

Next is the description about the finding on the technical support by the participants of the study about the assistance they received from the computer center when they experienced problems with ICTs. Below is the graphic representation of the technical support experienced by the participants of the study as it relates to ICT use.

Figure 23. Technical Support: time it takes for computer center to assist with ICTs



Analysis of data was performed using SPSS (v.24)

The participants who indicated that it took more than 10 days for the computer center to assist was 15.1% (11 out of 73 respondents); while 17.8% (13 out of 73 respondents) indicated that it took more than 5 days to get help from the computer center; 31.5% (23 out of 73 respondents) indicated that it took less than 2 days to get help from the computer center; 24.7% (18 out of 73 respondents) indicated that it took less than 1 day to get help from the computer center; 8.2% (6 out of 73 respondents) indicated that this category did not apply to them; while 2.7% (2 out of 73) respondents did not answer this question.

The participants where further asked, whether the problems were solved to their satisfaction by the computer center or not. Below is the graphic representation on the satisfaction level of the participants about computer center assistance.

Figure 24. Technical Support satisfaction level

Analysis of data was performed using SPSS (v.24)

The participants where further asked about the satisfaction level about the assistance they received from the computer center in using ICTs. 4.1% (3 out 73 respondents) indicated that they were not at all happy with the assistance they received from the computer center in using ICTs; 32.9% (24 out of 73 respondents) indicated that they were sometimes happy with the assistance they received from the computer center in using ICTs; 32.9% (24 out of 73 respondents) indicated that they were most of the times happy with the assistance they received from the computer center in using ICTs; 21.9% (16 out of 73 respondents) indicated that they were always happy with the assistance they received from the computer center in using ICTs; 6.8% (5 out of 73 respondents) indicated that this category did not apply to them; 1.4% (1 out of 73 respondents) did not fill out this category;

When asked on the questionnaire, what the ICT technicians can do to help the participants to do their work better; some of the responses were "solve technical problems immediately. Sometimes IT devices fail during class", "they should do regular checks on the computers, attend to problems promptly", "ICT technicians do not understand the importance of teaching with ICT", "react faster as their inability to act hampers my accessibility to ICT resources and thereby my work", "help with the speed of internet. It is too slow and its always down", among others.

During the interview, anonymous 7 suggested that staff from the computer center can come and sit in her class, and observe how she teaches so that they can observe and understand her teaching approach, then they can see how they can hinder or improve her teaching. Anonymous 2 indicated that the computer center staff should get better skills to maintain the computers, which confirms some of the answers on the questionnaire.

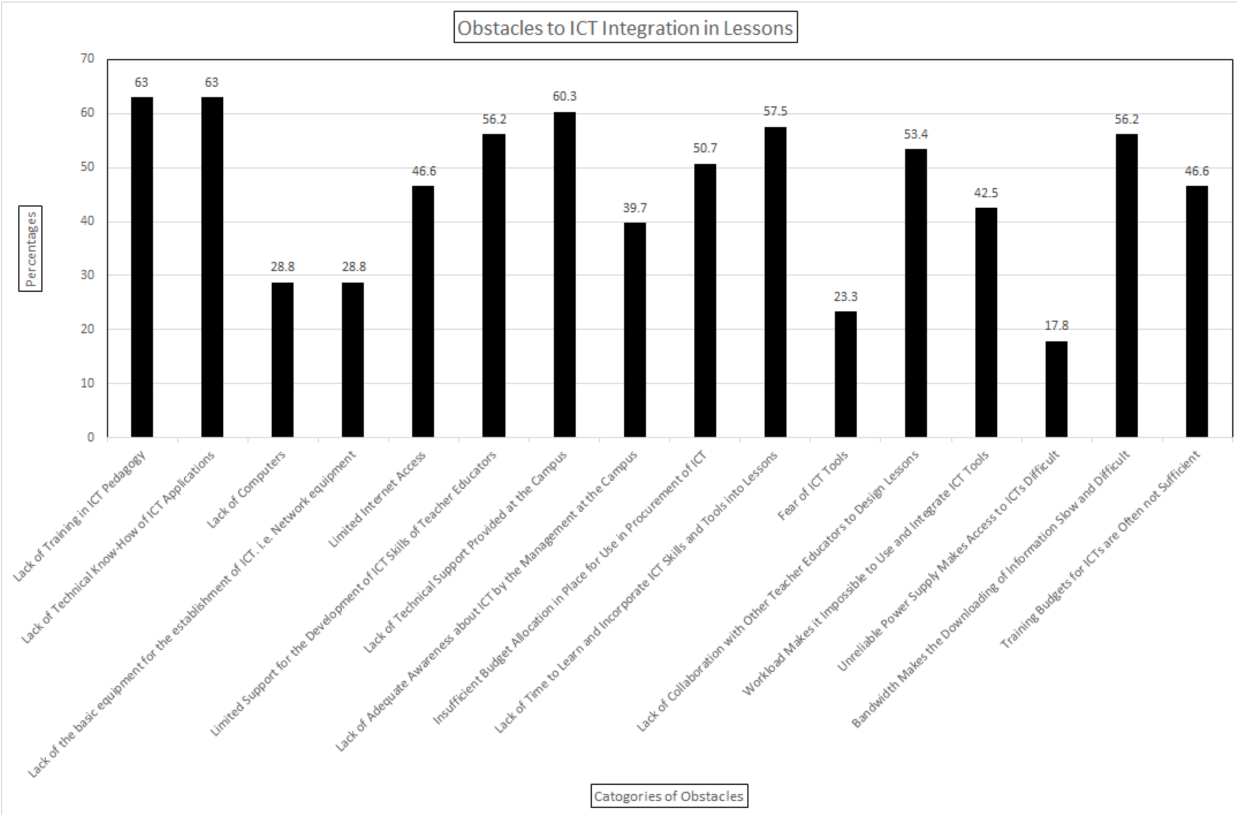
4.15 Obstacles to ICT Integration in Teaching

Following is the description about the obstacles participants encountered during ICT uses at the different campuses. On the next page are the obstacles encountered during the implementation of the ICT Policy for Education in the Faculty of Education:

Next is the presentation about the obstacles encountered during teaching with ICTs. Respondents who indicated a lack of training in ICT pedagogy where 63% (46 out of 73 respondents); 63% (46 out of 73 respondents) indicated a lack of technical know-how of ICT applications; 60.3% (44 out of 73 respondents) indicated a lack of technical support provided at the their campus; 57.5 (42 out of 73 respondents) indicated a lack of time to learn and incorporate ICT skills and tools into lessons; 56.2% (41 out of 73 respondents) indicated limited support for the development of ICT skills for lecturers; 56.2% (41 out of 73 respondents) indicated bandwidth makes the downloading of information slow and difficult; 53.4% (39 out of 73 respondents) indicated lack of collaboration with other teacher educators to design lessons that accommodate ICT integration across subjects; 50.7% (37 out of 73 respondents) indicated insufficient budget allocation in place for use in procurement of ICT tools such as hardware and software.

