



**ICT innovation for public higher
education administration efficiency
in South Africa: A comparative study**

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DECLARATION

In submitting this thesis for the degree Doctor of Philosophy in Public Management and Governance, I declare that this thesis is my own work and has not previously been submitted for a degree at this or any other institution.

DEDICATION

This thesis is dedicated to my late parents, Stenner and Grace Sikoya, who deserve more than just my thanks. The sacrifices they made for me will never be forgotten. Their sacrifices and encouragement are what helped me get to where I am today. I pray that their dearest souls rest in peace knowing that they fought a good fight for me.

Additionally, the dissertation is dedicated to Langton, my loving husband, and our two sons, Farai and Tafara. It would have been impossible for me to complete this program without your unwavering support. Without your prayers and encouragement, I would have given up.

My love to you all

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ABSTRACT

Information and Communication Technology (ICT) are widely acknowledged in educational administration in this time when information flows freely through satellites and the internet, thus enhancing knowledge dissemination and administrative efficiency. In addition to facilitating educational change and reform via cost-effective technologies, flexible learning, and administrative activities, ICTs are also essential for promoting learning institutions' efficiency. This study was an exploratory descriptive survey to determine the extent of information and communication (ICT) use in the administration of two South African higher education institutions (HEIs) namely Sedibeng TVET College and North West University. In this study, Rogers' Diffusion of Innovation theory was used to determine how institutions were using ICT to improve administrative efficiency in the digital era and factors influencing their adoption of ICT or lack of it. Data collection was conducted using an exploratory sequential mixed-method approach. The researcher first collected and analysed quantitative data, then followed up with qualitative inquiry to confirm the quantitative findings. Research methods included literature review, website analysis, two questionnaires for staff and students, and an interview protocol. Statistical analyses of quantitative data were performed using descriptive statistics, which presented data as frequencies and percentages for easier understanding. For interview data, content analysis was used. In the wake of the Covid-19 outbreak, this study revealed how technology can support uninterrupted learning and teaching. Research findings however, revealed a substantial technological gap between the two study institutions, with the TVET institution displaying limited use of ICT in its information and knowledge management functions in comparison to the university. Study results also showed unequal access to ICT resources among university and TVET students, with the latter group showing greater disadvantage. It is critical to address this digital divide between university students and students at TVET colleges if both institutions are to effectively integrate ICT in their administrative and academic functions. It is imperative to build the ICT capacity of the TVET institution by upgrading its ICT facilities, providing better institutional support regarding resources, and training staff and students effectively. These appear to be major factors affecting successful integration of ICT in both academic and administrative practices at the college. Taking into account the policy implications of the study, higher education institutions need a more defined ICT policy framework governing how they use ICT so that they can thrive within the digitally driven education landscape of the digital age.

Keywords: Information and Communication Technology, knowledge administration, administrative efficiency, information administration, digital era governance.

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LIST OF ACRONYMS

AHRQ	Agency for Healthcare Research and Quality (AHRQ)
DEG	Digital Era Governance
DHET	Department of Higher Education and Training
DOI	Diffusion of platforms
HE	Higher Education
HEI	Higher Education Institution
ICT	Information and Communication Technology
KMS	Knowledge Management System
LMS	Learning Management System
MOODLE	Modular Object-Oriented Dynamic Learning Environment
NPM	New Public Management
NSFAS	National Student Financial Aid Scheme
OECD	Organisation for Economic Co-operation and Development
PSET	Post School Education and Training
SDG	Sustainable Development Goals
TAM	Technology Acceptance Model
TVET	Technical Vocational Education and Training
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VLE	Virtual Learning Environment
WPPSET	White Paper for Post School Education and Training
WoCTVET	World Congress on TVET

CHAPTER 1: INTRODUCTION: ICT INNOVATION AND HIGHER EDUCATION ADMINISTRATION

1.1 INTRODUCTION

The dawn of the digital age is fast changing the ways people and organisations communicate and manage their daily activities and resources. The digital revolution of the 21st century has pushed societies to live in a digitised era where digital media and advancements in technology are affecting every aspect of personal and working lives globally (Riehemann and Jucks, 2017; Michikyan, 2015) . Hence, today's societies and economies are undergoing transformation due to the rapid integration of information and communication technologies (ICTs).

There is a universal recognition of Information and Communication Technology (ICT) as innovative tools that are useful in educational administration in this era whereby information flows freely through satellite and the internet, thus enhancing dissemination of knowledge as well as administrative efficiency. ICTs are appraised as a powerful tool for educational change and reform because they combine cost-effective technologies, flexible education, and administrative activities, in addition to promoting the efficiency of educational institutions (Nanbam, Ringim and Ringim, 2018).

Higher education as an entity of the public sector is aimed at ensuring the delivery of quality and responsive educational services to all citizens in most developing states since the overall prosperity of a nation depends highly on the quality of its higher education system (Krishnaveni and Meenakumari, (2010). Hence, it is increasingly becoming the desire of most nations to provide higher education systems that meet their developmental requirements. Both developing and developed states are thus experiencing tremendous growth in their higher education sectors. However, this rapid growth in higher education is beginning to make administration (i.e. the day-to-day management of operational activities of the institutions) a mammoth task. The administration of public higher education institutions is becoming more complex each day due to large quantities of data that need proper handling as well as the increased demand for quality services by their stakeholders.

Various studies however, have revealed that the integration of Information Communication Technologies (ICTs), goes a long way to reduce the administrative complexities and enhancing overall administration of higher education institutions (Anwar and Matthew,

2014; Krishnaveni and Meenakumari, 2010; Barta et al, 1995; Hashim et al, 2010, Solomon et al, 2016). ICTs are technologies that contribute to the creation, dissemination, and exchange of information, according to UNESCO (2009). Apart from their widest adoption and application in teaching and learning, ICTs may have a positive effect on the efficient and effective administration of higher institutions of learning.

The advent of the Fourth Industrial Revolution (4IR) presents opportunities for higher education administrators to take advantage of the rapid explosion of technologies to provide reliable, innovative multi-channel access to information and essential services as per citizen expectations (Badimo, 2019). Initiatives for the use of ICT applications, the internet, and portable devices to ensure effective management and administration, support principles of good governance and reinforce relationships with stakeholders are the demand of time in this e-government age (Gupta, Shakya, and Marasini, 2015). Hence, there is a need for more focus on reforms in higher education administration to meet the citizens' changing demands.

Although ICT has been present in higher education for some time now, their impact on the functions of different higher education institutions has not been very extensive (Solomon et al., 2016). It is arguable that ICT integration in education tends to incline more towards knowledge administration (teaching and learning) and to be minimally applied as part of the operational activities / administration of the institutions (Meenakumari and Krishnaveni, 2011; Saud et al, 2011; Nanbam et al., 2018; Andugo , 2017). To what extent are South African higher education systems using ICT as administrative enhancement tools?

Furthermore, several studies have been carried out on the application of ICT in universities (Nanbam et al, 2019; Chidobi , 2015; Juma and Raihan, 2016; Guma , Faruque, and Khushi, 2013; Council on Higher Education (CHE), 2006; UNESCO 2009), there is a paucity / scarcity of literature on the application of ICT in TVET college administration (Saudi et al 2011). In spite of research on the quality of service in South African higher education (De Jager and Gbadamosi, 2010), little is known about the extent to which ICT is used by the major HEIs such as universities and TVET colleges. It is an avenue that needs further investigation if ICTs are to benefit both universities and TVET institutions.

If effectively used, ICTs can help address and respond to the challenges of expansion in education, together with the increasing demand for educational service quality (Chua , 2004; Voss et al, 2007; Pereda et al, 2007). Lately, the COVID-19 pandemic lockdown has also posed challenges on both the basic and higher education sector schedules as most institutions have been forced at sometime to close down all contact classes in order to manage the spread of the pandemic worldwide. In response to these challenges,

employees and students were forced to fall behind on their work or to work online. As the future is uncertain, higher education service providers will need to rethink their service delivery models.

The South African institutions of higher education are not spared from the wave of ICT adoption and integration as well as online service that has become the norm in most countries. Today's higher education must pave the way for electronic administration in order to facilitate modern methods of service delivery and administration. Thus, Sarkar (2012) argues that with the many challenges in higher education in developing countries, there is an increasing need to ensure technological possibilities in the context of education. Given this scenario, are the different types of South African HEIs equally harnessing the power of ICTs given the importance of ICTs in the above discussion? Are they well prepared to move to online administration and service delivery as opposed to traditional face-to-face models of service delivery that are mostly used by most institutions?

Due to this background, studies on the role of ICT integration in administrative functions of public higher education institutions are essential. This study was therefore designed to address the knowledge gaps above by investigating the nature and extent of ICT integration in the information and knowledge management of South African public higher education institutions. An analysis of ICT usage in one public university and one TVET institution in one province of South Africa was conducted for this purpose.

