Adoption of cloud pedagogy by Higher Learning Institutions in Southern Africa

By

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DECLARATION

I, Nowell Chibaro, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed Date…….

ABSTRACT

Previous Research work in the field of education has highlighted that technology plays an integral role in deepening and accelerating learning. New technologies are providing educators with new tools to support teaching. Cloud computing is one such new technology that promises to take the knowledge delivery process to greater heights. The integration of cloud computing into the teaching and learning environment will enhance the curriculum and creates an embedded learning environment known as cloud pedagogy.

Cloud pedagogy has been defined as the art of teaching while encouraging omnipresence learning via cloud based applications (Barack, 2014). In simple terms, it refers to any form of teaching and learning that is done using cloud-based learning. Higher Learning Institutions (HLIs) around the world have already started integrating cloud pedagogy into their curriculum and reaping many benefits from this. While the adoption of cloud pedagogy is gaining popularity around the world, this has not been the case in Southern Africa. The region is lagging behind in the adoption of cloud pedagogy and the adoption rate is largely unknown. In addition, few studies have tried to identify the factors that are influencing the slow adoption rate of cloud pedagogy in the region. This study addresses these issues by investigating factors that influence the adoption of cloud pedagogy in Southern Africa. It also investigates the barriers that hinder the adoption process.

This research is exploratory in nature and adopts a qualitative research approach. It therefore follows the interpretivist paradigm. The study was done at two universities in Southern Africa; Cape Peninsula University of Technology (CPUT) from South Africa and Great Zimbabwe University (GZU) from Zimbabwe. Survey questionnaires were used to collect data. The questionnaires were distributed online but printed copies were also made available to respondents who preferred hard copies. The study was guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) in both data collection and analysis. It employed the convenience and purposive sampling methods to select the two institutions and the respondents. Literature on adoption of cloud computing was also explored to arrive at a deeper understanding of the adoption of technology.

Thematic analysis was used to analyse the collected data. The themes were derived from the theoretical constructs of UTAUT. The aims and objectives of the study were conceptualised around the four main constructs from the theory (performance expectance, effort expectance, social influence and facilitating conditions). The findings of the study revealed that the four constructs from the UTAUT framework are important factors that may

influence the adoption of cloud pedagogy. The findings show that the respondents perceived cloud pedagogy to be easy to use. They also perceived it to be very useful. The respondents agreed that cloud pedagogy makes teaching and learning more effective and efficient.

The findings also revealed other factors that influence the adoption of cloud pedagogy. These include availability of ICT enabled infrastructure and resources, trust in technology and awareness of the technology. From these factors, a modified UTAUT model was built.

Key words: cloud computing, cloud pedagogy, UTAUT, adoption, factors

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DEDICATION

I would like to dedicate this project to my family and friends who have always been there for me.

GLOSSARY

Abbreviations and Acronyms

UTAUT- Unified Theory of Acceptance and Use if Technology

ICT- Information Communication Technology

ISP – Internet Service Provider

HLI – High Learning Institutions

SADC – Southern Africa Development Community

LMS – Learning Management System

WWW- World Wide Web

CPUT – Cape Peninsula University of Technology

GZU – Great Zimbabwe University

NIST – National Institution of Science and Technology

PaaS – Platform as a Service

IaaS – Infrastructure as a Service

SaaS – Software as a Service

CHAPTER ONE: GENERAL INTRODUCTION

1.1 Introduction

In the past few years, we have seen tremendous developments in information and communication technologies, (ICT) and the internet in Southern Africa. The use of the internet and ICTs to deliver solutions (be it business or educational) is now considered to be a mainstream practice. We have seen internet service providers (ISP) such as liquid telecoms rolling out base stations across the continent in a move to try to improve the availability and accessibility of internet resources to all areas of the African continent. This development has heightened the need for business organisations to utilise their potential so as to improve their service delivery to the public. Higher Learning Institutions (HLIs) have not been left out on this move; they have been challenged to also utilise their potential so as to improve the quality of, and widen access to education using online resources.

Educational institutions around the world are now searching for innovative ways to improve the delivery of knowledge to learners for them to attract more students and survive this challenging distributed knowledge production system (Mlitwa, 2005). They are adopting various kinds of technologies to attract new students, and to improve co-operation with various stakeholders (Gutlig, 1999; Middlehurst, 2003). HLIs have developed and adopted various forms of pedagogical technologies with the aim of improving knowledge delivery in a cost effective manner that will satisfy both the staff and the students (Ovum survey released 23 November 2013). This has changed their curriculum into Blended Learning (BL) or flipped classrooms. Pedagogical technologies are those learning technologies that are used to complement the traditional face-to-face knowledge delivery system through interactive learning using ICT tools such as computers, smartphones or the internet.

The role of learning with technology is evolving rapidly, as are institutional expectations for functionality and service. Many higher education institutions in Southern Africa have adopted various learning management systems, including video conferencing and multimedia facilities, but delivery is still facing many challenges. These challenges include the high costs ICT infrastructure, high cost of bandwidth and inadequate availability of competent technical staff (Unwin et al, 2010; Lwoga, 2012). The recent emergence of new technologies like cloud

computing provide an opportunity for HLIs to alleviate most if not all of these challenges by effectively utilising the potential of these services.

Cloud computing for instance has the potential to alleviate these challenges as well as making the knowledge delivery process more efficient. Educational institutions worldwide are putting a lot of investment towards ICTs, trying to realise the benefits tired to the incorporating technology into the teaching process and also increasing their digital visibility, hence giving rise to a greater demand for the use of cloud computing. According to Navneet Johal, institutions that shun the adoption of cloud-based applications may find it difficult to survive the ever competitive education industry (Ovum, 2013).

1.1 Background to the Research Problem

Nowadays, higher learning institutions experience a lot of problems in their operations. These range from the increase in competition for attracting new students, decreased enrolments rates, increased numbers of non-traditional students and lack of adequate funding from government (Baltaci-goktalay & Ocak, 2006). The institutions have now turned to technology as a solution to their challenges (Hooper & Rieber, 1998). They believe that integrating ICTs into all their operations would help in eliminating most of these problems and also present them with more opportunities for expansion.

Although the current interest in technology-enhanced learning is a phenomenon fuelled by developments since the creation of the World Wide Web in 1992, the history of learning with technology goes back much further. Some researcher argue that the use of papers, books and the traditional chalkboard is a form of technology meditated learning (Jones, 2011a).

Due to the ever increasingly competitive higher education market, institutions have developed and adopted various forms of pedagogical technologies with the aim of improving their operational efficiency (Ovum survey released 23 November 2013). They have made significant investments to procure, and maintain various technologies in order to complement the traditional face-to-face education delivery system. (Mtebe, 2013) cited that a study conducted by Munguatosha, Muyinda, and Lubega (2011) revealed that 80.2% of HLIs in Africa were using various Learning Management Systems (LMS) by the end of 2011 (78% Moodle, and 2.5% Blackboard).

Advancements in ICT technologies like autonomic computing and virtualisation have fuelled the development of cloud computing. Initiated from the idea of resources virtualisation; cloud computing promises to be the “next big-thing” in the world of information technology (Sultan, 2010). This promises significant benefits for higher educational institutions that adopt the technology. The emerging new technology for teaching and learning have gave rise to the need to better understand the process of technology adoption to ensure that institutions reap the benefits tired to adopting the cloud.

With all the interest and speculation that cloud computing has attracted, very few researchers have tried to determine its adoption by higher education institutions into their learning technologies using the unified theory of acceptance and use of technology. Previous research on the adoption of cloud computing have mainly concentrated on organisations in developed economies like in Europe and North America, neglecting those in Africa, and none of them have put great emphasis on the education field. Adoption of cloud computing for pedagogical technologies promises a significant amount of benefits to the institutions and the students themselves. It will increase the scalability, flexibility, and availability of higher education systems.

1.2 Statement of the Research Problem

In this technological era, student learning is no longer limited to the classroom; but rather it can be improved by providing students with access to learning resources anywhere. New technology like cloud computing promises substantial benefits to higher education, but its adoption for pedagogical technologies by higher education institutions in Southern Africa is very low, and the sector has not been able to obtain related benefits from the technology.

According to Rivard et al. as cited by Trope (2014), cloud computing gives organisations in developing countries the opportunity to access large scale remote IT resources in a very efficient manner which is less costly to them. Applying this to the education sector, HLIs would accumulate a lot of benefits from this technology if they were to integrate it into their operations

1.3 Research aim

HLIs are known to be innovators and early adopters of new technology but however, this has not been the case with cloud computing. The adoption of cloud computing in the education sector in the SADC countries is still largely unknown (Muriithi & Kotze, 2012). This research aimed to explore the factors that are affecting the widespread adoption of cloud pedagogy by HLIs in the SADC region. It also explored how cloud computing can help improve the education delivery process. The research was also aimed at evaluating the possible benefits that the institution can get through the implementation of the cloud concept in the learning operations.

1.4 Research question, sub-questions and objectives

The research questions are as outlined in the table below:

Table 1.0 Research questions, methods and objectives

Research question	What factors affect cloud computing adoption into the technology-enhanced learning environment in Southern Africa's HLIs?	
Research sub-questions	**Research method(s)**	**Objectives**
1. What are the learning technologies that are currently being implemented by higher educational institutions and how are they being implemented?	Questionnaire	Identify the technological learning tools that are currently being used by higher learning institutions.
2. How is cloud computing being implemented by higher education institutions?	Literature analysis Questionnaire	Identify how cloud computing is currently being used in HLIs.
3. What challenges and factors are associated with cloud pedagogy adoption?	Literature analysis Questionnaire	Identify challenges and factors regarding the adoption of cloud technologies in education
4. What is the future of cloud computing in education?	Literature analysis. Questionnaire	Explore the possible benefits and developments that cloud computing can bring.

1.5 Rationale of study

It has been proved that new technological innovation play an important role in economic development and it helps business organisations to achieve economies of scale. The new generation of students that are being enrolled at universities currently are well versed in the new technologies. These students, known as digital natives (Prensky, 2011) have not known a world without the internet. Such students can cope easily with using technology as a medium to deliver education in and outside the classroom.

The study recognises that HLIs implement many ICT systems from accounting systems, HR systems and email systems through to educational systems. Pedagogical technologies are only a small part of ICT systems. The study only looked at cloud computing adoption on pedagogical systems, leaving out other systems. It avoided considering other business applications because of the on-going debate about cloud privacy and security; that is the general distrust of having critical company data stored remotely. Organisations believe that it is much better to run or store your own applications than to entrust someone else with your critical data. However, these concerns do not affect pedagogical technologies; hence this study has an exploratory nature.

Adopting cloud-based pedagogical technologies will bring a lot of advantages to both the institution and the students. Some of these advantages include:

Cloud based pedagogical technologies have great flexibility. The number of concurrent users on a cloud LMS is very flexible. Having many users online at the same time will not affect the functionality of the system. If the number of system users increases, the system will not experience an overload, and will not slow down at all. This is a huge boon for HLIs with large numbers of students. As the numbers grow, they can all be seamlessly initiated into the system.

Cloud computing has ideal infrastructure for e-Learning. Cloud computing can offer arguably the best infrastructure to host an e-Learning solutions. eLearning is increasingly becoming more important in education; with the increase in numbers of non-traditional students, many universities now offer online platforms for learning to their students (graduate and undergraduate degree programmes.)

Hosting pedagogical technologies on the cloud can increase the depth of the curriculum. Cloud computing would allow learners to access sources that are external to their institution. This can allow the student to create an individualised learning that suits their learning Cloud-based learning tools are more accessible to learners and educators. Students will be able to access learning material on-the-go, anywhere and anytime as long as they have internet enabled devices.

Cloud computing offers ideal collaborative learning environments. Collaborative learning is when come together in small groups with the objective of learning. The students help each other in the learning; hence they are responsible for each other's learning. Collaborative instructional methods are easily accessible when pedagogical technologies are hosted on the cloud. Pixel-online.net recommends the use of cloud computing as an "infrastructure that enables universities to share their resources with businesses and industries for technological advancement."

Cloud computing can change the way learning is done in institutions. Cloud applications can help change the way information is passed in the classroom. It can help change from the traditional set up where instructions are delivered by the lecture to an an environment where there is interaction and collaboration among the learners and the lecturer. Research has suggested that learning in small groups allows the student to identify their areas of weakness and correct each other easily (Gayatan & McEwen, 2007). This improves the student's problem solving skills hence encouraging interpersonal debelopment (Vygotsky, 1978.

Cloud computing can remove learning barriers. Cloud applications allow students to have access to learning material from anywhere. This extends the learning environment beyond the classroom or the school premises. This type of learning known as remote learning will help incorporate diversity in learning and also provide instructional value.

1.6 Contribution of the Research

The research has the potential to make several contributions to the implementation of the cloud concept in the educational sector. From a practical standpoint, the output of this research study will be of great relevance to the Southern African education community:

(i) An outline of the factors that prevent HLIs from adopting cloud computing on pedagogical technologies.
(ii) A means by which higher education institutions can systematically assess the significance of cloud computing in their organisations
(iii) Some guidelines to encourage HLIs to use cloud computing.

In so doing, the above would increase the awareness of the benefits that can be derived from cloud computing. It would also have a significant impact on how ICTs can be utilised in Southern Africa. It is the researcher's contention that this increase in cloud pedagogy awareness will attract the attention of scholars. This infers a contribution of this study to the community of researchers. The application of UTAUT and the resultant modified UTAUT will be this study's direct contribution to the cloud pedagogy body of knowledge.

1.7 Significance of study

This study outlines basic information that can be used to do further research on ICT-driven curricula in the SADC region. Identifying factors that influence the adoption of cloud based learning applications helps stakeholders and service providers to take into consideration these important factors. This will help them to find possible solutions to the problems and challenges faced by both HLIs and students to meet their specific needs. The identified factors will contribute to the development of a relevant model for cloud adoption by HLIs in developing countries. Knowledge of these factors can also contribute towards the shaping of government policy on education development.

1.8 Limitations of study

This study recognises many methodological and technical limitations. The major limitation experienced was the lack of adequate reference material or limited access to required resources. Since the researcher is the primary instrument of data collection and analysis, another limitation to the study was investigator sensitivity (Merriam, 1998).

1.9 Southern Africa: The empirical setting.

This section provides a brief background on Southern Africa, the ICT developments in the region and the rationale behind the selection of the case.

1.9.1 The Southern African Region

Figure 1 SADC Map

The Southern African region is made up of 15 countries namely Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. All these countries are still developing.

In April 1980, the countries came together in Zambia and formed the Southern African Development Co-ordination Conference (SADCC). This was after the Lusaka Declaration. SADCC was formed with the aim of advancing political liberation and facilitate independence for its member states. It was also aimed at facilitating economic development through coordination of the member states (SADC, 2012a). On its formation, four principal objectives were stated, these are:

- *"Reduce the dependence of its member states*
- *Create linkages that would lead to equitable regional integration*
- *Mobilisation of Member States' resources to promote the implementation of national, interstate and regional policies*
- *Concerted action to secure international cooperation within the framework of the strategy for economic liberation."*

Sources (SADC, 2015) (http://www.sadc.int/about-sadc/overview/history-and-treaty/)

In 1992, the organisation was transformed into Southern African Development Community (SADC); which had a mandate to ensure economic development for its members. This was done through the signing of the SADC treaty. SADC's main objective are:

- *"Achieve development and economic growth*
- *Alleviate poverty*
- *Enhance the standard and quality of life of the peoples of Southern Africa*
- *Support the socially disadvantaged through regional integration"*
  (source:* (SADC, 2015))*

The member states plan to achieve the objectives through increased alliance, that is supported by democracy and sustainable development (SADC, 2012a).

1.9.2 ICT developments in the region

As mentioned earlier, SADC is made up of developing countries, countries which are still striving to maximise ICT usage to facilitate their economic development programmes. In 2012, the committee released a Regional Development program which outlines the strategies to be taken to develop new infrastructure by the year 2027 (SADC, 2012b). from the developed program, it is evident that the region already has most of the ICT infrastructure in place, but it was implemented inefficiently.

According to a study done by the Southern African Regional Universities Association (SARUA), all the members of SADC are developing their ICTs at different rates(Wilson-Strydom & Fongwa, 2012). The study used the key ICT indicators to compared the countries' levels of ICT development.

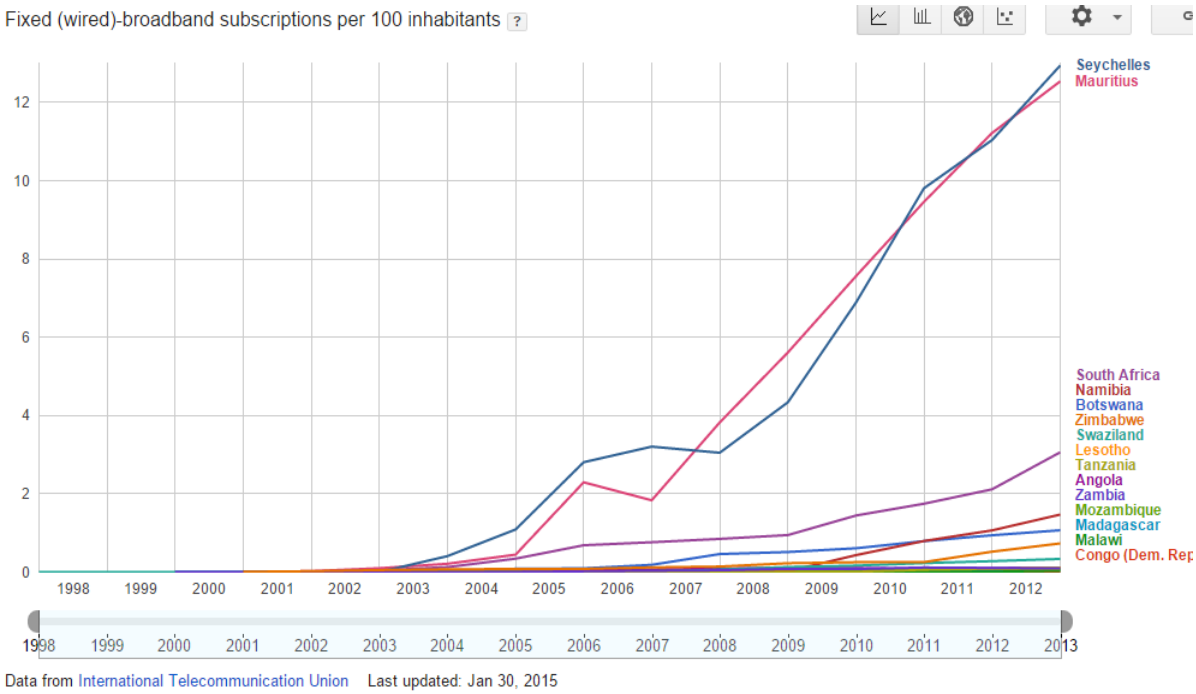


Figure 1.2 Fixed (wired) broadband subscriptions per 100 inhabitants

Source: (http://www.itu.int/net4/itu-d/icteye/)

The study showed that Seychelles and Mauritius are the most developed in ICTs followed by South Africa, Namibia, Botswana and Zimbabwe. When comparing the levels of ICt for counties in the SADC region with other parts of the world, it is evident that the region still needs to develop more infrastructure. However with the current levels of ICT, we can say that Southern Africa is slowly progressing though the transition is happening at a slow pace.

According to SADC (SADC 2012b) ICTs in the region in 2012 were at the following levels:

- About 60% of the SADC population are using mobile technology
- Only 4% of SADC population use the internet.
- The use of postal mail is declining at a rate of 5% every year

Source: (http://www.sadc.int/themes/infrastructure/icttelecommunications/)

1.9.3 SADC higher education system

According to the Southern Africa Regional Universities Association (SARUA), it is very difficult to create an exact profile of the higher education system in the region at present (Wilson-Strydom & Fongwa, 2012). They attributed this to the fact that there region does not have records of all the universities in its member states. They also attributed the problem to the lack of coordination at both national and regional level among the universities and also the fact that the education sector in the region is still developing with new institution being developed.

However, a survey done by SARUA in 2012 cited that the SADC region had approximately 109 public universities, 526 publicly funded technical universities and polytechnics, and 456 privately funded higher education institutions (Wilson-Strydom & Fongwa, 2012). This is represented in Table 1.1.

Table 1.1 Number of higher education institutions per country in the SADC region
(Wilson-Strydom & Fongwa, 2012)

Country	Number of publicly-funded universities	Number of publicly-funded technical universities/colleges	Number of privately-funded, accredited universities and colleges	Other higher education institutions
Angola	6	No data	No data	
Botswana	2	23	7	
DRC	36	416	140	
Lesotho	1	3	9	
Madagascar	6	2	55	
Malawi	3	0	7	
Mauritius	11	0	55	
Mozambique	4	9	13	
Namibia	1	1	2	
Seychelles	1	0	0	
South Africa	17	6	118	50 (FET* colleges)
Swaziland	1	1	2	
Tanzania	8	11	22	
Zambia	3	43	32	239 (TEVETA)**
Zimbabwe	9	0	5	
Total	109	515	467	289

* Further education and training (FET) colleges
** Technical Education, Vocational and Entrepreneurial Training Authority (TEVETA)

Source: (Wilson-Strydom & Fongwa, 2012)

With these numbers it is evident that the accessibility of higher education is increasing in the region; but however, the region is still falling short of international and continental averages.

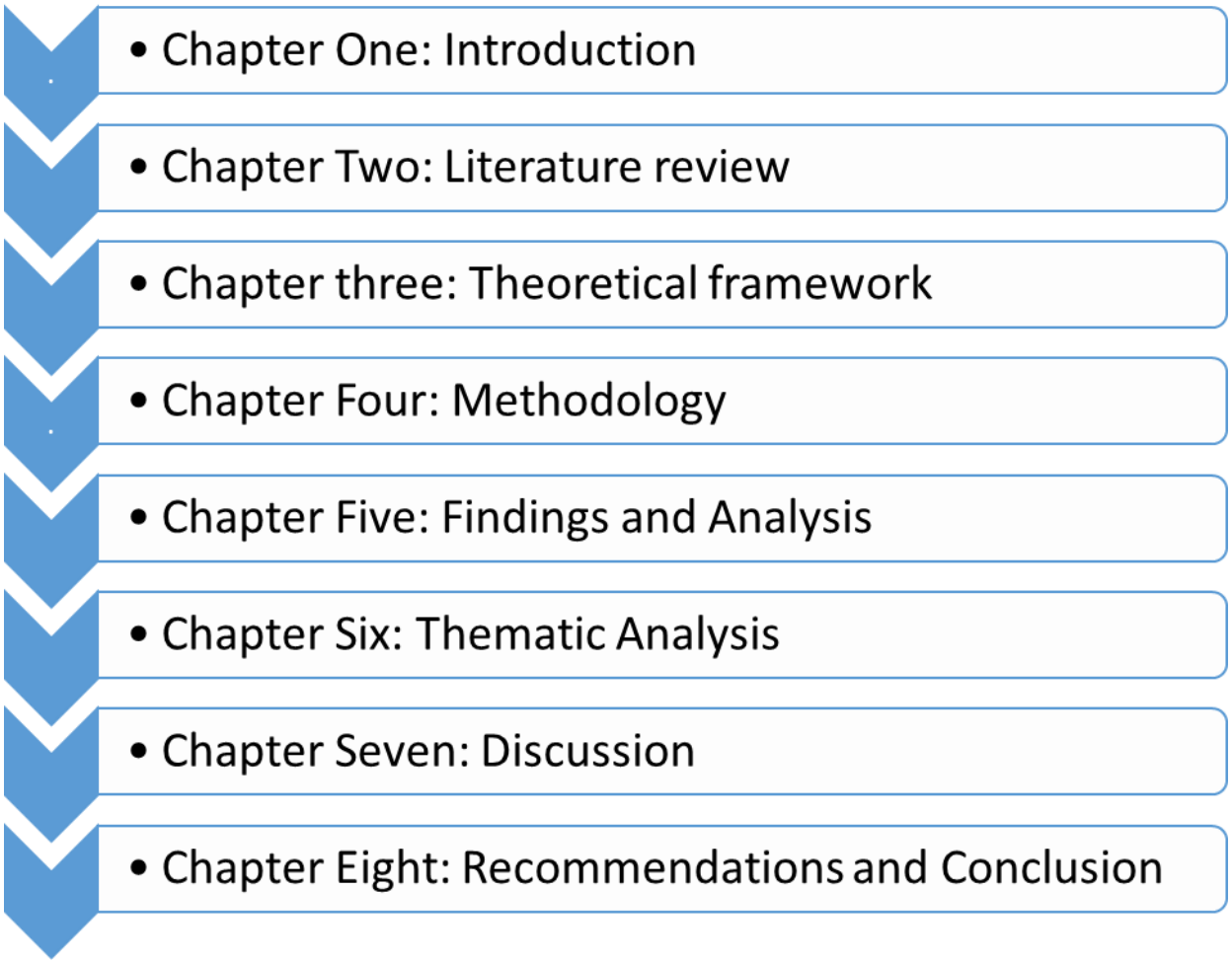
None the less, it is still committed to providing equal access to basic education to everyone (SADC, 2015) .

In 1997 the regional board established a pact on Education and Training which facilitates e the implementation of regional policies and programmes. This was done to ensure the availability of education to everyone in the region. As a result of this and other programmes, the enrolment in education in the region has increased with tertiary enrolment recording an increase of about 6.3% in 2010 (SADC, 2015).

Since the 1970s, the SADC region has invested heavily in the education sector. According to Kotecha, (2012), every year the member countries have spent approximately 5% of gross domestic product on education. This is almost equivalent to the 6% that is recommended by UNESCO (Kotecha, 2012).in 2010, the region spend more on improving education than any other region in the world (Kotecha, 2012).

1.10 Thesis structure

The thesis will be structured as follows:



Chapter one serves to introduce the problem to be addressed, the objective of the study, the background of the study, the research questions and the significance of the study.

Chapter two provides a literature review on the current status of the adoption of cloud pedagogy in the SADC region and also other parts of the continent.

Chapter three covers the various theories of technology adoption. It then describes the theoretical framework underpinning the study and justifies why it was selected.

Chapter four highlights the approach and methodologies taken to do the research and why it is appropriate. It also explains the sampling method, data collection method and analysis used as well as the ethical considerations of the study.

Chapter five presents the findings and analysis. The analysis will be divided into two parts. This chapter will present the first part of the analysis, which is narrative analysis.

Chapter six provides the second part of analysis which is thematic analysis.

Chapter seven presents a discussion of the findings.

Chapter eight concludes the study and presents a set of recommendations according to the findings.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter covers a review of the previous studies done on cloud computing adoption and cloud pedagogy. It starts with brief background information about ICT in education and online learning today and then goes on to describe cloud computing and cloud pedagogy. It also highlights models of cloud computing and theoretical and empirical studies on cloud computing adoption. Finally, it highlights potential applications of cloud computing in the education sector.

2.2 ICT in education

In the past century, we have witnessed significant technological developments that have had a positive impact on how society communicates, collaborates and shares knowledge. This has led to a revolutionary period in higher education marked by massive adoption of various ICTs into the sector. This initiation of information and communications technologies (ICTs) into the education sector is now in metamorphosis from 'flapping' to mass take-off (Salmon, 2005). Almost every learning institution in the world has adopted some form of ICT into their operations, be it in the teaching and learning process or the administrative side. ICTs can greatly facilitate the delivery and acquisition of knowledge to learners, offering an unprecedented opportunity to enhance the education sector. It promises to open up access to knowledge in many ways that were unimaginable a few years ago (World Bank, 1998).

According to Bonjoko (2008), ICTs have the ability to increase access to educationa resources; thus it presents an eqaulising strategy for developing economies (Banjoko 2008).

In a typical higher learning institution, ICT can be used in multiple ways. According to Nair and Hindle (2013), ICT in education has various definitions and it can be categorised as:

- ICT as a subject
- as a tool to support teaching
- as an administrative tool (i.e., learner management system, human resource systems).
- as a mode for communication.

This research is centred on educational technologies; hence it will adopt the definition of ICT as a tool to support traditional teaching methods. Educational technologies or pedagogical technologies can be seen as a new way of doing something familiar. Educational institutions around the world are now searching for innovative ways to improve the delivery of knowledge to learners for them to attract more students and survive this challenging distributed knowledge production system and also to improve their interaction with various stakeholders (Gutlig, 1999; Middlehurst, 2003).

2.2.1 What are educational technologies?

Educational technologies can be defined in many ways. It is sometimes defined as more than just computers and networks but rather anything that is used in the teaching and learning process; be it writing instruments, printed books or audio-visual media.

Rist and Hewer (Learning Technology Dissermination Initiative, 1996) defined learning technologies as "the application of technology for the enhancement of teaching, learning and assessment". Their definition mainly describes learning technologies as any form of using technology to supplement the face-to-face teaching process.

Additionally, some educators define learning technologies as any electronic or media devices such as computers, fax, mobile phones, radio broadcasting, teleconferencing or satellite that can be used either partially or fully as a means of delivering educational material (Siritongthaworn et al., 2006). Learning technology refers to any form of ICT that can be used to support the dissemination of knowledge.

The Association for Educational Communications and Technology provided a broader definition. They defined education technology as:

"…the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological process and resources."

This definition emphasises on ways to teaching and learning while using various forms of media. It also examines all aspects of the use of technology in an educational institution, from direct student learning to the administrative side.