On the next page is the graphic representation of the obstacles encountered during teaching with ICTs.

Figure 25. Obstacles to ICT integration in teaching



Analysis of data was performed using SPSS (v.24)

The least reported obstacles encountered in ICT integration were unreliable power supply which made access to ICTs difficult was 17.8% (13 out of 73 respondents); 23.3% (17 out of 73 respondents) reported fear of ICT tools; 28.8% (21 out of 73 respondents) reported lack of computers; 28.8% (21 out of 73 respondents) reported lack of network equipment, among others.

During the interview, anonymous 5 indicated that the ICT Policy is not clearly understood by management and staff. Anonymous 6 indicated that there is no periodic review of the ICT Policy.

Anonymous 6 further indicated that sometimes equipments fail during practicals, and the technicians are not available to provide the necessary support.

An analysis of variance using the Eigenvalue factor analysis yielded one factor greater than 1, which was 15.979, and the percentage of variance was 99.871. Below is table describing the analysis of variance using the Eigenvalue factor analysis.

Table 47. Obstacles in ICT integration

Total Variance Explained

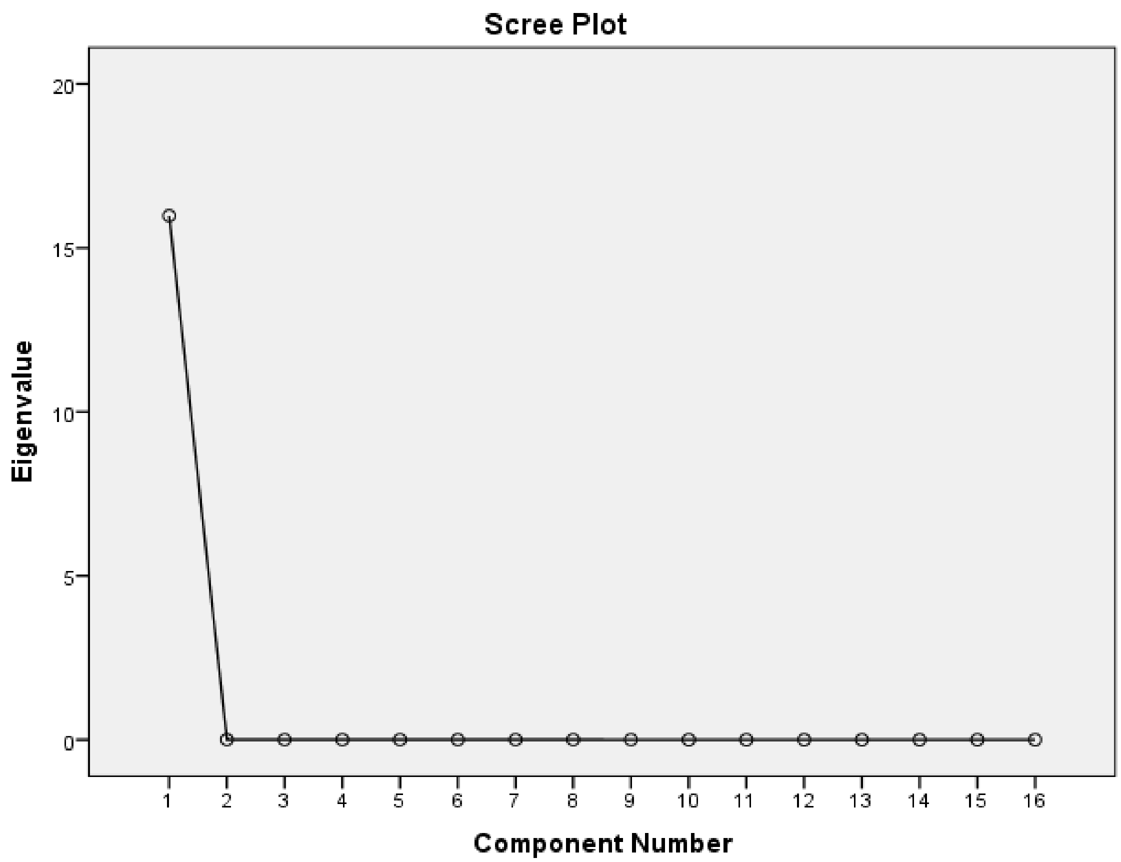
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.979	99.871	99.871	15.979	99.871	99.871
2	.004	.025	99.896			
3	.003	.017	99.913			
4	.002	.015	99.928			
5	.002	.011	99.939			
6	.001	.009	99.948			
7	.001	.009	99.956			
8	.001	.007	99.964			
9	.001	.007	99.971			
10	.001	.006	99.977			
11	.001	.005	99.982			
12	.001	.005	99.987			
13	.001	.004	99.991			
14	.001	.003	99.994			
15	.000	.003	99.997			
16	.000	.003	100.000			

Extraction Method: Principal Component Analysis.

Analysis of data was performed using SPSS (v.24)

Below is the scree plot representing the table above.