1.2 RESEARCH GAPS AND PROBLEMS LINKING ICT INNOVATION AND HIGHER EDUCATION ADMINISTRATION

The past two decades have seen public sector organisations worldwide go through major changes in response to challenges of globalisation, technological change among other challenges. This period of transformation according to Hughes (1998), represents a paradigm shift from traditional public administration to New Public Management (NPM), leading to Digital Era Governance (DEG). More economic theories are constantly replacing the theory of bureaucracy as the efficacy of public sector organisations' ways of managing affairs is repeatedly under debate. Phrases like re-inventing government, mission-driven governance, process re-engineering, citizen empowerment, responsive governance, etcetera, have increasingly become buzzwords in most developed and developing countries alike (Kapur , 2000). While the above phrases reveal good intentions by organisations using them, without their practical application they remain theory without tangible results. There is a need to convert the promises in these buzzwords into performance, as well as their agenda into action. Providing quality, accessibility, and speed

of information and services through innovation is fast becoming a pre-requisite for effective governance of public sector organizations (Hughes, 1998; Singh and Karn, 2012; Kapur, 2000). Public organisations are therefore increasingly viewing technology-based reform of public administration as a way to retain their relevance in the 21st century.

Processes and principles of public administration / governance are highly affected by the strong winds of change and the thrust of ICT revolution that is sweeping across the globe (Nanbam et al, 2018; Pohekar , 2018). The public sectors worldwide recognise the potential benefits offered by ICT to fit citizens' needs, to provide better services and to increase efficiency through streamlining internal processes. This sector is therefore increasingly adopting ICTs in public organisations as a way of promoting and implementing good governance principles and improving service delivery in their daily operations (Ndou , 2004). With this in mind, for public managers and administrators with the vision and knowledge to recognise and select good technology, redesigning of internal processes through integration of ICTs in day-to-day administration should present them with real opportunities for effective administration and implementation of good governance principles.

New Public Management, born out of citizens' frustration at not receiving quality services and information from government (Dunleavy, 2005) lays emphasis on using ICTs to support transformational change in administration. Consequently, services will be delivered efficiently and more cost effectively while combating the administrative inefficiencies that arise from the use of traditional service delivery methods. Digital governance, implying the networked extension of ICTs inclusive of fast access internet, mobile service delivery and use of multi-channel information technologies to achieve two-way transactions (Milakovich , 2012), is the right move towards reducing costs and meeting citizen needs, thus ensuring responsive governance. A great deal of consensus is evident among governments worldwide regarding the need to revitalise public administrations to make them more customer-centric, cost-effective, and user-friendly services to citizens and business thereby improving quality of services and functions (Bhuiyan , 2011). Technological innovation in administration has become fundamental to such reform and modernisation. Thus, Meenakumari and Krishnaveni (2011) posit that electronic-administration should focus on efficiency and effectiveness of administration through handling resources economically and offering responsive services. Modern public administration also greatly recognises the potential of technology to improve transparency, control corruption and ensure responsiveness to citizens' needs. ICT integration in administrative functions is therefore fast becoming a necessary move to achieve the objectives of transparency, effectiveness, responsive services and accountability Sarker, et al (2013).

A vital function of any organization that ensures efficiency and effectiveness is administration, which is defined as the process of planning activities and utilising resources to meet set objectives (Juma et al., 2016). With advancement in technology, administrators need to take advantage of emerging technologies to make right and timely decisions that are responsive to stakeholder / citizens' needs (Opara and Onyije, 2014). However, in the field of education, the use of ICTs for administrative purposes has not received much attention. Online services facilitated through ICT integration have mostly been in the form of portals to link with static school websites (Amaripuja, 2016), limiting the improvement in public sector educational services to mainly the dissemination of information without many changes in interaction and transactional business processes.

With higher education experiencing rapid growth and development, new reforms in institutional administration are increasingly required (Meenakumari and Krishnaveni 2011), with ICT integration driving accountability, responsiveness, transparency, efficiency, and effectiveness for both private and public higher education institutions. Solomon , et al, (2016) also affirm ICTs as fast becoming a mandatory element in the functioning of the tertiary administration system. ICTs in public administration are consequently, valued for improvement of quality, increasing access to higher education, and the enhancement for operational efficiency across all higher education functions. Ben-Zion Barta et al, (1995) and Suri (2005) thus identified about five areas of effective ICT use in educational administration, which are also applicable to higher education namely, general administration, payroll management, financial accounting, student data management, inventory management, personnel management, as well as library system management. Oboegbulem and Ugwu (2013) observed that utilising ICTs in higher education administration is important for the following:

- Management of administrative transactions and records
- Rendering well organised and quick services
- Reducing bureaucratic processes in management
- Increasing efficiency of institutions
- Reducing staff workload and saving information processing time
- Managing student admissions, records and attendance
- Monitoring and evaluation of staff.

With the expansion in higher education and training, there has been a global increase in research on integration of ICTs in the higher education field in the past two decades (Council on Higher Education (CHE), 2006; Juma and Raihan, 2016; Chisholm, 2009). More attention however, has been paid towards research on the effective role of ICTs in teaching and learning as well as on problems of ICT integration in university institutions (Guma et al 2013; Angelino et al, 2007; Augustine, 2013; Saud et al, 2011; Yasak and Alias, 2015; Thinyane , 2010).

From the above-mentioned studies, it is arguable that research on the use of ICTs in higher education has so far mostly evolved around universities. UNESCO (2009) placed emphasis on the need for governments to put in place national and institutional policies to support the use of ICTs and checked their part in reinforcing the developmental role of Higher Education Institutions (HEIs) in their communities. Given the growing demand for Higher Education (HE) particularly in developing countries, the role of ICTs in improving access, quality as well as minimising costs in the instructional and administration function therefore needs attention and thorough examination in all different types of HE institutions not universities only.

The winds of service delivery transformations are equally affecting the South African Higher Education system. The path for South Africa's higher education transformation immediately took shape under the guidance of the Education White Paper 3 promulgated in July 1997. This was a framework, envisaged to overcome the past higher education legacy of fragmentation, inequality and inefficiency (Education, 1997). With the creation of the Department of Higher Education and Training (DHET) in 2009, public higher education expanded to incorporate all formal and informal training after secondary school by coming up with post-school education and training (PSET). The aim was to ensure expanded access to higher education, improved quality of services, increased diversity of provision and responsiveness to the needs of citizens (White Paper on Post School Education and Training (WPPSET, 2013).

With this expansion in access however, came complexities / challenges in administration of the sector. In the past few years, service delivery protests have been rife in most public institutions of higher learning. Angry students, prospective students and sometimes employees often take to the streets in remonstrance against what they feel is poor performance and poor service delivery in the institutions of higher learning. Of late, the South African higher education system, which consists mainly of universities and TVET colleges, is increasingly recording more incidents of protests. Employees, current and potential students are often expressing dissatisfaction with the level of services they are

receiving. For instance, the 2019 VUT student protests, “National Total Shut-down of TVET Colleges in 2019” and the VUT employee protests spearheaded by trade union NEHAWU in February 2019, are evidence of stakeholder dissatisfaction with the way the institutions are being managed and the information administration thereof. The 2018-2019 financial year alone saw many universities and TVET colleges engaging in different protests due to dissatisfaction with the quality of service rendered in the institutions. Central to their grievances were delays in payment of NSFAS funds / allowances, registration hassles, lack of access to the desired higher education, financial mismanagement, among other service delivery challenges.¹ It is possible that most unrest extensively reported across the country is results of failure by the government or its agencies to deliver information and services efficiently and effectively, that is, administrative inefficiency, and this needs steering in a more positive direction. Hence, President Cyril Ramaphosa had this to say in the 2018 national address:

The state employs one million public servants, the majority of whom serve our people with diligence and commitment. We applaud them for the work they do. However, we know the challenges that our people face when they interact with the state. In too many cases, they often get poor services or no service at all. We want our public servants to adhere to the principles of Batho Pele, of putting our people first’. (State of the Nation Address, 2018).

The South African concept of ‘Batho Pele’ and the principles of good governance are interconnected. They are both aimed at strengthening, stabilizing and enhancing democratic systems. Access to and right to information (RTI) is regarded as an essential element of democracy and good governance. Upholding the principle of RTI through opening up a variety of information communication channels, access and processing methods, is likely to make administrators more responsive, accountable, and transparent, thus meaningfully practising the principles of good governance in their institutions (Singh and Karn 2012). Information and communication technologies can penetrate all areas of governance, making administration of information and knowledge, as well as the provision of services, more cost-effective and efficient. To meet the requirements of the Batho Pele principles in the higher education sector, ICTs should thus play a significant role in supporting effective management and administration, with technology used from student administration, personnel administration to resource administration in any institution (Juma et al, 2016; Maki , 2008; Chisholm, 2009). Digital technologies should be used where possible to promote access, improve communication with stakeholders and optimise

¹ For more information on the unrests and their causes visit <https://pmg.org.za/committee-question/9711>

service provision. Institution managers / administrators need to make right and timely decisions that are transparent and highly responsive to the needs of the citizens / clients hence; they should recognise the power of ICTs in the improvement of their administrative efficiency. The dream of any institution should be to achieve quality goals through an effective and efficient managerial process (Shaikh, 2009; Juma et al, 2016). However, the question one may ask is, 'How far are higher education administrators going to ensure improvement of administrative efficiency through use of digital technologies in the administration of South African institutions of higher learning?'