There are various types of ICTs that can be used for learning. Educationists have classified use of ICTs in teaching and learning into various categories; these include computer-based learning and multimedia materials and the use of networks and communications systems to support learning. In the past, most of these learning technologies had been classified under various acronyms such as: Computer Aided Instruction (CAI), Computer Aided Learning (CAL), Computer Based Learning (CBL) and Computer Based Training (CBT) (Learning Technology Dissermination Initiative, 1996). With the evolution and invention of new technology that can also be classified as learning technology, new acronyms appeared, and these include Computer Aided Assessment (CAA) and Computer Mediated Communications (CMC), to mention a few (Learning Technology Dissermination Initiative, 1996).

2.2.2 Evolution / history of learning with technology

The 21st century has witnessed an abrupt increase in interest in technology enhanced learning environments. This interest was fuelled by developments using the internet since the creation of the World Wide Web in 1992. Although this phenomenon caught the interest of the public recently, the history of learning with technology dates back much further. The history stretches back to more than a decade ago.

If the definition of technology enhanced learning is fully expanded, the use of papers and books will be viewed as early examples of technology-mediated learning (Jones, 2011b). Some researchers argue that every form of instructional delivery involves some form of technology in some way (Reiser, 2001). (Saettler, 2000) as cited by Jones (2011) argued that educational technology antecedents go back to at least the fifth century BCE.

Aside from the use of papers and books, the history of learning with technology can be traced to the late 19th century when the chalkboard was invented. The chalkboard allowed teachers to share information with students on a face-to-face basis. It was a great invention although text had to be erased every time the teacher ran out of free space.

Many other learning technologies were introduced in the early 20th century. These range from the film strips which were invented in the 1920s which were delivered via overhead projectors and the Scantron devices which used machine language to read multiple choice answers. With the advent of the Apple II in 1977, desktops were introduced to the world of learning with technology. However it was the invention of the WWW in 1996 which sparked a big breakthrough in the field of learning with technology.

After the WWW was invented, many leaning applications were developed and put on the internet for public use. These range from interactive whiteboards which blend handwritten lecture notes with interactive technology to YouTube which educators use to upload and share instructional videos and tutorials with students.

The WWW also led to the development of online learning, thus the integration of online applications like learning management systems, eLearning and web 2.0 into the teaching and learning environment. Online learning was made more efficient by the introduction of mobile devices such as smartphones and tablets which are currently being used worldwide by educators and students to access learning applications and learning materials which are on the internet. In this day and age a high proportion of students own either one or both of these devices. In well developed economies, these devices have been fully integrated into the curricula, while in the developing world the process is still in progress.

2.2.3 Online learning today

Online learning has been in existence since the introduction of the WWW. Some refer to It as eLearning or virtual learning. Most people associate online learning with distance education but online learning itself now plays a very big role even within the formal education system. The rise of online learning's popularity is not showing any signs of slowing down. It has become so popular mainly because of the current generation of students who are being enrolled at universities who are well versed in the new technologies. These students, known as digital natives (Prensky, 2011) have not known a world without the internet. They are acquainted with using new technologies (smartphones, tablets, etc.), so introducing them to online course will be easy for them (Epignosis LLC, 2014).

Online technologies have revolutionised the learning process. They have changed how people acquire knowledge and skill. Educational institutions around the world are now adopting various kinds of technologies to supplement their traditional teaching methods. Some institutions have actively shifted from the traditional face-to-face teaching in a classroom to an entirely online mode; that is they have designed curricula which are offered fully online via the internet. Other institutions have partially adopted the online learning mode to supplement the traditional face-to-face teaching in what is commonly known as a blended learning environment (Karacapilidis, 2010).

There are various types of pedagogical technologies or learning technologies that are being adopted, with the most common being Moodle (with the largest adoption rate) followed by MOOC's, Edmodo, Blackboard, Eliademy and Skillsoft, among others.

In South Africa's Western Cape province, Mlitwa (2005), observed different patterns of the adoption of LMS among universities in the period from 2004 to 2005. The University of Stellenbosch and the Cape Peninsula University of Technology adopted a proprietary learning management system (WebCT), The University of the Western Cape (UWC) adopted an open source software based system (www.kewl.uwc.ac.za) which is a home-grown system (Mlitwa, 2005).

All these systems are online based and some are being hosted in-house by the institutions. Most HLIs in developing countries are still facing challenges in the delivery of these educational technologies. These challenges range from the cost of acquiring, managing, and maintaining ICT infrastructure, to inadequate availability of competent technical staff (Unwin et al, 2010; Lwoga, 2012), but with the recent emergence of cloud computing, most of these problems could be overcome. Cloud computing provides an opportunity for HLIs to alleviate some if not all of these challenges by effectively utilizing the potential of cloud services (cloud pedagogy).

Cloud computing is one of the current phenomena that are being discussed in the online education world. According to Miller (2008), many authors have suggested that cloud computing has numerous advantages for our everyday lives, including education (Kop & Carroll, 2011).

Adopting cloud computing in the teaching and learning process would create a new phenomenon called cloud pedagogy (Barack, 2014). Cloud pedagogy could arguably become an integral part of the future of learning in the coming years. Before we talk of cloud pedagogy, we need to understand what cloud computing is and how will it shape the future of learning and teaching.

2.3 What is cloud computing?

(Katz et al., 2011) state that “Literature on cloud computing suffers from hype and divergent definitions and viewpoints”. Many different authors have come up with various definitions of the term cloud computing with some arguing that it is just a new name given to a service that has been operative for some time. Katz et al. (2011) cited a report by McKinsey & Co. which detailed 22 distinct definitions of cloud computing. Armbrust et al. (2009) described cloud computing as being the “new term for the long-held dream of computing as a utility”.

Some ICT specialists have define cloud computing narrowly as an updated version of grid and utility computing; that is basically virtual servers available over the internet (Knorr, 2008). On the other hand, others argue that anything you consume outside your firewall is “in the cloud.” This definition also includes any form of outsourcing. For instance at a typical institution which hosts various systems within their IT department, accessing those resources from an environment outside the institutions’ network would be considered cloud computing.

However, notwithstanding the various definitions of cloud computing, the one proposed by the US National Institute of Standards and Technology (NIST) (Mell & Grance, 2009) is the most widely accepted and used. The Institute defined cloud computing as:

*“…*a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction*.”* (Mell & Grance, 2009).

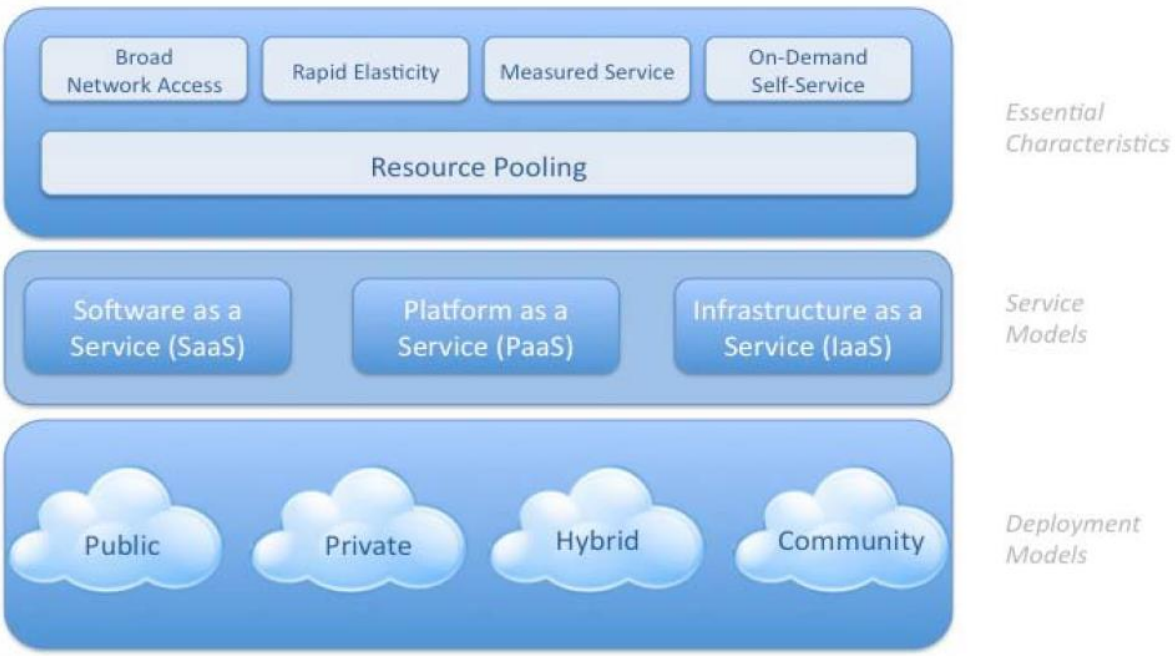


Figure 2.1 Visual representation of cloud computing

The Dialogic Corporation in their white paper on cloud computing (Dialogic Corporation, 2010) stated that the term cloud computing itself may have originated from diagrammatic representations of the internet or its various parts. They went on to state that it was devised to relate the result of moving applications and services onto the internet "cloud." This shows that they argued that cloud computing is just a new term invented to describe something that has been in existence for some time.

Cloud computing as a term was first introduced to the public realm by Amazon in 2006 when they introduced the Amazon Elastic Computing Cloud (EC2) system. However, other applications which utilise the same concepts, e.g. Google's Gmail were already in use but they were not being described as being on the cloud. The metaphor "cloud computing" became more popular in 2006 when Google described their commitment to this new mode of computing (Bogatin, 2006).

Some researchers argue that there is nothing new about cloud computing but it effectively utilises computing concepts that have been in existence from long back. Reese (2009) states that "*there is nothing fundamentally new about any of the technologies that make up cloud computing*". In this view, the history of cloud computing began in the late 1960s when Licklider introduced the idea of an "intergalactic computer network" (Kiiru, 2011). Licklider's

main vision was for everyone to be globally interconnected and to have access to information regardless of location.

2.3.1 Characteristics of cloud computing

Cloud computing is distinguished from other forms of computing by its various characteristics. The NIST identified five essential characteristics and eight common characteristics (Plummer et al., 2009; Mell and Grance, 2009).

The essential characteristics:

On-demand access: storage space and services that are consumed directly from the cloud can be automatically provisioned and released as per user request.

Broad network access: cloud computing services have huge network accessibility. They can be accessed over any network and they promote use of heterogeneous client platforms (e.g., mobile phones, tablets and laptops).

Resource pooling: the resources that are available on the cloud can be accessed by many consumers simultaneously. The resources can be easily assigned to a consumer according to their individual needs.

Rapid elasticity: allows for rapid provisioning of capabilities, in some cases automatically. The capabilities are unlimited to the consumer and can be easily scaled either inwards or outwards depending on the needs.

Measured service: cloud computing uses the pay as you use model. This means that consumers only pay for the amount of resources they want to use.

2.3.2 Cloud service models

Cloud computing can be classified into service or delivery models. There are three basic delivery models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) (IBM, 2013). These models are available to consumers

depending on their needs. A customer can choose one or more services at the same time depending on how they want to use the cloud.

Table 2.1 Cloud service models

Service model	Available services	Example
Infrastructure as a Service (IaaS).	Virtual machines, storage services, and backup services	Amazon EC2.
Platform as a Service (PaaS).	Services for developing, testing, managing, and hosting software applications	Google App Engine
Software as a Service (SaaS).	Software applications such as email, word processing, and customer relation management tool	SalesForce.com, Google Mail, and Google Docs

Infrastructure as a Service (IaaS)

This is when a consumer accesses necessary IT infrastructures such as processing, storage, networks and other fundamental computing resources that are hosted on the cloud. The consumer can build a customised computing environment and retains full control of the it. The Cloud Service Provider, however, is responsible for maintaining all of the physical equipment. IaaS uses the concept of virtualisation extensively. A good example of IaaS is Amazon EC2.

Platform as a Service (PaaS)

This is when cloud providers provide an online platform for consumers to develop their software. The platform includes the programming environment, tools, configurations and it supports a full software lifecycle. The consumer uses the online environment to create, test, and manage applications. An example is Google App Engine.

Software as a Service (SaaS)

This is when applications are provided as a service. The software and the associated data are hosted in a cloud environment by a cloud service provider. The consumer choses the applications they want to use based on their demands. The consumer accesses the software online. Consumers do not buy the software but they buy the software licenses instead. Examples include SalesForce.com and Google Mail.

2.3.3 Cloud deployment models

A cloud deployment model represents a specific type of cloud environment, primarily distinguished by ownership, size, and access (Dialogic Corporation, 2010). There are three basic cloud deployment models:

- Public clouds
- Private clouds
- Hybrid clouds

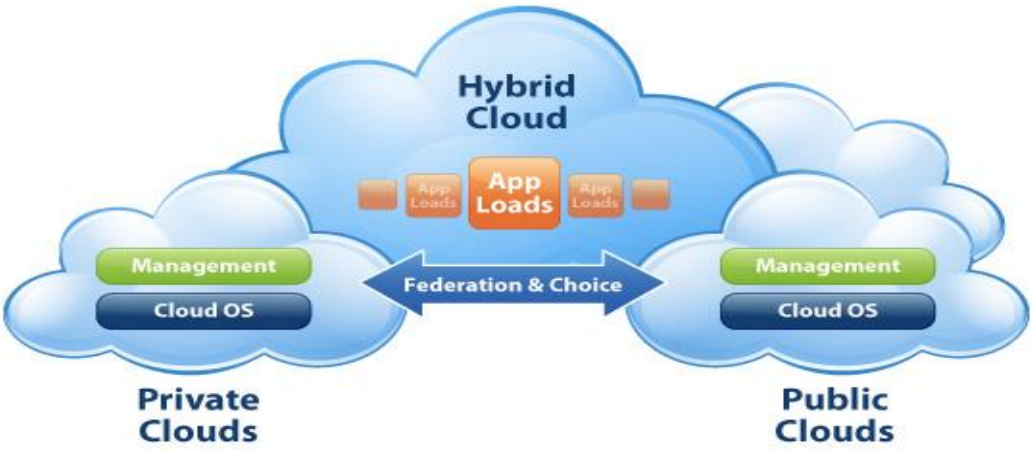


Figure 2.2 Cloud deployment models

The Public Cloud

A public cloud is a cloud environment which is publicly accessible to everyone. The services are provided to various clients either for free or using the pay per user license model. The cloud environment is owned by a third-party cloud provider. This deployment model represents true cloud hosting. The cloud provider is responsible for the creation and on-going maintenance of the public cloud and its IT resources. A good example is Google.

Private cloud

This is when the cloud environment is owned by a single organisation. It is usually used as a way to centralise access to ICT resources in an organisation. The private cloud can only be accessed by the member of the organisation who owns it. It restricts outsiders from accessing the resources in the private cloud. The private cloud environment may managed by organisation that owns it or by an outsourcing company.

The Hybrid Cloud

A hybrid cloud is a combination of two or more different cloud deployment models. For example, an organisation may choose to put its sensitive data on a private cloud where few people will have access to it and then put less sensitive data on a public cloud which will be open for access to everyone. The result of this combination is a hybrid deployment model

This deployment architecture can be complex as it combines two or more different cloud environments. This is usually used by organisations when they want to create different access levels to their data. A hybrid model helps organisations to secure their sensitive information on the private cloud.

2.3.4 Cloud vs. hosted services

Many people find it difficult to distinguish between cloud computing and web hosting. At first sight these two services might appear to be similar but they are in fact completely different. Although they can have very similar kinds of setups, these two services are very different and a lot of differences can be drawn from them.

By definition, web hosting is the process of offering remote storage and maintenance for files and server space. It allows individuals and organisations to make their websites accessible via the World Wide Web.

Cloud computing by definition, is a service that involves the connection of consumers to vendors through connected networks. A cloud consumer sends data to a vendor over a network trajectory called "the cloud." Data is then stored and maintained on remote servers owned and operated by the vendors. Cloud computing itself can also support remote web hosting.

2.3.5 Cloud computing adoption

The adoption of any technology is strongly influenced by the driving forces behind it. Usually the adoption of any new technology is influenced by the myriad benefits that it would bring to an entity. The adoption decision also needs to be made in the context of ever changing technological needs, existing investments and changing organisational demands that are placed on IT by the organisation.

Cloud computing has gained much popularity in the world of information communication technology (ICT). When it was first introduced, it promised to have a significant impact on many sectors of the economy; education included (Ercan, 2010). Many business organisations have adopted cloud computing into their operations and some are still in the process of adopting it. According to RightScale's fourth annual State of Cloud survey done in January 2015, there has been a huge increase in the adoption of cloud computing in the past few years (RightScale, 2015). The survey was done by questioning 930 IT professionals of whom 8% were in the education industry. It asked about their adoption of cloud infrastructure and related technologies. 93 % of the respondents reported that they were adopting cloud computing (RightScale, 2015). The results of this survey showed that more organisations are considering moving their applications to the cloud every day.

In 2011, Tata Consultancy Service (TCS) conducted an extensive study on how more than 600 primarily large companies were using applications in the cloud. They did interviews with the companies on their attitude and experience with cloud applications. One company involved in the survey (TB/McGraw Hill - an educational assessment testing company) believed that cloud computing services will help it fund the investment it needs to continue to move its school assessment from print to online.

Another study done by IDG Enterprise in 2014 on enterprise cloud computing found that capital investments in cloud computing have increased by 19% in large scale enterprises (IDG Enterprise, 2014). They went on to predict that in 2015 about a quarter of IT budgets will be allocated to cloud solutions. With the findings from these surveys, it can be seen that the adoption of cloud computing is increasing every year. More organisations are moving their IT systems to the cloud.

Cloud computing adoption in education

With the ever increasing take up of cloud adoption, the education sector has not been left untouched. Educational institutions have also joined the drive to adopt cloud technology into their operations. Cloud applications are currently being integrated into our everyday life activities. In one way or the other, we are using cloud applications such as email, YouTube, Dropbox, and so on. The adoption and use of cloud services in the education sector is spreading globally although the rate and scale varies with location and the economic state of regions (Muriithi & Kotze, 2012). Other large corporations like Microsoft have stated initiatives to provide cloud services to universities for free. These services include email, document storage, creation of and sharing documents and the ability to create websites (Muriithi & Kotze, 2012).

Sultan (2010) identified students, lecturers, administrative staff, developers and researchers among others as the main users of IT resources in a typical higher education institution.

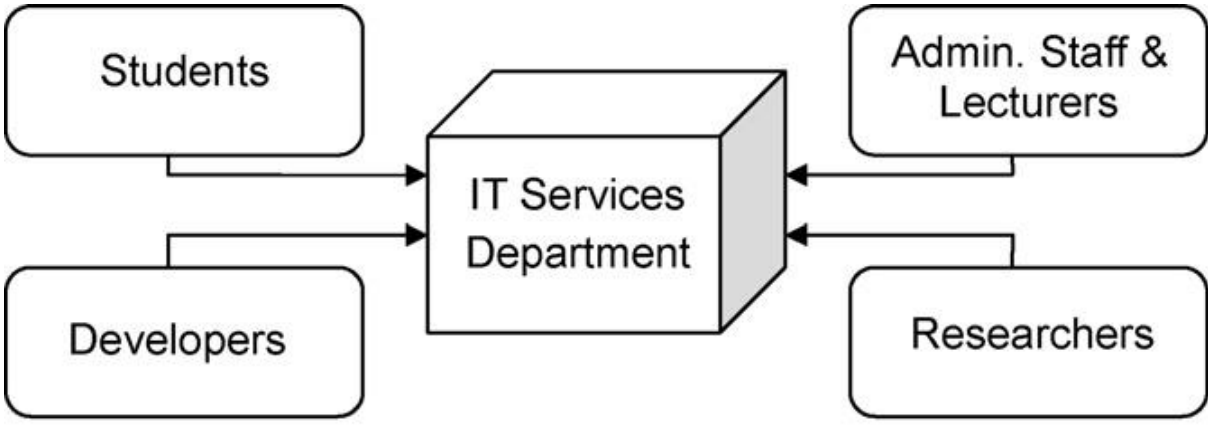


Figure 2.3: Main users of IT services in a typical university (Adapted from Sultan, 2010)

Traditionally, HLIs have an in-house IT services department where all their ICTs are managed. It has been proven that these services can be moved to the cloud where they can be accessed over the internet.

Cloud computing can play a vital role in education. It can offer direct access to a wide range of different academic resources, research applications and educational tools. These represent a huge percentage of innovative and rapidly developing services that are on the internet (Kumar et al., 2013). Cloud computing providers are now working with HLIs creating global forums (e.g. IBM released the IBM academy in 2009) for educators, researchers and other IT personnel for them to come together and share ideas. These initiatives help to improve the quality and access to educational material at very low operating costs (Le Roux & Evans, 2010). According to IBM, " Cloud computing allows learners and educators to gain access to a wide pool of learning material and research applications and tools," (Le Roux & Evans, 2010)

Cloud computing infrastructures have helped accelerate the innovation and adoption of various technologies in academia. Several innovations have been made possible utilising the resources and facilities of the cloud (Mannir & Getso, 2014). Tout, Sverdlik & Lawver, (2009) observed that the University of California adopted cloud computing to enable them to effectively meet research and conference deadlines, and allocate resources efficiently, whilst avoiding the costly pitfalls of over or under provisioning

Several authors have also investigated the potential of cloud computing in the education sector. Akin, (2014) cited that in 2013, Edtech interviewed a panel of technologists. They discussed the technological trends that were shaping the education sector, especially "education in the cloud" trend. They also discussed issues relative to benefits of cloud adoption, risk factors and risk management practices (Akin, 2014).the interview highlighted a number of benefits that can be attained by using cloud applications in education(Akin, 2014).

In the United States, Marist Colleges adopted cloud computing into their operations. This adoption of cloud computing has reduced costs by sharing a data centre with other educational institutions (Erenben, 2009). They opted to join what is commonly referred to as a community cloud.

North Carolina State University (NCSU) also adopted cloud computing for all their ICT operations. They opted to house their cloud solution in-house. This has increased the productivity of their students and information technology personnel, and resulted in educational and technological cost savings (Erenben, 2009).

Abdulsalam and Fatima (2011) concluded that that cloud computing is the solution to many problems that higher education in Africa and other developing economies face when integrating ICTs into their curriculum. The authors identified issues like the scarcity of ICT infrastructure, high cost of ownership, and unreliable and inadequate electrical power supply as factors that are limiting the integration of ICT in African higher education. They claimed that the cloud's on-demand access and pay-as-you-use characteristic can help cut down on the capital expenditure of institutions. (Akin, 2014).

Adopting cloud computing models in teaching within the higher education sector can bring massive benefits to educational institutions. An e-learning system hosted on the cloud would create a new learning environment where lectures and tests are done on a cloud platform utilising the concept of virtualisation (Isăilă, 2014). Knowledge can be made available to learners through cloud-based solutions which can be accessed anytime, regardless of location, through any internet enabled device. Many colleges and universities have already began to develop such initiatives (Manro et al., 2012).

2.3.6 Cloud computing penetration in Southern Africa

Cloud computing has several specific benefits for organisations in various sectors of the economy, i.e. governments, private companies and public corporations, and hence its promotion is an important matter for policymakers and regulators internationally.

Findings and conclusions drawn from surveys and studies on the potential and impact of cloud computing in the developing world are confusing and remarkably inconsistent (Kshetri, 2012). Analysts have suggested that developing economies are attractive markets for cloud services. They predicted that this technology will soon facilitate "healthcare 2.0," "banking 2.0," and "education 2.0" realities in these economies (Kshetri, 2012).

Most countries in the SADC region are still developing, hence adopting cloud computing will be of great benefit to them. According to Raphaël Nkolwoudou as cited by (Maaref, 2012), cloud computing is suited to the African continent. He adds that it would make a significant contribution to reducing the digital divide through:

- *“the ability to have immediate access to the latest innovations;*
- *the possibility for an organization to do away with heavy investment in infrastructure, particularly where computation centres are concerned, given the unreliability of the electric power supply in the region*.”

On paper, this would mean that developing countries have the opportunity to catch up with the developed world as this would give them access to the same IT infrastructure, data centres, and applications as those being used in developed countries.

The adoption of cloud computing in the SADC region is still at its infancy. Some researchers have argued that this is due to a lack of awareness, even among large corporations. A survey by Gartner in 2009 on large enterprise adoption of cloud computing indicated that more than half of the respondents in the emerging markets had not heard about cloud computing and did not even know what it is. In Southern Africa, the software development industry and the call centre industry have been the fastest growing areas for cloud computing.

2.3.7 Cloud computing and tertiary education in Southern Africa

Most higher learning institutions in Southern Africa have only adopted cloud computing for small sub-systems of their ICT systems. Most of them have adopted it in their email systems, including the universities that are used as case studies in this research. They still display a hesitation in fully adopting the cloud and moving all of their ICT systems to the cloud.

There are more than 200 higher educational institutions in Southern Africa. This figure comprises of 23 public universities and more than 50 Further Education and Training (FET) colleges spread across South Africa’s nine provinces (Muriithi & Kotze, 2012). The figure also includes 16 universities (both private and state owned) and 22 Further Education and Training (FET) colleges spread across Zimbabwe’s ten provinces. It is common for these institutions to have several campuses. Currently the institutions operate their individual IT departments. Although these institutions offer similar services, there is very little intergration of services between them.

However, the adoption of cloud computing in the education sector in the SADC countries is still largely unknown (Muriithi & Kotze, 2012). Even as it continues to make its way into higher education in the developed world, its adoption in universities and colleges in Southern

Africa still remains unclear. It also seems that the rate at which HEIs in the region are adopting cloud computing still remains low.

(Kshetri, 2012) indicates that the level of awareness and adoption of cloud computing in developing economies is still in its infancy. The table below depicts the limited application of cloud computing within Southern Africa as compared to other parts of the world as of 2012.

Country	E-education	E-health	E-commerce/ e-business/ supply chain	E-governance	E-environment	Telecommuting
China	X	X	X		X	
East Africa	X					
India	X	X				
Korea			X			
Qatar	X					
South Africa			X			X
Turkey	X					
Vietnam	X			X		
West Africa					X	

Table 2.2: Cloud computing application areas in developing countries

Source: (Kshetri 2012)

From the table above, the adoption of cloud computing in e-education, e-health, e-governance and e-environment for South Africa is unknown. This shows that the education sector in the SADC region is lagging behind as South Africa is regarded as the most advanced country in Southern Africa in terms of ICT infrastructure.

According to a survey on cloud computing adoption among high learning institutions in South Africa by Gerald & Eduan (2012), the institutions offer similar operations, these range from admissions to graduations. The study went on to state that these operations can be standardised and offered as a shared service on the cloud and this would significantly lower the costs of offering the services for the institutions (Akin, 2014).

Some researchers have tried to take advantage of this lack of empirical research on cloud adoption, and have attempted to identify potential challenges and solutions, although they have largely addressed technical problems (Morgan & Conboy, 2012). Most of the research has been done in well developed economies in North America and in Europe. Additionally,

the perceived benefits and challenges they identify lack strong empirical validation (Iyer and Henderson, 2010).

Cloud computing has become one of the most interesting research phenomena among modern technologies. As far as its application in the education field is concerned, most studies have mainly associated it with the technology for future distance education (Jian, 2009 as cited by Huang, 2012), teaching information systems and teaching systems development (Xiaomei and Xiaoqiang, 2010).

2.3.8 Challenges of cloud adoption in education in the SADC region

The SADC region and Africa generally has certain favourable conditions for cloud computing to thrive. According to Christo Briedenhann, the African continents ever growing infrastructure and the mobile-centric future makes the continent a prime candidate for cloud computing (Briedenhann, 2013). In spite of this, there are challenges unique to Africa that need to be addressed for the cloud to thrive. These include the “last mile”, the remoteness of some areas, and the lack of high-speed internet connections that is still prevalent in some areas (Briedenhann, 2013).

Maaref (2012) did a study on cloud computing in Africa in which he examined the issues from a legislative and regulatory perspective. The study concluded that although cloud computing has many benefits, issues of security, confidentiality, data protection and network reliability must be addressed (Maaref, 2012).

Overall, the main barriers that hinder the adoption of cloud computing in the SADC region are as follows:

Poor network infrastructure

The lack of adequate network infrastructure has always been a major obstacle to the use of ICTs in developing economies. The term network infrastructure refers to all technological tools, methods and access models that are used to facilitate the efficient management and transfer of information. The SADC region is mostly comprised of developing economies; these countries are still developing in most sectors of their economies. According to Jorge (2002), there is very limited telecommunications infrastructure in most developing countries

and costs are exceedingly high. The limited available infrastructure is mostly found in larger urban areas, thereby neglecting and depriving the rest of the population in other, more rural areas.

High cost of ICT

According to Jorge (2002), the high cost associated with acquiring and maintaining the ICT equipment and infrastructure is also an issue in developing countries. Personal computers, laptops, smartphones and some ICT equipment are expensive and unaffordable to the majority of the population in developing countries. This cuts down the populations who are able to buy ICT equipment. As a result, a lot of potential users are barred from using the internet because of high costs

Lack of cloud awareness

Most people in the SADC region are not aware of the existence of cloud computing and cloud application. This is mainly attributed to the higher percentage of illiteracy in developing countries. Most countries in Sub-Saharan Africa with the exception of South Africa and its neighbours have a poor e-readiness score (World Economic Forum and INSEAD, 2015; Economist Intelligence Unit, 2010; Ifinedo, 2005). This is evidenced by the fact that there is a general lack of community awareness about the potential benefits and capabilities of the cloud. This high level of unawareness is a contributing factor in the low adoption of cloud computing in the region.