Figure 26. Scree Plot providing a visual representation of Table 48

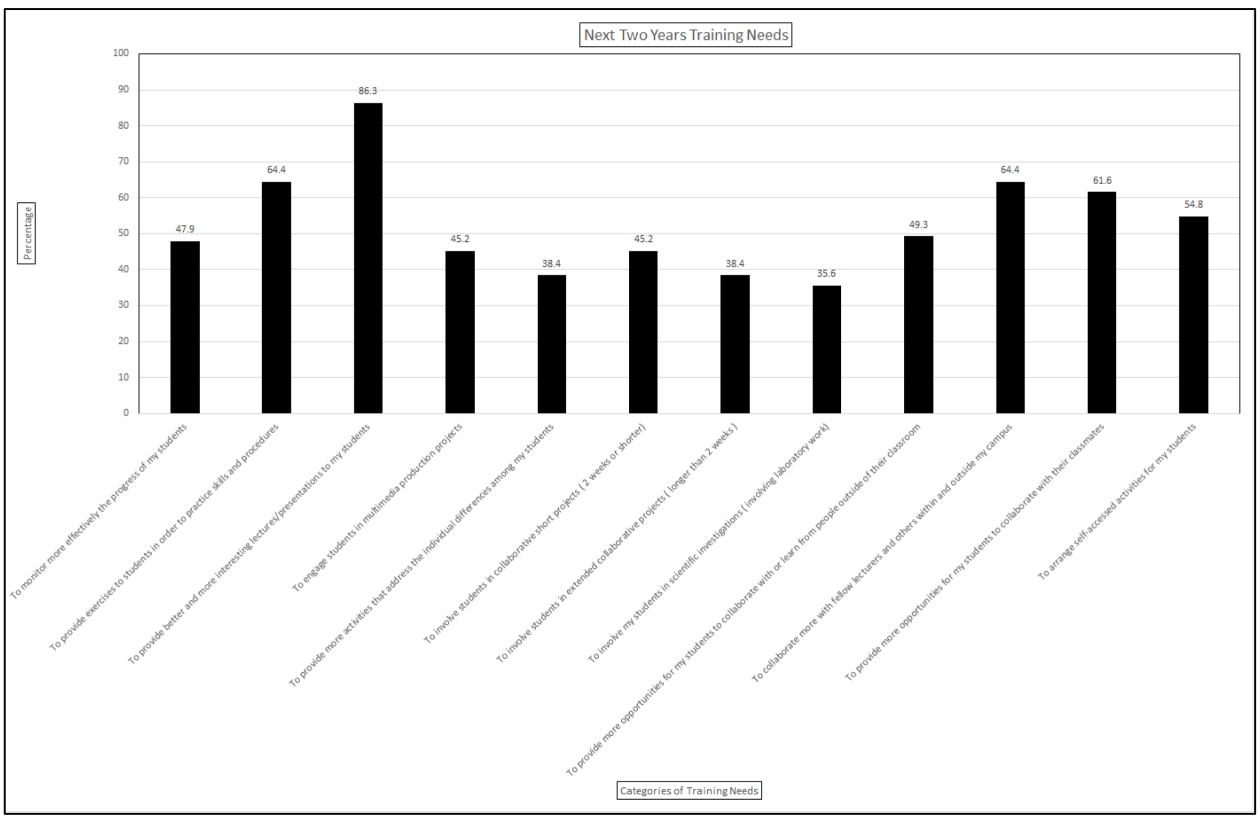


Analysis of data was performed using SPSS (v.24)

4.16 Next Two Years Training Needs

Last is the description of future training needs identified by respondents. The training needs identified as high priority where to provide better and more interesting lectures and presentations to their students, was 86.3% (63 out of 73 respondents); to provide exercises to students in order to practice skills and procedures, was 64.4% (47 out of 73 respondents); to collaborate more with fellow lecturers and others within and outside their campus, was 64.4% (47 out of 73 respondents); to provide more opportunities for their students to collaborate with their classmates, was 61.6% (45 out of 73 respondents); to arrange self-assessed activities for their students, was 54.8% (40 out of 73 respondents); to provide more opportunities for their students to collaborate with or learn from people outside their classroom, including peers and external peers, was 49.3% (36 out of 73 respondents); to engage students in multimedia production projects, was 45.2% (33 out of 73 respondents); to involve students in extended collaborative short projects (2 weeks or shorter), was 45.2% (33 out of 73 respondents), among others.

Figure 27. Next two years training needs



Analysis of data was performed using SPSS (v.24)

The categories that received least training needs were to involve students in scientific investigations, involving laboratory work which was 35.6% (26 out of 73 respondents); 38.4% (28 out of 73 respondents) indicated to involve students in extended collaborative projects, longer than 2 weeks as important; 38.4% (28 out of 73 respondents) indicated to provide more activities that address the individual differences among students as important; 47.9% (35 out of 73 respondents) indicated to monitor more effectively the progress of their students, as important, among others.

During interview, anonymous 5 indicated "pedagogy and ICT use" as important. Anonymous 2 indicated equipping himself with the latest up to date technology and training on how to use them in teaching as very important. Anonymous 3 indicated that she wants to equip the Media centers with modern equipment. Training on how to use, plan, deliver and use them in assessment. Use ICTs to help learners with learning difficulties as very important.

4.17 Summary

In answering the first question, various sub-questions were asked and included, namely: knowledge about the ICT Policy for Education, categories of ICT uses in the classroom, installed software on PCs, speed taken to download teaching materials from the internet or network, frequency of ICT applications uses, hours per week of teaching with PCs, and hours per week of internet use for teaching purposes were discussed.

The findings indicated that the ICT Policy was not properly implemented. The majority of the teacher educators indicated that they were at the beginning level of using ICTs for teaching. They mainly used word processors and presentation tools for teaching. Few have taken introductory courses in internet use. Few have taken advanced course applications in word processing and complex relational databases. Few teacher educators took subject-specific training with learning software for specific content goals, and few have taken courses in multimedia use.

In answering the second question, ICT qualifications, different ways of acquiring ICTs skills, community of practice, technical support, obstacles encountered during the ICT implementation, and future training needs in ICTs were discussed.

The findings indicated that the teacher educators experienced slow speed to download teaching materials from the internet. The technical staff was not readily available to assist with ICTs. Few teacher educators collaborated on how to teach better with ICTs.

CHAPTER 5: DISCUSSION, SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In this chapter, there will be a discussion based on the results of the study. Summary and conclusions will be drawn based on the interpretation of the data generated by the research and related to the review of the literature. Lastly, a model was developed on how to better implement the ICT Policy for Education. This study will fill the gap on the limited research data about the National ICT Policy for Education at the tertiary level. Lastly, recommendations for future research was provided. Below are the research questions that guided this study:

1. How is the ICT Policy for Education being implemented in the Faculty of Education at the University of Namibia?

2. What are the factors encountered in the implementation of the ICT Policy for Education in the Faculty of Education?

3. What recommendations can be provided in order to better implement the ICT Policy for Education in the Faculty of Education at the University of Namibia?

In answering the first question:

(i) knowledge about the ICT Policy for Education,

(ii) categories of ICT uses in the classroom,

(iii) installed software on PCs,

(iv) speed to download teaching materials from the internet or network,

(v) frequency of ICT applications uses,

(vi) hours per week of teaching with PCs, and

(vii) hours per week of internet use for teaching purposes were asked.

In answering the second question:

(i) ICT qualifications,

(ii) different ways of acquiring ICTs skills,

(iii) community of practice,

(iv) technical support,

(v) obstacles encountered during the ICT implementation, and

(vi) future training needs in ICTs were identified.

Three instruments where used for data collection purposes, namely questionnaire, interview and observation schedule. The instruments were developed by the researcher, in collaboration with the supervising team and was pilot tested before they were rolled out for data collection purposes.