Regardless of the hiccups faced in the adoption of e-government initiatives by some government agencies for instance, the DHA's "Who am I online project", transformation of the public sector through adoption of digital communication methods and e-services continues to be a fundamental aspect that government institutions should embrace in South Africa. Governments in developing countries, including South Africa, have increasingly turned to ICT to deliver citizen-centered services (Visser, Twinomurinzi, 2008). Therefore, in his first State of the Nation Address in 2018, President Cyril Ramaphosa said,

"Our prosperity as a nation depends on our ability to take full advantage of rapid technological change. We will soon establish a Digital Industrial Revolution Commission which will include private sector and civil society to ensure that our country is in a position to seize opportunities and manage the challenges of rapid advances in Information and Communication Technologies"

As (Ajayi, 2008) observed however, *"Today's schools in developing countries are organised around yesterday's ideal, yesterday's needs and yesterday's resources"*. With the arrival of the Fourth Industrial Revolution (4IR), it is imperative that the focus of today's higher education be in line with the demands posed by current technological advancements and the ever-changing needs of citizens. It is important to note that the current population of students in higher education institutions mostly consists of a new generation of learners raised in a technological environment. These learners according to Prensky (2001) and Thinyane (2010) are digital natives greatly affected and influenced by the arrival of and rapid dissemination of digital technology in the concluding decades of the 20th century. Such natives have a fluency in the language of technology, computers, video games, the internet and social media interaction, hence do adapt easily to technological changes. As a result, advancements in technology should give the South African higher education sector an opportunity to rethink current service delivery models (SDMs) in order to address service delivery challenges and other social challenges affecting South African communities and students at present and in the future. Internal organisational environments that are capable

of delivering on their mandates and increasingly improving their processes to the delight of customers are now a prerequisite for public organisations so that they are responsive to the dynamic external environments (Singh and Karn, 2012). Effective ICT adoption and online service is the way to go for the enhancement of administrative efficiency and meeting the needs of a dynamic society.

In view of the above, public higher education institutions need to utilise ICTs efficiently thereby modernising programmes to bring their services into the 21st century drive. With the call for more humane, transparent, responsive and accountable government becoming louder with the dawn of the new millennium (Kapur, 2000), higher education administrators and management should use enabling technology to improve the citizen-government interface and realise high quality but low-cost and speedy services to their stakeholders. To realise this interface improvement in higher education institutions, are there professional and modernised systems for information communication and control for the benefit of stakeholders in higher education institutions?

Higher education institutions must therefore be ready to make a paradigm shift from traditional administration processes and traditional governance models to more advanced and modern approaches. Such modern approaches can better accommodate the needs of digital natives, that is, those born in the era of technology (Prensky, 2001; Chisholm, 2009) who constitute most of the population found in our higher education institutions today. This implies that higher education institutions must adapt to the pace of technological change in the Fourth Industrial Revolution by keeping at par with new administrative techniques and trends that contribute to effective administration and ultimately to good governance of the higher education sector. If properly implemented, ICT could lead to a major step towards more effective TVET and university institutions of higher learning. In order for these institutions to be able to process information requests more quickly, effectively, and efficiently, they need to start storing information more efficiently, making it readily accessible to decision makers and planners. This calls for involvement of a considerable amount of digitisation and computerisation, which will enable officials to easily access information, respond to clients' requests for transparency and responsiveness, and open more channels of communication with stakeholders while improving quality.

Nonetheless, while UNESCO (2009) emphasises the importance of ICT integration in universities, the question to ask is, what role is ICT application playing in other institutions of higher learning, particularly the South African Technical and Vocational Education and Training (TVET) institutions? Therefore, are TVET colleges, which also fall under the higher education spectrum in South Africa, equally tapping into the benefits of ICTs in their

administration? Saud et al (2011) recognised the scarcity of literature on the application of ICTs in the TVET sector. They argue that the area of ICT application in this sector has attracted few scholars of advocacy, with a few contributions from TVET professionals like Kotsik (2009), Basu and Majumdar (2009), and Yasak and Alias (2014). Literature further reveals that studies in ICT integration in both basic and higher education tend to focus more on classroom level variables of teaching and learning, seemingly neglecting other important areas of administration and promotion of good governance (Saud et al 2011).

In the South African context in particular, not many researchers and scholars have studied the application of ICTs in the TVET sector, except for a few like Dzvapatsva , Mitrovik and Dietric, (2014) who investigated the use of social media platforms for improving academic performance at Further Education and Training (FET) colleges in South Africa. Studies recorded mostly addressed the issue of integrating ICT in instruction, leaving out the crucial area of integration in higher education administration. The TVET sector therefore, seems to have less research attention in the area of ICT integration in its activities, both in its instructional activities and in its information administration, as studies tend to focus more on basic education and universities. These gaps in literature on ICT usage in TVET colleges need research attention so that TVET institutions do not continue to lag behind in their uptake of technology and improvement of their administrative efficiency. There is a need for more probing into the potential uses and benefits of ICTs in the universities and TVET administration functions too, thus steering the sector in tune with the 21st century drive ushered in by the Fourth Industrial Revolution, (4IR).

Zhang et al (2020), state that public emergency management is an essential function of public administration. The Federal Emergency Management Agency (FEMA, 2020), posits that emergency management is an administrative function charged with creating guidelines for communities to reduce vulnerabilities to hazards and to cope with disasters. The focus is on promoting safer, less vulnerable communities that have the capacity to cope with disasters. This involves integrating and coordinating necessary activities for preparation, response to and recovery from threatening or actual disasters, be it natural or fabricated (Zhang et al, 2020). The following principles according to FEMA (2020) and Petak (1985) should guide administrators in emergency management of various organisations:

- i. Flexibility – administrators should use creative and innovative ways to solving disasters and challenges
- ii. Coordinated – Managers synchronise all relevant stakeholders' activities to achieve a common goal.

- iii. Progressive – emergency managers should anticipate future problems, take precautionary, preventive and preparatory measures to foster disaster resilient and disaster oriented communities.
- iv. Mitigation – deciding where a risk is detected and implementing reduction programmes.
- v. Preparedness - administrators need to develop response plans and identify critical resources to put the plans into action.
- vi. Response and Recovery - the focus of administrators should be on providing assistance and support until communities return to normal following a disaster period.

Petak (1985) asserts, however, that public administration has generally overlooked emergency management as part of its mainstream activities. This, the author argues, has resulted in increased exposure of citizens to extremely risky situations. Good examples of such risks include increased deaths in informal settlements due to shack fires, increased infection rates in contagious and infectious diseases in communities, etc. Thus, public administration ends up taking a reactive instead of proactive approach to crisis management. There is a need to develop a deeper understanding of public problems and the means to mitigate them from a policy perspective. This should place emergency management as a central activity of public administration at the national, local and institutional level of management.

The higher education sector also needs to place emergency management at the centre of their administrative activities. Sullivan (2012), observed in the Higher Education Emergency Management Survey observed that the past decade has seen colleges and universities continuing to be impacted by disasters and emergencies that require implementation of emergency management strategies and tools. Of late, COVID-19 is a global emergency that has called on the attention of higher education sectors worldwide to act quickly in a bid to contain the spread of Coronavirus. Most higher education institutions, including South African higher education, have temporarily closed educational institutions. UNESCO , (2020) observed that this has impacted 91% of the world's student population and educators, while Crawford et al, (2020) concur the Coronavirus 2019 pandemic has affected the global higher education sector so extensively. Zooming in to the South African context, with the increase in COVID-19 cases, the Department of Higher Education and Training put in place measures to deal with the pandemic in the Post-school Education and Training (PSET) sector. The Higher education minister, Dr Nzimande, ordered the closure

of all HEIs from 18 March to 15 April 2020 on an extended break, with institutions being encouraged '*to explore digital and online delivery methods for teaching and learning to support programmes at a later stage*' (Government SA, 2020). This was followed by "Lockdown South Africa", a government initiative that saw the whole of the country placed on Alert Level 5 lockdown, meaning further extension of semester breaks. This brought about a dilemma for higher education administrators in the sense that there was now a need to save lives on one hand and to save the academic year on the other. There was need for higher education administrators to ensure non-disruption of learning programmes at the same time preventing the spread of the virus. How best could HEIs use ICT to mitigate the challenges posed by this global pandemic? To what extent has the South African higher education system invested in ICTs for both information and knowledge administration to address this challenge?

This study addressed these identified gaps in knowledge described in the background by carrying out a comparative study on the usage level of ICTs for information and knowledge administration purposes in a South African university and a TVET institution in one province.