Unreliable internet

Internet reliability is one of the main challenge that is hindering the wide adoption of the cloud in Southern Africa. For cloud services to be successifully deployed, there is a pre requisite that the internet should be reliable as the cloud requires fast and reliable internet (Maaref, 2012; Briedenhann, 2013). However, according to (Le Roux & Evans, 2010), the cloud adoption in Southern Africa is still low because the region does not have fast and reliable high-speed internet access. They went on to say that this lack of reliable internet access has caused most developing nations not to adopt the cloud (Le Roux & Evans, 2010).

2.4 Cloud pedagogy

In 2014, The Education Endowment Foundation stated that “There is positive evidence that shows that technology has an integral role to play in deepening and accelerating learning”. The integration of cloud computing into the teaching and learning environment will enhance the curriculum and create an embedded learning environment known as cloud pedagogy.

Barack (2014) defined cloud pedagogy as “the art of teaching while encouraging omnipresence learning via cloud based applications”. She further referred to it as the use of internet-based tools and web 2.0 tools where computing resources are shared for enhancing the teaching and learning process.

In simple terms, cloud pedagogy refers to any form of teaching and learning that is done using cloud-based learning technologies; that is any form of learning using cloud-based applications or over a cloud-based platform. It is sometimes referred to as online learning , or eLearning that is available in the cloud; this means that the resources are stored in a virtual environment at a separate location and accessed from various forms of web-enabled devices like laptops, tablets, and smartphones (Pam Boiros, 2014). Other descriptions consider anything that is accessed outside an organisation’s firewall as being on the cloud, this includes conventional outsourcing.

The study of cloud pedagogy is still in its early stages, with not much research having been done on cloud pedagogy, and new learning and teaching models are still being developed (Barack, 2014).

There are many forms of cloud-based learning technologies. Currently, educators and students use cloud applications like email, YouTube, or Dropbox in their everyday activities. These applications offer many innovative and promising strategies for the delivery and dissemination of educational material. It offers an ideal platform for enhancing creative and innovative thinking, problem-solving, multi-media and ICT literacy (Barack, 2014).

Essentially, the cloud refers to a group of computers acting as one; that is computers connected to a network (World Wide Web) and they form a computing model that allows for scaling of resources based upon real-time needs (Oludipe et al., 2014). Cloud pedagogy takes the notion of a universally accessible, scalable and easy to access network of

computers and applies it to electronic learning (Oludipe et al., 2014). This combines everything from online classrooms at large accredited learning institutions, to smaller training modules to be used within private organisations or other private enterprises.

With cloud applications, lectures can be done from anywhere in the world, the applications help remove the limitation of classroom boundaries and allows learning to happen from anywhere as long as the learner has an active internet connection. Different institutions worldwide can administer the same curriculum synchronously; students from different countries can work together in study groups using learning platform like electronic boards. They can use virtual learning platforms to collaborate and share knowledge (Barack, 2014).

With this technology, learners can access their learning tools from any computing device, regardless of platform, as long as the device is able to connect to the cloud. Further, if there is an increase in traffic or the amount of resources available to the users of the system, the system automatically adjusts to the user requirements, ensuring that the user experience remains relatively the same.

Cloud based pedagogy can also replace textbooks with browser-based content delivery, and this would be offering the institution much more than just content as a service. The resources could be delivered as word processors, spread sheets or databases. A good example can be found in California where in 2009, the State Governor Arnold Schwarzenegger introduced a program to have the State stop buying textbooks and instead give students free digital devices (Howlett, 2012).

2.4.1 Benefits of Cloud Pedagogy

Using cloud based learning tools for educational purposes brings about a lot of benefits. These include the following:

Lower set up costs

With cloud-based learning tools there are no purchases of new software. Cloud computing does not require any capital expenditure for the creation and maintenance of data centres, purchase of servers and network equipment to create one's own IT infrastructure. This results in a lower initial cost. There is also no need to devote time or human resources to install programmes, work out glitches, or ensure that software is installed organisation-wide. All these costs are borne by the cloud vendor. This also reduces the load on the technical staff, allowing them to concentrate on other useful projects

Improved accessibility

Cloud-based learning tools offer better accessibility as compared to other types. Learners and educators are able to access learning materials on-the-go, anywhere and anytime. They can simply log in to their account and begin learning new skill sets and expanding their knowledge base, without limitations. The cloud learning tool can be accessed using any device that can connect to the internet.

Faster deployment

As a general rule, cloud-based eLearning is faster to set up and requires less time to actually deploy. One could, technically, sign up with a cloud-based service provider one day and have learners using the system the next. There is no hardware of software involved, so one can have immediate access to learning tools in a matter of minutes.

Scalability (elasticity)

Cloud computing is very scalable. Higher Learning Institutions may gradually increase the volume of services used without significant prior investment. They will not need to plan the

introduction of additional informational capacity as cloud services can be scaled automatically and are practically unlimited.

High availability

One of the main benefits of cloud services is the ir high availability rate. Most cloud service providers guarantee availability of their services of up to 99.9% (IBM, 2013). This is very convenient for educators and students as they can get access to the learning material at almost any time. The high availability of educational resources also has a positive effect on the ranking of the educational institution.

Cost predictability

With cloud-based learning tools, one knows exactly how much one is going to pay each month. Since cloud services use the pay per use model, the consumer knows exactly how much they will pay for the service and with cloud applications, there are no maintenance fees or unplanned upgrade fees so one can know exactly how much funding it is necessary to allocate.

More storage space

Cloud deployment models offer an unlimited storage space for information. When using cloud applications, one does not need to store data locally on their devices. They can just upload all their data on to the cloud and the data will be stored in a secure place where it can be made available to them as per their requests. The cloud platforms also allow users to share their data with other people easily and with cloud storage, users do not have to worry about their information being corrupted.

Drawbacks of cloud pedagogy

With all the benefits stated above, cloud pedagogy also has some draw backs. These drawbacks mostly come from the fact that it requires a fast and reliable internet connection. For one to access cloud applications efficiently, they need to have a reliable internet connection.

Another drawback of cloud pedagogy is that it requires the users to have a device which is internet enabled. The user needs to possess a device (smart phone, computer, tablet, etc.) that can connect to the internet. Some of the drawbacks include limited control as much work is done by the cloud provider and also there is iimplicit dependency, also known as “vendor lock-in”.

2.4.2 Cloud pedagogy adoption

(Huang, 2012) developed an e-Learning system architecture based on cloud computing which can be adopted by higher learning institutions. The platform combines the characteristics of a typical e-Learning application and cloud architecture. The author’s research involved introducing cloud computing to e-Learning and thus building an active e-learning cloud.

Oludipe et al. (2014) merged cloud-computing and e-Learning to present a design for and implementation of a cloud-based e-learning platform for scientific subjects. They used the three core science subjects (physics, chemistry and biology) as a test bed. Their work involved designing an artefact using PHP (hypertext pre-processor) programming language for server-side scripting, Action script and Macromedia-Flash for media content authoring and MySQL as the back-end database.

2.4.3 Factors affecting adoption of cloud pedagogy

Performance

When individuals adopt new technology, they anticipate that it will help them to accomplish their tasks faster and help improve the quality of their output. Performance expectance is one of the main factors that influence an individual’s decision to adopt a new technology (Changchit et al., 2014; Wu et al., 2008). With the low levels of bandwidth and poor network infrastructure in most countries in the SADC region (Jorge, 2002), cloud users are highly likely to experience poor performances when accessing cloud applications. Poor cloud performance is usually experienced when there is a poor network connection between the user and the Cloud server (Benlian & Hess, 2011). Analysts view Performance as being both a risk and an opportunity for cloud adoption.

Ease of Use

According to a study by Morgan & Conboy (2013), ease of use is an important factor when evaluating cloud computing technology. Ease of use is an important factor to consider when adopting cloud computing as the user experience when using an application is very important in evaluating whether the application was successful or not (Gupta & Thakur, 2014). Previous research on cloud computing adoption has proved effort expectance or ease of use as one of the main factors considered when making the decision to adopt cloud applications (Alawadhi & Morris, 2008; Dhulla, V & Mathur, 2014).

Integration with other services

HLIs adopt many different applications for various uses around the institution. These applications need to interact with each other. Lack of interaction between these applications poses a huge challenge to cloud adopters and providers. A study done by Gupta & Thakur (2014) noted that the major factor influencing the adoption of cloud computing in an educational institution is “Support and integration of institution services”. They insisted that this factor played a big role when institutions wanted to make a decision to adopt cloud computing.

Reliability

Although cloud service providers promise a 99.9% SLA to their customers, cloud consumers are still concerned about the reliability of cloud services. Any business organisation would want to avoid a situation where their operations are halted due to an outage of cloud services. According to Kim et al. (2009), an outage is at times unavoidable and cloud users should always take that into consideration when making the decision to adopt cloud based solutions. Reliability presents a risk and it is therefore also a major factor in cloud computing adoption. It determines the kind of application that can be migrated to the cloud (Kim et al., 2009).

2.5 Chapter Conclusion

The above statements show that cloud computing adoption is a phenomenon that is presently a major preoccupation in the application of ICT internationally. Researchers are trying to find ways to integrate cloud computing into education, placing much emphasis on how it can be used for online distance courses, information system design and development (Huang, 2012). In the area of integrating networks with e-Learning, much emphasis is put on the construction of campus e-Learning systems, e-Learning models on campus networks, e-Learning systems based on agent models and e-Learning grids (Huang, 2012). Huang (2012) notes that; research on applying cloud computing to eLearning has not been significantly reported on.

After this brief review of literature on cloud computing, this research focuses on the adoption of cloud-based learning technologies to facilitate integrating the teaching and learning process into the curricula of a typical HLI. It will also look for answers as to why its adoption and use in the education sector in Southern Africa is very low. Based on the findings unearthed by the literature review, this research will try to give an introduction of cloud computing to educators. It will try to highlight the aspects of cloud computing and how it can impact knowledge delivery in high learning institutions.

CHAPTER THREE: THEORETICAL FRAMEWORK

3.1 Introduction

Technology adoption and use is not a new phenomenon in the world of information systems. This concept has been studied for a long time now. A lot of research efforts have been made to investigate the theories that can be applied to explain the user's behaviour on accepting and using technology.

A theory can be defined as a supposition that explanations the occurrence of something. It is a set of accepted beliefs that explain what is being measured. Theory therefore identifies the variables that affect the problem that is being investigated by the researcher. Research theories highlight and explain the important concepts that need to be measured in a particular study. They also test relationships between important variables in a study (Borgatti, 2005).

This chapter presents the theoretical framework underpinning this study. A brief summary of relevant models used in technology adoption and use studies is given, followed by a detailed description of the theoretical framework to be adopted in this particular study.

3.2 Theories of technology adoption and use

The key to adoption of any technology is willingness to accept the proposed technological solution. There are many theoretical frameworks that have been applied by researchers to explain the determinants of the acceptance of any form of technology (Venkatesh, Morris, Davis & Davis, 2003). However, each theory has an area or situation where it is most applicable, and has its own advantages and limitations. Some theoretical models focus on individual adoption of technology whereas some have focused on implementation of infrastructure (Dhulla, V & Mathur, 2014).

As stated earlier, this study is concerned about the adoption and use of cloud pedagogy in HLIs; therefore the theoretical framework that was adopted for this study explains the adoption and use of ICT in such institutions. Studies on adoption and use of technology use a number of models. In this section, a few models are discussed in brief and one of them is chosen specifically for this study. The discussed theories include: The Technology

Acceptance Model (TAM), Theory of Reasoned Action (TRA), Diffusion of Innovation (DOI) and The Unified Theory of Acceptance and Use of Technology (UTAUT).

3.2.1 Technology Acceptance Model (TAM)

Most scholars attempt to explain the adoption of technology using the technology acceptance model (TAM). Originating from Fishbein & Ajzen's theory of reasoned action, Davis first proposed this model in 1986. It provides a guideline on which external variables that influence behaviour intentions can be traced. This model has produced significant results in explaining and predicting user behaviour in the adoption of information technology (Legris, Ingham, & Collerette, 2003). The originators of this theory believed that for an individual to use a new innovation, they must first accept it (Holden & Karsh, 2010).

The model suggests that there are two main factors that influence an individual's behaviour towards any new technology. These two cognitive beliefs are perceived usefulness and perceived ease of use. The theory also proposes that there are other external factors that affect the intention to use a technology.

- Perceived Usefulness (PU) – the degree to which an individual believes a certain technology will make them perform their jobs better (Davis, 1989).
- Perceived Ease-Of-Use (PEOU) – defined as "the degree to which a person believes that using a particular system would be free from effort".

TAM suggest that the use of any innovation is in some way influenced by the user's behavioural intentions, attitude, perceived usefulness of the system, and perceived ease of the system (Holden & Karsh, 2010; Siritongthaworn et al., 2006). The theory suggests that all the other factors affect technology adoption through mediated influence on the two main constructs. This theory was considered inappropriate for this study because it does not address questions such as "which factors would influence users' perception" (Damanik, 2010). Legris et al. (2003) also suggested that TAM is not a complete model; they went on to say that there is a need to add other variables to TAM so as to provide a more complete model structure.

3.2.2 Theory of Reasoned Action (TRA)

Another theory which has been widely used is the Theory of Reasoned Action (TRA). This theory tries to explain the motives behind every individual's decision to perform certain behaviour. It posits that "a person's performance of a specific behaviour is determined by his or her behaviour intentions (BI) to perform the behaviour" (Davis et al. 1989).

The model suggests that humans consider the implications of their actions before they decide to perform or not perform a certain behaviour (Bryant et al., 2012). Eveland (1986) observes that "ultimately, technology transfer is a function of what individuals *think* – because what they *do* depends on those thoughts, feelings and interests". This theory is mainly centred on the intention to use an innovation. It suggests that humans act upon their intentions where the intentions are directly influenced by attitude and beliefs.

3.2.3 Innovation Diffusion Theory

Another theory which enjoys wide acceptance by researchers to explain aspects of technology diffusion is Roger's Diffusion of Innovation theory (Kiplang'at & Ocholla, 2005). Diffusion of technology is the process through which some innovation is communicated within a social system (Bates, Manuel & Oppenheim, 2007).The theory seeks to explain how innovation (new ideas, behaviour or objects) are embraced in a population. According to (Rogers, 2003) the theory is governed by three insights:

- *"What qualities make an innovation spread?*
- *The importance of peer-peer conversations and peer networks.*
- *Understanding the needs of different user segments*." (Rogers, 2003).

These insights have been used since the 1960s and have been tested in more than 6000 research activities (Venkatesh, *et al.*, 2003). The model puts great emphasises on how individual behaviour influences the diffusion process of an innovation over a time span.

3.2.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

Another theory which has been widely utilised by researchers is the UTAUT model. This is a model of individual acceptance of technology that was developed from blending constructs that were adopted from previous research work done on technology acceptance (Venkatesh et al, 2003). UTAUT is based on the social cognitive theory and it was adopted from a the integration of eight prominent innovation acceptance models. It was built from combining The Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB), the Technology Acceptance Model (TAM), the Motivational Model (MM), a model combining the technology acceptance model and the theory of planned behaviour (C-TAM-TPB) , The model of PC Utilisation (MPCU), The Innovation Diffusion theory (ID) and the Socio-Cognitive Theory (SCT) (Zhou et al., 2010; Dhulla, V & Mathur, 2014; Venkatesh et al., 2012b). UTAUT was developed to address some limitations and uncertainties that were found in the predecessor models.

UTAUT is based on four core determinants that influence behavioural intention to adopt or to use a new technology: performance expectancy, effort expectancy, social influence, and facilitating conditions, together with four moderators of key relationships, i.e. gender, age, experience and voluntariness of use (Venkatesh et. al., 2003).

- **"*Performance expectance:*** *the extent to which an individual believe that using an innovation to perform a task will yield a positive outcome* (Casey & Wilson-Evered, 2012).
- ***Effort expectancy:*** *this construct is compared to the ease of use construct in TAM and is subjective to how an individual evaluation of ease of using a certain innovation* (Casey & Wilson-Evered, 2012)
- ***Social influence:*** *the extent to which a user perceive that it is important that others (e.g., family and friends) believe they should use a particular technology* (Alawadhi & Morris, 2008).
- ***Facilitating conditions:*** *refer to the users' perceptions of the resources and support available to perform a behaviour"* (Alawadhi & Morris, 2008; Venkatesh et al. 2003).

The four main constructs of UTAUT are theorised to influence an individual's intention to use an innovation, while behavioural intention influence the actual use of the technology (Casey & Wilson-Evered, 2012). The model also considers individual difference variables (age, gender, and experience) that have an influence on the main constructs (Alawadhi & Morris, 2008).

3.3 Theoretical framework underpinning the study

This study applies the UTAUT model. The model's constructs were seen as appropriate to study user behaviour towards adoption of cloud pedagogy.

Venkatesh, Thong, & Xu (2012) stated that there are three basic situations (types) where UTAUT can be applied, and these are:

- UTAUT explaining a new context, (e.g., new user populations)
- The addition of new constructs to the original UTAUT model.
- When including new constructs that are already present in the model but were developed from external factors.

This study implemented the first instance where UTAUT is used to explain the adoption of a new context, in this instance explaining HLIs' adoption behaviour of a new technology, which is cloud pedagogy.

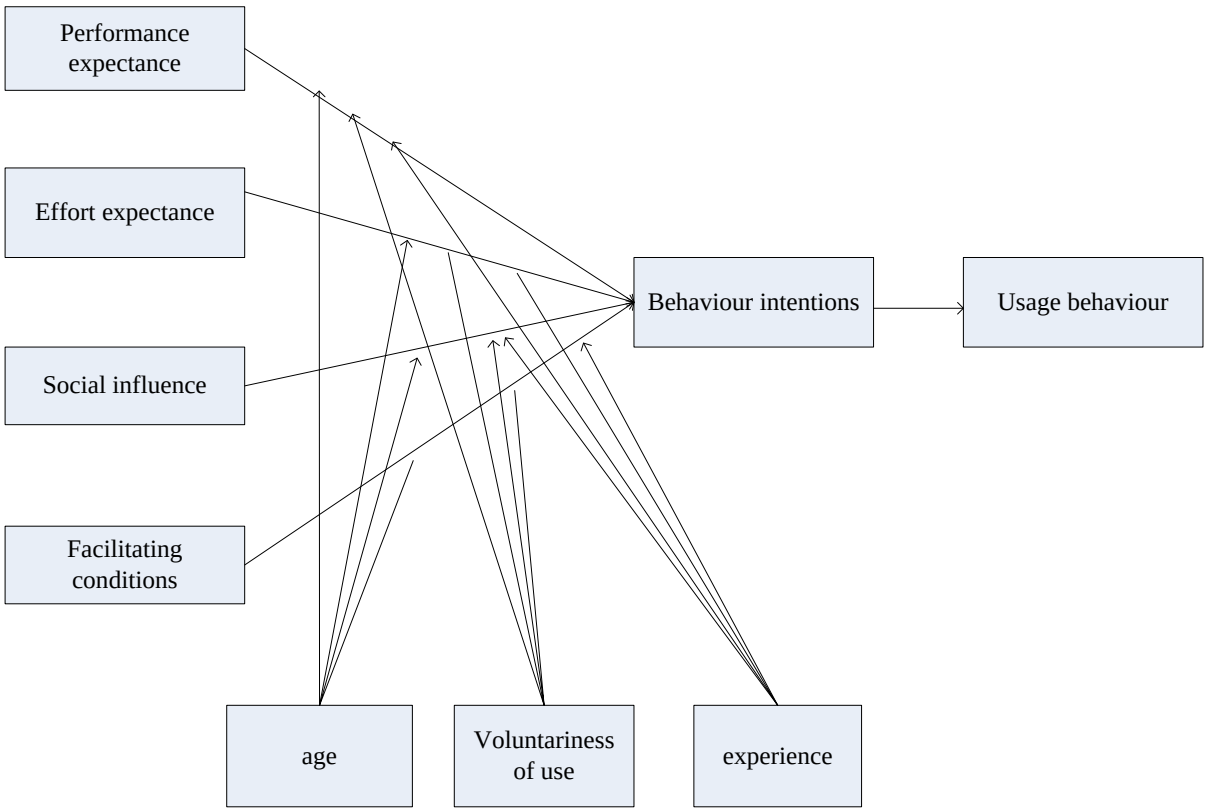


Figure 3.1 UTAUT model source: (Venkatesh et al., 2012b)

In this study, performance expectance was defined as the perceived usefulness of cloud pedagogy, and in particular the degree to which the participant believes that using the cloud pedagogy will help them enhance the teaching process. Previous studies of technology acceptance have found that participants are most likely to adopt new technology if they perceive it as useful (Venkatesh, et. al., 2003).

Effort expectance was defined as the perceived ease of use of a technology, and specifically, the degree to which cloud pedagogy is easy to use. This construct is identical to the perceived ease of use construct from TAM (Venkatesh, et. al., 2003). Previous studies have suggested that perceived ease of use is a positive predictor of technology acceptance (Thakur, 2013).

Social influence was defined as the degree to which people close to an individual (e.g., students, family and friends) are perceived to support the use of cloud pedagogy.

Facilitation Condition refers to the availability of organisational and technical infrastructure to support use of cloud pedagogy (Venkatesh, et.al. 2012).

Voluntariness of use refers to the extent to which potential adopters perceive the the adoption to be non-mandatory (Venkatesh et al., 2012b)

Experience is “an accumulative memory process of all kinds of senses and feelings” (Oi et al., 2009). It is based on the previous encounters experienced by an individual while using similar technologies.

3.4 Justification for using UTAUT

UTAUT was found to be the best existing model that would explain adoption of cloud pedagogy by HLIs as it is comprised of constructs from eight different models. The theory captures the essential elements of these eight previously established models. Critics of the UTAUT model argue that it is a recent model and so requires more validation, but MUKISA (2011) notes that other scholars have argued for the model by stating that it is based on a strong theoretical foundation which is a result of the rigorous development process of combining eight models (Schaper and Pervan, 2005, Han et al., 2004) cited by (MUKISA, 2011).

UTAUT has also been chosen because most of the previos studies on technology adoption have shown that the framework explains usage behaviour of individuals better than the other theories (Venkatesh et al, 2003). It also provides a better understanding regarding the factors that determine behaviour intentions (Casey & Wilson-Evered, 2012; Alawadhi & Morris, 2008; Juinn & Bing, 2013; Venkatesh et al, 2003), and it outperformed the other eight individual models (adjusted variance of 70%) compared to other models which account for between 17% and 53% (Venkatesh et al., 2003).

Since the inception of this theory, many empirical studies have been conducted using it, and so it can be assumed that it produces good results that are consistent. The model has been successfully used to explain the usage behaviour of various technologies e.g. online stock trading (Wang & Yang, 2005).

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

This chapter outlines the approach that was taken to conduct the study. It covers the methodology that was used to answer the research questions and archive the objectives. The chapter starts by discussing the research paradigm, research design, study's population, sample and sampling techniques, data collection procedure and data analysis tools that were used.

4.2 Research paradigm

A research paradigm is an approach taken to conduct a research study. It is a model or frame of reference that is used to observe and understand the phenomena under investigation (Babbie, 2012). It guides the researcher on how they will make decisions and carry out research.

A research paradigm is a belief system that interprets the nature of the world to its holder. Taylor, Kermode, and Roberts (2007), defined a paradigm as "a broad view or perspective of something". A research paradigm can also be described as a framework within which theories are built (Henning, van Rensberg, & Smit, 2004) and it helps the researcher to thoroughly analyse the phenomenon they are studying (Burke, 2007).

According to Grix (2004), as cited by Ruhode (2013), paradigmatic positions should underpin scholarly work because they directly inform the researcher's choice of research questions, methodology and intentions. Guba and Lincoln (1989)stated that "paradigms can be classified through their ontology (what is reality?), epistemology (how do you know something?) and methodology (how to go about finding out?)." There are different types of paradigms that researchers can use when conducting research with the two main ones being positivism and interpretivism.

4.2.1 Positivism

This paradigm is mainly based on the realist and empiricist philosophical assumptions of reality and the way of knowing it. Generally it focuses on the objectivity of the research process (Creswell, 2009). This paradigm is mainly used in quantitative research, that involve testing hypothesis and it involves hypothesis testing to obtain “objective” truth (Burke, 2007). The positivist paradigm is mostly aligned with natural sciences and related quantitative methods such as experiments, surveys and statistical analysis (Voce, 2004). It is mainly based on the philosophical ideas of Auguste Comte (Dash, 2005). Comte’s idea was grounded on the rational proof/ disproof of scientific assertion and it stated that “true knowledge is based on experience of senses and can only be obtained by observation and experiment” (Dash, 2005).

Its main limitation is that it does not cater for the understanding of context-based phenomena and inter-subject interpretations of the socially constructed aspects of knowledge associated with the humanities and socio-technical studies. The positivist paradigm was not suitable as a philosophical approach for this study.

4.2.2 Interpretivism

According to Saunders et al.(2009), Interpretivism has its origins in two intellectual traditions: phenomenology and symbolic interactionism (Mark Saunders et al., 2009)**.** Phenomenology is defined as the consciousness as experienced from a person’s point of view. It can be seen as how individuals make sense from their environment. Symbolic interactionism on the other hand is the continual process when individual extract meaning from their social environment as they interact.

Interpretivism assumes that knowledge of reality is only obtained through social constructions (Walsham, 1995). Interpretivist studies explain that reality can be fully understood only through subjective interpretation and intervention. Ojong & Muthuki, (2010) cited that “Interpretivism views knowledge as based on observable events, personal beliefs, values, reasons and understanding”. It aids in understanding people, how things are happening and what can happen in the future. The interpretivist approach depends on observations, interviews, and analysis of existing literature to provide a meaningful reality (Myers, 2009).

Interpretivism is mainly used in qualitative methodology as it focuses on analysing social behaviours by the collection, analysis, and interpretation of text (Murtonen, 2005). Since this study involves observing peoples' behaviours towards the adoption of cloud-based pedagogy, with the objective of understanding the factors that affect the adoption of cloud pedagogy in Southern Africa, this approach was considered more appropriate than any other.

4.3 Research design

Research design is the plan that guides the arrangement of conditions for data collection and analysis. It is the overall strategy used to obtain answers to the research questions (Kirk and Miller, 1986). In other words, it is the specifications course of action taken to acquire the information being investigated. It is the overall strategy that stipulates the type of data to be collected, the sources of the data and the procedure to be taken to collect the data.

Research design is that phase during which the researcher determines what they are going to observe and analyse, and it also covers why and how they are going to do it (Babbie, 2012). According to him, research design is comprised of two basic steps, the first step being to clearly specify what the research wants to find out and the second step being to determine the best way to do so.

Mouton (1996) also defined research design as a set of guidelines or instructions to meet the objectives that the researcher has set for himself/herself. Guidelines direct what should be done, how to do it and to who will do it. The aim of this study is to explore and describe barriers to cloud computing adoption in teaching and learning in the SADC region. A research design in this study, therefore, is a set of guidelines that seeks and discovers answers to the research questions. This study will adapt a 7-step research process which is summarised in the figure below:

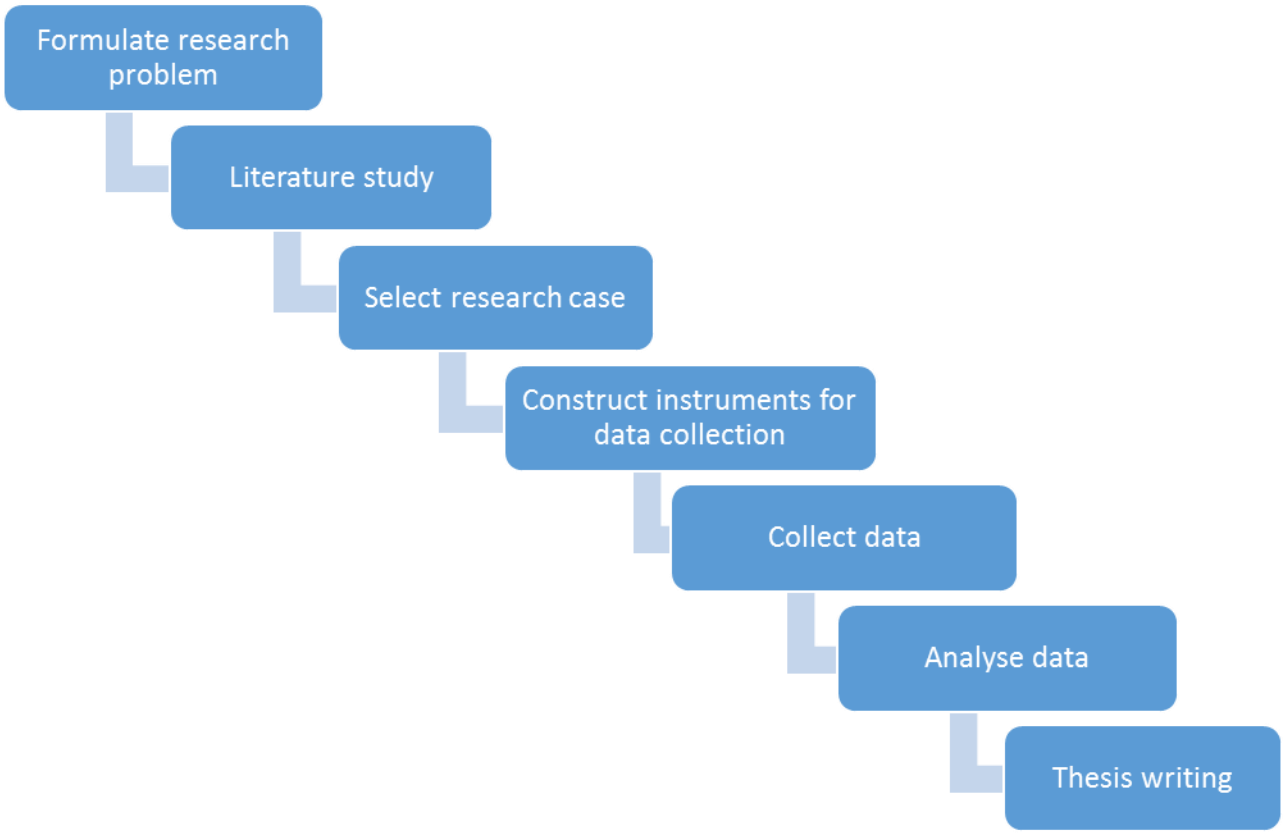


Figure 4.1 research process

Step 1: Formulate research problem

The following research problem:

> *Cloud computing is a new technology that promises subsequent benefits to education but its adoption for pedagogical technologies by higher learning institutions in Southern Africa is very low, and the sector has not been able to obtain the related benefits from the technology.*

…was formulated with the underlying objective of understanding the factors that are affecting wide adoption and use of cloud pedagogy by higher learning institutions in the SADC region.