5.1 Discussion of the Results

In answering the first question, the respondents scored high when questions were asked about their understanding of the different components of the ICT Policy for Education on the questionnaire. The reliability of the data was assessed through the Cronbach's Alpha analyses, which determines whether the instruments and the scales have internal consistency and reliability. Cronbach's Alpha reliability coefficient normally ranges between 0 and 1 with no lower limit to the coefficient. The more the Cronbach's alpha coefficient is close to 1.0, the greater the internal consistency of the items in the scale. The Cronbach Alpha for this category was determined to be at (α = .978).

A factor analysis was conducted using the Eigenvalue factor analysis. Eigenvalue factor analysis group categories in factors or components in order to better make sense of the collected data. The eigenvalues (λ) are real numbers representing the variation accounted for by each component (factor) and that satisfy the equation $| A - \lambda| x=0$, where A is a correlation matrix calculated from the observations to be classified and x a non - zero solution vector. A single component was identified, which was $\lambda = 9.957$. This means that a single factor was identified for this category.

It was further determined that the highest score was 86.3% (63 out of 73 respondents) and the lowest score was 57.5% (42 out of 73 respondents) about their understanding of the different components of the ICT Policy for Education from the questionnaire. It appears that the respondents from the different campuses of the University of Namibia understood the purpose of the ICT Policy for Education. The respondents indicated that the ICT Policy for Education's purpose is to increase learning motivation and to make learning more interesting, which scored 86.3% (63 out of 73 respondents); and to prepare students for the world economy of tomorrow, scored 83.6% (61 out of 73 respondents).

These findings are consistent with Winthrop, Anderson & Cruzalegui (2015), who indicated that the quality of learning should prepare students to acquire relevant skills to participate successfully in the twenty-first century society. A similar view was expressed in the UNESCO document (UNESCO, 2011). During interviews, the comments that best describes the respondents understanding of the ICT Policy was, "*It is a good policy. It is well thought out. It was trying to address the ICT literacy to achieve the goals of Vision 2030. It is intended for Namibia to be a knowledge based society*" (Anonymous 6, 2015).

Anonymous 7 (2015), indicated that "*we as teacher educators should prepare students in the use of ICTs in teaching in order to transfer skills to the prospective teachers*". Anonymous 5 (2015), indicated that "*the Policy setup will guide ICT in education. This is what needs to be done in terms of teaching, infrastructure, and materials. The vision looks fine*". Anonymous 6 (2015), indicated that the ICT Policy needs periodic review, about every two years. Every year review would be too soon, to monitor what was implemented. Every three years would be too late, because of the fast changes in technology.

The next category under investigation was the ICT uses in the classroom. The Cronbach Alpha for this category was determined to be at ($\alpha = 1$). It means that there was greater internal consistency of the items in this category. A factor analysis was conducted using the Eigenvalue factor analysis. A single component was identified, $\lambda = 15.983$. This means that a single factor was identified for this category.

In addition, the majority of the respondents indicated that they use ICT to communicate information and/or share information with the students, which scored 93.2% (68 out of 73 respondents) on the questionnaire. The respondents indicated that they used ICTs to create visual presentation, such as the use of Power Point to share information with students, which scored 84.9% (62 out of 73 respondents). The respondents who indicated that they use ICT to assess information as part of lessons was 82.3% (60 out of 73 respondents). The respondents who indicated that they used ICT to organize and store information was 80.8% (59 out of 73 respondents). These findings are consistent with (Ali, Haolader, Muhammad, 2013; Mtebe & Raisamo, 2014) about ICT uses in the classroom, where they indicated that ICTs can be used to create, manage and distribute information. This was further confirmed during classroom observations at the different campuses. Lecturers at the different campuses used Power Point presentations during lectures and other software such as Microsoft Word and Microsoft Excel to organize and store information.

On a different category about installed software on PCs, most respondents used Microsoft Office products which was 95.9% (70 out of 73 respondents) to prepare lessons and for teaching purposes. The Open Source software use was not observed during class visits. The respondents who indicated using Open Source software on the questionnaire was 23.3% (17 out of 73 respondents). The respondents who indicated using the internet for research and for teaching purposes was 94.5% (69 out of 73 respondents). The installed software products, was confirmed during class visits and office visits. The findings are consistent with the objectives of the ICT Policy for Education which specifies that the lecturing staff should use word processors, spreadsheet and presentation software to teach students.

The respondents were also asked about the frequency of ICT uses for teaching purposes. The respondents who indicated using word processing software on a daily basis was 67.1% (49 out of 73 respondents); while 11% (8 out of 73 respondents) of the respondents indicated using word processing on a weekly basis. Those respondents who indicated using presentation software on a daily basis was 74% (54 out of 73 respondents); while those respondents who indicated using presentation software on a weekly basis was 17.8% (13 out of 73 respondents) . Those respondents who indicated using e-mail on a daily basis was 87.7% (64 out of 73 respondents); while those respondents who indicated using e-mail on a weekly basis was 8.2% (6 out of 73 respondents). The respondents who indicated using the internet on a daily basis was 86.3% (63 out of 73 respondents), and those who indicated using the internet on a weekly basis was 11% (8 out of 73 respondents).

Furthermore, the respondents who used online discussion forum on a daily basis was 12.3% (9 out of 73 respondents); while 15.1% (11 out of 73 respondents) indicated using online discussion forum on a weekly basis. Those who indicated using drill and practice programmes on a daily was 6.8% (5 out of 73 respondents); while those indicated using drill and practice programmes on a weekly basis was 24.7% (18 out of 73 respondents). Those respondents who used databases on a daily basis was 8.2% (6 out of 73 respondents); while those respondents who used databases on a weekly basis was 12.3% (9 out of 73 respondents).

The findings indicate that the respondents from the different campuses of the University of Namibia are at the beginning level of ICT uses for teaching. The findings of this study are in line with the study done by Iipinge (2010). Other researchers with similar findings in the developing world were (Chitiyo & Harmon, 2009; Czerniewicz & Brown, 2009; Tongkaw, 2013). The University needs to train lecturers in more advanced uses of ICTs such as online discussion forum, educational software, simulations, drill and practice programs, mobile technology and Learning Management Systems.

The respondents were asked about the speed at which they downloaded their teaching materials. The speed to download teaching materials from the internet was identified as slow by the different participants in the study from the different University of Namibia campuses, based on the findings from the questionnaire. Those who indicated more than

5 minutes download time was 50.7% (37 out of 73 respondents). Those who indicated more than 2 minutes download time was 21.9% (16 out of 73 respondents). The bandwidth problem is experienced in different developing countries (Awidi & Cooper, 2015; Johnson & Hoba, 2015; Obijiofor, 2009).