1.3 PROBLEM STATEMENT

The overall prosperity of a nation depends highly on a good higher education system (Krishnaveni and Meenakumari, (2010). Hence, it has become the desire of both developed and developing states, to provide and sustain a higher education system that meets their developmental requirements. However, the rapid growth in education is posing a mammoth challenge to good governance and administrative tasks. Because of the growth of the higher education sector, the administration of higher education institutions is becoming increasingly complex. The South African higher education system is experiencing rapid expansion due to the high demand for tertiary education post-independence, adding to the complexity of the administration process. A large amount of data is available to institutions that they have to manage efficiently, as well as a large number of students they must regularly interact with to fulfil their mandates. This in turn is affecting their turn-around time for service delivery thus creating dents in their administrative efficiency. Meenakumari and Krishnaveni, (2011) identify these administrative tasks for higher education as falling under two broad categories of functional areas namely:

- i. Information administration, which covers among other things, general administration, student administration as well as staff administration.

- ii. Knowledge administration, which has to do with knowledge enhancement, knowledge delivery and knowledge evaluation in education institutions. Hence, in the context of this study, it refers to teaching and learning practices in the higher education system.

Manual, face-to-face ways of processing information in these functional areas are currently becoming less effective, resulting in many institutional stakeholders showing frustration at what they view as the administrative inefficiency of the institutions. Hence, protests have become the order of the day in the public higher education sector, with students and staff often complaining about the quality of services they receive. There is therefore a need to transform the way of offering services by adopting modern ways of administration that enable fast, efficient services and responsiveness to the stakeholders' demands for quality services.

Furthermore, studies in ICT integration in education have placed much emphasis on classroom level variables of teaching and learning, seemingly paying less or no attention to the important area of ICT in administration / e-administration (Juma et al. (2016). In addition to their widespread use and application in teaching and learning, ICTs have an impact on higher education administration. Hence Meenakumari and Krishnaveni, (2011) advocate for integration of ICTs in administration processes as a necessity to ensure efficiency, effectiveness, accountability, transparency and responsiveness of higher education to the stakeholder needs.

Although ICTs have gained their popularity in their application in general and higher education in the past two decades globally (Juma, Raihan and Clement, 2016), TVET colleges as public higher education institutions have been observed to be falling behind in their uptake of ICTs in most developing countries (Saudi et al, 2011; Adebayo , 2013). The uptake of ICTs in higher education has been significant in universities, but so far not much has been done to explore its application and usage in TVET college administration, with literature on ICT integration in these institutions considered rare in South Africa as well. The relatively limited information on the current use of ICTs in the TVET field of practice (Saud, et al, 2011; Yasak and Alias 2015), draws attention to the need for empirical studies on the level of ICT adoption and integration in both TVET and university administration, highlighting its management and administrative benefits. All higher education institutions need to step up their participation in the digital, networked economy through the adoption and maintenance of technology-driven services to stakeholders. Juma et al, (2016) further argue that ICTs are an engine for growth and innovation in the delivery of services and all higher education institutions need to embrace them to improve their administrative efficiency.

Since its establishment, the Department of Higher Education and Training (DHET), has been encouraging all providers of post-school education to network and increasingly make use of technologies to improve their efficiency. As digital technology has become more accessible in South Africa, it is necessary to incorporate it into the effective running of all higher learning institutions. In their paper to the 4th World Congress on TVET (WoCTVET), Yasak and Alias, (2015) however report that ICTs in the TVET sector of developing economies are mainly employed for presentation purposes rather than the promotion of 21st-century skills. They further argue that most studies attempted in the area of ICT application in TVET are mainly theory based without much empirical evidence. Are the South African TVET institutions any different in their use of ICTs after this report? To what extent are both university and TVET institutions harnessing the power of ICTs to enhance their processes of rendering good service delivery to students, staff (both academic and support) and to communities in line with the requirements of the modern public administration?

Both UNESCO (2009) and UNESCO (2020) stress the importance of national and institutional policies backing the use of ICTs and reinforcing the developmental functions of Higher Education Institutions (HEIs) in their communities. With the expanding demand for Higher Education (HE) particularly in developing countries, the role of ICTs in improving access, quality as well as minimising costs in the instructional and administration function should be paid attention to and examined in all different types of HE institutions not universities only. In South Africa, do TVET colleges, which fall under the higher education spectrum as well, benefit similarly from technology in terms of information and knowledge management?

The main goal of the South African government stated in the White Paper for Post School Education and Training (2013) has been to ensure equitable extension of ICT infrastructure and tools to all post school students. More than five years after this announcement by government, has this become a reality in all higher education institutions? Are the higher education institutions equally harnessing the power of technology in support of their different functions, particularly for information and knowledge administration? Is there uniform e-readiness for ICT integration for e-administration in all the universities and TVET institutions?

Although ICTs have gained their popularity in their application in general and higher education in the past two decades globally (Juma, Raihan and Clement, 2016), TVET colleges as public higher education institutions have been observed to be falling behind in their uptake of ICTs in most developing countries (Saudi et al, 2011; Adebayo, 2013). While

the uptake of ICTs in higher education has been significant in universities, so far not much has been done to explore the extent of ICT application / usage in TVET College administration, with literature on ICT integration in these institutions considered scarce in South Africa too. The relatively limited information on the current use of ICTs in the TVET field of practice (Saud, et al, 2011; Yasak and Alias 2015), draws attention to the need for empirical studies on the level of ICT adoption and integration in the TVET system administration as compared to its adoption by universities, highlighting their management and administrative benefits. All higher institutions need to step up their participation in the digital, networked economy through the adoption and maintenance of technology-driven services to stakeholders. Juma et al (2016) further argue that ICTs are an engine for growth and innovation in the delivery of services and all higher education institutions need to embrace them to improve their administrative efficiency.

Saud et al, (2011) also observed that not much research has been published in developing countries to compare the use of ICTs in a variety of higher education institutions except mainly in universities and this applies in the South African context as well. This calls for descriptive and comparative studies to assess the level of use and need for ICTs in the post-school education and training (PSET) sector of South Africa, to determine the levels of e-readiness of the institutions, identify integration challenges and to chart a way forward towards redressing any inequalities if they still prevail.

With the populations in HEIs currently consisting mainly of digital natives (Prensky, 2001; Thinyane, 2010), knowledge administration can no longer be practised the way it was done before the dawn of the digital era. There is a need for a shift from traditional to digital pedagogy to suit the natives' digitally modernised needs. According to the Institute for Academic Development (IAD , 2018), digital pedagogy, which implies the innovative incorporation of technological tools into teaching and learning processes, may be applied to hybrid, online and face-to-face learning environments. This includes the use of blended teaching, which makes use of multiple methods that combine face-to-face interactions with the use of ICTs and online activities. In the South African context, to what extent are universities and TVET colleges modernising their educational programmes to bring services into the 21st century drive through digital pedagogy?

In undertaking this study, the researcher aims to bridge these gaps in knowledge using the South African university and TVET systems as the focus of the study. This study is set to critically assess and appraise the extent of information and communication technology adoption and usage in public higher education administration in South Africa. Particular attention was on levels of ICT usage in a South African university and TVET college.

1.4 SIGNIFICANCE OF THE STUDY

Empirical studies on the integration of ICTs in the PSET sector of South Africa are limited, with most research having focused on integration in university academic practices. There is so far a dearth of literature on the use of ICTs for administrative purposes in the South African higher education system, especially among TVET institutions. This study aimed at filling up this knowledge gap and made informed recommendations on the importance of e-administration by all types of higher education institutions in this present digitally driven era. The researcher's interest therefore lay in carrying out a comparative study into the extent of ICT use by a university and a TVET College to facilitate both general administration and knowledge administration.

This study is significant in that it contributes to the field of public administration and governance at institutional level, with a special emphasis on the administration of public TVET colleges and universities in South Africa. The study aimed to contribute to a growing area of research on innovative public service delivery through ICT integration in the core administrative functions of higher education institutions. Few researchers who undertook studies in ICT integration in educational administration focused mainly on the functional area of general information administration only (e.g. Krishnaveni and Meenakumari, 2011; Jaleel , 2014, Egoeze et al, 2018; Samprathi , 2019). In this study however, the researcher focused on ICT innovation for both information administration and knowledge administration in South African public universities and TVET colleges, assessing and appraising the ICT innovation experiences of the different higher education institutions. This issue has not had much research attention so far in South Africa. Furthermore, since literature is observed to be scarce on the integration of ICTs in administrative functions of TVET (Saud et al, 2011), this study aims to fill this literature gap in the South African context. The study may offer valuable insight to policy makers, institutional managers and administrators on the importance of adopting and adapting ICT policy frameworks and practices for addressing the challenges of ever-changing citizens' needs currently driven by the advent of the Fourth Industrial Revolution. Thus, the study contributes to literature on digital era governance and e-administration with a focus on qualitative service and information delivery. It creates a foundation for further studies where the study can be conducted on a large scale across different higher education institutions.