Step 2: Literature study and research paradigms

During this stage, the researcher conducted an extensive study of the previous research work done on cloud computing adoption in the education sector. The literature was obtained from secondary sources of data and it included theories, journals, and previous research on cloud computing adoption. Literature and models reviewed are explicitly explained in Chapter Two.

Step 3: Selecting research case

Southern Africa was identified as the research site. It was selected because it is composed of developing countries which are the target area for this research. Two universities were chosen, Cape Peninsula University of Technology which is in Western Cape Province, South Africa and Great Zimbabwe University which is in Masvingo, Zimbabwe. The decision to use the perspectives of these two universities from different countries was based on the assumption that the factors that affect the adoption patterns in the two countries may differ, so this may help provide more information and will provide a framework for comparing cloud computing adoption in the two countries.

Step 4: Constructing an instrument for data collection

Research questionnaires were developed using a cloud computing adoption research framework. The instruments were aimed at soliciting how the universities are implementing their learning management tools and to see the current state of cloud computing adoption. They were also aimed at examining the factors which affect cloud computing adoption on pedagogical technologies by the higher learning institutions in the SADC region.

Step 5: Collecting data

The questions on the questionnaires were all “knowledge questions”. These are the questions which seek to collect factual data. Survey questionnaires were used to gather data from the institutions. The questionnaires were self-administered to various university lecturers. The questionnaires were sent out at random. The first phase of the data collection was done at Great Zimbabwe University and the second phase was done at Cape Peninsula University of Technology.

Step 6: Data Analysis

The collected data from the document study and questionnaires were analysed to extract meaningful patterns. The data was analysed using the inductive approach to qualitative data analysis.

Step 7: Writing research document

The document was written following the structure explained in Chapter One. It started from the methodology to data analysis then to model development. The literature review was written last to accommodate any new work which might have been published during the research period.

4.4 Research site

The research was conducted in Southern Africa using one university from South Africa and another from Zimbabwe.

4. 5 Unit of Analysis

The survey was focused on university lecturers from all the various departments of the universities. The involvement of lecturers from all departments during the research process enabled the study to be conceptualised using views from people with different experiences in the education delivery process (i.e. some with a science background, some from commerce and others from art departments). In that context, lecturers involved in the education delivery process were the unit of analysis of the research. They contributed to the understanding of the context.

4.6 Research population

Research population refers to the aggregation of elements from which a small portion will be selected. The survey will be done using a random sample of university lecturers; hence the research population for this study are the university lecturers. However, to get a deeper understanding of the subject, online journal articles on previous research that was done in the same field will also be used.

4.7 Research methodology

According to the dictionary definition, research methodology is the course of action taken to gather data that will be used for decision making. Research methodology is a scientific system used to guide research studies; the focus here is on the procedures used to obtain research findings (Babbie & Mouton, 2001). This study employed a qualitative approach to examine the phenomena under study. While the research followed a qualitative approach, quantitative data also emerged from the collected data and It could not be ignored. The qualitative data was also presented alongside the qualitative one.

A qualitative study is any study that produces results that are not statistical in nature and that do not involve numerical quantifications (Lincoln & Cuba, 1985). Qualitative study according to Turner, (2010) is used to study attitudes, opinions and behaviour with a focus on text. It tries to highlight people's using their own terms (Labuschagne 2003).

The main focus of a qualitative research is to capture meaning from the issue being studied in a "real world" setting. This minimises researcher bias in doing the research. It is based on evidence rather than numbers. This highlights the fact that in many cases the evidence cannot be reduced to numbers, which is why statistics are not preferable for qualitative research.

A qualitative research approach was chosen because it helps the researcher to get a deeper understanding of the phenomena being studied as is allows direct interaction with the subjects in their awn environments (Creswell, 2009).

Qualitative research design was also chosen because it mainly focuses on the depth (Russek and Weinberg, 1993), which is what this study is all about. It also requires the researcher to be active throughout the study. This also attracted the researcher to the design because as a student researcher there is a need to understand the role of the researcher when using qualitative design so as to have an insight into how to conduct research. It is also observed that research design involves human initiation and judgment in order to reach a certain conclusion, and which is the main subject being studied in this research.

Within the framework of a qualitative approach, various research methods exist. These include ethnography, grounded theory, surveys and case study. This research was most suited for a case study design.

4.7.1 Case study

Saunders et al. (2009) define a case study as a strategy that involves an empirical investigation within a real life context. It gives the researcher an opportunity to have an in-depth study on a particular study subject and it usually involves gathering and analysing information (Burke, 2007). Case studies allow the researcher to analyse real life situations rather than just generalising (Cohen et al., 2000), this helps the researcher to reach a conclusion that is closer to reality. In this regard, the case presented is aimed at having an in-depth analysis of the factors that affect the adoption of cloud computing on pedagogical technologies within two real life organisations which are CPUT and GZU.

Case studies are more appropriate when there is little knowledge known about topic being studied (Yin, 2003), and when the study is answering the 'what' and 'why' questions (Babbie & Mouton, 2001). A case study is used in this research for investigating a little known and poorly understood situation (Leedy & Omrod 2010). It is because of the above mentioned reasons that the case study approach was seen appropriate for this research.

4.7.2 Case setting

This study represents a case of two universities in Southern Africa: CPUT from South Africa and GZU from Zimbabwe. The decision to use the perspectives of these two universities from different countries was based on the belief that the factors that affect the adoption patterns in the two countries may differ, so this may help provide more information. The two universities were also chosen because of their convenient accessibility and proximity to the researcher.

- **CPUT case setting**

CPUT is a university of technology situated in Cape Town in the Western Cape province of South Africa. The university is the result of the merger in 2005 of two previous institutions, the Cape Technikon and the Peninsula Technikon. It became a university of technology, joining three other traditional universities in the province, Stellenbosch University (US), University of the Western Cape (UWC) and University of Cape Town (UCT).

The university adopted a proprietary LMS (WebCT) in 2001 to enhance their teaching and learning. In 2011 they switched from WebCT to Blackboard. This LMS is hosted locally at the university by their Communication Technology Services (CTS) department. In 2013 they moved their email system to the cloud, cancelling out the ICT system that operated at the university.

CPUT is currently operating on eleven campuses in the Western Cape which are: Cape Town, Bellville, Mowbray, Granger Bay, Worcester, Tygerberg, Thomas Pattulo, Groote Schuur, MARC, Athlone and Wellington. This study was conducted at the Cape Town campus only and it involved lecturers from the various faculties at the Cape Town campus.

- **GZU case setting**

The Great Zimbabwe University is a traditional university found in Zimbabwe. The university was established in 1999 after recommendations from the Chetsanga Report of 1995. When it was first established, the university was known as Masvingo State University which later changed to Great Zimbabwe University

GZU adopted the multi-campus system and is currently operating on five campuses, which are Main Campus, City Campus, Mucheke Campus, Centre of African and Asian Studies, and Mashava Campus. This study was held at the Main Campus as that is where the central IT department is housed.

4.8 Sampling method

Sampling is the act of selecting a subgroup (called a “sample”) of a population for the purpose of determining certain characteristics of the whole population (Mugo, 2002). The sample will be a small part of the whole population. Its properties would then be studied to gain insights about the whole (Webster, 1985). Sampling is done because sometimes the population might be too large, time consuming, costly and not easily accessible to the researcher (Cresswell, 2009). Sampling aims to select a set a subset of a group in a way such that the characteristics of the group represents the whole (Babbie, 2012).

Sampling has two basic types, these are: Probability and Non-Probability sampling. Probability sampling refers to any method of selecting a subset that in some way utilises random selection using probabilistic methods. The researcher sets up parameters that ensure an equal chance of selection to all the members in the sample. This allows for generalisation to be done on the data collected from the sample. For this study, probability sampling was chosen as the study looks to explore lecturer's perception on the adoption of cloud pedagogy.

Non-Probability sampling is the process of selecting a sample from a specific research population that does not have a known finite number of units (Barbie and Mouton, 2004). The selection criterion for the sample is not based on the probability theory (Babbie, 2012). The samples are selected based on the subjective judgement of the researcher and the units may not have an equal chance of being selected. Non-Probability sampling is more suitable for qualitative research. Its examples include: quota, snowball, purposive and convenience sampling.

On selecting the two universities used in this research, the researcher used convenience sampling. After selecting the two institutions, the researcher then used both convenience and purposive sampling to pick the participants from the two institutions.

Convenience sampling

This is a sampling method where the selection of participants is influenced by their easy accessibility and nearness to the researcher (Blanche *et al*., 2006). It produces a sample which does not fully represent the entire population. Convenience sampling can also be used when there is not enough time and money to carry out the research. The two institutions were selected because of their proximity and ease of access and also because there were not enough funds for the researcher to investigate more, let alone all, HLIs in Southern Africa.

Purposive sampling

Purposive sampling is a method of selecting a small subset of a population based on the suitability of their characteristics for the purposes of the study (Babbie & Mouton, 2001). Purposive sampling is "selecting information-rich cases for in-depth study" (Patton 1990). This type of sampling involves the researcher making subjective judgements as to which units would best provide more detailed information for the study (DeVaus, 2002; Burns & Grove, 2007). McMillan and Schumacher (2001) highlighted two facts about purposive sampling:

- it is done to get rich data from the best sources.
- A pre-test should be done before actual data collection is carried out.

Qualitative and explorative research requires detailed analysis (Blanche *et al.*, 2006).

The purposive technique was adopted because the researcher seeks information from the respondents who are directly involved in the knowledge delivery process, and this type of sampling also allows the researcher to select the sample which is likely to give more information regarding the subject under study. The research used population elements such as ICT lecturers from the two universities as a representative of the larger population. This was done in order to gain insight into the status quo and its causal factors, so as to inform remedial efforts.

4.8.1 The Sampling process

According to Bhattachejee (2012), the sampling process consists of three stages. Stage one is selecting the target population, stage two is choose the sampling frame where the sample will be drawn from and the last stage is selecting the sample.

As stated earlier in the chapter, this research is mainly focused on the adoption of cloud pedagogy by HLIs in Southern Africa with the main emphasis being on how educators are using cloud-based applications to facilitate the distribution of knowledge. This served as the target population and the sampling frame. On choosing the sample both convenience and purposive sampling were used. There was also some form of snowball sampling as some respondents referred the researcher to their colleagues whom they thought would also provide useful insights.

4.9 Data Collection Methods

Data collection is a systematic way of gathering data that answers pre stated research questions, test hypotheses, and evaluate outcomes. It encompasses both the techniques that can be used and the instruments to be constructed in making the measurements (de Vos, 1998). In order to maintain research integrity, the data collection process should be done accurately using the right methods. In this research, both primary and secondary data sources were used.

The primary data sources were predominantly the lecturers who responded to questionnaires. Officially published material in the form of the university ICT policy were also part of primary data. Secondary data sources included books, white papers and journals, which provided data and information on ICT and cloud computing adoption in teaching and learning.

This study recognizes that there are a number of data collection methods that can be applied in a case study. According to Yin (2003) as cited by Ochara (2009), data collection sources include policies, interviews, direct observation, participant observation as well as examination of available physical artefacts (Ochara, 2009). In this research questionnaires were used. The study employed a qualitative approach to data collection. The questionnaires were designed in such a way that they would collect qualitative data.

Secondary resources:

The researcher studied many research papers, journals and industrial white papers on cloud computing adoption as well as adoption of learning management systems in higher learning institutions. The main objective for this was to acquire more information about the subject from the documents relating to the phenomenon under study. Many documents relating to ICT adoption from both the developed and developing worlds were collected and studied.

Primary sources

Primary sources included documents, and questionnaires. The questionnaire was the main source of data while the documents mainly supported the questionnaire. The questionnaire involved both structured and unstructured questions.

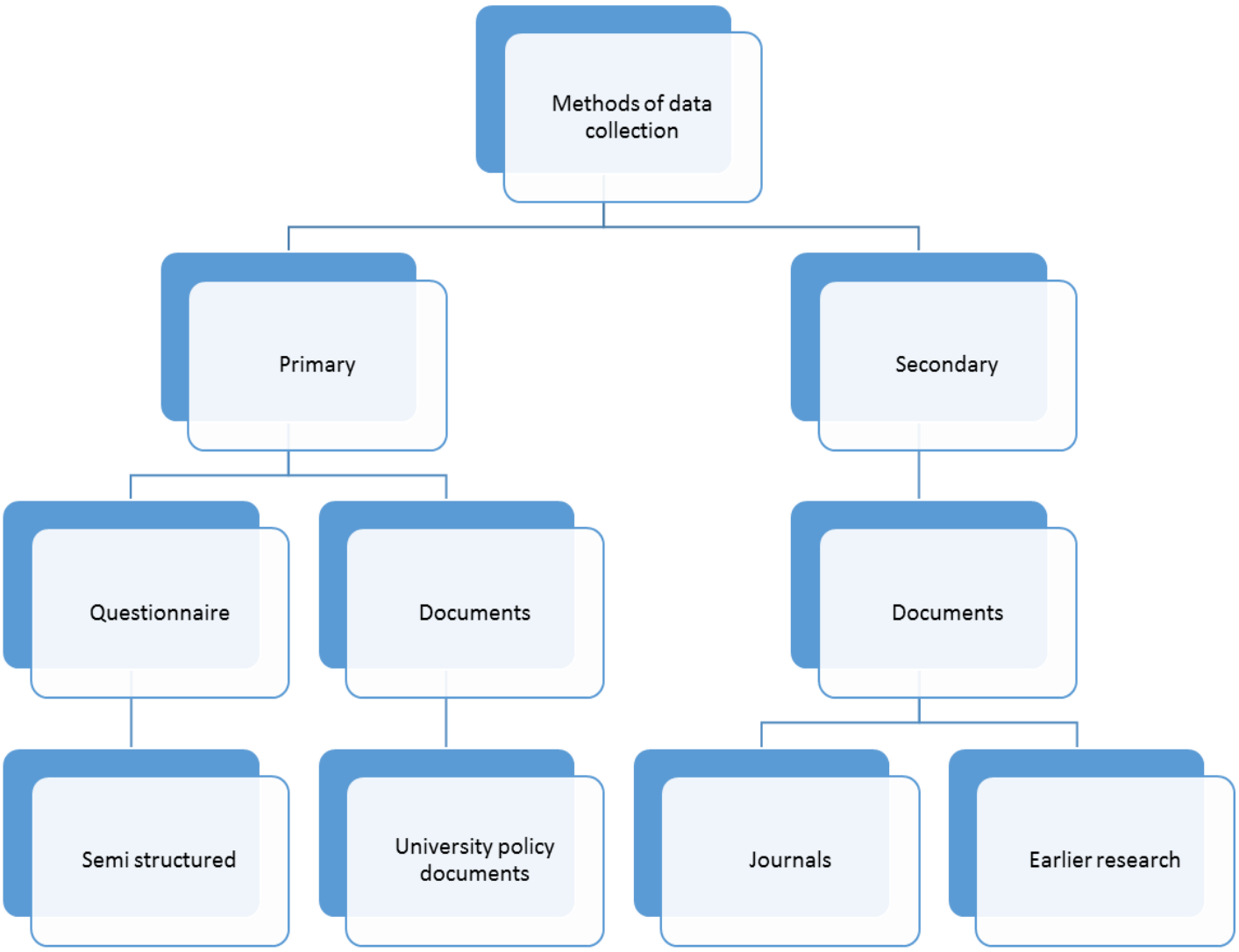


Figure 4.2: Data Collection Process (Adapted from Kumar 1996): Al-Azazi, (2008)

4.9.1 Questionnaire

A questionnaires is a sequence of related questions drafted to collect data about a subject from the respondents (Babbie, 2012). The questions can either be structured or unstructured. Questionnaires can be used in any type of research, be it qualitative or quantitative they allowed data to be gathered from a large pool of respondents while maintaining control over the responses.

Questionnaires were found to be flexible as they can be used to collect data from people in different arrears while touching a variety of topics. The research employed an online based questionnaire which was created using Google docs which is a cloud-based application, however hardcopies were also made available for those respondents who preferred the printed copies to online, as they had limited internet connectivity. The researcher personally

approached the respondents to convince them to participate in the research. This approach enabled the researcher to get the views of respondents with minimum effort and also without wasting their time as they were able to complete them in their own spare time.

The questionnaires mainly consisted of closed-ended questions and some open-ended ones. Closed-ended questions are those questions where the researcher provides choices for the respondent to choose from while open-ended questions are those questions where the respondent is free to give their own point of views (Babbie, 2012).

Closed-ended questions were mainly used because they allow a great deal of uniformity on the responses. They were also chosen because they are easy to code and analyse, easier for respondents to answer, and there are fewer irrelevant or confused answers to questions. The closed-ended questions were used in the form of matrix and contingency questions.

The questionnaires included a title to identify the domain of the investigation to the respondents. The title was chosen so as to attract the attention of respondents.

The questionnaire was also accompanied by an introduction. The introduction had a brief description of the study, the purpose of the study and also the key terms in the questionnaire. The researcher also made sure that respondents were assured of the confidentiality of information gathered and also highlighted that there were no correct or incorrect answers to the questions.

Pre-testing

After preparing the questionnaire, it was tested using a small group of lecturers before being deployed to the actual sample. The group comprised of five lecturers from GZU and five from CPUT. This was done to check if the questions were clear, understandable and relevant. It also helped to improve the wording of the questionnaire and also to identify questions that were not necessary (Rothgeb et al., 2007). Respondent that were involved in the test were no longer eligible to be selected to be part of the research sample. Revisions were made based on the results of the pre-test and the questionnaire was sent out to respondents.

Validity and reliability

To ensure validity, relevance and reliability, the questionnaire was designed after consulting previous related researches. The test and re-test approach was also used to check for consistence in the data. The UTAUT constructs were used to gain insights into the dimensions that were chosen to characterise the factors affecting the adoption of cloud pedagogy.

4.9.2 Literature analysis

This is the process of gathering, reading and studying relevant background information on the phenomenon under study. It involves reviewing material such as books, documents, white papers and journals, which are considered to be rich sources of information (Maree, 2007). Literature study helps the researcher to compare opinions and findings.

Documents such as university policies, ICT policies, journals and books were also used to collect data. When analysing documents, the researcher should take into consideration all forms of written communication (Maree, 2007).

4.10 Data analysis

Data analysis is the process of trying to make sense out of data gathered during the data collection. It is the process of evaluating all the raw information collected from sources such as interviews, questionnaires and literature analysis into meaningful information which will be used to draw conclusions (Neuman, 2006). Patton (2002) states that: “Analysis makes clear what would have been most important to study, if only we had known beforehand.”

Data analysis can be seen as a process of generating meaning from raw data which has been collected during the study through questionnaires, interviews or other data collection methods. This process of categorising data into meaningful categories or themes may be either deductive and / or inductive.

- Deductive phase uses predetermined themes and produces an initial classification. This phase allows a large data corpus to be refined down so that it is manageable for the inductive phase, where a single researcher can generate new themes from the whole data set.

- Inductive phase is when the collected data is used to extract thenmes that will then be used for analysis. This produces conclusions that are more related to the data (Braun & Clarke, 2006).

This study follows a mixed method approach in data analysis with the qualitative approach being the most dominant one; hence it will implement both qualitative data analysis methods and a qualitative data analysis method. There are various types of qualitative data analysis methods, namely constant comparison, hermeneutical, matrix, narrative, heuristic, qualitative content analysis and thematic analysis. After examining various analytic techniques, thematic analysis was seen as appropriate for this study.

4.10.1 Thematic analysis

According to Braun & Clarke (2006), Thematic analysis is a technique of determining repetitive pattern within the collected data a method for identifying, analysing, and reporting patterns (themes) within data (Braun & Clarke, 2006). This method is mainly used in qualitative researches. It searches across the data set to identify repeated patterns of meaning.

Thematic analysis identifies patterns that emerge as relevant to the description of the phenomenon under study through “careful reading and re-reading of the data. It is a form of pattern recognition within the data, where emerging themes become the categories for analysis” (Fereday & Muir-Cochrane, 2006).

Thematic analysis has enjoyed much use in qualitative studies because it is simple to understand and do, does not consume much time and is a very flexible approach as it can be applied to any qualitative study. Thematic analysis can also be used as part of other data analysis methods like IPA, content analysis and grounded theory (Braun & Clarke, 2006).

The main goal of thematic analysis is to provide a simplified depiction of the findings**.** It helps present the data in a simplified version that is easy to draw conclusions from. When doing thematic analysis, data is arranged into themes. The themes can be discovered or identified either inductively or deductively

In deductive thematic analysis, uses a pre-determined framework that is defined before the data is collected (Braun & Clarke, 2006). Usually the researcher sets out variables or uses a

theory to do the analysis. Inductive thematic analysis is more appropriate where the research questions already identifies specific categories that can be used to group the data. It is also useful when there is limited time and resources as it is relatively quicker and easier to perform.

Inductive thematic analysis does not use predetermined theories or cartegories (Braun & Clarke, 2006) Categories or themes emerge as the researcher looks deeper into the data. The emerging categories are strongly linked to the data itself since they emerge from it (Braun & Clarke, 2006). This approach requires a lot of time and preparation and produces more valid results. This approach usually involves six phases: familiarisation with data; generation of initial codes; searching for themes among codes; reviewing themes; defining and naming themes; and producing the final report (Braun & Clarke, 2006).

Table 3.1 Phases of thematic analysis. source (Braun & Clarke 2006)**.**

Phase	**Process**	**Description**
Phase1	Familiarising yourself with your data	Read through the data to become familiar with what it entails paying more attention to repeating patterns.
Phase 2	Generating initial codes	Document where and how the patterns are occuring. This is usually done through data Data complication is also completed here.
Phase 3	Search for themes	Combine codes into overarching themes that accurately depict the data. It is important in developing themes that the researcher describes exactly what the themes mean, even if the theme does not seem to "fit." The researcher should also describe what is missing from the analysis.
Phase 4	Review themes	In this stage, the researcher looks at how the themes support the data and the overarching theoretical perspective. If the analysis seems incomplete, the researcher needs to go back and find what is missing.
Phase 5	Define and name themes	The researcher needs to define what each theme is, which aspects of data are being captured, and what is interesting about the themes.

Phase 6	Produce the report	When the researchers write the report, they must decide which themes make meaningful contributions to understanding what is going on within the data. Researchers should also conduct "member checking." This is where the researchers go back to the sample at hand to see if their description is an accurate representation.

According to Braun & Clarke,(2006), thematic analysis has various characteristics which make it more suitable for social science researches, these are:

- *"It can be used with any epistemological and ontological spectrum*
- *It can be underpinned by phenomenology, as well as by any number of other theories.*
- *It can be used to address a wide range of research questions.*
- *There are no specific requirements for sampling."* (Braun & Clarke, 2006)

Myers (2009) as cited by Achieng (2013) argued that "there is no one data analysis approach that is better than all the others," each analysis approach has its advantages, disadvantages and a certain scenario that is best suited for it to be used. Thematic analysis was adopted for this study over the other approaches because when using themes and codes to describe text, the data will become easy to retrieve and organise (Miles and Huberman (1994).

For this study, thematic analysis was used to synthesis the responses obtained about the respondent's (the various lecturers from the two institutions) views on the factors that are limiting the widespread adoption of cloud pedagogy by HLIs in the SADC region. The data was grouped into themes which are in line with the Unified Theory of Acceptance and Use of Technology (UTAUT).

4.11 Limitations of the study

This study recognises many methodological and technical limitations. The major limitation experienced was the lack of adequate reference material or limited access to required resources. Since the researcher is the primary instrument of data collection and analysis, another limitation to the study was investigator sensitivity (Merriam, 1998).

4.12. Delineation of the research

The research is to be conducted in Southern Africa and located at the Cape Peninsula University of Technology from South Africa and Great Zimbabwe University from Zimbabwe. Only these two HLIs will be used.

4.13 Ethical considerations

This research was done following the appropriate behaviour as recommended by CPUT and the Faculty of Informatics and Design research ethics standards. The research participants in this study were not forced to partake in the study without their knowledge and consent at the time. All research participants were informed of their rights as far as this research is concerned. Participation in the research was voluntary, research participants had rights to decide to participate or not to participate. Furthermore, it is acknowledged that information provided by research participants is for the sole purpose of enabling the researcher to complete the fulfilments required to obtain the Master's degree in Information Technology. The research subject did not involve discussion of sensitive topics, nor did it involve procedures that are harmful to the participants

4.14 Chapter Conclusion

This chapter provided details of the research approaches followed. It presented the philosophical paradigms, framework, the methods and techniques used to collect data, the data analysis process performed as well as the ethical issues taken into consideration in the study.

CHAPTER FIVE: PRESENTATION OF FINDINGS AND NARRATIVE ANALYSIS

5.1 Introduction

This chapter presents the empirical results of the main findings from the data that was collected from the surveys conducted at the two institutions and an analysis of the collected data. The data analysis will be done together with the presentation of findings. The analysis will try to answer the following research sub-questions:

- What are the learning technologies that are currently being implemented by higher educational institutions and how are they being implemented?
- How is cloud computing being implemented by higher education institutions?
- What are the associated challenges and factors regarding adoption of cloud pedagogy?
- What is the future of cloud computing in education in the SADC region?

The data analysis is spread over two strata. The first section of the data analysis will be the narrative analysis. The second phase is thematic analysis. This section of the analysis was done in the next chapter (Chapter six).

The first section of this chapter presents the empirical findings while the last section will be the narrative analysis.

The first section, on the analysis, discusses the general information about the respondents. It should be noted that most of the questions on the questionnaire allowed for multiple responses and a respondent would choose more than one option. Therefore, some of the results were presented in terms of percentage responses, not percentage respondents. However, it is stated if percentage responses or percentage respondents were used. Some questions have subsections that were only completed when the respondent qualified for the first part of the question. The stated results are for the whole sample, unless stated otherwise. From the study, the following information was found about cloud pedagogy access, awareness, adoption and usage patterns and the perception and attitudes towards cloud pedagogy of the various respondents that participated in the survey.

5.2 The Analysis of Findings

One major aspect of data analysis involves assertions about the research findings. This calls for the researcher to search for repeated patterns of generalisation across the collected data. Several authors have employed various steps or procedures for analysis and interpretation of data (Yin, 1994). However, many authors generally agree that addressing the research question or research objective are the key issues to focus on in data analysis and interpretation. This study was centred on a number of research questions that were posed in Chapter one to guide the study. A theoretical framework (UTAUT) was also adopted to guide the questionnaire design and the analysis.

In this section, an analysis of the research findings is done to answer the research questions. Although some of the research questions were answered through the literature review that was presented in Chapter two, they are briefly re-stated here under the appropriate and pertinent research question headings.

5.2.1 The analysis process

In the methodology chapter, we discussed that this study follows a qualitative research design. Since this study is qualitative in nature, a qualitative data analysis approach was seen to be appropriate. Qualitative data analysis involves a sequence of steps working on raw data to generate the meaning hidden in the data.