During observations, anonymous 4 (2015) brought his own device which he used when the internet was slow or not working. During the interview with some participants, anonymous 2 (2015), indicated the speed to download information from the internet as "*Very, very slow*". Anonymous 5 (2015) described it as "*Very slow. It is frustrating. The network is on and off*". The University needs to upgrade its infrastructure in order to reduce the download time to less than a minute. Besides the slow internet, 49.3% (36 out of 73 respondents) used the internet more than 5 hours per week for teaching and research purposes; 50.7% (37 out of 73 respondents) indicated using their assigned PCs for teaching related activities. The respondents saw the need to use the internet, even though it was slow.

In answering the second question, ICT qualifications, different ways of acquiring ICTs skills, community of practice, division of labour, obstacles encountered during the ICT implementation, and future training needs in ICTs were identified.

The respondents from the different campuses of the University of Namibia indicated that 57.5% (42 out of 73 respondents) had no qualifications in teaching with ICTs. The findings indicate that the majority of the lecturers are not qualified to teach with ICTs. The ICT Policy for Education stipulates that over half of the teaching staff should have

ICT qualifications. The University needs to train the lecturers in the use of ICT for teaching purposes.

The respondents were further asked which training they received in ICTs, 26% (19 out of 73 respondents) indicated having taken an introductory course for internet use; 15.1% (11 out of 73 respondents) received training in advanced course for internet use; 20.5% (15 out of 73 respondents) received training in a course on pedagogical issues related to integrating ICT into teaching and learning; 15.1% (11 out of 73 respondents) received training in a course on multi media use, while 6.9% (5 out of 73 respondents) received training in a course on subject specific training with learning software for specific content goals. The findings confirm the lack of training on courses that will help the lectures at the different campuses of the University of Namibia to teach with ICTs.

On a different aspect, the respondents were asked to respond to questions dealing with communities of practice on the questionnaire. The respondents scored low on the communities of practice related to ICT uses at the different campuses of the University of Namibia. On most components of the communities of practice, the participants scored below 30% (22 out of 73 respondents). Communities of practice is intended to create communities within the departments, faculties, campuses and the University at large on how to share knowledge on the best ways to teach with ICTs. The findings by several resarchers (Al-ghamdi & Al-ghamdi, 2015; Garavaglia & Petti, 2015; Tsiotakis & Jimoyiannis, 2016) confirm communities of practices expectations, where they focused on content sharing areas, supportive tools, such as community dashboard, timeline and member profile and created community repository areas where the participants activities and learning materials can be shared and stored.

The ICT Policy for Education stipulates that networking should be established with the aim of increasing communication and collaboration with the local and international community as essential. The findings indicate that the participants have limited knowledge on how to share knowledge about the effective use of ICTs at the different University of Namibia campuses. The Katima Mulilo campus scored slightly higher on all the components of communities of practice, meaning the Katima Mulilo campus used this aspect better than the other campuses.

In terms of technical support, the technicians do not provide the necessary support as needed, as confirmed by the low percentage of support provided by the support staff and technicians. During classroom observations, two practical sessions for anonymous 1 and anonymous 4 were cancelled, because the technical staff was not available to fix the problems the participants had.

In terms of the obstacles encountered during teaching with ICTs. The respondents indicated the following; 63% (46 out of 73 respondents) indicated a lack of training in ICT pedagogy; 63% (46 out of 73 respondents) indicated a lack of technical know-how of ICT applications; 60.3% (44 out of 73 respondents) indicated a lack of technical support provided at their campus. The findings indicate the lecturers lack training in ICT pedagogy, technical know-how of ICT applications and technical support provision at the different campuses of the University of Namibia. These findings are consistent with several researchers findings in the developing world dealing with the lack of training in ICT pedagogy, lack of technical know-how in ICT applications and poor support from the technical staff (Ali, Muhammad, & Haolader, 2014; Chitiyo & Harmon, 2009; Mtebe & Raisamo, 2014; Tongkaw, 2013). Training in ICT pedagogy, good technical know-how in ICT applications and good support system from the technical staff when ICTs are not working properly, are needed in order to successfully implement the ICT Policy for Education.

Concerning the aspect dealing with the future training needs, 86.3% (63 out of 73 respondents) of the respondents indicated a high priority in training to provide better and more interesting lectures and presentations to their students at the different University of Namibia campuses; to provide exercises to students in order to practice skills and procedures, was 64.4% (47 out of 73 respondents); to collaborate more with fellow lecturers and others within and outside their campus, was 64.4% (47 out of 73 respondents); to provide more opportunities for their students to collaborate with their classmates, was 61.6% (45 out of 73 respondents). The findings indicate that the respondents require training in ICT integration in teaching, and to collaborate with fellow lecturers within and outside their campuses on how to best teach their subjects. The respondents further indicated the need for their students to collaborate with their class mates.

5.2 Summary and Conclusions

Regarding the responses about the knowledge of the ICT Policy for Education. It was determined that the respondents showed a good understanding about the different components of the ICT Policy for Education from the questionnaire. The highest score on a category was 86.3% and the lowest score on a category was 57.5%. The respondents from the different campuses of the University of Namibia understood the purpose of the ICT Policy for Education. The findings are consistent with the ICT Policy for Education, which advocates the use of ICT to create, manage and distribute information. Also to prepare students for the world economy of tomorrow.

Concerning the categories of ICT uses in the classroom. It was established that the respondents are at the beginning level in the use of ICTs. They used ICTs to share information with students. They routinely used ICTs to create visual presentations, such as in Power Point presentations. They specified that they used ICTs to assess information as part of lessons. They revealed that they used ICTs to organize and store information. However, the respondents pointed out that they seldom used ICT in classrooms to create models or simulations to perform calculations. They infrequently collected data or used ICT for assessment purposes. They occasionally created diagrams, pictures and figures. They rarely used ICTs to support individualized learning. This denotes that the teacher educators need to be trained and guided in the advanced uses of ICTs in teaching.

With regard to the frequency of ICT application use, it was established that the respondents used basic computer applications, such as E-mail, search engines, word processing and presentation software. However, they seldom used online discussion forum, databases and websites to enhance the use of ICTs in teaching and learning. The lack of ICT applications use, can be attributed to the few educational software installed on teacher educators personal computers and slow internet which was a hindrance in downloading teaching materials.

Pertaining ICT qualifications of teacher educators in ICTs, the majority of the teacher educators did not have ICT qualifications. Some had certificates in ICTs, such as ICDL. Few had degrees and diplomas. Few had training in advanced courses in internet use. A limited number had taken a course in pedagogical issues related to integrating ICT into teaching and learning. Few have taken a technical course in operating and maintaining computer systems. A small number has taken a course on the use of multimedia in education. An insufficient number have taken an advanced course in advanced word processing, or complex relational databases. Therefore, teacher educators need to be trained in the advanced use of ICTs in teaching and learning.