1.5 RESEARCH QUESTIONS, OBJECTIVES AND HYPOTHESES

Given the preceding context and motivation, the overarching purpose of the study was to assess and appraise the role of information and communication technology (ICT) as a change agent for administrative efficiency in public higher education institutions. The

researcher intended to achieve this through conducting a comparative study on the level / extent of ICT innovation, integration and usage in both information and knowledge administration of one public TVET institution and one university in South Africa.

1.5.1 Research questions

The study was prompted by the following primary question:

“What role is ICT innovation and integration playing as an agent for improved administrative efficiency and knowledge administration in South African public higher education institutions namely, TVET colleges and universities?

Based on the primary question, the following secondary questions guided the study:

- i. To what extent are higher education institutions using ICT in promoting effective knowledge administration (teaching and learning)?
- ii. To what extent are South African higher education institutions employing ICTs to mitigate Covid-19 imposed challenges on teaching and learning?
- iii. In what ways are South African public higher education managers integrating ICT as an agent of change in their general administration and student information administration functions?
- iv. What are the challenges faced by South African higher education institutions in implementing e-pedagogy and e-learning?

1.5.2 Research objectives

The major objective of this study is to assess and appraise the role of ICT integration as a change agent for administrative efficiency in public higher education institutions. The following minor objectives guided the study:

- i. To assess the level of ICT use by one TVET College and one university in South Africa in enhancing Knowledge administration.
- ii. To examine the technological responses of one TVET College and one university to the Covid-19 imposed challenges on teaching and learning.
- iii. To evaluate the extent to which ICTs are used as change agents in the general administration and student information administration of higher education institutions in South Africa.

- iv. To assess the e-readiness and implementation challenges higher education institutions face in integrating technology into their teaching and learning practices.

1.5.3 Research assumptions

Following are the assumptions underlying the study:

- Information and communication technologies (ICTs) are integral to the administration/instructional delivery and information administration of higher education institutions.
- Innovation in ICT is directly related to increased efficiency of higher education institutions in South Africa.

The predominant postulation behind this study is that integrating ICTs in the administration functions of higher education institutions would greatly improve the way institutions perform their pedagogical and administrative functions; and meet the ever-changing needs of various stakeholders in this digital era. The assumption is that ICTs have the power to facilitate efficient and effective administration of both knowledge and information to the satisfaction of both higher education administrators and their stakeholders, especially in this period when online activity is fast outpacing traditional administrative activities.

1.6 META-THEORETICAL PARADIGM: PRAGMATISM

Before embarking on an investigation, the researcher must adopt a philosophical perspective regarding the subject, which guides them to operate within a specific paradigm. Paradigmatic approaches differ from researcher to researcher due to the different ways in which they view the world. This necessitates selection of an appropriate strategy by which one observes and interprets the phenomenon under study. Below, I describe my metatheoretical paradigm (my world view) which in turn shaped my methodological approach (research methods).

Pragmatism was deemed the appropriate paradigm for this study as it provides insight into how research approaches can be fruitfully blended in a way that provides the most effective means of answering the research question (Johnson and Onwuegbuzie, 2004; Morgan , 2014). In situating the study as a pragmatist, the author consequently believes that research requires workable approaches to problem solving, with emphasis on the 'how to' aspect of research. Thus in this study pragmatism offered attractive support for using a variety of approaches and methods to obtain valid data and results. I was cognisant of the importance of collecting multiple data using a combination of approaches in a way that brings out complementary strengths in order to have clear and meaningful study findings.

Hence the researcher collected and analysed data on participants' opinions and listened to narratives of their lived experiences so as to gain understanding of their feelings, experiences and challenges as they made attempts to adopt and incorporate ICT into their teaching and learning.

1.6.1 Methodological approach.

Johnson and Onwuegbuzie (2004) posit that Mixed Method Research (MMR) is a third research paradigm in educational research after constructivism and positivism. In this study, the researcher adopted MMR as a methodological approach to guide data collection. The researcher used an exploratory sequential mixed methods research approach in which quantitative and qualitative data were collected within a natural setting. An important part of this research was a quantitative approach followed by a qualitative inquiry through semi-structured interviews. The choice for this approach is based on the belief that the best method for getting comprehensive answers to research phenomena is to integrate quantitative and qualitative research approaches (Morgan, 2014). As my interest was in understanding the opinions/feelings of participants as well as their lived experiences regarding ICT integration in their institutions, this approach made sense for this study. This was in agreement with Morgan (2014) and Johnson and Onwuegbuzie (2004) who purport that mixed methods research results are superior to mono-method study results.

1.6.2 Research design

Research design, which is the way a researcher plans to carry out a study (Maxwell, 2012; Creswell, 2016) depicts the framework that provides a researcher with guidelines regarding what to include in their research, how to conduct it, and what inferences may be made. De Vaus, (2001) suggests that a research design constitutes the blueprint for the collection, measurement, and analysis of data. This empirical study is a descriptive type of research, based on a case study of one TVET college and one university institution from one province of South Africa. According to Dulock (1993), a research of this kind seeks information about a phenomenon and explains what is known about the variables that affect it. Descriptive research thus describes existing phenomena and focuses on existing relationships between variables, current conditions and processes as well as developing trends among other phenomena. Hence, in this study, descriptive research aims to answer questions like 'what is happening with regards to ICT use for information and knowledge administration in public higher education organisations? To what extent is ICT innovation influencing administrative practices of both universities and TVET institutions in South Africa? How effective is ICT application in improving the administrative efficiency of organisations? How e-ready are higher education institutions for effective e-administration? What challenges

are affecting ICT integration, and what can be done to promote effective ICT use in higher education institutions?

The study incorporated a case study approach to enable a real-life examination of a phenomenon through an empirical inquiry. A case study allows exploration and analysis of a social unit where inferences from the study may be applied to other units from similar backgrounds. Kanyemba (2017) postulates that a case study enables one to grasp and understand the factors and causes of a particular phenomenon. The use of a case study in this study also made sense since there were constraints on the part of the researcher to look into all TVET colleges and universities in the province. Attempting to study all of them would need both time and other resources that were not readily available to the researcher. Hence, studying the two institutions would give an insight into the similarities and differences in the level of ICT use by universities and TVET colleges, which would in turn help provide policy makers and administrators with an insight into the digital needs and challenges of different institutions.

1.6.3 Research methods

To come up with answers to the research questions in this study, the researcher employed the mixed methods approach, which collected qualitative and quantitative data to address the research problem. Data was collected using methods discussed below that support identification of quantifiable and qualitative data:

1.6.3.1 Literature study

The researcher first consulted global and local literature on ICT implementation in higher education, e-readiness assessment and ICT implementation models. This helped to identify constructs and theories contributing to e-administration as well as identifying ICT items / elements for use in constructing the questionnaire and interview protocols for this study. Sources used include, but are not limited to, the following:

- i. Master's and Doctoral theses - to gain insight into previous research and findings on ICT innovation and integration in higher education administration locally and internationally
- ii. Online articles – for scholarly and professional articles with evidence of the benefits, challenges and opportunities of ICT integration in information and knowledge management within higher education institutions in developed and developing countries, thus providing insight into international best practices in ICT application for improved administrative efficiency.

iii. Local and international textbooks on public service delivery and e-government, which provided secondary data for the study.

1.6.3.2 Structured questionnaire

Two structured survey questionnaires for students and staff of selected higher education institutions were developed. The purpose of the questionnaires was to assess their opinion of the current level of use and need for ICT intervention in their institutions. According to De Vaus (2001), a questionnaire provides a platform for observing common data beyond the physical reach of the observer through carefully laid down questions. Questionnaires have an advantage in their potential to permit anonymity of the respondents, thereby, allowing them to freely volunteer information without fear of victimization (Maxwell, 2012). More importantly, they ensure that respondents respond to the same set of questions, thereby improving the objectivity of the data collected (ibid). When time is limited, the questionnaire enables the researcher to gather information from many people without having to engage with them physically. Accordingly, it is a time-saving tool (Kanyemba, 2017).

The original plan was to conduct the survey online and in person to reduce response bias common with online surveys alone. Factors ranging from low response rates, slow completion rates, and inaccessibility to the internet may create a heavy response bias that affects the validity of the outcome if a survey is conducted online only. However, with the challenge posed by the threat of Covid-19, the researcher depended mainly on the use of an online questionnaire. This is because chances were limited for direct personal contact with students (contact research) social distancing regulations that were encouraged by the World Health Organisation (WHO) and the South African government as a way of curbing Covid-19 spread. The original planned sample was 200 students and 30 staff members. Participants received the questionnaire electronically via emails, WhatsApp and on the institution's learning management systems. They were expected to complete the survey outside of work / lecture times and electronically submit it to the researcher at their convenience. However, the researcher received fully completed questionnaires from 150 students and 27 staff members, making the final quantitative sample of 177 participants in total. This sample was acceptable, as it constituted almost 77% of the original sample. The data collection began in July 2020, just after institutions started operating under Covid-19 lockdown Alert Level 3 amid loosened pandemic restrictions. Since both students and staff were busy with adjustments to the new norm in teaching and learning and cover up for lost time, the response rate was a bit slow hence, it took up to November 2020 for some people to respond after regular reminders from the researcher.