The data analysis was done using Miles and Huberman's (1994) interactive model of data analysis. The model states that qualitative analysis follows three stages; which are data reduction, data display and conclusion drawing/verification (Bazeley, 2013). They emphasised that:

- *"The cycle commences before data collection begin.*
- *Data reduction is part of analysis.*
- *Data display presents data in a simplified way to allow for easy interpretation.*
- *Meanings drawn from the data have to be tested against the data with more being sought as necessary*. " (Miles and Huberman's, 1994)

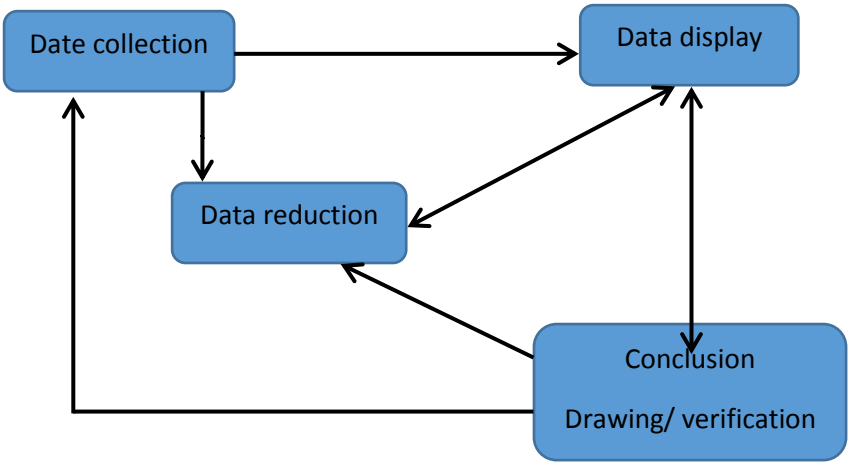


Figure 5.1 Components of data analysis: Miles and Huberman's interactive model

Source (Bazeley, 2013)

5.3 Narrative Analysis

This section presents the narrative analysis of the results that were extrapolated from the survey questionnaire at both the institutions, and also discusses the findings in line with the research questions. In doing the narrative analysis, the researcher approached the data with three specific central questions as follows:

- What are the learning technologies that are currently being implemented by higher educational institutions?
- How are they being implemented?
- How is cloud computing being implemented by higher education institutions?

All the collected data that relates to each of the questions was presented and analysed under the appropriate sub-heading. It should be noted that most of the questions on the questionnaire allowed for multiple responses and a respondent would choose more than one option. Therefore, some of the results were presented in terms of percentage responses not percentage respondents. However, it is stated if percentage responses or percentage respondents were used. Some questions have sub-sections that were only completed when the respondent qualified for the first part of the question. The stated results are for the whole sample, unless stated otherwise. From the study, the following information was found about the cloud pedagogy access, awareness and use patterns and perception and attitudes towards cloud pedagogy of the various respondents that participated in the survey

5.3.1 General information

This section discusses the analysis derived from the online survey questionnaire. Hard copy questionnaires were also printed and made available for those respondents who preferred the printed version to the online platform. A total of 160 questionnaires were sent out (80 questionnaires at each of the two institutions). Out of the 160 potential respondents, only 111 responses were received (54 were received from CPUT while 57 were received from GZU). This constitutes an average response rate of 69% for the whole survey. Independently, CPUT had a response rate of 67.5% and GZU had a response rate of 71.3%.

The questionnaire had both open-ended and closed-ended questions. The next section presents the narrative analysis for the closed-ended questions from the questionnaire.

Personal data

This section gives an overview of the personal data about the respondents which was collected from the first section of the questionnaire. The personal data includes the position held, years of experience, number of subjects or modules they teach and the average number of students they have in each class.

Position held

The first question on the questionnaire asked about the respondent's current position as an educator. It had five options were the respondent could choose from; these are teaching assistant, junior lecturer, lecturer, senior lecturer and professor.

Table 5.1 Respondents' current positions

Position held	GZU	CPUT	Total
Teaching assistant	5	6	11
Junior lecturer	0	4	4
Lecturer	39	35	74
Senior lecturer	9	7	16
Professor	4	2	6
Total	**57**	**54**	**111**

As shown on Table 5.1, lecturers accounted for the greater portion of the sample. They accounted for about 67 percent of the respondents. Senior lecturers contributed the second largest part of the sample, and accounted for about 14 percent. Teaching assistants accounted for 10 percent, professors accounted for 5 percent while junior lecturers were 4 percent of the sample. No junior lecturers were involved from GZU because the institution does not have that type of position; they only have teaching assistants, lecturers, senior lecturers and professors. PhD holders who are not yet professors were recorded as senior lecturers. Fig 5.2 shows the percentage representation of the positons held by the respondents.

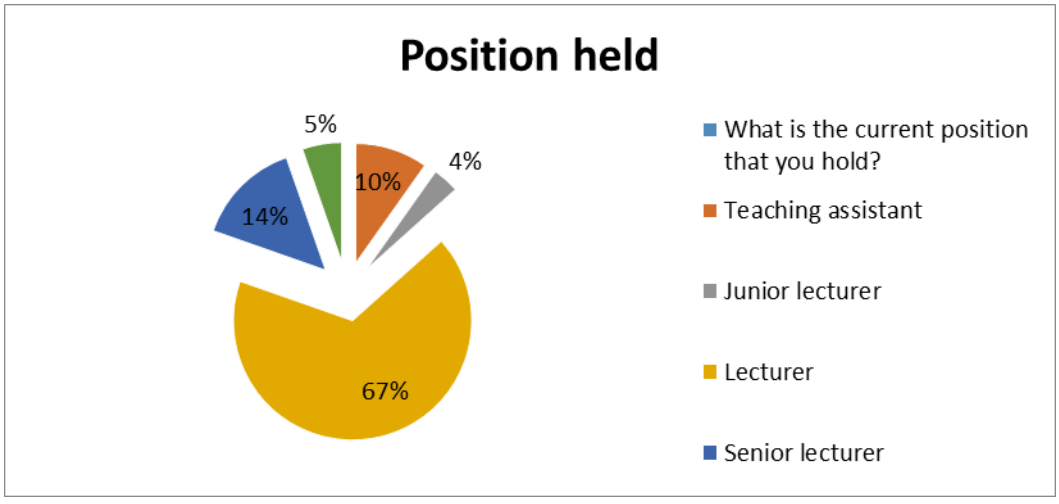


Figure 5.2 Percentage respondents' current positions

Years of experience

The respondents were then asked about their years of experience; that is the number of years they have been serving as educators. They were presented with four options to choose from. The responses were as shown in table 5.2.

Table 5.2 Respondents' year on their current positions

Years in the position	**GZU**	**CPUT**	**Total**
Less than 1 year	6 (8.9%)	8 (14.8%)	14 (12.6%)
1 to 3 years	22 (39.3%)	19 (35.2%)	41 (36.9%)
3 to 5 years	15 (26.8%)	5 (9.3%)	20 (18.1%)
More than 5 years	14 (14%)	22 (40.7%)	36 (32.4%)
Total	**57 (100%)**	**54 (100%)**	**111**

The majority of the respondents had between 1 to 3 years at their current positions, they accounted for almost 40 percent of the total population (22 from GZU and 19 from CPUT). About 13 percent of all the respondents combined had less than one year in their current positions. Respondents from CPUT had a larger contribution to this figure (8 compared to GZU's 6). Approximately 18 percent of the sample had between 3 to 5 years in their current positions while around 32 percent had more than 5 years in their current positions. These two groups contributed about 50 percent of the whole sample.

The data shows that the sample drawn was evenly distributed as it comprises of both respondents who have been in the educative field for a long time and those who had just joined the profession. This gave an equal representation of the views from both more experienced people who had been in the field before cloud pedagogy was devised and those who had just joined the profession.

Average workload per semester

The respondents were further asked about the number of modules or subjects they teach and the average number of students they have in each class. Most of the lecturers in the sample were teaching at least two modules (GZU) or subjects (CPUT) during the period when the data was collected (that is between June 2015 and July 2015). Some respondents highlighted that they were involved with two distinct groups of learners. Respondents from CPUT noted that they were teaching fulltime students as well as part-time students. Some respondents from GZU stated that they were teaching fulltime students, students on the parallel program - which is equivalent to part time at CPUT - and block release students which is a group mainly made up of those students who are employed and will only come to the university for six weeks per semester, these six weeks being spread evenly across the semester.

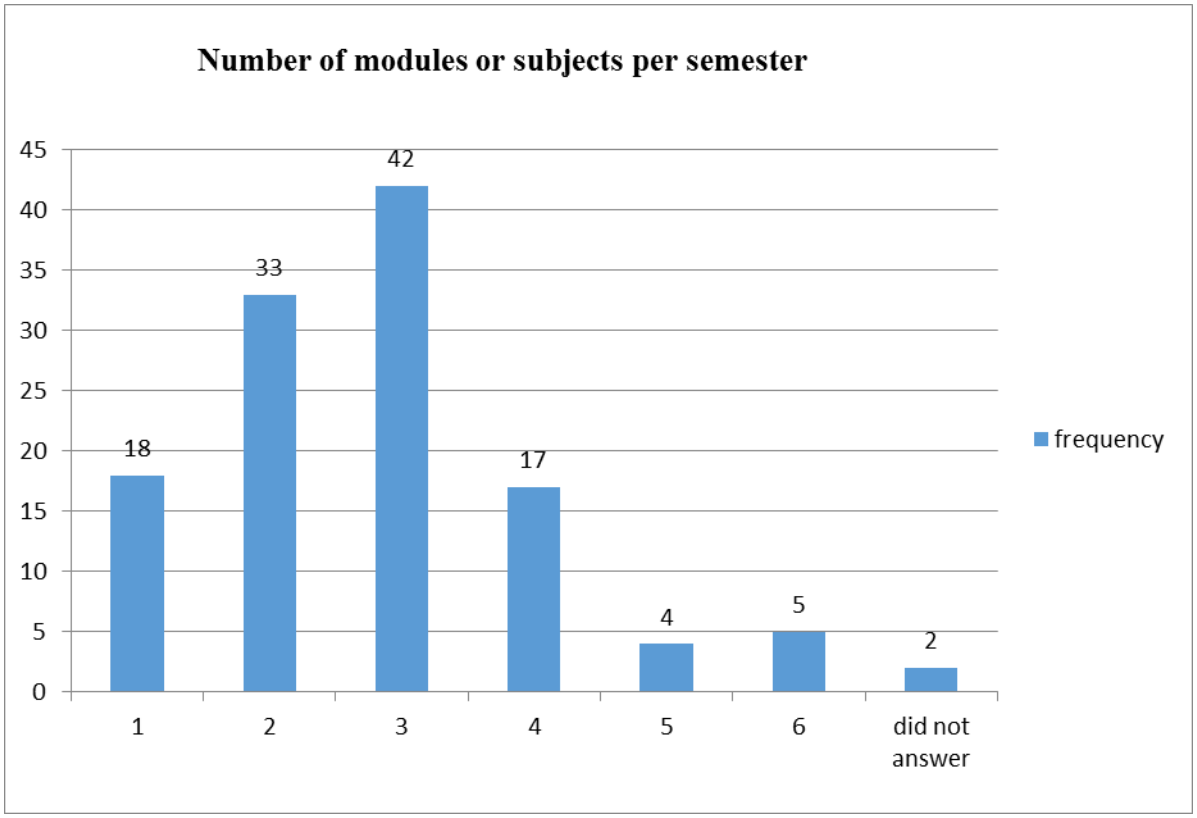


Figure 5.3 Number of modules taught per semester

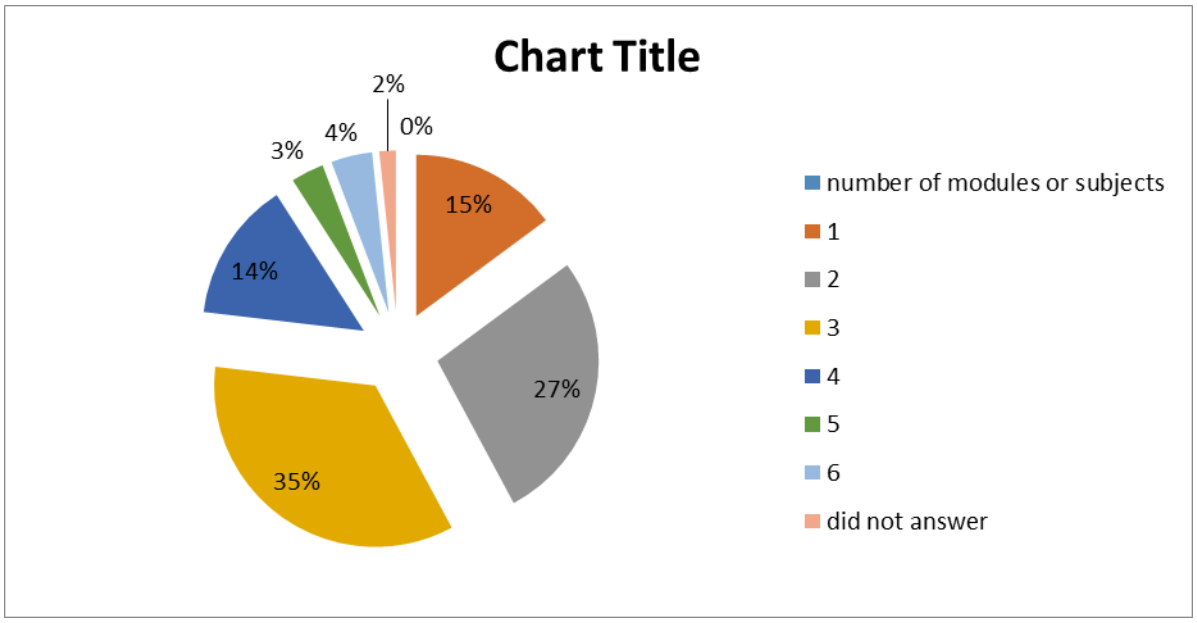


Figure 5.4 Percentage representations of modules being taught

Fig 5.3 shows frequencies for the average number of modules the respondents were teaching when the study was conducted and the pie chart shows the percentage representation of the modules being taught by the respondents. More than 80 percent of the sample was teaching at least two modules or subjects. Only 2 percent of the respondents did not answer the question, with reasons given being that they were not teaching any modules/ subjects this semester. Most of the respondents were teaching 3 modules/subjects, accounting for approximately 35 percent of the population, followed by those who indicated that they had 2 modules who also accounted for around 27 percent. Some respondents indicated that they had up to 5 or 6 modules to teach that semester.

The respondents further highlighted that each class had at least 20 students, with some having up to 100 students, with the average number of students in each class being 60. These numbers show that the lecturers have a very high work load. From the data, the ratio of lecturer to student is very high and the lecturers might not be able to reach out to all their students equally. Figure 5.5 shows average the number of students per class.

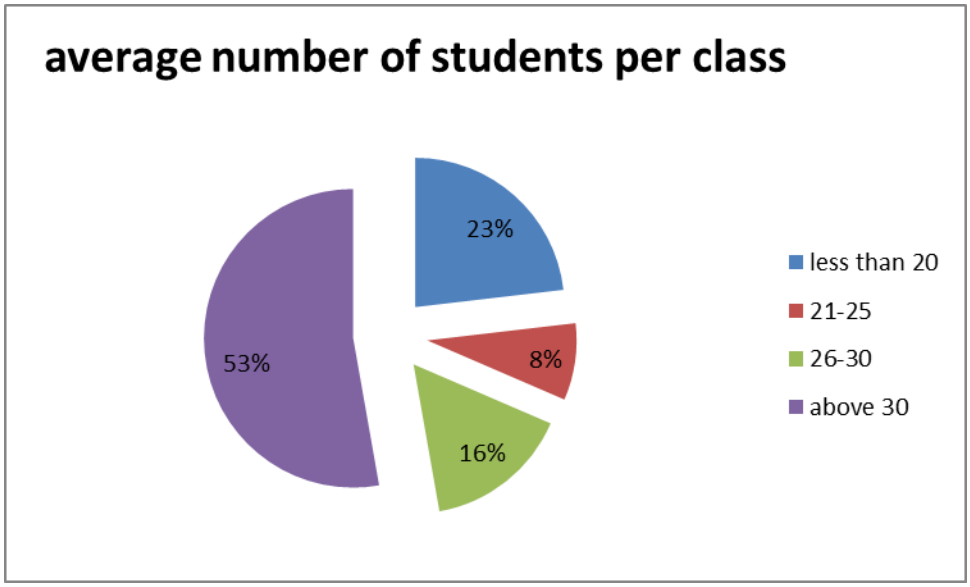


Figure 5.5 Average number of students per class

5.4 ICT adoption in the class room

The respondents were presented with options to indicate whether they use ICT tools to facilitate teaching. As shown on Table 5.3, about 91 percent of respondents from GZU use ICT tools to facilitate teaching, while about 9 percent do not use any ICT tools to facilitate teaching. All respondents from CPUT indicated that they use ICT tools to facilitate teaching. Cumulatively, about 95 percent of the sample use ICT tools to facilitate teaching. On the other hand, the remaining 5 percent of responses do not use ICT tools to facilitate teaching. This is typical of the lecturers who do not know how to use these tools or are just ignorant to use ICT tools.

Table 5.3 Respondents' use of ICT tools in teaching

Do you use ICT tools to facilitate teaching?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Yes	52 (91.2%)	54 (100%)	106 (95.5%)
	No	5 (5.3%)	0 (0%)	5 (5.5%)
	Total	57 (100%)	54 (100%)	111 (100%)

The respondents who indicated that they use ICT tools in teaching were presented with options to indicate which ICT tools they use. They could choose more than one option. As shown in fig 5.5, most of the respondents use internet and email to communicate with their students, with email enjoying the highest usage overly and the intranet with the least usage.

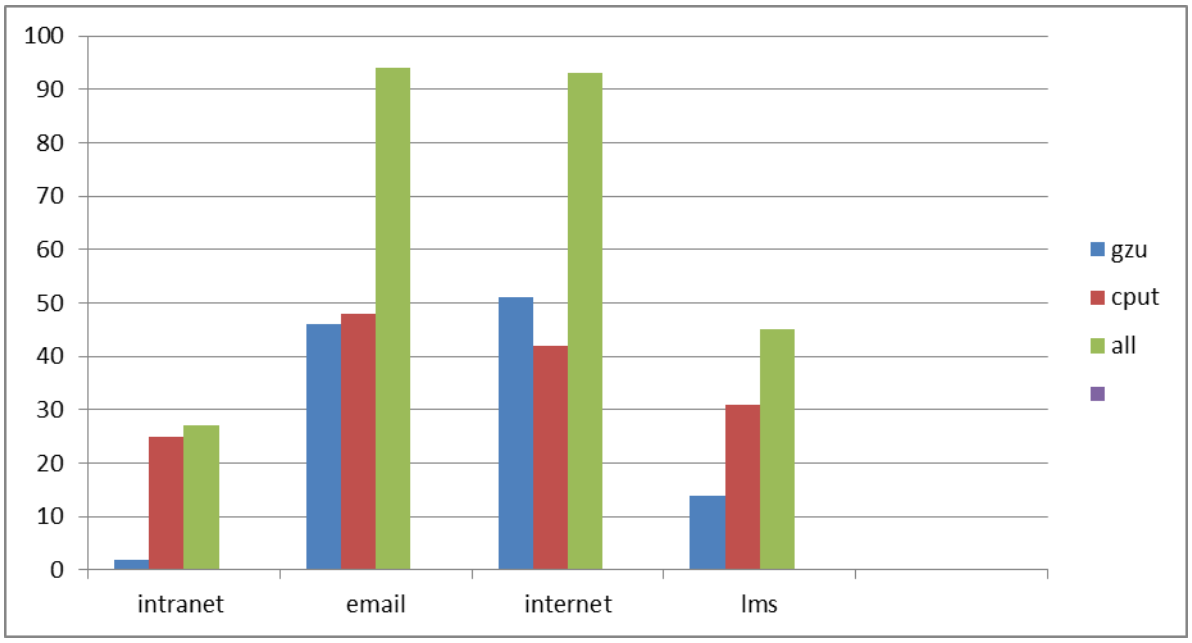


Figure 5.6 ICT tools usage by respondents

For respondents from GZU, about 4 percent use intranet, approximately 94 percent use internet, about 85 percent use email and about 26 percent use Learning Management Systems (LMS). Of those from CPUT, about 46 percent use intranet, about 78 percent use internet, 89 percent use email and 57 percent use LMS. Cumulatively, about 26 percent of respondents use their institution's local intranet, about 88 percent use the internet, 89 percent use email, and 43 percent use LMS.

5.5 Cloud services awareness and use

To determine whether the respondents were aware of cloud computing services that are available for use by the public, the respondents were requested to indicate whether they are knowledgeable about any application that is accessible from the cloud.

From GZU, 82.5 percent of the respondents indicated that they were knowledgeable about cloud-based applications and the remaining 17.5 percent indicated that they were not knowledgeable about any cloud-based applications.

From CPUT, about 67 percent of the respondents indicated that they were knowledgeable about cloud-based applications and the remaining 33 percent indicated that they were not knowledgeable about any cloud-based applications.

Table 5.4 Respondents' knowledge of cloud technologies.

Are you knowledgeable about any cloud services?				
		Frequency		
		GZU	**CPUT**	**Cumulative total**
Valid	**Yes**	47 (82.5%)	36 (66.7%)	83 (74.8%)
	No	10 (17.5%)	18 (33.3%)	28 (25.2%)
	Total	57 (100%)	54 (100%)	111 (100%)

Cumulatively, about 75 percent of the respondents have knowledge of cloud computing services while only about 25 percent did not have any knowledge of cloud technologies. This shows that most of the respondents were highly aware of the new technology trends that are happening in the world and also aware of the existence of cloud technologies.

The respondents who highlighted that they were knowledgeable about cloud technologies were further asked if they have used any cloud technologies to facilitate teaching, which services they have used and what task they used those services for. They were presented with a list of cloud services to choose from.

Table 5.5 Respondents' use of cloud technologies

Have you used any cloud services?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Yes	43	36	79
	No	4	0	4

All respondents from CPUT who had highlighted that they are knowledgeable about cloud services said they have used them to facilitate teaching and only 43 of the 47 respondents from GZU who had highlighted that they are knowledgeable about cloud services said they have used them to facilitate teaching. Seventy nine respondents highlighted that they have used cloud technologies to facilitate teaching.

Of the respondents from CPUT, about 83 percent indicated that they use a cloud-based email facility; about 67 percent said they use cloud-based LMSs, about 61 percent said they use cloud-based eLearning systems and about 47 percent said they use social networks.

For those from GZU, about 95 percent indicated that they use a cloud-based email facility, about 16 percent said they use cloud-based LMSs, about 35 percent said they use cloud-based eLearning systems and about 51 percent said they use social networks.

Table 5.6 Cloud technologies used to facilitate teaching

Which of these cloud technologies do you use?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Email	41 (95.3%)	30 (83.3%)	71 (89.9%)
	LMS	7 (16.3%)	24 (66.7%)	31 (39.2%)
	eLearning	15 (34.9%)	22 (61.1%)	37 (46.8%)
	Social networks	22 (51.2%)	17 (47.2%)	39 (49.4%)

Cumulatively, about 90 percent indicated that they use a cloud-based email facility; about 39 percent said they use cloud-based LMSs, about 47 percent said they use cloud-based eLearning systems and about 49 percent said they use social networks.

The respondents were further asked how they normally use the cloud technologies in facilitating the teaching process. As shown in table 5.8, approximately 89 percent said they use cloud technologies for posting assignments, about 82 percent said they use them for posting lecture notes, about 51 percent said they use them to post continuous assessment marks and about 52 percent said they use them for discussions with their students. Thirteen percent noted that they also use the cloud technologies for other purposes like doing research, submitting journal articles and sharing information.

Table 5.7 Tasks they use cloud technologies for

What do you normally use them for?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Posting assignments	37 (86%)	33 (91.7%)	70 (88.6%)
	Posting lecture notes	32 (74.4%)	33 (91.7%)	65 (82.3%)
	Posting continuous assessment marks	16 (37.2%)	24 (66.7%)	40 (50.6%)
	Discussions with students	22 (51.2%)	19 (52.8%)	41 (51.9%)
	Other	5 (11.6%)	8 (22.2%)	13 (16.5%)

Respondents were further asked on the locations where they get access to cloud services and how frequently they access them.

Table 5.8 Sources of cloud access for the lecturers.

Where do you access them from?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Home	22 (50%)	20 (55.6%)	42 (53.2%)
	Work	44 (100%)	32 (88.9%)	76 (96.2%)
	Internet café	6 (13.6%)	2 (5.6%)	8 (10.1%)
	Other	0 (0%)	4 (11.4%)	4 (5.1%)

At GZU all the respondents said they access the cloud applications at work, 50 percent said they have access at home while only about 14 percent said they also get access at internet cafes, and no respondent highlighted that they have other means of access to cloud services.

At CPUT, about 89 percent of the respondents said they access at work, approximately 57 percent said they also have access at home, about 6 percent said they also get access at

internet cafes, and about 11 percent of the respondent highlighted that they have other means of access to cloud services.

Collectively, about 96 percent of the respondents said they access them from work, approximately 53 percent said they access them at home, 10 percent said they go to internet cafes while about 5 percent said they use other sources like their smartphones and tablets.

Respondents were given options to choose on how frequently they access these cloud services. They could choose either regularly which meant more than twice a day; everyday which meant once a day; once a week; or once a month.

Table 5.10 Lecturers' use of cloud services

How often do you access them?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Regularly	13	14	27 (34.2%)
	Everyday	31	19	50 (63.3%)
	Once a week	0	2	2 (2.5%)
	Once a month	0	0	0 (0%)
	total	44	35	79

All the respondents from GZU indicated that they access at least once a day. Only a small percentage from CPUT indicated that they access them at least once a week as presented on table 5.9.

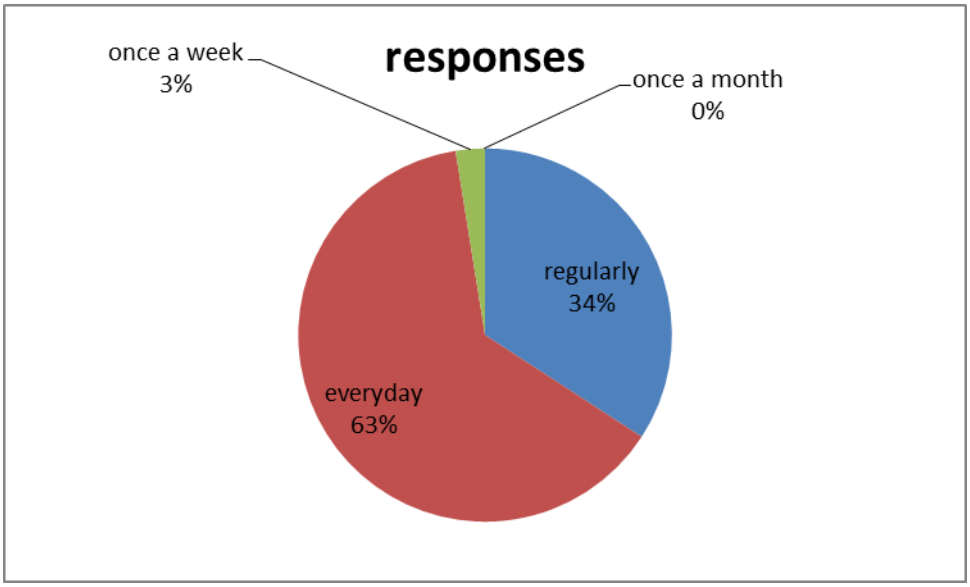


Figure 5.7 Lecturers' use of cloud services

Overall, about 98% of the respondents' access cloud services at least once a day, this figure being composed of the 63 percent who said they access every day and the 34 percent who said they access regularly. Only about 2 percent of the respondents access them once in a week. This shows that the lecturers at these two institutions are very much aware of cloud services and are using them more often.

Level of satisfaction with cloud

Respondents were asked about the level of satisfaction they get from using the current cloud-based applications that they are using. They were given four options to choose from. The options were: very satisfied, satisfied, dissatisfied and very dissatisfied.

Table 5.10 Respondents' level of satisfaction with cloud services

How often do you access them?				
		Frequency		
		GZU	CPUT	Cumulative total
Valid	Very Satisfied	7	8	15 (19%)
	Satisfied	35	27	62 (77%)
	Dissatisfied	1	1	2 (2%)
	Very Dissatisfied	2	0	2 (2%)

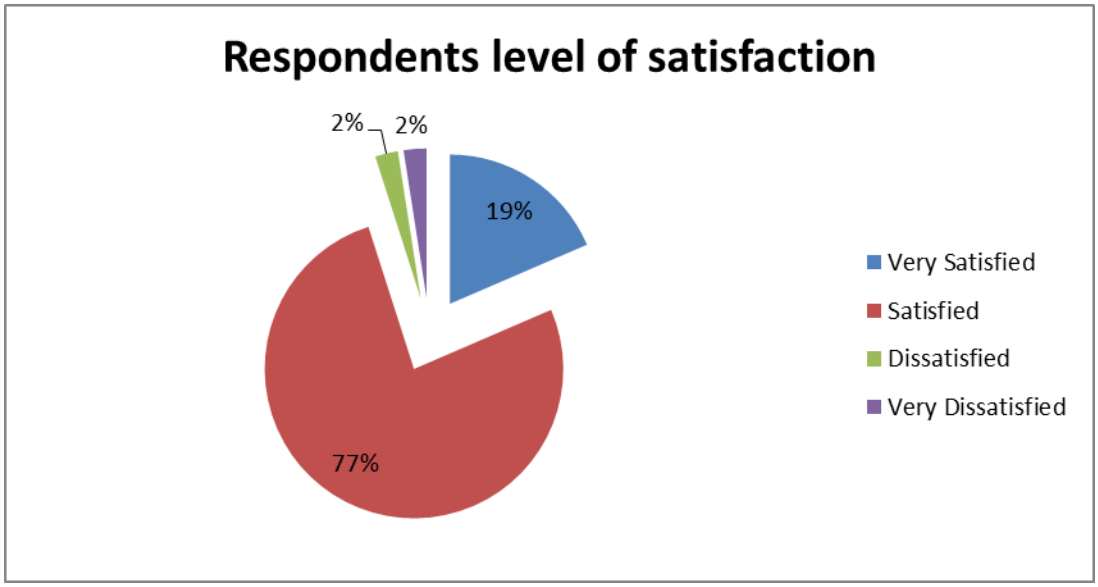


Figure 5.8 Respondents level of satisfaction from cloud services

An interesting point to note from fig 5.7 is that most of the respondents are satisfied with the experience they had while using cloud-based applications with very few being dissatisfied. Approximately 77 percent of all the respondents are satisfied with cloud services, about 19 percent are very satisfied, 2 percent said they are dissatisfied while the remaining 2 percent also said they are very dissatisfied.