In terms of technical support, the technicians did not provide the necessary support as needed, as confirmed by the low percentage of support provided by the technicians. More than half of the respondents where not happy with the level of support received from the computer center. Some of the comments from the respondents included, “solve technical problems immediately”, “ICT technicians do not understand the importance of teaching with ICT”, “react faster as their inability to act hampers my accessibility to ICT resources and thereby my work”, were some of the comments about the level of satisfaction with the technicians from teacher educators.

As regards to community of practice, the respondents scored low on communities of practice as it related to ICT uses at the different campuses of the University of Namibia.

The respondents scored below 30% on all the categories. The categories included having meetings with colleagues on issues to better teach their courses. Few had conferences, meetings and workshops with colleagues about the subjects they taught at their campuses. A smaller number of teacher educators indicated that they felt cared about what the community members thought about their actions. Few teacher educators felt that they benefited daily from the relationships established with their colleagues. A limited number indicated that the University of Namibia is friendly, cooperative and pleasant environment within the community that uses ICT. Teacher educators at the University of Namibia need to get involved with communities of practice. Communities of practice are intended to create communities within the departments, faculties, campuses and the University at large to share knowledge on the best ways to teach with ICTs.

Pertaining the training needs of teacher educators, they indicated involving students in scientific investigations, involving laboratory as important. They specified involving students in extended collaborative projects as important. They further articulated more activities that address individual differences among students as important. During interviews with teacher educators tasked to teach with ICTs, they designated that pedagogy and ICT use as important. They also pronounced equipping themselves with the latest up to date technology and training on how to use them in teaching as important.

In light of the above stated challenges the researcher proposed a five year implementation plan on how to best implement the ICT Policy for Education in the Faculty of Education. On the next page is the five year implementation plan.

	Year 1	Year 2	Year 3	Year 4	Year 5
Evaluation	Yes	No	Yes	No	Yes
Monitoring	Yes	Yes	Yes	Yes	Yes
Qualifications	Foundation Level ICT Literacy Certificate	Intermediate Level ICT Literacy Certificate	Advanced Level ICT Literacy Certificate	Advanced Level ICT Literacy Certificate	Advanced Level ICT Literacy Certificate
Classroom facilities	Audio visual and broadcast facilities	Audio visual and broadcast facilities	Audio visual and broadcast facilities	Audio visual and broadcast facilities	Audio visual and broadcast facilities
	Educational television	Educational television	Educational television	Educational television	Educational television
	Local and wide area networks	Local and wide area networks	Local and wide area networks	Local and wide area networks	Local and wide area networks
	Instructiona l software	Instructional software	Instructional software	Instructional software	Instructional software
Personal Computer	Yes	Yes	Yes	Yes	Yes
Skills	Technical know-how in ICT applications	ICT pedagogy	ICT pedagogy	Promote communities of practice	Self driven efforts in the use of ICTs

Internet Access	Broad band internet	Broad band internet	Broad band internet	Broad band internet	Broad band internet
Timetabling of ICTs	Yes	Yes	Yes	Yes	Yes

After having discussed the opportunities and the challenges that ICTs bring in teaching. Next is the future research recommendation in teaching with ICTs.

5.4 Future Research Recommendations

5.4.1 Future research should be carried out to identify better methods to present more interesting lectures and presentations to students in using ICTs in teaching.

5.4.2 More research should be carried on how to collaborate more with fellow teacher educators and with other teacher educators within and outside the University of Namibia campuses.

5.4.3 Additional research should focus on how to incorporate indicators which would adopt state-of-the-art data collection methods, in order to prioritize and develop, modify, and highlight what needs to be put in place in present and future needs in the use of ICTs in teaching. These indicators will help to determine whether the objectives are met and to compare Namibia with other countries in the use of ICT in teaching at the tertiary level.

5.4.4 Further research should focus on how to integrate ICT in education across the curriculum.

5.4.5 Other research should focus on how the technical staff can better assist teacher educators in the use of ICTs in teaching.

5.4.6 Added research should focus on more opportunities for students to collaborate with their classmates or learn from others outside their classroom.

5.4.7 Research should focus on how to engage students in multimedia production projects.

5.4.8 Further research should focus on ICT integration for students with disabilities in teacher education.

5.4.9 Additional research should focus on how NGO, Philanthropist individual and Private companies can get involved in ICT in education.

5.4.10 Other research should focus on how to effectively use Social Media in teaching.

5.4.11 More research should focus on how Learning Management Systems can be better incorporated in teaching.

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Appendices

Questionnaire for the teacher educators

Purpose: *The purpose of this study is to evaluate the implementation of the Information and Communication Technology (ICT) Policy for Education in the Faculty of Education at the University of Namibia*

Directions: *Please answer all the questions. Information provided and all research materials collected will be held in strictest confidence and will only be used for research purposes. Your response to this questionnaire is highly appreciated.*

This questionnaire comprises the following parts:

Part A:	Biographical Information
Part B:	ICT Policy for Education
Part C:	ICT usage
Part D:	Professional Development
Part E:	Infrastructure
Part F:	Division of Labour
Part G:	Community of Practice
Part H:	Obstacles

A. BIOGRAPHICAL INFORMATION - Please tick (√) item 1-5

1. Sex**:** □ Male □ Female

2. Age: □ <30 □ 30-39 □ 40-49 □ >50

3. Highest Qualification:

□ High School □ Bachelor Degree □ Masters □ PhD

4. Rank:

□ Tutor □ Lecturer □ Senior Lecturer

□ Associate Professor □ Professor

5. Campus:

□ Windhoek - Khomasdal □ Windhoek - Main

□ Hifikepunye Pohamba □ Rundu □ Katima Mulilo

6. Department:____

7. Years of teaching with ICTs at your campus: ___________________________________

8. Which subject fields do you teach at your campus? (please tick (√) all that apply)

Mathematics Education		Integrated Media and Technology (IMTE)	
Social Studies/Science		Science Education	
Languages		Agriculture and Life Science	
Practical skills		Other (please specify)	
Education Theory and Practice			
Commerce			
Education Theory and Practice			
Commerce			

B. ICT POLICY FOR EDUCATION

9.Below are choices as they relate to the ICT Policy for Education.

Please put only one (tick (√)) in each row

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
a. To foster global partnerships with other Institutions founded on common interest					
b. To promote equality premised on good governance, democracy, and human rights					
c. To harness the possibilities of ICT for education					
d. To remove the constraints in implementing ICTs in education					
e. To provide scenarios for applying ICTs in different environments					
f. To prepare students for the world economy of tomorrow					
g. To cover the prescribed curriculum content					
h. To improve students' performance on assessments/examinations					
i. To individualize student learning experiences in order to address different learning needs					
j. To increase learning motivation and make learning more interesting					
k. To foster communication skills in face-to-face and/ or on-line situations					
l. To prepare students for responsible Internet behaviour (e.g., not to commit mail-bombing, such as spam, etc.) and/orto cope with cybercrime (e.g. Internet fraud, illegal access to secure information, etc.)					