For the development of the questions for both quantitative inquiry, the researcher adapted the item categories from literature review. Extensive literature study helped to identify the content included in category items for the knowledge and information management domains. The questions in the instruments were mainly closed questions and multiple-choice ones formulated based on the content in Table 1.1 below. The researcher triangulated data collected through a survey questionnaire, literature study and website analysis to inform the findings of the quantitative research.

Table 1.1. Item Categories Generated for E-Administration.

Section	CONSTRUCT	CONTENT CATEGORIES
1	Student Information Administration	• Usage of electronic media by students to apply for admissions • Usage of computers for student registration / enrolment Availability of timetable / class schedule in electronic form for students • Usage of computers for maintenance of attendance of students Communication of academic details of students to their parents / guardians through e-media • Usage of e-media for notifications regarding hostel accommodation • Usage of e-media for notifications regarding transportation, • Usage of ICT for communication of examination results • Usage of ICT to apply for funding e.g. NSFAS
2	General information administration	• Scheduling / allocation of exam halls through e-media • The use of e-kiosks to disseminate information in the institution • Student use of e-media to apply for university exams • Usage of e-media for the processing and display of results of students • Electronic payment option for students • Use of electronic physical access controls
3	Knowledge administration	• Use of online library system • Electronic assessments • Online distance learning and exams

		• Use of LMS / e-learning portals • Web. 2.0 tools in education • Online Open educational resources
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Adapted from a literature study

1.6.3.3 WEBSITE ANALYSIS

The researcher also conducted a desktop study / analysis of the selected university and TVET College websites to determine their current level of ICT usage in their management and administrative functions. The researcher identified the links to a variety of services offered online by the institutions to both internal and external stakeholders. In the end, the researcher made a list of the services that the institutions offer online and did a comparison between the two institutions' levels of online service delivery.

1.6.3.4 INTERVIEWS

The study followed an exploratory sequential mixed methods approach. Therefore, after collecting and analysing quantitative data on the problem, the researcher followed up with semi-structured interviews with both staff and students to clarify issues that arose from the quantitative survey. The researcher purposefully selected a sample independent of the quantitative sample and conducted interviews by phone and face-to-face between January and February 2021. Interviews are crucial to the researcher in understanding how people feel regarding an issue under study. Baguma (2018) argues that properly planned interviews enable the researcher to elicit rich and deep data about the participants' lived experiences through narrative inquiry. As such, the interview protocol focused on the experiences of staff and students with regard to integrating ICT in teaching and learning practice as well as in information administration. These interviews were conducted with a group of 18 participants made up of nine lecturing staff and nine students selected purposively sampled from the two institutions. The interviews gave participants the opportunity to provide a detailed narrative of their experience with the use of ICT in their institutions in a conversational nature while allowing the researcher to assess their attitudes towards ICT integration. The researcher realised the participants' hesitance in being recorded hence, collected key responses in writing during the discussions.

The interview data were compared to the findings that arose in the quantitative survey, thereby validating the findings (Johnson and Onwuegbuzie, 2004). Interview data was analysed using content and thematic content analysis and compared with quantitative data in order to establish any corroborating findings.

1.6.4. Data analysis and interpretation

For the analysis of the quantitative survey responses, the researcher used SPSS version 27. The researcher made use of descriptive statistics involving calculation of frequency distributions related to participants' perception of the use of ICT in their different institutions. A simple cross-tabulation of data was conducted to find the relationship between the institution type and the use of ICT for different functions. This information was displayed in tables and clustered bar graphs showing both counts and percentages per response. Services available on the institutions' websites were presented through summative content analysis. Qualitative data collected through a structured interview with students and lecturing staff to determine the level of ICT use in pedagogy was analysed using thematic analysis. In this step, data were examined to find common themes, ideas and patterns of meaning within them. Descriptive theme categories based on Roger's (2003) innovation characteristics were drawn and explained from the presented interview findings. The researcher triangulated data from the quantitative survey, interviews, literature study and website analysis to corroborate the emerging themes from the quantitative and qualitative samples insofar as the integration of technology in higher education administration is concerned.

1.7 THEORETICAL FRAMEWORK: DIFFUSION OF INNOVATION

Rogers' (2003) diffusion of innovation (DOI) theory was the theory that underpinned this study in attempting to understand factors that influence adoption and integration of ICT in higher education institutions' academic and administrative functions. Rogers (2003) explains the concept of DOI in terms of how new ideas are spread over time within social systems. In this study, the diffusion of innovations is defined as the way that higher education institutions adopt ICT in their academic and administrative functions. The focus of the framework is not to elucidate the adoption process but rather the features that influence institutions to quickly either adopt or reject technological innovations. Rogers argues that adoption of innovations by groups or individuals is not an instantaneous act but takes place over a period of time in which they make a series of decisions. The users according to Rogers (2003) usually make decisions based on their perceptions of the innovation's complexity, observability, relative advantage, trialability and its resemblance to previously used strategies (compatibility).

The DOI is an information systems theory that models how users accept and make use of technology; that is why the researcher deemed it relevant for this study. Therefore, this study employed the DOI in trying to understand how and why South African HEIs adopt or

reject innovations and technology in their functions. More details of the theory are given in the next chapter.

1.8 RESEARCH POPULATION AND SAMPLE

1.7.1. Study population

A study population refers to the totality of persons, events, organisations or cases with which a specific research problem is concerned (De Vaus, 2001; Goddard and Melville, 2001). The population in other words is the broader group of people/objects to whom research results will be generalised. It can also be referred to as the focal group from which the researcher learns something. The target population consisted of all students, administrative staff and senior managers at North West University and Sedibeng TVET College in Gauteng province of South Africa.

1.8.2 Sample and sampling techniques

The samples for this study that is, the actual people to participate in the study (De Vaus, 2001), were drawn from one TVET college and one university in the Gauteng province. The two institutions under study were conveniently sampled as they are within close range of the researcher. The researcher also used purposive sampling to develop the quantitative and qualitative samples. Andrade (2021) purports that while convenience sampling derives a sample from a source that is conveniently accessible to the researcher, purposive sampling creates a sample whose characteristics are defined for a purpose that is relevant to the study. The researcher used purposive sampling to come up with quantitative and qualitative study samples consisting of clearly recognised sub-populations namely middle managers (HODs, / senior Lecturers), administrative staff, and students, who responded to two survey questionnaires designed to collect data for this study. The researcher used purposive sampling because participants are selected based on availability and willingness to take part (Goddard and Melville, 2004) making it easier for the researcher to achieve the desired sample size in a relatively fast and cheap way. Purposeful sampling of senior management staff, Student Academic Lifecycle Administrative (SALA) staff and administrative assistants was done to ensure the study sample represents both university institutions and TVET colleges and to get information from those directly involved in the information and knowledge administration of the institutions. Students' participation was required to determine their perceptions of the services enabled for them by ICTs and their judgement of the degree of ICT use for their benefit in the organisations. For the qualitative sample, the researcher employed purposive sampling to get the perspective of knowledge instructors and students on the level of technology integration in the pedagogical practices

of the institutions under study through direct qualitative enquiry. The researcher also analysed the websites of the two sampled institutions to determine their current level of use of ICT in administration as indicated by number of links to services available electronically on their websites.

The Agency for Healthcare Research and Quality (AHRQ), suggests that participant recruitment in most studies involving human subjects is a major challenge. They argue that findings from several studies reveal the following:

- i. That participation rates are low, only (3-20%) of the eligible pool chooses to participate.
- ii. That 34% of studies manage to recruit less than 75% of their originally planned samples, leading to reductions in the statistical power of the study.

Hence, to be on the safe side, a sample has to be as big as possible to ensure that the mentioned factors in the findings above do not affect the study negatively. The sample size for the study therefore consisted of 195 participants as described below:

1. Quantitative Sample

- i. Staff N= 27.
- ii. Student n=150

Sample Size N= 177

2. Qualitative sample

- i. Lecturers N= 9 (three per campus)
- ii. Students N= 9 (three per campus)

Sample size N= 18

Total sample size for study N = 195

1.9 RIGOUR / VALIDITY AND RELIABILITY TESTING

1.9.1 Reliability testing

Neuman, (2014) posits that social researchers desire that their measures be reliable and valid in order to establish the truthfulness and believability of findings. Singleton, Straits and Straits, (1993) posit that reliability assessment is done in social research to check for

consistency in measurement using the same instrument. Although most of the category items of this questionnaire were pretested by Krishnaveni and Meenakumari, (2010), to ensure reliability of data collected in this study, the researcher pilot-tested the designed instrument (questionnaire) with a small group of twenty respondents using the test-retest method. It would be irrational to assume that the item categories of the questionnaire will be applicable to this study without testing it again considering differences in the contexts in which it would be used. Hence, the researcher personally identified the participants for the pilot study and explained to them the purpose of the activity before they consented to participate. The researcher pilot-tested the instrument a month before distributing the questionnaire to the actual research sample. The same group of people completed the same questionnaire after an interval of two weeks from the first test. The researcher then calculated the statistical correlation between the scores of the two tests. The results were above .80, hence, the instrument proved to be reliable. Re-testing the instrument helped in developing a survey form that is user-friendly, and which provides the required information (Fink and Litwin, 1995). Pilot testing through test and re-testing immediately revealed if respondents would understand the instructions and answer the survey questions correctly. Hence, focus was on clarity of language, simple straightforward questions as well as mostly closed questions that would provide possible responses from which respondents could choose.