To assess whether the respondents were aware of the cloud services that their institutions have adopted, they were asked if their institutions had formally adopted any cloud application.

Table 5.11 Respondents' knowledge of cloud adoption at their institution

Has your institution formally adopted cloud based pedagogical technologies (cloud pedagogy)?				
		Frequency		
		GZU	**CPUT**	**Cumulative total**
Valid	**Yes**	32	27	59
	No	12	8	20

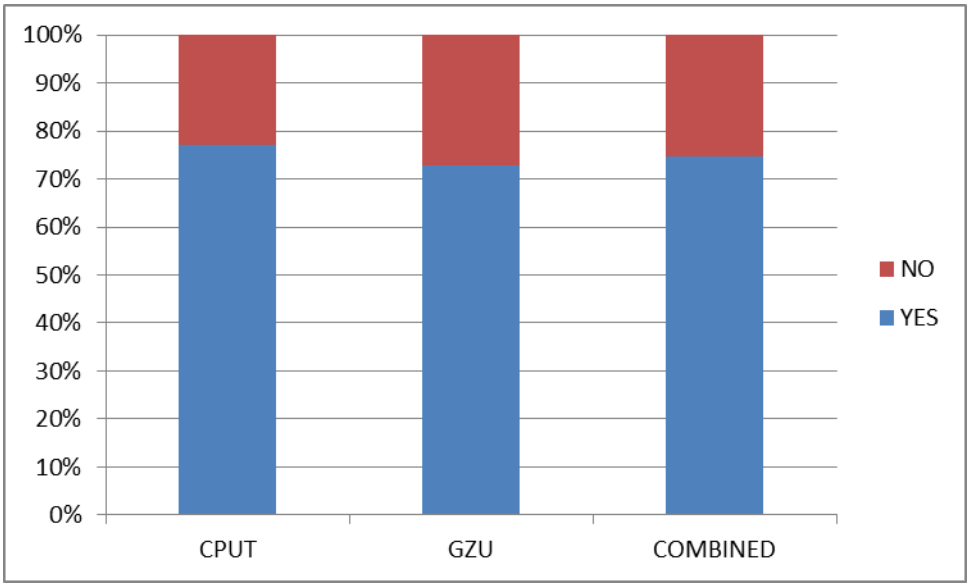


Figure 5.9 Respondents' knowledge of cloud adoption at their institutions

As shown in table 5.11, about 73 percent of the respondents from GZU indicated that their institution has formally adopted cloud services while only about 27 percent indicated that their institution has not adopted cloud services. While preliminary investigations had shown that the institution has indeed adopted cloud services in the form of their email system and Moodle (a cloud-based open source learning management system), this shows that almost three quarters of the respondents are aware of the ICT developments that are happening at their institution.

The scenario was the same for the responses from CPUT though the percentage for those who knew was a bit higher, about 77 percent of the respondents from CPUT indicating that their institution has formally adopted cloud services while only about 23 percent indicating that their institution had not adopted cloud services. Preliminary investigations at CPUT discovered that the institution has indeed adopted cloud services for their email system (Microsoft live@edu). This shows that more than three quarters of the respondents are aware of the ICT developments that are happening at their institution.

5.6 Critical assessment of the findings

5.6.1 Different kinds of learning technologies that are being used by HLIs

HLIs have adopted various ICTs into their operations. These technologies are used for numerous operations around the institution including financial systems, human resource systems, payroll system, learning technologies, and student record keeping systems, among

others. Literature showed that ICTs are used in different institutional departments depending on type and function. However when referring to ICT in education the reference is usually to "teaching and learning with ICT" (ELMO Global, 2012).

From the results of this study as presented in the findings, almost all the respondents from the two institutions indicated that they use ICTs in teaching and learning. This is acceptable in the current technology-driven era where the majority of the population of new students being enrolled at universities are well versed in the new technologies. These students, known as digital natives (Prensky, 2011) have not known a world without the internet.

Regarding the type of technology they use, the respondents stated that they mainly use email and the internet to communicate with their students. Email emerged as the most widely used technology because almost everyone these days has at least one email address. At almost all HLI nowadays, every new person (be it student or lecturer) is given a personal email address upon enrolment. The email addresses are registered on the institution's private domain and they use the student number or staff number as the email address (e.g. 12345@cput.ac.za, where 12345 is the student or staff number and cput.ac.za is the institution's domain). Email also has the largest use because most institutions have adopted it as the official way of communicating issues relating to either the teaching process or the administrative side. For instance at GZU, when the Microsoft Live@edu email system was adopted, all the members of staff were encouraged to use the university's official email system as a way of communicating all information which was related to university business, be it information directly linked to teaching and learning, or administrative information.

The internet also emerged as the most used technology because all the HLIs have free internet access through Wi-Fi hot spots that are enabled at all of their campuses for use by both staff and students. The institutions also have a wired internet facility which is accessible through the institution's intranet. This is mainly used by the lecturers as they have ethernet cables running through their offices. The internet also recorded high levels of use due to the developments in mobile network facilities. All mobile network service providers have enabled internet access at a reasonable price. The general increase in the use of smart phones and tablets has also contributed to high internet use by the respondents.

Apart from using emails and the internet, the lecturers further indicate that they also use their institution's local intranet and learning management systems (that is Blackboard for CPUT and Moodle for GZU). This is because these systems are mainly used on a day-to-day basis

at the institutions and university management has made provision so that they are freely available to both lecturers and registered students. The systems are also used because the institutions have made it mandatory for lecturers to use these technologies when communicating with their students. In some faculties it is mandatory for students to submit their assignments through learning management systems that are available at the institution. The fact that most lecturers use these systems implies that almost all students also use them. Fig 5.9 below shows the distribution of the different technologies being used by the respondents.

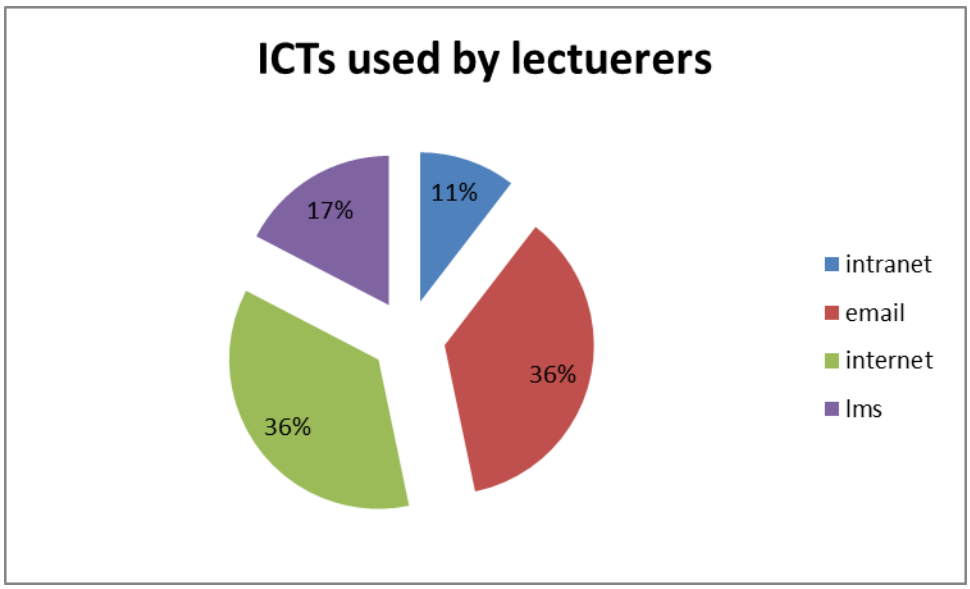


Figure 5.10 ICTs used by the respondents

Some lecturers also indicated that they use social network sites like Facebook and Whatsapp to communicate with their students. They stated that these were also convenient as an increasing number of students these days own a smartphone, a tablet or an iPad.

The lecturers indicate that email is most convenient mainly because they can have access to their email address from anywhere as long as they have internet access. They also said that emails have more privacy as no one is able to view personal messages if they do not have the personal password. The least used ICT is local intranet. This technology received the least responses mainly because the respondents were not fully knowledgeable of what it really is even though they use it every day.

5.6.2 How the learning technologies are being implemented at the institutions

There are various ways in which technology can be implemented at an organisation. Depending on organisational preferences, IT policies and strategies, and available resources, an organisation can choose to host in-house all its ICT systems or to outsource to an external vendor.

An in-house hosting is an arrangement whereby an organisation has all of its ICT systems kept at its own IT department. This means that the systems will be housed on the organisation's own servers and their IT department will be responsible for the maintenance and support of the systems.

Outsourcing is an arrangement in which an organisation sub-contracts an entity outside of its formal structure to provide services for all or part of its IT (Information Technology) function. The trend of outsourcing is becoming more common in the business world. A lot of ICT outsourcing companies have been formed to cater for the increasing demand of outsourced IT services. An organization can outsource services ranging from infrastructure to software development, maintenance and support. This provides an entity with the opportunity to have better ICTs and the possibility of achieving technological improvements while saving on some costs ranging from buying own infrastructure to employing qualified personnel.

From the findings it is evident that the two institutions use both of the hosting options. They have some systems that are hosted in-house and some that are outsourced. CPUT hosts its Learning Management System (Blackboard Learn application) in-house at their local servers at the CTS department. They also host their other non-pedagogical ICT systems like the HR system hosted in-house. It is only their email (Microsoft Live@edu) system that they have outsourced to an outside cloud vender (Microsoft). On the other hand, GZU has its Learning Management System (Moodle, an open source system) on the cloud. They also have a cloud-based email system that is hosted by Microsoft. All the other remaining systems are hosted in-house by their CTS department.

5.6.3 How Cloud computing is being used by the institutions

From the literature review, it is seen that cloud computing can be applied to a lot of applications in a typical HLI. The three cloud service models; Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) can be used to service many functions in a HLI. SaaS is used so that software or applications run on the cloud provider's servers and users interact with it via internet-enabled devices (Mtebe, 2013). For this service, an institution can adopt software packages that that are already hosted on the cloud or migrate current software applications to the cloud.

Platform as a Service enables access application development platforms through APIs which support a specific set of programming language (Mtebe, 2013). The institution would gain a framework which it can build upon to develop or customise applications. This would make the development, testing, and deployment of applications quick, simple, and cost-effective.

Infrastructure as a Service enables the cloud consumer to access, monitor and manage remote data centre infrastructure such as computers, storage, networks and network services (e.g. firewalls) (Mell & Grance, 2011). It also gives the consumer the ability to control operating systems, storage, and other network components. This would save the institution from the problems of purchasing the latest technology, of maintenance and the upgrading of software and software licenses (Mtebe, 2013).

The findings show that the institutions have both adopted a cloud-based email system (Microsoft Live@edu). The service utilises both SaaS and IaaS. It utilises SaaS in that the email software is owned by the vendor (in this case Microsoft) and the institutions access it remotely. It also falls under IaaS in that the institutions do not need to buy servers to host the email system as it is hosted externally by the cloud provider. This means that the institutions do not have to keep a localised email server where they store their email system, but just access it remotely on the cloud.

As shown in the finding (Chapter 5) on table 5.2 which shows the respondents' use of cloud technologies, seventy nine of the eighty three respondents who indicated that they are knowledgeable about cloud computing stated that they are actually using cloud-based applications. This shows that a greater percentage of the research population have actually adopted cloud pedagogy in their teaching practise.

Apart from those applications that are formally adopted by their institutions, the respondents also indicated that they use other cloud-based applications to facilitate easy communication with their students. The respondents said that they also use social networks such as Facebook and WhatsApp to communicate and set up meetings with their students. Some respondents went on to indicate that they have created WhatsApp groups and Facebook pages where they have discussions with their students. They indicated that this was a very effective way to keep in touch with their students during after-class times as almost all of the students use those social media applications.

5.6.4 Uses of cloud application in teaching and learning

HLIs have adopted various forms of cloud applications that they are using for different tasks in their institutions. Some are used directly in the knowledge delivery process while others are used for other activities that support the teaching process. This study was focussed on the uses of cloud applications in the knowledge delivery process.

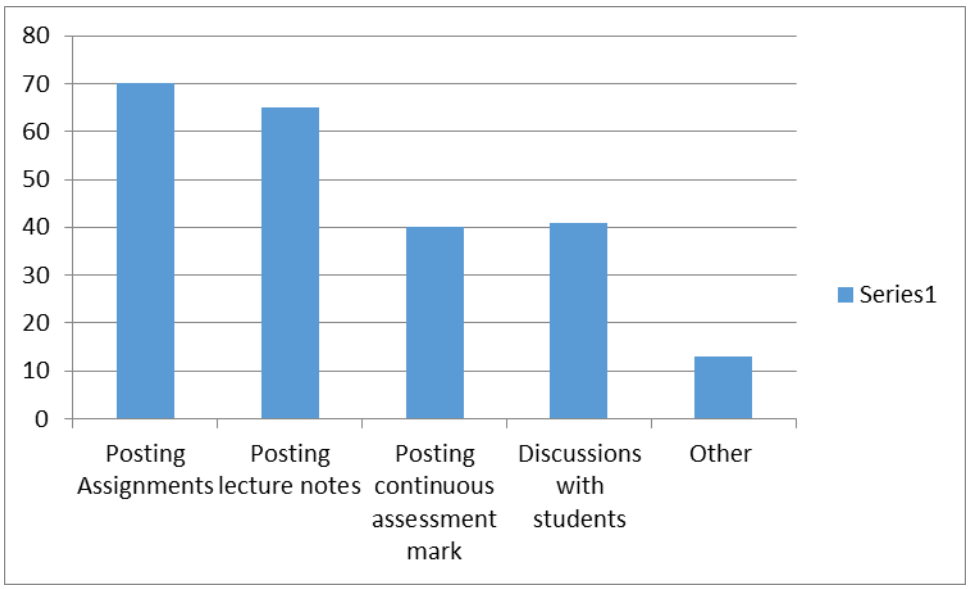


Figure 5.11 Respondent's use of cloud pedagogy

From the findings, the respondents indicated that they use cloud applications for various tasks that support their teaching processes. The respondents stated that they use cloud applications for posting assignments, posting lecture notes, posting continuous assessment marks and as forums to conduct discussions with their students. Others highlighted that they also use cloud technologies for other purposes like doing research, submitting journal articles, sharing information or setting appointments with their students.

CHAPTER SIX: THEMATIC ANALYSIS

6.1 Introduction

As stated in Chapter 5, data analysis will be done in two strata, and this chapter presents the second strata of the analysis of the results that were found from the survey questionnaire. It presents the thematic analysis part. It presents the qualitative data analysis of the data obtained from the questionnaire.

The contribution of this study towards the theoretical model is also presented. Yin (2014) stated that "the validation of data analysis should be based on the theoretical framework and its propositions*."* With that statement, a detailed description of each theoretical construct with respect to the findings of the study is reviewed in this section.

Chapter 3 stated that this study follows a qualitative approach with an interpretivist view, exploring the factors that are slowing down the widespread adoption of cloud pedagogy; it is exploratory in nature. Usually exploratory approaches to qualitative analysis are not specifically designed to confirm hypotheses; this does not mean that they are theoretical. This study employed an exploratory approach with pre-determined analytic categories which were generated from the theoretical framework adopted for the study. The coding and theme development was directed by existing concepts or ideas.

The analysis in this chapter was done at the same time with the presentation of findings on the questions that were pre- categorised under the themes that were pre stated from the theoretical frame work. It also includes the analysis and presentation of findings from the questions that were open ended fin the questionnaire.

6.2 Thematic Analysis

Thematic analysis is usually dependent or focused on the interpretation of data. According to Boyatzis (1998), as cited by Alhojailan (2012), thematic analysis illustrates data in great detail and deals with diverse subjects. It is considered the most appropriate data analysis method for studies that seek to discover hidden patterns in data using interpretations (Alhojailan, 2012). Because of its interpretive power, this method was considered for this study.

As mentioned in Chapter 3, this study follows the interpretivism paradigm. Interpretivists explain that reality can be fully understood only through subjective interpretation and intervention. They view knowledge as based on observable events, personal beliefs, values, reasons and understanding that humans interpret (Ojong & Muthuki, 2010).

According to Sandunders et al.(2009), Interpretivism has its origins in two intellectual traditions: phenomenology and symbolic interactionism (Mark Saunders et al., 2009)**.** Phenomenology is defined as the consciousness as experienced from a person's point of view. It can be seen as how individuals make sense from their environment. Symbolic interactionism on the other hand is the continual process when individual extract meaning from their social environment as they interact (Saunders et al., 2009). Thematic analysis is considered the strongest analysis method to interpret and generate meaning or knowledge from data, hence it was considered the most appropriate method for this study.

6.3 Themes from the survey

There are many techniques for discovering themes in text. These techniques may be based on an analysis of text looking for repetitions of words and generate word frequency, searching for metaphors, and linguistic connectors (Ryan & Bernard, 2003). Themes can also be generated from previous literature on the same subject or from common sense (Ryan & Bernard, 2003). For this study, themes came from the theoretical construct chosen for the study, which is UTAUT.

Two main categories were stated:

- Perception of cloud technologies.
- Attitude towards cloud technologies.

Attitude is defined as what is reflected in an individual's behaviour towards a certain thing or how individuals react to their own perception of a situation. For the study, attitude was defined as how individuals react to the adoption and use of cloud pedagogy. All the constructs from the theoretical framework were grouped into these two main categories as summarised in Table 6.1.

Table 6.1 Themes from the framework

Category	Theme	Description
Perception	Performance expectance	The degree to which the participant believes that using cloud pedagogy will help them enhance the teaching process.
	Effort expectance	The degree to which cloud pedagogy is easy to use.
	Social influence	The degree to which the participant's adoption behaviour is influenced by people around him/her.
	Facilitating conditions	These are other conditions that support the use of cloud pedagogy e.g. organisational policies, technical infrastructure, finances, state of the economy, etc.
Attitude	Behaviour intentions	Participant's intentions to use cloud pedagogy.

6.4 Perception of technology

Perception is defined as how individuals see things, how they view the world. From the data, perception is defined as how the participants view cloud pedagogy in relation to their jobs.

The responses from the questionnaire reveal various perceptions about the adoption of cloud pedagogy and the general adoption of technology into teaching and learning. Most of the lecturers had a perception that with cloud pedagogy, the teaching process would be improved. They were of the view that it would enable them to communicate with their students more easily and also simplify the distribution of learning material. Most of the lecturers agreed that benefits can be derived from cloud pedagogy. These perceptions are fully explained in the themes that follow.

6.4.1 Performance expectancy

This theme is derived from the general perception of what respondents expect from cloud pedagogy in terms of its performance. Venkatesh et al. (2003) defined performance expectance as the degree to which using a certain technology to perform a certain task will provide benefits to the consumer. They further described it as the perceived usefulness of a certain technology, and in particular, the degree to which the participant believes that using the technology will help them enhance their work. In light of this, this study analysed the agreement levels of lecturers regarding their perception towards the performance expectancy of cloud pedagogy.

For individuals to fully embrace a technology, it must demonstrate that it will have a positive impact on what they will use it for. Previous studies of technology acceptance have found that participants are most likely to adopt new technology if they perceive it as useful (Holden & Karsh, 2010; Venkatesh et al., 2012a).

For this study, the respondents were asked about the degree to which they believe that using cloud pedagogy will help them enhance the teaching process. They were presented with questions which were seeking their views on the perceived advantages or usefulness of cloud pedagogy when adapted to aid traditional teaching methods. The section had nine distinct questions all enquiring about the respondent's perception of the usefulness of cloud pedagogy.

PE1 Adoption of cloud pedagogy improves the teaching process.

PE2 Cloud pedagogy facilitates the easy flow of and access to learning material.

PE3 Adoption of cloud pedagogy enhances collaborative learning.

PE4 Cloud pedagogy expands the breadth and depth of the curriculum.

PE5 The adoption of cloud computing technology at the university helps to activate new services.

PE6 The adoption of cloud computing technology at the university helps to improve the quality of its services.

PE7 The adoption of cloud computing technology at the university helps in distinguishing the university in its provided services, which is different from that provided by other universities.

PE8 The adoption of cloud computing technology at the university helps to improve the performance of current university services.

PE9 The adoption of cloud computing technology in IT operations will support the learning process.

The responses from the questionnaire reveal various perceptions of cloud pedagogy when adopted in HLIs. Most of the lecturers surveyed had a perception that with cloud pedagogy, the knowledge delivery process would be improved and learning material will become easier to share and access. They were of the view that cloud pedagogy adoption would enhance collaborative learning as students will be able to interact with other students and professionals from other institutions around the world. This is supported by the fact that most cloud-based learning tools that are currently being designed (e.g. Moodle being used at GZU) have a discussion forum where learners and educators can engage in discussions and share ideas and knowledge.

Respondents also agreed that cloud pedagogy would expand the breadth and depth of the curriculum. They said learners would be able to access other learning material from different sites giving them a rich pool of learning material to use for their studies rather than being limited to only what their lecturers give them. They were also of the view that the adoption of cloud computing technology at the university would help to activate new services at the institution like distant learning, mobile learning since learning material would become available on the go and also virtual classrooms were students would be able to do lectures and experiments. Respondents also had the view that cloud pedagogy would help to improve the quality of the various services offered at the institution. Most cloud service providers offer a minimum of 99.9 % as the guaranteed service availability level (IBM, 2013), this would mean that cloud-based learning technologies will be available to the learners at almost all the time.

The responses also showed that most respondents had the view that the adoption of cloud computing technology at the university would help in distinguishing the university in its provided services, which is different from that provided by other universities. The respondents also highlighted that the adoption of cloud computing technology at the university helps to improve the performance of current university services. They highlighted

that cloud computing would ensure high availability of the university's online resources as most cloud providers guarantee high availability rates of around 99%.

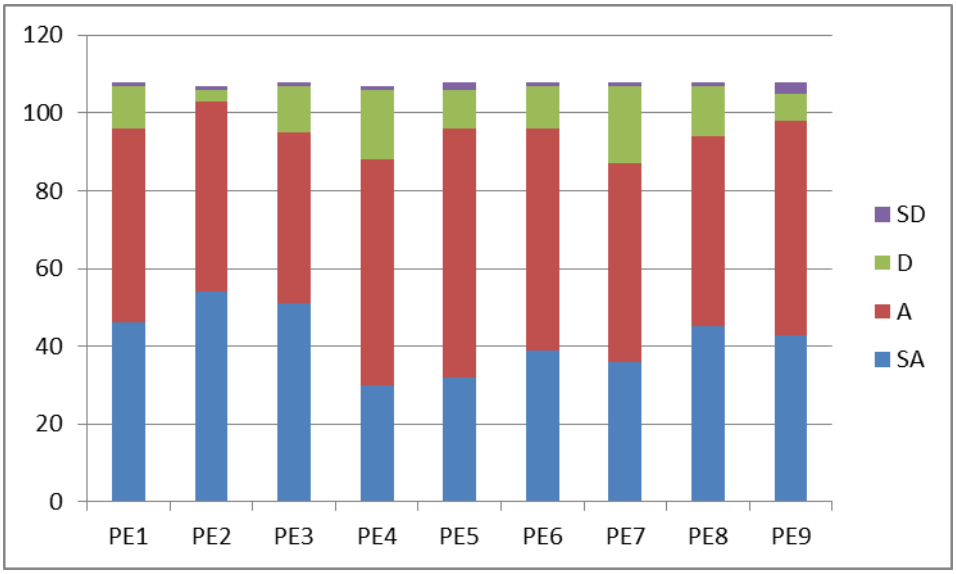


Figure 6.1 Cumulative respondents' views on performance expectance

The findings presented above show that most respondents perceived cloud pedagogy as a very useful initiative to facilitate the knowledge delivery process. This shows that performance expectance has a strong influence on the adoption of cloud pedagogy.

6.4.2 Effort expectance

This theme is derived from the general perception of what respondents expect from cloud pedagogy in terms of effort. For the study, effort expectance is defined as the perceived ease of use of a technology, and specifically, the degree to which cloud pedagogy is easy to use. Effort expectancy is conceptually and empirically identical to perceived ease of use from TAM (Venkatesh, et. al., 2003).

Previous studies have suggested that effort expectance is a positive predictor of technology acceptance (Thakur, 2013). For individuals to fully adopt a new technology, it must show/demonstrate that it will help them to accomplish their tasks with little effort. The individuals must perceive the technology as being easy for them to use. If a new technology proves to be complex and individuals do not enjoy the experience of using it, they tend to neglect it.

This study assessed the agreement level of lecturers on four statements derived from the performance expectance construct of UTAUT. They were asked about the degree to which they believe that using cloud pedagogy will help them accomplish their tasks with ease.

EE1 Interaction with cloud applications is clear and understandable.

EE2 Cloud-based pedagogy is easy to use.

EE3 Cloud pedagogy makes teaching easier.

EE4 Cloud pedagogy makes it easy to interact with all my students at any time.

Lecturers expect cloud pedagogy to be easy to use. They perceive their job as an educator to be stressful and time consuming, so every additional minute they spend trying to accomplish their tasks is seen as a challenge. The lecturers do not expect to invest more time trying to navigate their way through the technology to get acquainted to it.

The responses revealed interesting perceptions of cloud pedagogy when adopted in HLIs. Most of the lecturers surveyed had a perception that cloud pedagogy is easy to use and that it would make teaching easier.

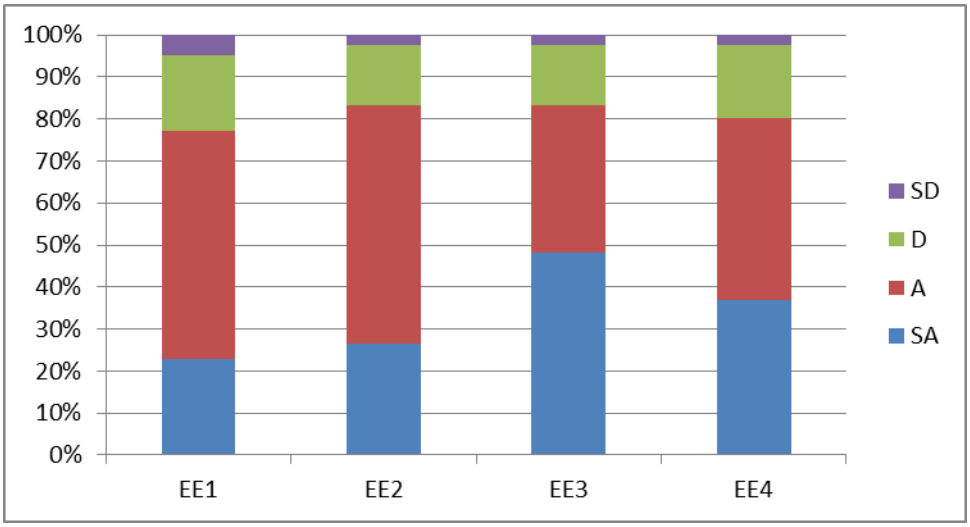


Figure 6.2 Cumulative respondents' views on effort expectance

As shown in Figure 6.2, most lecturers agreed with the given statements. They were of the view that cloud pedagogy adoption would facilitate the easy flow and distribution of learning

material. Since most learning applications allow educators and students to share and upload files on them, the lecturer would just upload the lecture notes online and all the registered students would be able to access them.

Respondents also agreed that the interaction with cloud applications is clear and understandable. They agreed that the applications are designed using simple and understandable instructions with an easy to navigate user interface. The lecturers do not have to spend more time trying to learn how to use the technology. This is of great importance as educators do not want to experiment with new technology they are not familiar with on their students. They prefer to familiarise themselves with it before recommending it to their students.

In a nutshell, the responses obtained on the statements which measured the degree to which cloud pedagogy fared in terms of effort expectance reveal that the technology has the ability to help the respondents to accomplish their tasks with ease. The responses were highly in favour of cloud pedagogy. They show that cloud pedagogy requires little effort to use and accomplish tasks.

6.4.3 Social influence

Social influence was defined as the extent to which the lecturers perceive that it is important that others (e.g., students, family and friends) believe they should use cloud pedagogy. In trying to measure the degree to which the lecturers believe that others influence their behaviour on adopting new technology (cloud pedagogy), four questions were presented.

SI1 University management support teaching with technology.

SI2 My colleagues think I should use cloud pedagogy.

SI3 Students prefer cloud pedagogy for distributing learning material.

SI4 People who influence my behaviour think that I should use cloud pedagogy.

The respondents displayed mixed perceptions on how others influence their behaviour to adopt cloud pedagogy and other learning technologies. The participants seemed to be unaware of whether their colleagues had adopted cloud pedagogy in their teaching, but they

gave their opinions on what they felt about their colleague's behaviour to them on adopting cloud pedagogy. The respondents stressed that their colleagues encourage them to adopt technology in teaching. They also stated that they encourage others to adopt technology in teaching as it has demonstrated significant benefits to them.