C. INFORMATION ON ICT USAGE

10.Rate your computer skills. (Please tick (√) one)

- ☐ Novice (not really comfortable using a computer)
- ☐ Intermediate (comfortable using a computer)
- ☐ Advanced (have developed some expertise and enjoy using a computer)

11.Approximately how often do you use each of these ICT applications/tools in your teaching?

Please put only one tick (√) in each row.

	Daily	Weekly	Monthly	Once or twice a year	Never	Not Available
a. A web site (e.g. Blackboard)						
b. Word processing packages						
c. Spread sheets						
d. Databases						
e. Online discussion forums						
f. Presentation software (e.g., Power Point)						
g. E-mail communication						
h. Search engines for the Internet						

(e.g., Google, Yahoo)						
i. Drill/Practice Programmes, Tutorials						
j. Others (Please specify)						

12.How do you use ICTs in your classes? (Please tick (√) all that apply)

a. to organize and store information	
b. to collect data and perform measurements	
c. to manipulate/analyze/interpret data	
d. to communicate information	
e. to create visual displays of data/information (e.g., graphs, charts, maps)	
f. to plan, draft, proofread, revise, written text	
g. to create graphics or visuals of non-data products (e.g., diagrams, pictures, figures)	
h. to create visual presentations	
i. to perform calculations	
j. to create models or simulations	
k. to support individualized learning	
l. to access information as part of lessons	
m. to post course information and resources	
n. to supplement face-to-face instruction	
o. to collaborate with others	
p. to deliver a course	
q. other (please specify)	

13.Looking ahead to the coming two years, what priority will you give to the use of ICT in enhancing your teaching practice in the following areas?

Please mark only one choice in each row.

	Not at All	Low Priority	Medium Priority	High Priority	Undecided
a. To monitor more effectively the progress of my students					
b. To provide exercises to students in order to practice skills and procedures					
c. To provide better and more interesting lectures/presentations to my students					
d. To engage students in multimedia production projects					
e. To provide more activities that address the individual differences among my students					
f. To involve students in collaborative, short projects (2 weeks or shorter)					
g. To involve students in extended collaborative projects (longer than 2 weeks)					
h. To involve my students in scientific investigations (involving laboratory work)					
i. To provide more opportunities for my students to collaborate with or learn from people outside of their classroom, including peers and external experts					
j. To collaborate more with fellow lecturers and others within and outside my campus					
k. To provide more opportunities for my students to collaborate with their classmates					
l. To arrange self-accessed activities for my students					
m.Others (Specify)…………………………………………………………					

14.How much do you believe ICT has changed the way you deliver lessons (Please tick (√) one)

Greatly	Somewhat	Not at all

D. PROFESSIONAL DEVELOPMENT

15.Have you received any professional training in the use of ICT during the past two years (2013-2014)? (Please tick (√) one)

Yes	No

If, no why not? ***If yes, specify?***

16.Specify your qualification(s) for teaching with ICT's?,

(Please tick (√) all that apply)

None	Certificate	Diploma	Degree	Other (Please specify)

17.Have you acquired knowledge and skills in using ICT for teaching and learning in any of the following ways?

Please mark only one choice (√) in each row.

	Yes	No
a. Via informal contacts/communication		
b. Via the ICT coordinator or technical assistant		
c. Via university courses		
d. Via training from a teacher who has attended a course		
e. Via the campus working group or committee for ICT in education		
f. During meetings of the teaching staff where the use of		

ICT/computers in education is a regular item for discussion		
g. Via a regular newsletter (printed or electronic)		
h. Via courses conducted by an external agency or expert (in the university or on distance)		
i. Via observation of and discussion with colleagues		
j. Via reading professional journals and similar publications		
k. Others (Specify)		

18. For each of the following ICT-related courses, please indicate whether it is available to lecturers at your campus and who provides the course (inside or outside the campus).

Please put only one (tick (√)) in each row

	Not Available	Available Provider at the campus	Provider is an external organization
a. Introductory course for Internet use and general applications (basic word-processing, spreadsheet, databases, etc.)			
b. Technical course for operating and maintaining computer systems			
c. Advanced course for applications/ Standard tools (e.g., advanced word-processing, complex relational databases)			
d. Advanced course for Internet use (e.g., creating websites/developing a home page, advanced use of Internet, video conferencing)			
e. Course on pedagogical issues related to integrating ICT into teaching and learning			
f. Subject-specific training with learning software for specific content goals (e.g., tutorials, simulation, etc.)			
g. Course on multimedia use (e.g., digital video and/or audio equipment)			
h. Others (Specify)..			

E. INFRUSTRACTURE

19. Do you have a computer assigned to you at your institution?

(Please tick (√) one)

Yes	No

20. If your answer to the above question is **Yes**, which software are installed on your computer that you use for teaching purposes? If your answer is **No**, please go to question **21.**

(Please tick (√) all that apply)

a. Microsoft Office (Word, Excel, Powerpoint, Publisher)	
b. Open Source software	
c. Media Player	
d. Educational Software	
e. Adobe Reader	
f. Internet	
g. Others (Please specify)	

21. If your answer to question 19 is **No**, do you have access to a computer that you use or teaching purposes?

(Please tick (√) one)

Yes	No

If your answer to question 21 is **No**. Please proceed to the next section. (**F. Division of Labour**)

22.How many hours per week do you use the internet for research and school related activities?

(Please tick (√) all that apply)

Less than 1 hour	1 hour	2 hours	3 hours	4 hours	5 hours	More than 5 hours

23.How many hours per week do you use your computer for teaching related activities apart from internet use?

(Please tick (√) all that apply)

Less than 1 hour	1 hour	2 hours	3 hours	4 hours	5 hours	More than 5 hours

24. How would you rate the speed at which you find and download materials from the internet.)? (Please tick (√) one)

More than 5 minutes	More than 2 minutes	Less than 30 seconds	Less than 10 seconds	Not Applicable

25. Do you download your teaching materials from the network or internet ? (Please tick (√) one)

Yes	No

26. Do you upload your teaching materials to the network or internet? (Please tick (√) (one)

Yes	No

F. DIVISION OF LABOUR

27.Below are choices as they relate to the division of labour at the University.