1.9.2 Validity testing

A research instrument's validity is its ability to measure what it claims to measure (Fink, 1995; Singleton et al, 1993). Validity testing is concerned with answering the question, "is the research tool measuring what it is intended to measure?" The researcher thus used content validity to determine whether the instrument covers all sufficient content of the aspect under investigation to avoid a low measure of validity. Content validity is the extent to which a measure adequately represents all elements or facets of a concept Neuman , (2014). The questionnaire was therefore designed in a way that it covers a wide range of aspects of the variable (ICT) being checked in this study. Using one or two elements only (e.g. emails and cell phone) as elements of information communication with staff and students produces a low measure of validity as these are not the only aspects covered by ICT. Hence, the questionnaire included as many aspects of ICT as possible identified through literature study that an institution can integrate into its administration.

1.10 ETHICAL CONSIDERATIONS

Firstly, the researcher obtained ethical clearance from the North West University in order to conduct the study. The researcher further obtained consent from all participants for

participation in the study by formally inviting them to participate in the study, explained the purpose of the study and made participants aware that participation was voluntary. Further, the researcher informed the participants of the research methods, the nature of their participation, and the possibility of publication, but he also ensured their confidentiality. The researcher respected the respondents' need for anonymity during the data collection process by ensuring that no information collected is linked directly to its source, people's names are not used in the report. No confidential information from participants and any of their identification information would be published without their approval.

1.11 LIMITATIONS OF THE STUDY

Maxwell (2012) posits that identifying limitations in a study has the importance of establishing boundaries and exceptions characteristic of a particular study. Therefore, limitations have to be scrutinised to identify anything that could have undermined the study's findings.

This study has limitations in that the selected sample reflects on experiences of only two higher education institutions in a country that has 50 public TVET colleges and 26 universities. This means findings from this empirical study could not be generalised to all higher education institutions in South Africa. The purpose of this study however, was not to generalise findings but to give an insight into how differences in how TVET colleges and universities are making use of ICTs for their administrative and instructional functions and to make recommendations on how best to use ICTs in all higher education institutions to improve administrative efficiency in the 21st century.

1.12 CHAPTER SUMMARY

Chapter 1 introduced the study and its supporting background, highlighted research gaps in the area of ICT integration in higher education and clarified the problem statement for the study. The chapter also highlighted research objectives and questions, explained methodological paradigms and methods, clarified issues of research ethical considerations and the importance of the study. The next chapter presents details of contextual, theoretical and conceptual frameworks that guided the study.

1.13 THESIS OUTLINE

This section provides an outline of the entire thesis as well as a summary of each chapter.

CHAPTER 1: Introduction: ICT innovation and higher education administration

The chapter focuses on introducing the topic of study and providing clear background information leading to the study. It presents the research gaps identified in literature, the problem statement, research aims and objectives. The Chapter further presents an

overview of the research paradigm followed, strategies for ensuring validity and reliability, rationale/ significance of the study as well as ethical issues that were considered in conducting the study. The chapter ended by providing a general overview of the whole study chapters.

Chapter 2: Contextual, theoretical and conceptual frameworks for ICT integration in higher education administration.

This chapter began with an explanation of the New Public Management Theory, the Digital Era Governance Theory, and their influence on public administration in the digital age. An analysis of two theoretical frameworks namely the Diffusion of Innovation and Technology Acceptance Model and their influence on ICT adoption in higher education followed this and the chapter ended by providing the conceptual framework that guided this study.

Chapter 3: ICT integration in educational administration. A review of literature.

The objective of this chapter was to appraise the role of ICT integration in the knowledge and information administration of higher education institutions. The chapter started by providing an overview of the use of ICTs in higher education institutions (HEIs) from a global and local perspective, as highlighted from various literature and research studies, highlighting the uses, advantages and potential challenges to effective integration of technological tools in pedagogy. The chapter ends with a presentation of recommendations for effective ICT integration in higher education derived from literature.

Chapter 4: The level of innovation in South African higher education knowledge administration: The ICT factor

In this chapter, the researcher examines the ways in which two different higher education institutions are employing technology in their teaching and learning practices. The aim was to determine the extent to which TVET Colleges and Universities were integrating ICT in their knowledge administration in line with 21st-century teaching and learning. The chapter also sought to establish factors influencing adoption or non-adoption of ICT by HEIs based on the theoretical framework of the DOI, which underpinned this study.

Chapter 5: Suspending contact without stopping learning: Higher education's technological response to the Covid-19 challenge in South Africa.

This chapter analyses the responses of two higher education institutions to the challenges posed by the Covid-19 pandemic on teaching and learning. Furthermore, the study identifies the challenges that affected a smooth move toward online teaching and learning

during the strict lockdown and beyond. In conclusion, the chapter puts forth suggestions on how to improve remote teaching and learning in the face of the bleak future facing higher education systems globally.

Chapter 6: The Extent of ICT use in higher education general and student information administration in the digital covid-19 era: A comparative study

This Chapter's focus was on examining and appraising the role that ICTs play in the improvement of general information administration in higher education institutions as well as its place in the management of student information. The researcher reviewed and presented literature supporting the value of electronic administration, highlighting best practices from different studies. An empirical study and analysis of findings was done on the level of ICT use in general information administration as well as student information administration at one TVET college and one university in South Africa during the digitally driven Covid-19 era. The aim was to establish whether different types of HEIs are equally tapping into the advantages presented by technology in this era of digital governance presented by the Fourth Industrial Revolution, to promote responsive, efficient and effective administration despite challenges posed by the pandemic. The Chapter closed with recommendations that can guide higher institution administrators on the effective use of technology to enhance their administrative efficiency.

Chapter 7: Digital transformation pathway to e-pedagogy and e-learning: Assessing challenges to ICT integration in South African higher education

Not only do ICTs present opportunities, but also a myriad of challenges to institutions looking towards integration. Based on literature study and empirical findings, this chapter presents the common challenges that affect integration of technology in higher education general and knowledge administration in one TVET college and one university in South Africa. Recommendations were made on how to counteract some of the challenges for a better adoption of ICTs.

Chapter 8: Summary of findings, Conclusion and Recommendations

This chapter is a review of the whole thesis and a summary of the key findings. Limitations of the current study are highlighted and recommendations are made concerning the findings of the study, the limitations thereof and the importance of further study on the use of ICTs in more institutions. The conclusion and recommendations draw the study to its final close.

CHAPTER 2: CONTEXTUAL AND THEORETICAL FRAMEWORKS FOR ICT INNOVATION IN EDUCATION

2.1 INTRODUCTION

In the past two to three decades, public sector organisations worldwide have undergone major changes in response to challenges brought by globalisation and technological change. Important issues in public management have of late been revolving around making informed strategic decisions in the face of rapid social, cultural and technological change (Dunleavy and Margetts, 2010). According to Hughes (1998), public administration / management refers to how managerial functions of government / its agencies are organised, how information is processed, and produces outputs in the form of policy, goods or services. Many public management approaches have emerged with the goal of improving the efficiency and effectiveness of public sector organizations to meet the ever-changing needs of citizens. Public administration literature therefore reveals transitions in public administration theory from traditional/classical theory, Neo-classical theories through to the most recent Digital Era Governance model. Dimeski, (2019) argues that such evolution of theories was inevitable given the changing social, economic, political and technological environments to which public sector organisations are exposed. Traditional public management elements of public sector organisations are no longer immune to new technological developments, which have enforced more efficiency and effectiveness in the achievement of organisational goals. Hence, knowledge of different theories by administrators is essential as it affects how they approach bureaucratic problems in service delivery.

Public administration, in the context of this study, deals with management of the affairs of a public organisation, particularly higher education organisations. This study is rooted in the New Public Management Theory (NPM) and the Digital Era Governance theories, which place emphasis on the use of modern technology for efficiency and effectiveness of service delivery as the key focus of organisational performance and economic analysis in the digital age.

This chapter is divided into three sections. The first section presents a discussion of theories that support the need for technological innovations in the administration of public sector organisations and with a focus on the higher education sector and how they relate to this study. Three theories discussed that have had an influence on technological transformation of the sector and higher education in particular, are the New Public Management Theory (NPM), Digital Era Government Theory (DEG) and Connectivism.