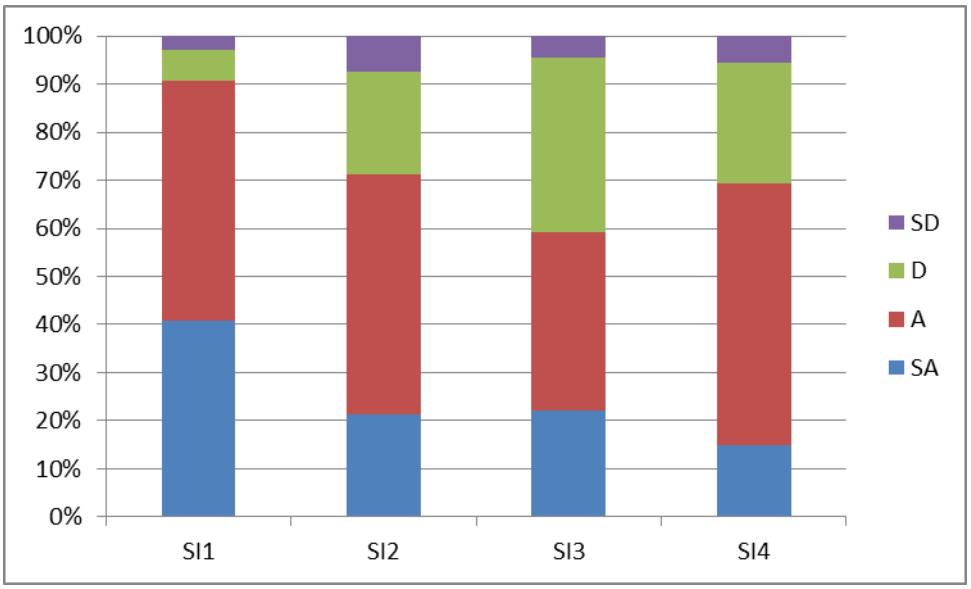


Figure 6.3 Cumulative responses on social influence

The lecturers agreed that their institution's management and faculty heads support the use of various technologies in teaching, and this is supported by the formal adoption of various learning technologies at the institutions (Moodle at GZU and Blackboard at CPUT). The lecturers explained that in some departments policies that assignments should be submitted on the learning management system officially adopted by the universities have been put in place.

Many lecturers state that they have adopted cloud pedagogy and other technologies into their teaching because they know that students like interactive lessons with animations and digital material. Most of the new generation of students who are enrolled into the institutions are well versed in technology and use it in their everyday activities. The lecturers believe that students tend to concentrate better when they are using interactive digital learning material than they do in class. One respondent indicated that it is easier for him to motivate his students when using the LMS. He stated that more students participate in the discussions on the LMS forum than when they discuss in class.

However, a few lecturers answered that some of their students do not have access to the technology as they do not have computer resources to use, so it is pointless for them to fully adopt cloud pedagogy. A lecturer in the education department at GZU stated that some of her block release students are teachers who teach in new resettlement areas where there is no electricity and poor network reception and hence these students find it difficult to access cloud-based learning tools.

6.4.4 Facilitating conditions

This theme as defined in the original UTAUT theory referred to the degree to which an individual believes that there is sufficient organisational and technical infrastructure to support use of the system (Venkatesh et al., 2012b). For individuals to fully embrace a technology, sufficient infrastructure must exist to support the technology. An organisation must demonstrate that it has proper infrastructure to support the adoption of the technology. Previous studies of technology acceptance showed that participants are most likely to adopt new technology if there is proper and standardised infrastructure to support the running of the technology.

For this study, the respondents were asked about the degree to which they believe that their institutions and the SADC region at large has sufficient support structures to champion the adoption of cloud technology.

FC1 Cloud computing is affordable.

FC2 Cloud computing has ideal infrastructure for eLearning.

FC3 The university has high speed internet access, and uninterrupted services.

FC4 The university focuses on new IT system projects, which aim to increase student satisfaction.

FC5 The university focuses on new IT system projects, which aim to increase data and information security.

FC6 There is a possibility of moving existing applications and services provided by the IT Department at the university to the cloud.

FC7 Systems, technological services and applications at the university are continuously updated to keep pace with technological development.

Respondents indicated that their adoption behaviour is influenced by various conditions in their environment; learning or personal.

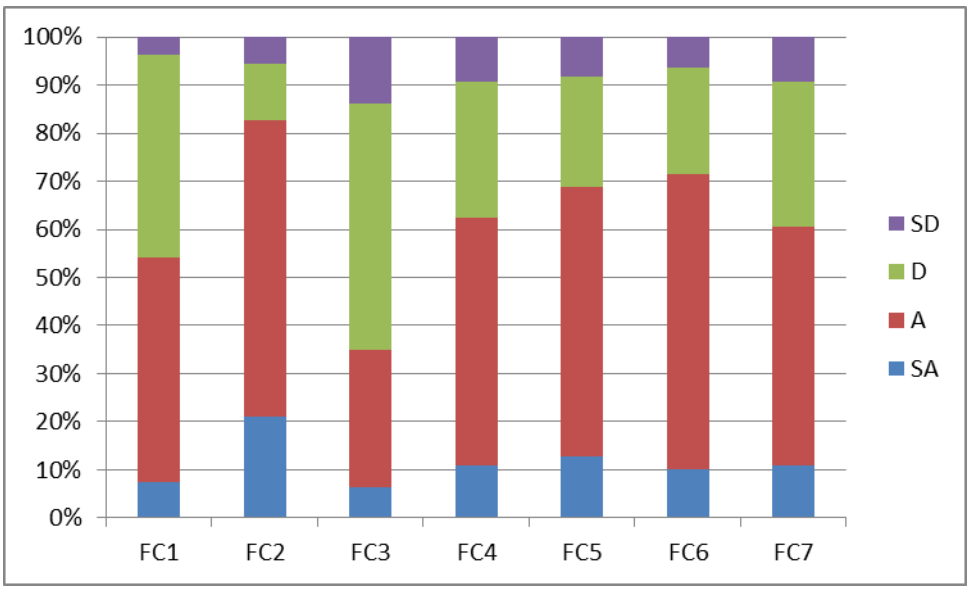


Figure 6.4 Cumulative responses on facilitating conditions

The responses from the questionnaire reveal various perceptions of cloud pedagogy when adopted in HLIs. Most of the lecturers surveyed had a perception that cloud computing has ideal infrastructure that would address all the challenges they have in the current eLearning systems which are hosted at their local institutions. They were of the view that it would reduce the downtime they always experience with their current system. However, they were not sure about the costs involved in moving to the cloud. Although the majority of the respondents stated that cloud computing is cheaper, a significant portion of the respondents although it was less than half were of the view that it is quite an expensive technology. This shows that there is a high level of unawareness about cloud computing and its associate benefits. People simply assume that since it is a new trend, then it must be accompanied by high cost just like other new technologies that come on the market.

The respondents also indicated that their institution had poor internet connections. They stated that their internet connection was very slow, sometimes they fail to even log into their email system. This is the email system that has been moved to the cloud. Because of the slow internet connection, they feel that adopting cloud applications will not help them in

teaching as the applications require a fast and reliable internet connection. It will be difficult for them to access the cloud applications with the current internet connection problems they always experience. They said that their students might miss deadlines to submit assignments and tests that are done online as the system is at times not available.

The respondents also strongly highlighted that their institutions focus on introducing new systems and technologies that aim to increase student satisfaction and make the institution more competitive and also adapt to new dynamics. The universities try to live up to the expectation of being innovators and early adopters of new technology. They also highlighted that the institutions make great efforts to protect institutional data from unauthorised access. They emphasised their institutions' rigid adherence to data privacy and security. They also agreed that there is a great possibility of moving existing applications and services provided by the IT department at the university to the cloud, since it has high data security measures.

6.5 Attitude towards technology

Attitude is defined as what is reflected in an individual's behaviour towards a certain thing or how individuals react to their own perception of a situation (Joffe, 2012). For the study, it was defined as how individuals react to the adoption and use of cloud pedagogy.

An individual's attitude towards a technology has a very huge influence on their decision whether to adopt it (Robinson, 2009). The lecturers' attitude towards a cloud pedagogy is conceptualised as their assessment of the desirability of using it.

An individual's attitude towards a new technology is linked to how they perceive it. The findings show that the respondents who had positive perceptions of cloud pedagogy adopted it and those who had negative did not. The responses also reveal that the lecturers ' perception that cloud pedagogy could make the learning delivery process more convenient and more accessible had a positive effect with regards to the attitude they had towards the possible adoption of the technologies. On the other hand, the negative perception generated a negative attitude

6.5.1 Behaviour intentions

Behaviour intention is defined as a person's perceived likelihood or "subjective probability that he or she will engage in a given behaviour" (Venkatesh et al., 2012b). For this study, it

was defined as the likelihood that the lecturers would adopt or use cloud pedagogy. The lecturers were presented with three statements to enquire about their intention to use cloud pedagogy.

BI1 I intend to use cloud computing services.

BI2 I predict I will use cloud computing services.

BI3 I will always use cloud computing services.

The findings of the study showed that behaviour intentions are highly influenced by an individual's perception of technology. Most lecturers who had positive perceptions of cloud pedagogy highlighted that they intend to adopt it and those with negative perceptions indicated otherwise.

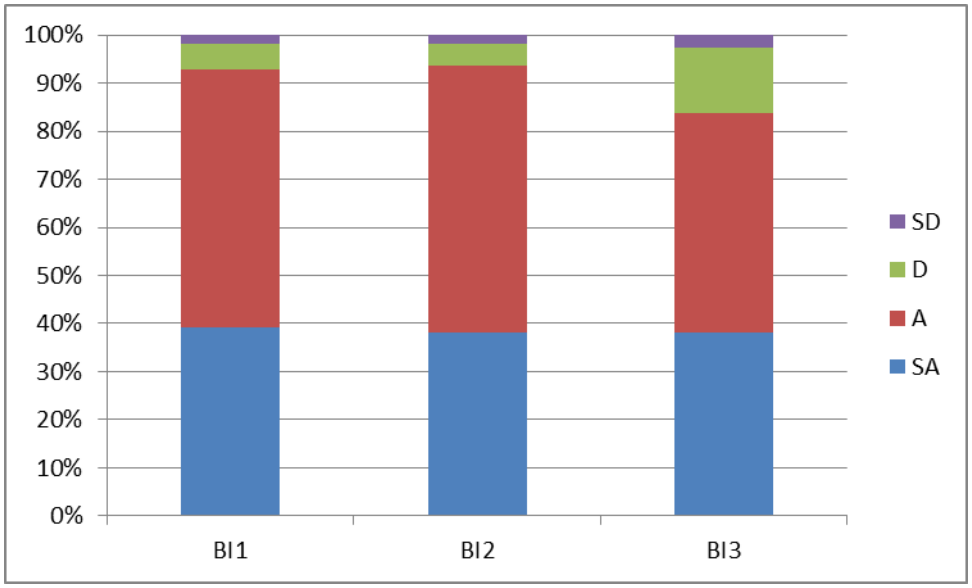


Figure 6.5 Cumulative responses on behaviour intentions

Since most of the lecturers involved in the study showed positive perceptions, their responses on the intention to adopt cloud pedagogy was high. Although they highlighted a lot of factors that still need to be addressed for them to fully realise all the benefits derived from cloud pedagogy, they showed a positive attitude toward adopting cloud pedagogy. Most of the lecturers stated that they intend to use cloud pedagogy, and even went on to predict that they will always use it with their students. If these high intentions are an indication, then

if this intention results in real use then the utilisation of cloud services in HLIs will have a rapid growth.

6.6 Major barriers that hinder the adoption of cloud pedagogy by HLIs

The respondents were also asked to give what they think are the major barriers that are slowing down the wide spread adoption of cloud pedagogy in the region. This was an open ended question were the respondents had to express their own views on the matter. They highlighted a lot of factor which included poor infrastructure in the region, poverty, lack of knowledge associated with negative attitude, shortage of funds, lack of IT skills among educators, lack of ICT resources on the part of student, poor network connectivity, resistance to change, crumpling economy, ignorance and ;ack of will power from institutional leaders. These factors are fully explained below.

Most countries in Southern Africa are still developing and they are ranked among the poorest countries in the world, with roughly 70 % of people in the region living below the poverty datum line (Chiripasi, 2015). The high level of poverty within this region may account for the slow growth in the adoption and use of cloud pedagogy by the HLIs in the region. With such high levels of poverty, it is evident that the majority of the population cannot afford to buy computers or other smart devices for them to access the internet, let alone cloud applications.

The state of the economy in most countries in the SADC region is also a call for concern. Most respondents highlighted that the ever deteriorating state of the economy in most countries in the region is slowing down developments in ICT and hence impeding the widespread adoption of cloud pedagogy. They noted that governments and private organisations are concentrating on initiatives that try to improve the economy. This is paralysing other sectors which do not have a direct effect on the living standards of people.

The findings of this study showed that the major barrier inhibiting the adoption of cloud pedagogy by HLIs is the high cost of purchasing and accessing ICT equipment. The lecturers indicated that most of the students they teach come from very poor backgrounds and the breadwinners in their families receive very low incomes. Given that, it is difficult, if not impossible, for them to buy ICTs of their own. Most of these students struggle with

paying their tuition fees so buying computer equipment is to them a luxury they cannot afford.

The respondents also revealed the existence of inequalities within the groups of students they have with regard to their incomes and social classification. This creates a situation where those students from higher social classes can afford to buy their own ICTs and would therefore enjoy access to cloud applications, while those from lower social classes would be excluded due to lack of funds, or other economic reasons, from buying their own ICTs. This situation promotes the creation of a digitally divided student community, with divisions based on social status.

From the findings, the lack of ICT infrastructure and resources in the region plays a large role in the low adoption of cloud pedagogy. The respondents highlighted that infrastructure developments in the region are at a very low level compared to other, more affluent parts of the world where cloud pedagogy is making inroads into HLIs. Some of the respondents went on to state that their institutions did not have reliable internet connections due to lack of proper infrastructure. They said that adoption of cloud pedagogy will not be a good idea as the technology requires a reliable and fast internet connection.

Low quality networks and poor communication reception are also concerns. The respondents indicated that this is a major barrier. Respondents also indicated that they have some students on block release programmes who work in rural areas where there is poor or no internet access. These students spent most part of the semester away from university and are not able to access the cloud due to poor network access in their home areas. In addition the increase in power outages affecting the region (including both countries where the study was done) are worsening the situation.

A number of lecturers regarded high levels computer illiteracy on the part of their students as a huge factor. They stated that the students lack the necessary training and awareness of ICT. Some of their students come from rural backgrounds, have never encountered a computer in their lives, and therefore do not know how use ICTs to access learning technologies. Illiteracy and lack of training in the use of ICTs in the student body impedes lecturers using cloud pedagogy productively to supplement their teaching. The lecturers recommended that university management should make sure that all students are trained in the use of ICTs during their first year, and that this would promote the use of cloud pedagogy.

Some lecturers indicated the lack of will power exhibited by institutional leaders as a factor. They stated that university management are not putting enough effort into promoting the general use of ICTs to supplement teaching. They declared that if university management put in place proper procedures or policies for lecturers to use technology during their classes, it would help in spearheading the adoption of cloud pedagogy. They said the lack of will power from management resulted in low allocation of funds towards the acquisition and development of infrastructure which would facilitate the use of ICTs and cloud pedagogy.

Respondents also highlighted ignorance associated with negative attitudes toward use of technology as a contributing factor. They stated that some educators and students are not fully informed about cloud pedagogy and its benefits. They also stated that though some educators are aware of cloud applications for teaching and learning, they are not using them because they have a negative attitude toward the use of technology. Certain educators do not adopt cloud pedagogy because they are resistant to change, and feel secure using only their traditional teaching methods.

The adoption and use of cloud computing in Southern Africa is still in its infancy. As a result, this places a limitation on a number of institutions and their members who actually adopt and use cloud pedagogy. This is further exacerbated by the fact that most students do not have access to ICTs. Even if lecturers use cloud pedagogy, if their students do not use it, the distribution of learning material cannot be facilitated. What this suggests is that for cloud pedagogy to be successfully adopted, all participants involved in the teaching and learning process must be using it. This will greatly improve the use of cloud applications in the education sector and enable the institutions to benefit from using them.

6.7 Summary

The respondents highlighted a lot of barriers that hinder the adoption of cloud pedagogy. The barriers can be summarised into four main categories which are technology, personal, environmental and external factors as shown in Table 6.2.

Table 6.2 Barriers to cloud adoption

Category	Sub-categories
Innovation characteristics	Relative advantage Security Usefulness Ease of use Complexity Cost
Personal or human factors	ICT skills User awareness User innovativeness User intention to use Ignorance Resistance to change
Environmental factors	Infrastructure Cloud readiness Competitive pressure Internet connectivity Availability of skilled support people Economic situation
Social factors	Management support Management innovativeness Student influence Colleague influence

6.8 Chapter Conclusion

This chapter presented the second strata of the analysis of the data from the questionnaire which reveals several themes from the data set. It utilised the main constructs from the UTAUT theory; performance expectance, effort expectance, social influence, facilitating conditions and behaviour intentions.

Generally from the analysis presented in this and the previous chapter, it is interesting that most of the lecturers are knowledgeable about cloud computing and cloud pedagogy. Most of them actually use these services though some are not aware that they are using them. The analysis also revealed that most of the respondents appreciate the advantages of using cloud pedagogy in the learning delivery process; this increases their likelihood to adopt the technology. The respondents' also see the compatibility of cloud pedagogy in their teaching styles, most lecturers highlighted that they have used other innovation for teaching and cloud pedagogy would fit well with their curriculum. The ease of use of the technology is also revealed as an important factor from the point of view of the intended adopters. The participants reveal that the easier using and understanding the technology is, the more likely it was that they would adopt it.

CHAPTER SEVEN: DISCUSSION

7.1 Introduction

This study aimed at exploring the factors that affect the adoption of cloud pedagogy in Southern Africa. The objectives were to determine the factors and barriers that could influence the adoption of cloud pedagogy and also to make recommendation that could assist in improving the adoption of cloud pedagogy in future. The findings indicated support for the four main constructs of the adopted UTAUT theory (performance expectance, effort expectance, social influence, facilitating conditions). The findings also show that the theoretical constructs have a strong influence on an individual's intention to adopt cloud pedagogy. Other factors that influence cloud adoption like user innovativeness, cloud readiness, resource and infrastructure were also revealed. The following section presents a detailed discussion of the findings while answering the main research question;

- *What factors affect cloud computing adoption into the technology-enhanced learning environment in Southern Africa's HLIs?*

To answer this question, the study discussed the associated challenges and factors regarding adoption of cloud pedagogy in the SADC region. It also discussed the future of cloud pedagogy in the SADC region.

7.2 Discussion on the factors that influence the adoption of cloud computing

This section discusses the findings from the data and literature analysis that address the factors that influence the adoption of cloud pedagogy. Understanding the factors influencing the adoption of technology (cloud pedagogy) would help university management and policy makers to know which technology will enhance their core business as an institution delivering knowledge to leaners. The findings of the study revealed several other factors that could influence the adoption of cloud pedagogy within the Southern African context.

7.2.1 Performance expectance

According to Venkatesh et al. (2012a) performance expectance strongly influences an individual's decision to adopt technology. If an individual perceives a new technology to enhance their work, they are most likely to adopt the technology.

Based on the findings, the lecturers perceived cloud pedagogy to hugely contribute to enhancing the teaching and learning process. They had a higher performance expectance of cloud pedagogy. The findings reveal that the lecturers have the perception that cloud pedagogy would be a very useful initiative if adopted to facilitate teaching and learning. The findings also show that the lecturers had the view that cloud pedagogy would improve the teaching process, would facilitate the easy flow of and access to learning material between lecturer and student, and the university to improve the quality of its services.

The findings further show that performance expectance can be subdivided into sub-categories which would make it easier to define exactly what the lecturers expect from the technology. From the findings, it can be subdivided into three sub-categories; usefulness of technology, compatibility and relative advantage

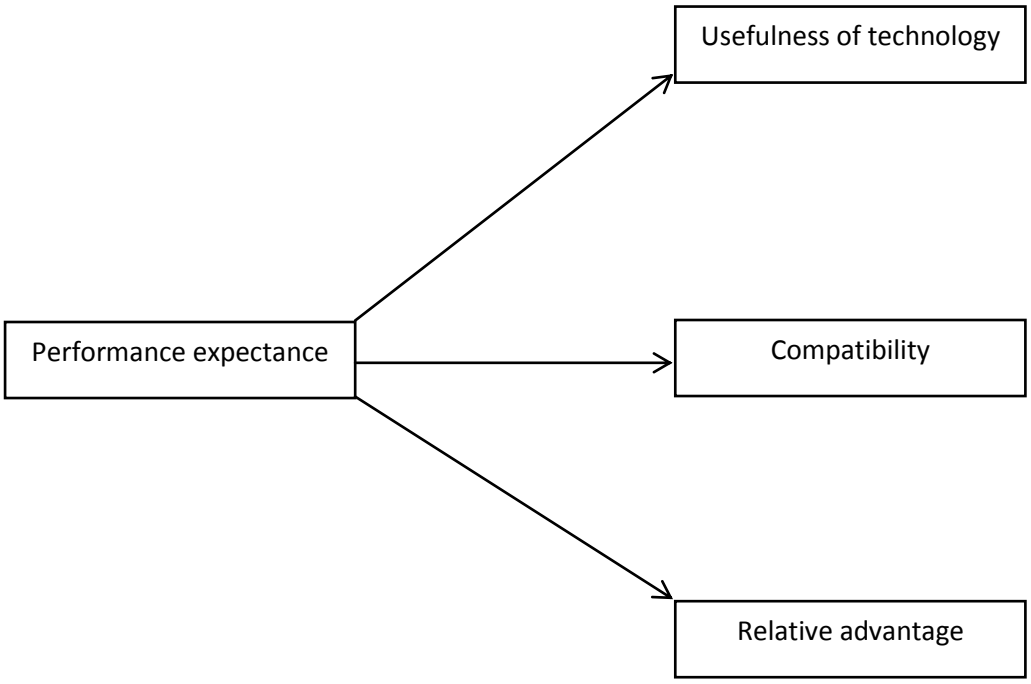


Figure 7.1 Performance expectance sub-categories

Usefulness of technology

Usefulness of technology is the belief that such technology would enhance an individual's job performance and help them accomplish their tasks with ease. The findings show that cloud pedagogy would be a very useful tool in the teaching and learning process. The lecturers agreed that it would add value to the teaching process. They agreed that it would facilitate the sharing of learning material, enhance collaborative learning and also expand

the breadth and depth of the curriculum. This shows that they believe that it would help them perform their job better. Previous studies show that if users perceive a technology to be beneficial to them, they will adopt it (Changchit et al., 2014; Wu et al., 2008), hence the findings show that there is a high likelihood of the lecturers adopting cloud pedagogy.

Compatibility

Compatibility is the extent to which a new system is perceived to be able to integrate and work with other technologies that are already being used at the organisational (Lin & Chen, 2012). It is the ability of the technology (cloud pedagogy) to be used together with other technologies or teaching practises that the lecturers are already practising. The findings show that the respondents perceived cloud pedagogy to be very compatible with their current teaching methods. They stated that it would help the university to activate new services and also help improve the performance of current university activities. This shows that they believe that it can be used hand-in-hand with current services and even help improve them. According to Rogers, (1995) as cited by Lin & Chen, (2012), if a potential adopter perceives an innovation to be more compatible with existing values and needs, their uncertainty will decrease and will lead them to consider adopting the innovation. This increases the chances of the lecturers adopting cloud pedagogy as they perceive it to be compatible with their current/ existing values and systems.

Relative advantage

Rogers (2003) defined relative advantage is the degree to which using an innovation is perceived to be make an individual better off than otherwise. It is the perceived added value that an innovation id perceived to bring over the idea, programme, or product it replaces. Individuals are likely to adopt an innovation when they believe that it will aid increase in efficiency and effectiveness, and lead to economic gains (Lin & Chen, 2012). It is seen as a positive indicator of whether the benefits of adopting an innovation exceed those of the previous design. In general, before an individual decides to adopt an innovation, they tend to analyse the advantages they will gain from using the technology Rogers, (1995) as cited by Trope, (2014).

Literature states that the relative advantage of cloud pedagogy can be measured by costs, reliability, compatibility, ease of use, and flexibility (Trope, 2014; Robinson, 2009; Morgan &

Conboy, 2013). From the findings of this study, most of the lecturers agreed with the statement that cloud pedagogy is less costly as it operates on a pay-as-you-use basis. They also agreed that it is compatible and useful. These findings are in line with the literature which suggested the same perceptions. Therefore, the relative advantage of cloud pedagogy should encourage IT professionals to consider using cloud computing to provide products and services to their customers.

Overall, in terms of performance expectance, the findings reveal that the lecturers perceive cloud pedagogy to be very useful, compatible and also to have a huge relative advantage when adapted to teaching and learning by HLIs. These findings from the data seem to coincide with other scholar's findings in the literature of the technology adoption field. The literature also show support for performance expectance in the adoption of technology (Juinn & Bing, 2013; Kohnke et al., 2014; Alawadhi & Morris, 2008; Venkatesh et al., 2012a).

7.2.2 Effort expectance

Effort expectance in simple terms is the degree to which individuals believe using an innovation will be easy and require little or no effort. It can be seen as the perceived ease of use of an innovation (Venkatesh et al., 2011). The literature suggests that performance expectancy plays a crucial role in influencing an individual's decision to adopt an innovation (Juinn & Bing, 2013). Research done latterly provides evidence of the significant effect effort expectance has had on the behavioural intention regarding the adoption of an innovation (Dhulla, V & Mathur, 2014; Alawadhi & Morris, 2008) .

The findings show that the lecturers agreed that cloud pedagogy is easy for them to understand and use. They agreed that the interaction they would have with cloud applications is clear and that the applications are understandable. The lecturers also agreed that cloud pedagogy would make it easy for them to interact with all their students at any time with little effort regardless of their location at that time. The simplicity of the cloud applications in terms of understanding how to use them would be an important influencing factor, especially for those who have few computer skills.

The overall perception of the lecturers was that cloud pedagogy would be easy to use and understand. These perceptions were formed on the basis that these lecturers are already using other cloud applications like Gmail, YouTube, Google Drive and OneDrive. These findings on effort expectance are in line with the findings from the literature. Previous

research also suggested that interaction with cloud applications was easy and a new user can easily get acquainted with them provided they have reliable networks (Morgan & Conboy, 2013).

7.2.3 Social influence

Social influence was evaluated in terms of support from management, colleagues and students. Venkatesh et al., (2011) used similar constructs to evaluate the extent to which other people influence an individual's decision to adopt technology.

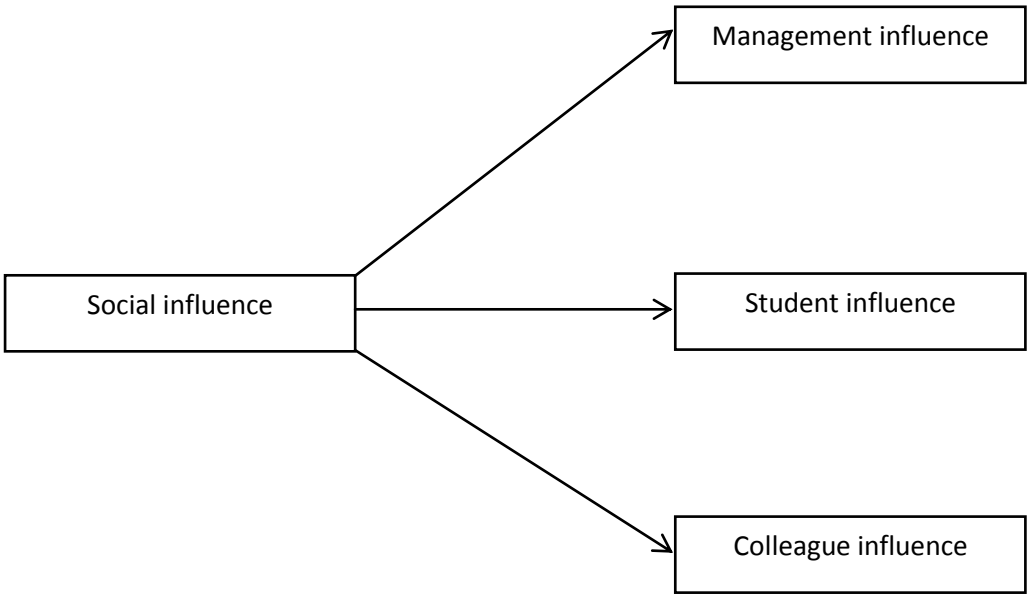


Figure 7.2 Social influence sub-categories

The findings from this study reveal that the management of the two institutions provide full support for the use of technology in teaching. This support from relevant institutional leaders favours the adoption of cloud pedagogy. The findings also show that lecturers feel that their colleagues fully support their use of technology in teaching. These findings coincide with other studies that have been done by other scholars in the field of technology adoptions. Le Roux & Evans (2010) state that higher levels of support from management are associated with positive behaviour towards the adoption of cloud computing.

The findings also show that student influence plays a big role in the adoption decision; the lecturers pointed out that their students are indeed well versed in new technology, but that with the lack of basic computer equipment and slow internet speeds, it will be difficult for

them to access cloud applications. This is in line with findings from previous studies which stated that the absence of fast and reliable high-speed Internet access is one (if not the) main stumbling block to progress (Le Roux & Evans 2010).