Please put only one (tick (√)) in each row)

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
a. There is clear division of labour at the University					
b. My role at the University is clearly specified					
c. Support staff and technicians successfully complete their tasks on time					
d. My job offers me the opportunity to grow					
e. I am personally in agreement with the stated goals of my work duties					
f. Routine technical matters are handled quickly					
g. There is review on the mission, goals, and objectives periodically at the University about the ICT Policy for Education					
h. My immediate supervisor has ideas that are helpful to me and my work group					
i. I have the information that I need to do a good job					
j. Others (please specify)…………………………………………………………………………					

28. When you report a problem to the support staff (in the lab or in the classroom), how long does it take to fix the problem)? (Please tick (√) one in each row)

More than 10 days	More than 5 days	Less than 2 days	Less than 1 day	Not Applicable

29. When you report a problem to the Computer Centre how long does it take to fix the problem)? (Please tick (√) one in each row)

More than 10 days	More than 5 days	Less than 2 days	Less than 1 day	Not applicable

30. When you report a problem to a co-worker/colleague, how long does it take to fix the problem)? (Please tick (√) one in each row)

More than 10 days	More than 5 days	Less than 2 days	Less than 1 day	Not applicable

31.When the problem is solved by the support staff, is it solved to your satisfaction? (Please tick (√) one in each row)

Not at all	Some times	Most of the times	Always	Not applicable

32.When the problem is solved from the Computer Centre, is it solved to your satisfaction? (Please tick (√) one in each row)

Not at all	Some times	Most of the times	Always	Not applicable

33.When the problem is solved by a colleague, is it solved to your satisfaction?
(Please tick (√) one in each row)

Not at all	Some times	Most of the times	Always	Not Applicable

34.What can the support staff do to help you to do your work better?

35.What can the ICT technicians do to help you to do your work better?

G: COMMUNITY OF PRACTICE

36.Below are choices as they relate to the community of practice at the University.

Do you have a community of practice, where you share knowledge about the effective use of ICTs at your campus? If your answer is **YES** to question 36 answer do (**a** to **o**). If your answer to question 36 is **No**. Please proceed to the next section. (**H. OBSTACLES)**

(Please tick (√) one)

Yes	No

Please put only one (tick (√) in each row)

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
a. The community strengthen collaboration across departments, offices, and units					
b. There is a sense of trust, rapport and a sense of community					
c. Members roles and expectations are clearly articulated					
d. The community solves problems and make decisions using job-relevant knowledge					
e. My views are usually welcomed					
f. The atmosphere at the University is friendly, cooperative and pleasant within ICT					
g. I benefit daily from the relationships established					
h. There is orientation for new members at the University					
i. Meetings generally have free discussion					
j. The purpose of each task or agenda item is defined and kept adhered to					

H. OBSTACLES

37.What are the constraints that hinder the use of ICT in teaching and learning at your campus? (Please tick (√) all that apply)

a. lack of training in ICT pedagogy	
b. lack of technical know-how of ICT applications	
c. lack of computers	
d. lack of the basic equipment for the establishment of ICT i.e. network equipment	
e. limited Internet access	
f. limited support for the development of ICT skills of teacher educators	
g. lack of technical support provided at the campus	
h. lack of adequate awareness about ICT by the management at the campus	
i. insufficient budget allocation in place for use in procurement of ICT tools such as hardware and software	
j. lack of time to learn and incorporate ICT skills and tools into lessons	
k. fear of ICT tools	
l. lack of collaboration with other teacher educators to design lessons that accommodate ICT integration across subjects	
m. the workload makes it impossible to use and integrate ICT tools	
n. unreliable power supply makes access to ICTs difficult	
o. the information technology bandwidth makes the downloading of information slow and difficult	
p. training budgets for ICTs are often not sufficient	

q. Others (Please specify)	

Thank you for taking time to complete the questionnaire.

Interview questions for the teacher educators

Purpose: The purpose of this study is to evaluate the implementation of the Information and Communication Technology (ICT) Policy for Education in the Faculty of Education at the University of Namibia.

Instructions: The interview will last about 30 minutes. The information gathered will be treated confidential and the identity of the interview will be kept anonymous.

Construct	**Questions**
Biographical information	What is your name? How long have you been a lecturer at your campus?
Vision	What is your understanding about the vision of the ICT Policy for Education? How does the University management facilitate the ICT Policy implementation? Does the University management suggest or prescribe to you the type of ICT you use in the classroom? Do you think it is important to use ICTs to teach your subjects? Why or why not?
ICT usage	How do you rate your computer skills? How do you use ICTs to present tasks? How do you use ICTs to support learning? How to do you use ICTs to assess learning outcomes? How many hours per week do you use the computer to do research and school related activities? How many hours per week do you use the computer for teaching and learning activities?

	Have students benefited from using ICTs? If yes, how? If not, why not?
Professional Development	Have you received any professional training in the integration of ICT during the past two years? If yes, in what, if not why not? List your qualification(s) in teaching with ICTs? In the coming two years, what training would you require to do your job better?
Infrastructure	Do you have an assigned computer at your campus? Which software programs do you use to prepare and teach your course(s)? How would you rate the speed at which you download or upload information from the internet? Do you use ICTs to communicate with colleagues and/or administration? Do you use ICTs to communicate with the Ministry of Education?
Maintenance	When you report a problem to the computer center, how long does it take to fix the problem? When a problem is solved from the computer center, is it solved to your satisfaction? What can the computer center do to help you do your work better?
Impact	Did your ICT skils improve as a result of ICT Policy implementation?

	Do you incorporate new teaching methods as a result of ICT Policy implementation? Do you use ICTs to prepare lessons and teach your course(s)? Do you complete your administrative tasks using ICTs? What is your judgement regarding the implementation of the ICT Policy for Education in teaching and learning?
Obstacles	What is your view regarding the constraints that hinder the implementation of the ICT Policy at your campus? How do you overcome the barriers affecting the integration of ICT in teaching and learning?

Observation schedule for lecturers

Date: .... *Lecturer:* .... *Campus:*................. *Subject:*.......................

A. **Student groupings (single, small, large, etc.) and Roles:** --------	**Notes on what to follow up**
B. **Brief description of classroom infrastructure/lab setting Activity/Lesson:** --	--
C. **ICT usage by the teacher educator for teaching and learning:** **C.1 Facilitate and Inspire Student Learning and Creativity** -- **C.2 Design and Develop Digital-Age Learning Experiences and Assessment** -- **C.3 Model Digital-Age Work and Learning** -- **C.4 Promote and Model Digital Citizenship and Responsibility** -- **C.5 Engage in Professional Growth and Leadership** --	--
D. **Curriculum relationship to the ICT(s) used and the learning/content objectives:** --	--
E. **Description of any example of technological failure and how it was handled:** --	--