7.2.4 Facilitating conditions

Facilitating conditions are the various external factors that influence an individual's decision to use an innovation. The findings from the study revealed three main conditions that facilitate the adoption of cloud pedagogy; cost, security and availability of supporting infrastructure.

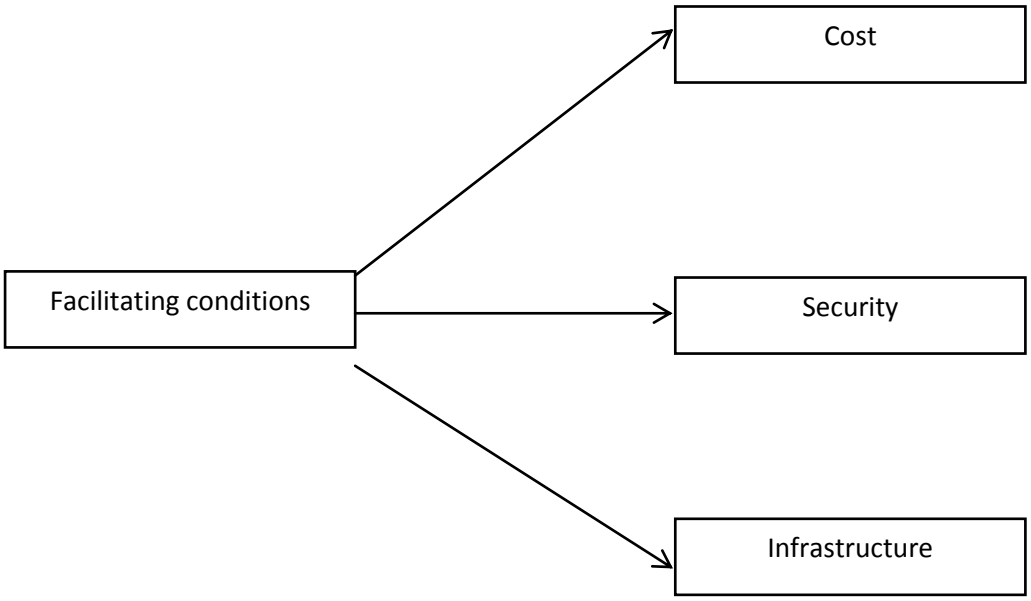


Figure 7.3 Facilitating conditions sub-categories

The findings show that cost has a huge influence on adoption behaviour. Respondents who perceive cloud pedagogy to be cheap are more likely to adopt it. The respondents were not fully aware of the costs associated with adopting cloud applications. Some of them indicated that they were already using some Open Source cloud applications such as Google Docs, Gmail and Google Drive to share lecturer notes with their students.

Literature shows that security plays a big role in the adoption decision (Maaref, 2012). Users of any technology are concerned about the safety of the information they put online. The findings show that the lecturers were not worried about security as they did not upload any sensitive information on the cloud application. This is in contrast to what is described in the

literature which states that security plays a big role in the adoption of the cloud in Africa (Maaref, 2012; Mtebe, 2013).

On the infrastructure, the findings show that the institutions had poor internet connections. The lecturers stated that their internet connection was very slow, sometimes they even fail to log into their emails. However the lecturers pointed out that their institutions were making efforts to upgrade their networks to support the use of technology in teaching and learning. These findings coincide with literature which suggested that Africa as a continent had the best infrastructure suitable for the adoption of cloud applications (Maaref, 2012). However it supports findings from other studies which suggested that there is a great need to improve infrastructure to facilitate the adoption of new technology in education (Briedenhann, 2013)

Overall in terms of facilitating conditions, the findings reveal that the lecturers perceive that facilitating conditions play a huge role on the adoption of cloud pedagogy. These findings from the data seem to be similar to other findings in the literature of technology adoption. The literature also supports the notion that facilitating conditions play a big part in the decision to adopt new technology (Juinn & Bing, 2013; Alawadhi & Morris, 2008; Casey & Wilson-Evered, 2012; Venkatesh et al., 2012b).

7.3 Discussions on the barriers to cloud adoption

This section discusses the findings from the data and literature analysis that address the barriers to the widespread adoption of cloud technology in higher education in the SADC region. Understanding these barriers would help university management and policy makers to know which technology will enhance their core business as institutions delivering knowledge to learners. The findings of the study revealed several barriers that influence the adoption of cloud pedagogy within the Southern African context.

From the findings, the lecturers mentioned numerous barriers that they felt were hindering the widespread adoption of cloud computing. As shown in the previous chapter, the findings were grouped into three distinct groups, namely personal or human factors, environmental factors and social factors (Table 6.2).

7.3.1 Personal or human factors

These are those barriers that are directly linked to the users. They range from the behaviour characteristics of the individuals who want to adopt the technology, their ICT skills, and their awareness about the technology, their innovativeness and intention to use the technology.

User Awareness

The study discovered that a number of lecturers are not even aware of cloud applications that can be used for teaching. About a quarter of the respondents stated that they were not aware of cloud technologies (as shown on Table 5.5). It is impossible for an individual to adopt any technology that they are not aware of, so if the lecturers do not have any knowledge about cloud computing then they cannot adopt cloud applications. However the findings nevertheless show that some of the lecturers, although they said they were not aware of cloud computing, were actually using cloud applications. The two institutions in the study adopted cloud-based email systems and all lecturers have institutional email addresses that they use, which shows that they are using cloud applications but are not aware of it.

Ignorance or resistance to change

The findings also show that some of the lecturers, though they are knowledgeable about cloud applications, are unwilling to adopt them. This is usually because they are ignorant of and resistant to new technology. They feel that they can do their jobs competently without the use of technology.

Innovativeness

The findings also show that an individual's level of innovativeness can be a barrier to adoption of technology. Some lecturers are so proficient in new technology that they would want to be among the first to try it while others that are not so well versed would hesitate to adopt a technology. This could be seen as a barrier because most of the lecturers fall into the second group; they will not adopt cloud pedagogy until it has been proved to them that it is very useful.

7.3.2 Environmental factors

These are the barriers that are linked to the external environment. They range from infrastructure to support for cloud applications, cloud readiness, competitive pressure in the higher education sector, internet connectivity, availability of skilled support staff and the economic situation of the countries in the region.

Infrastructure

The findings indicated that this is one of the main barriers. The lecturers claimed that both their institutions and the SADC region as a whole had poor ICT infrastructure. They claimed that their institutions experience slow network connections due to low bandwidth. However the findings conflict with literature. Though there are some studies which state that ICT infrastructure in Africa needs to be improved in order to support cloud services efficiently (Briedenhann, 2013) these findings contrast with literature which suggests that Africa as a continent has the best infrastructure suitable for the adoption of cloud applications (Maaref, 2012).

Economic situation of the countries in the region

From the findings it is seen that some of the lecturers highlighted the economic situation prevailing in most of the countries in the region, which was another barrier to the adoption of technology. Most people do not see technology as a basic need but rather a luxury. In times of hardship such as those experienced in failing economies, with serious unemployment, people tend to put their focus on basic things for survival. This would act as a barrier to technology adoption.

7.3.3 Social Barriers

These are the barriers that are linked to the perceptions of the people in the social circles of the potential cloud adopter. They range from management support, management innovativeness, student influence and colleague influence. As mentioned before under the heading “Social influence”, people who associate with a potential adopter of any technology have a huge influence on to the decision to adopt a technology or not.

The findings show that the lecturers stated that their management was very innovative and recommended them to adopt technology into their classrooms. However they also strongly stated that it would be pointless for them to adopt cloud applications when some of their students do not have access to these applications; hence student influence plays a role in the lecturer’s decision to adopt cloud applications

7.4 Discussion on the research model

The findings show that all the constructs of the theory have a big influence on the adoption of cloud pedagogy in the SADC higher education sector. They show that performance expectance and facilitating conditions are the most significant predictors for adoption of cloud pedagogy.

The findings also indicated a simplified UTAUT theory to understand the factors that affect the adoption of cloud pedagogy. They broke down the main constructs of the theory into sub-categories which were covered by the umbrella terms. The original constructs were broken down as follows:

Perfomance Expectance
Usefulness of technology
Relative advantage
Compatibility

Effort Expectance
Ease of use

Social Influence
Management influence
Student influence
Colleague influence

Facilitating conditions
Cost
Security
Infrastructure available

After breaking down the constructs of the theory, the simplified UTAUT theory is as shown in Figure 7.4

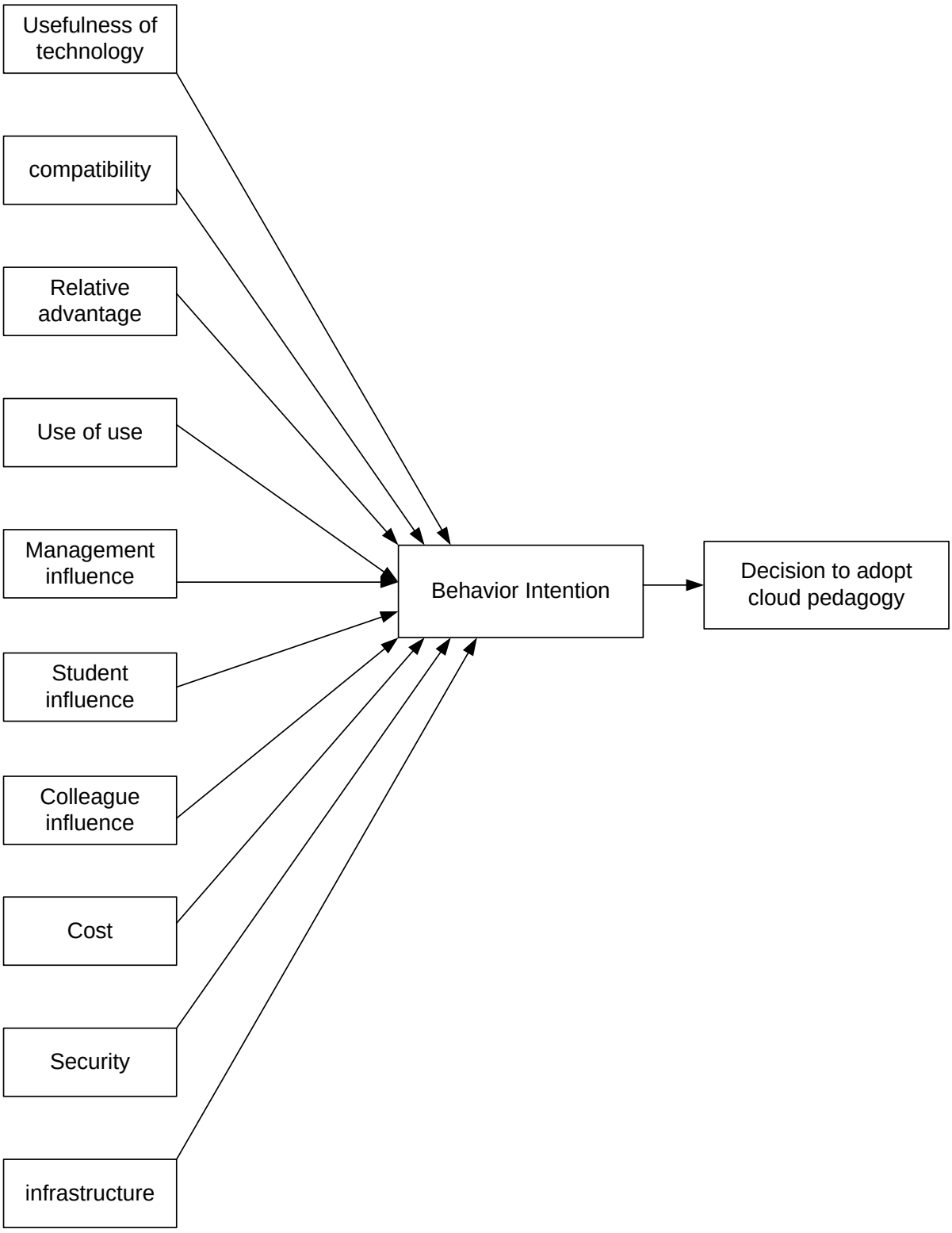


Figure 7.4 Factors influencing adoption of cloud pedagogy

7.5 Chapter Summary

The first section of this chapter discussed the factors that affect the adoption of cloud pedagogy in the SADC region. The study revealed several factors from the perspective of the surveyed lecturers. The findings from the study seem to correlate with the findings from the literature analysis. Some of the factors revealed include usefulness of technology, ease of use, relative advantage, compatibility, management support, student influence and costs involved in acquiring the technology, to mention a few. The second section of the chapter discussed the barriers that hinder widespread adoption of cloud pedagogy. Several barriers were mentioned. These include availability of infrastructure, lecturer innovativeness, ignorance, unawareness and the economic situation in the region. The last section of the chapter presented a simplified UTAUT theory based on the various factors and barriers to the adoption of cloud pedagogy that were revealed from the findings.

Chapter Eight: Recommendations and Conclusion

8.1 Introduction

This chapter presents a summary of the study and highlights the main findings and conclusions drawn from the study. The study focused on the adoption of cloud pedagogy in the Southern African Higher Education system. To attain a deeper understanding of the phenomenon, the study investigated the various educational technologies that are currently being used by HLIs, how they are being deployed, the status of cloud computing awareness and adoption in Southern Africa and the factors that affect its adoption.

The study focused on the educators (lecturers) who are directly involved in the knowledge delivery process at HLIs. The lecturers were selected from all the departments at the universities. The study was done at two selected institutions in Southern Africa: Cape Peninsula University of Technology (CPUT) which is in the Western Cape province of South Africa and Great Zimbabwe University (GZU) from Zimbabwe. One of the universities selected (CPUT) is a university of technology and the other (GZU) is a traditional university. These two universities were selected in order to get different patterns of adoption of technology from a university of technology and a traditional university.

Due to the inclusion of these two different universities from different countries, the study was done in two phases. In the first phase, questionnaires were distributed at GZU. The questionnaire was created online using Google forms. Hard copies of the questionnaire were also made available as most of the respondents from GZU preferred hard copies to the online platform. Phase two was then done at CPUT. The same procedure as done at GZU was followed but at CPUT most lecturers preferred the online platform. The questionnaires investigated the use of educational technology, the different types of ICT used in teaching and learning and what they are used for, awareness levels and use of cloud applications, levels of satisfaction with cloud services and factors affecting adoption of cloud applications, among other things. One hundred and eleven lecturers took part in the survey.

From the study, it was found that the use of cloud based educational technologies at HLIs in Southern Africa is still growing. Cloud applications are still finding their way into the SADC higher education sector, although other educational technologies have been successful in supplementing traditional face-to-face teaching. Although the adoption of cloud applications

in teaching and learning is still at a low rate, cloud applications have helped in improving the way educators communicate and distribute learning materials to their students, thereby facilitating easy communication and access to information. This makes the flow of information between educators and students easier. Besides communication, cloud applications have helped improve collaborative learning among learners and educators regionally and internationally. Learners are now able to share knowledge with other learners and experts from around the world from the comfort of their homes.

8.2 Summary of findings

The aim of this study was to explore why the adoption of cloud pedagogy by HLIs is very low in the SADC region. It will also explore how cloud computing can help improve the education delivery process. It will look at the factors that influence the adoption and use of cloud pedagogy by tertiary institutions in the SADC. A summary of and explanations for the findings are presented in Tables 8.1 and 8.2

Table 8.1 Summary of findings

Variable	**Status**
Awareness	• The awareness level regarding cloud applications is very high
Adoption	• Institutions have adopted cloud computing on some of their ICT applications. • One institution has adopted a cloud-based learning management system. • Both institutions adopted cloud-based email systems
Use	• Institutions now using cloud applications • Use among lecturers is still low. • Lecturers use other cloud application that have not been officially adopted by institutions
Uses of cloud services	• For posting assignments • Posting lecture notes • Having discussions with students • Posting continuous assessment marks doing research work

Table 8.2 Summary of findings on the factors affecting adoption

Factors	Sub category	description	Effect on adoption
Performance Expectance	Relative advantage	• It increases efficiency and effectiveness in teaching • Less costly	+ -
	Compatibility	• Very compatible with current teaching methods. • Helps the university to activate new services • Helps improve the performance of current university activities	+ + +
	Usefulness	• Adds value to the teaching process. • Facilitates the sharing of learning material • Enhances collaborative learning • Expands the breadth and depth of the curriculum.	+ + + +
Effort expectance	Ease of use	• Easy to understand and use • Makes it easy for them to interact with all their students at any time with little effort	+ +
	Complexity	• Interaction with cloud applications is clear	+
Social influence	Management influence	• Management from the two institutions give full support for use of technology in teaching	+
	Student influence	• Students are well versed in technology • Some students do not have ICT equipment to access cloud applications • Some students do not have	+ - -

		access to internet at all times	
	Colleague influence	• Colleagues fully support their use of technology in teaching	+
Facilitating conditions	Cost	• Cloud computing is affordable	-
	Security	• Cloud computing has adequate security measures	-
	Infrastructure	• University has adequate ICT infrastructure	-

The surveyed lecturers acknowledged the importance of ICTs in education. Almost all of the lecturers surveyed are using ICT tools to facilitate teaching. The lecturers also showed a considerable awareness of cloud services. Three quarters of the surveyed lecturers acknowledged that they are aware of cloud applications; they indicated that they have used at least one cloud application for the purpose of teaching and learning. Most of them stated that they have used email systems, social networks, eLearning systems and learning management systems that are based on the cloud. They indicated that they use them for posting assignments, posting lecture notes, having discussions with students, posting continuous assessment marks and also doing research work. The majority of the lecturers indicated that they access these applications at work, while a considerable number indicated that the access from home, internet café and other public places. The survey findings show that the lecturers are satisfied with the experience they have had with using cloud applications.

8.3 Limitations

The major limitation of this research study is that the respondents were selected from just two universities, one from Zimbabwe and another from South Africa. This makes it difficult to generalise the findings for the rest of the SADC region. The findings would be more valid if more institutions from the other countries in Southern Africa had been included. Unfortunately this study could not include more institutions due to financial constraints, but for future research work, studies like this would need at least two institutions in each of the countries in the SADC region. Another limitation is the sample size. The number of lecturers who participated was too small. Research such as this requires a bigger sample size. It was

very difficult for the researcher to find and recruit willing and committed participants as participation in the study was based on individual consent. More research and investigation is needed in this area to reach a general conclusion.

8.4 Future Research

This study has created a foundation for further investigations on the adoption of cloud pedagogy in the SADC higher education sector. The study was only concerned with revealing the factors that limit the widespread adoption of cloud pedagogy using the UTAUT theory; future research studies could perhaps use other adoption models with different constructs to try to look at the phenomenon from a different angle

This study was done only using lecturers; other studies could try and widen this base by involving students and university policy makers who are involved in making decisions at the various institutions. Future studies could also take advantage of the theoretical insights presented here as a useful launching pad for continued study and research.

8.5 Recommendations

Cloud computing plays an important role in the education sector, especially in higher education. However, some educators have been left out of this technological revolution. Opportunities presented in the digital age are not equally accessible and the gap is greater in developing countries. There is a digital divide between developed countries and Africa in general. Equal access to world class educational resources is one of the most vital principles of the emerging technology era, but this is lacking in the education sector in Southern Africa. For the region to produce versatile graduates equipped with necessary skills and competencies relevant to the needs of the modern dynamic business environment there is a need for HLIs to adopt relevant ICTs that are in line with developments in the technology world.

Despite the various merits that cloud pedagogy brings to a typical HLI, its adoption in Southern Africa is still low. This study has unearthed the factors and barriers that are slowing

down the widespread adoption of cloud pedagogy. To achieve an improvement in the adoption rate of cloud pedagogy in Southern Africa, the following general recommendations need to be taken into consideration.

- The region should design a strategy for the effective adoption and implementation of technology into teaching and learning. This will help educators to plan and teach with technology and assist learners to become technologically compliant with 21st century demands.

- The various governments and stakeholders from SADC member countries should facilitate the improvement of ICT infrastructure in the region. Governments can assist by making funds available to boost these developments.

- Internet service providers should improve their networks to increase internet speed and also make it accessible in remote areas where there is no connection.

- Institutional leaders should adopt a uniform cloud learning application for everyone at their institutions to use.

- Run workshops to raise the awareness of cloud computing and cloud applications that can be used for education among educators.

- Institutional leaders should encourage teaching with technology. They should put into place policies that encourage lecturers to use technology in their teaching

- Government and other stakeholders should assist learners with subsidies for them to acquire computer equipment to use to access cloud applications.

8.6 Conclusion

This study contributes to the on-going debate regarding the adoption of cloud-based applications for teaching and learning in developing countries. Even though the topic of cloud pedagogy has not received much attention from educators, this study presented a clear understanding of what cloud pedagogy is, its benefits to HLIs, educators and also learners. The aim of the study was to explore the reasons why the adoption of cloud pedagogy by HLIs is very low in the SADC region. To achieve this, the study looked at the

factors that influence the adoption and use of cloud pedagogy by tertiary institutions in the SADC region.

In summary, the objectives of the study were achieved and the research questions were answered. The different learning technologies used by HLIs and how they are being implemented were discussed, the status of cloud adoption by the HLIs was also examined and the various factors and barriers that affect the adoption were reviewed. Some of the factors discussed include the usefulness of the technology, complexity of the technology and compatibility with current teaching methods. Some of the barriers identified are availability of infrastructure, ignorance on the part of some lecturers, support or the lack thereof from university management and poor internet connectivity. These factors and barriers were identified using thematic analysis, and these factors are specific to the SADC region.

From the findings of this study, it can be concluded that cloud pedagogy can have a positive impact in enhancing the dissemination of knowledge in developing countries. In this 21st century where new technology is developed every day, teaching and learning is no longer confined to the classroom where learners have to physically interact with educators. With the aid of appropriate technology, learning can now be done from anywhere at any time. Cloud pedagogy is one technological intervention that can help facilitate teaching and learning while bridging the distance and location barrier. Participants in this study agreed that cloud pedagogy makes teaching and learning easier and more efficient. They also agreed that it facilitates the easy distribution of learning material with a little effort. With the current developments that are currently occurring in the SADC countries, cloud pedagogy has a bright future in the region. Its adoption will bring about vast benefits to the institutions that embrace it.

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APPENDICES

Appendix A: Research questionnaire

Research questionnaire

This questionnaire is part of a research that seeks to establish factors that affect the widespread adoption and use of cloud pedagogy by higher learning institutions in Southern Africa. Cloud pedagogy is the art of teaching while encouraging omnipresent learning via cloud-based applications. It is an information technology paradigm where the learning services are hosted and accessed from the “cloud”. A cloud consists of an information technology infrastructure (servers, data centres, applications and platforms) that are located on the internet. This infrastructure is owned and managed by a vendor or service provider e.g. Google.

The user does not need to know the physical location of cloud infrastructure or deployment and configuration details; they can access and use the services available in the cloud from anywhere as long as the user has a connection to the internet.

Privacy and Confidentiality statement:

Your privacy and confidentiality is guaranteed as you participate in this study. The information you give in this questionnaire will be treated as private and confidential and will ONLY be used for the purposes for which is collected.

SECTION A: GENERAL INFORMATION

Q1. What is the current position that you hold?

Teaching assistant ◯ lecturer ◯ senior lecturer ◯ Professor ◯

Q2. How many years have you been in that position?

◯ Less than 1 year

◯ 1 to 3 years

◯ 3 to 5 years

◯ More than 5 years

Q3. How many modules are you teaching this semester?

…….

Q4. What is the average number of students that you have in each class?

…….

SECTION B: ICT AND CLOUD SERVICES ADOPTION

Q5. Do you use any ICT tools to facilitate your teaching?

◯ Yes

◯ No

Q6. Which type of ICT tools do you use?

◯ Intra net

◯ Internet

◯ Learning Management System

◯ Email

Q7. Are you knowledgeable of cloud technologies?

☐ Yes

☐ No

If answer is NO, go to question 14

Q8. Have you used any cloud computing service: (**Email**, **Google Docs**, **YouTube**, **Sendspace**,

Dropbox, **Sky Drive**, **Google Apps Engine, Ubuntu-one** or **Windows Azure**)

☐ Yes

☐ No

Q9. Which of these cloud technologies do you use to facilitate teaching?

☐ Email

☐ Learning Management Systems

☐ eLearning

☐ Social networks

Others specify

……

…

Q10. What do you normally use it for?

Posting Assignments	
Posting lecture notes	
Posting continuous assessment marks	
Discussions with students	

Others specify

……

……

Q11. Where do you usually access them from?

Home	
Work	
Internet café	
Other	

Q12. How often do you access them?

☐ Regularly ☐ Everyday

☐ Once a week ☐ Once a month

Q13. Kindly rate your level of satisfaction with the cloud services you use?

Very dissatisfied ☐ Dissatisfied ☐

Satisfied ☐ Very satisfied ☐

Q14. Has your institution formally adopted cloud based pedagogical technologies (cloud pedagogy)?

☐ Yes

☐ No

SECTION C:

Indicate the extent to which you agree or disagree with the following statements by ticking the most appropriate column. (Strongly Agree -**SA**, Agree –**A**, Disagree - **D,** Strongly Disagree **SD**)

Q15.PERFOMANCE EXPECTANCE (PE)

NO	STATEMENT	SA	A	D	SD
PE1	Adoption of cloud pedagogy improves the teaching process				
PE2	Cloud pedagogy facilitates the easy flow of and access to learning material.				
PE3	Adoption of cloud pedagogy enhances collaborative learning.				
PE4	Cloud pedagogy expands the breadth and depth of the curriculum.				
PE5	The adoption of Cloud Computing technology at the University helps to activate new services				
PE6	The adoption of Cloud Computing technology at the University helps to improve quality of its services				
PE7	The adoption of Cloud Computing technology at the university helps in distinguishing the university in its provided services, which is different from that provided by other universities				
PE8	The adoption of Cloud Computing technology at the university helps to improve the performance of currently university services				

PE9	The adoption of Cloud Computing technology in IT operations will support the learning process				

Q16.EFFORT EXPECTANCY (EE) **(if you have used any cloud based technologies)**

NO	STATEMENT	SA	A	D	SD
EE1	Interaction with cloud applications is clear and understandable.				
EE2	Cloud based pedagogy is easy to use.				
EE3	Cloud pedagogy makes teaching easier.				
EE4	Cloud pedagogy makes it easy to interact with all my students at any time.				

Q17. SOCIAL INFLUENCE (SI)

NO	STATEMENT	SA	A	D	SD
SI1	University management support teaching with technology				
SI2	My colleagues think I should use cloud pedagogy.				
SI3	Students prefer cloud pedagogy for distributing learning material.				
SI4	People who influence my behaviour think that I should use cloud pedagogy.				

Q18. FACILITATING CONDITIONS (FC**)**

(Answer based on the definition of cloud pedagogy given above)

NO	STATEMENT	SA	A	D	SD
FC1	Cloud computing is affordable.				
FC2	Cloud computing has ideal infrastructure for eLearning.				
FC3	The university has high speed internet lines, and uninterrupted services.				
FC4	The university Focuses on new IT system projects, which aim to increase students satisfaction				
FC5	The university Focuses on new IT system projects, which aim				

	to increase data and information security				
FC6	There possibility of moving existing applications and services provided by IT Department at the university to the cloud.				
FC7	Systems, technological services and applications at the university are continuously updated to keep pace with technological development				

Q19. BEHAVIORAL INTENTION (BI)

NO	**STATEMENT**	**SA**	**A**	**D**	**SD**
BI1	I intend to use cloud computing services				
BI2	I predict I will use cloud computing services.				
BI3	I will always use cloud computing services.				

SECTION D: BARRIERS TO CLOUD ADOPTION

Q20. List any barrier(s) to cloud computing adoption by higher education institutions in the SADC region?

a)……

b)……

c)……

Q21. Below are some of the factors hindering or limiting the use and/or adoption of cloud pedagogy, kindly rate the level of your agreement or disagreement as applicable to your

Statement	**SA**	**A**	**D**	**SD**
Poor network infrastructure to support cloud services				
Poor network connectivity to support cloud services				
No reason to throw away existing System				
Unaware of cloud based pedagogical technologies.				
Unaware of the benefits that cloud pedagogy can bring				
Limited availability of funds to move to the cloud				
Lack of sufficient funds to finance the move to the cloud				
Security issues associated with the cloud				
Lack of skilled manpower				
Resistance to change/ to new technology				

institution.

Q22. What, in your view, should be done to encourage cloud computing adoption in higher education institutions in the SADC region?

……
……
……

Q23. Suggest any strategies that can be used to minimise challenges associated with the adoption of cloud computing in higher education institutions in the SADC region.

a)……..

b)……..

c)……..

Q24. In your opinion, is there any future for adopting cloud computing in higher education institutions in the SADC region?

……
……

Appendix B: Letter of approval to collect data at CPUT

I Antony Staak, in my capacity as Deputy Vice-Chancellor: Academic at Cape Peninsula University of Technology give consent in principle to allow Nowell Chibaro a student at the Cape Peninsula University of Technology, to collect data in this company as part of his/her M Tech (IT) research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No				

18/06/14

NB: This consent is contingent on Ethics Clearance being obtained, which will also determine whether the company's name may be used.

18/06/14

Appendix C: Letter of approval to collect data at GZU

I SINIKIWE TIRIVANHU, in my capacity as REGISTRAR .....give consent in principle to allow Nowell Chibaro a student at the Cape Peninsula University of Technology, to collect data in this University as part of his M Tech (IT) research. The student has explained to me the nature of his research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the University's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes	✓	✓	✓	✓
No				

signature

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2/9/14
date