This is followed by the theory of technology adoption and integration namely the Diffusion of Innovations, which inform the study regarding adoption of ICT in higher education institutions under study. The chapter ends by presenting the conceptual framework that guided this study.

2.2 CONTEXTUAL, THEORETICAL AND CONCEPTUAL FRAMEWORKS FOR ICT INTEGRATION IN HIGHER EDUCATION ADMINISTRATION

Public administration has seen an evolution that has brought about an increasing demand for a value-oriented public service approach, based on appropriate administrative practices that provide effective and efficient services to meet the ever-changing needs of society (Hope , 2001). Hence, well-organised and enabled administrators should aim to engage in thought processes and actions that promote delivery services that satisfy the needs of society. A relationship should exist between a social system, its service environment and its administrative practices (Tolofari (2005).

This section of the study presents a contextualisation of reform strategies that guide this study. As a point of departure, the section provides a contextual perspective of the New Public Management (NPM), Digital Era Governance (DEG) and the Connectivism Theory as the contextual frameworks guiding the need for modernisation and technological innovation in the context of higher education administration. The Diffusion of Innovation theory by Rogers, (2003) is presented in this section as the theoretical framework underpinning this study insofar as explaining how ICTs are diffused and adopted differently in higher education instructional and general administrative functions. The section ends by clarifying the conceptual framework used in this study for ICT-Based administration.

2.2.1 New Public Management and its influence on ICT innovation.

The New Public Management Model (NPM) is a culmination of the Public Management revolution that started in the early 1980s and spread globally, bringing in a wave of transformations that affected the administration of public organisations. This wave of transformation came because of the drawbacks of the bureaucratic theory, after benchmark countries (UK, New Zealand, USA, Canada etc.) raised concerns over problems with the Bureaucratic Model, which had been in use. Severe budgetary constraints faced due to growth of the welfare state under bureaucracy, affected governments' ability to deliver services effectively, efficiently and economically. This new movement (NPM) therefore, arose in response to citizens' desire for quality, responsive, effective and efficient services from the government, hence, it is clearly focused on economic rationalism through encouraging public value for public money (Hope, 2001). According to analysed literature

(Commonwealth Secretariat, 1995; Borins , 1995; Hope, 2001), the NPM was a reaction to the following realities faced by most government organisations in the early 1980s:

- Public sector organisations that were too large and expensive.
- Need to increase efficiency and improve governance through the use of information technology
- Increased public demand for quality services.
- Poor public sector performance promoted by centrally planned and managed systems woven around the classical public administration theory.
- Public sector employees' quest for personal growth and job satisfaction.

Millan (2013) thus argues that instead of cutting welfare services, political leadership encouraged public administrators to do more with few resources available for the benefit of the citizens. This involved considering the following elements in management:

- i. Incorporating private-sector management styles and techniques into public-sector management
- ii. Advocating for the “Let the managers manage” slogan- thus limiting the monopoly power of politicians and empowering managers through decentralisation of authority - thus enabling resource allocation and decision-making to be more localised.
- iii. Allowing administrators flexibility in how they administer public services, thus doing away with rigidity in public service delivery.
- iv. Use of information technology to enhance information dissemination and service delivery (e-government).
- v. Focusing results on efficiency, effectiveness and service quality, that is, cost-effective policy outcomes
- vi. Promoting efficiency of public service provision through establishment of performance targets (Millan, 2013; Borins, 1995)
- vii. Strengthening state agents' capacities to respond to external changes (e.g. globalisation) automatically, flexibly and at low cost.

Many governments as a way of modernising government adopted the NPM and re-engineered public sector processes; hence, the NPM concept connects to the idea of

reinventing and re-engineering government. Re-engineering involves a process of revamping public organisations' ways of working in a bid to increase efficiency, effectiveness and competitive ability of the organisations (Hope, 2001). Existing studies commonly refer to re-engineering approaches as reforms, which argue for technology-enabled solutions to service delivery issues (Weerakkody, Janssen, and Dwivedi, 2011). The guiding hypothesis for the reforms under this paradigm is that a more business-oriented public sector leads to more rationality and efficiency in the use of public funds. Therefore, NPM defines client-oriented, purpose-driven and quality enhanced management through novel means of heightening efficiency and effectiveness. Dimeski, (2019) thus views New Public Management as a step towards entrepreneurial public administration that is aimed at creating new values for services delivered to citizens as consumers. This concept of public sector entrepreneurship rooted in the NPM principles became popular among public service officials in the past two decades before the new millennium. NPM as a new paradigm existed to satisfy public interest by delivering information and services in a way that satisfies growing public need (Dimeski, 2019; Nhema, 2015, Borins, 1995, Millan, 2013) in an entrepreneurial approach to service delivery.

NPM emerged because of the weaknesses of the state bureaucracy under the Weberian model of management, which included managerial inefficiency, unmanageable public sector size, excessive corruption and the self-serving agenda of political leaders (Borins, 1995). Hence, it is arguable that among the driving forces for New Public Management are administrative reasons namely:

- i. The need to promote efficient, effective and economical public sector management.
- ii. For administrators to focus on serving citizens better and effectively execute policies
- iii. The need to ensure transparency and accountability of public officials

Tolofari, (2005) posits that the drivers for NPM reform are packaged into five categories namely economic, political, social, intellectual and technological. The focus of this study though, is on the technological driver and its influence on the general and knowledge administration of higher education institutions. The technological motive presents advancements in information and computing technologies (ICT) as having given impetus to e-Government adoption under the New Public Management system of administration. The need for rapid sharing of information and reduction of duplication of work by administrators under the decentralised structures advocated by the NPM could not have happened in the absence of ICTs. With the advancements in technology, the public

expectation for access to services and information, speed of service transactions, convenience, reliability as well as responsiveness of service delivery to citizens' needs is on the rise (Milakovich, 2012). Hence, the notion of technology-enabled administration paved the way for e-government under the general reforms of the NPM, which have also influenced higher education as a public service.

However, the overall reforms brought by the NPM theory to address public sector governance and administration problems cannot be successful in this digitally driven 21st century era in the absence of digital interventions in the administrative functions of public organisations if the citizen's expectations and demands are to be met. Emerging models of 'electronic' government (e-government) ushered by the NPM are increasingly recognised and epitomised as 'digital era governance' (DEG) due to the infiltration of the internet in administrative practices. A range of digitally enabled changes is critical for the current public administration, with more focus on adoption of digital governance as an extension to NPM reforms.

2.2.2 The role of Digital Era Governance in administrative ICT innovations

After the New Public Management package of reforms in the late twentieth century (1980s and 90s), a new era titled Digital Era Governance (DEG) started to emerge. This new era is somewhat a continuation of the New Public Management, although Dunleavy and Margetts, (2005) argued that it is a replacement of the NPM, which they believe to be 'dead'. Digital Governance emerges as a public management model mainly because of the central role digital technologies played in shaping organisational structures and processes of public organisations in the current millennium. Wojciech, (2017) argues that the transformational power of the internet in the early 2000s had a significant influence on government-citizen relations. Thus, the internet paved the way for a new public administration model, the Digital Era Governance (DEG) model, which embraces the infiltration of government by the culture of the internet.

Many scholars have attempted to come up with different definitions of digital governance. Digital governance according to OECD (2017a) and Milakovich (2012) refers to the advanced utilisation of information and communication technologies (ICTs) to create networked relationships that enable strategies for improving organisational performance. This includes strategies for fast web access, mobile service delivery as well as the use of multi-channel technologies that enable two-way transactions and interactions between organisations and their stakeholders. Omar (2020) and Dunleavy et al (2006) understand digital governance as entailing the exploitation of the digital space by governments and their departments to transform citizen-government engagements and interactions.

Welchmann, (2015) also defines digital governance as a framework for establishing accountability, roles, and decision-making authority for an organization's digital presence. Digital government on the other hand, is the production and delivery of information and services within government and the interaction of government with citizens through the use of information communication technologies (ibid).

Common among the scholars above is the idea of digital governance as involving the potential manipulation of technologies by public administrators to enhance government-citizen relations, interaction and improve efficiency of services. Thus, digital governance in the context of this study involves management/governance that is influenced by internet use and other digital technologies for efficiency and effectiveness.

Kosorukov (2017) argues that digital governance comes into existence to fix shortcomings of three theories of public administration namely Weber's Bureaucracy Theory, Progressive Era Model and the most recent New Public Management Theory. Its overarching goal is to create value for an organisation through accountability, that is, efficient and effective use of resources to improve the organisation's welfare. The Digital Government Model is greatly concerned with delivery of information and services inside government and between government agencies and the public using a range of ICTs (Tassabehji et al, 2016). Technology integration is profoundly transforming society and the economy due to the change in citizens' expectations about how government interacts with them. Therefore, Margetts and Dunleavy (2010) suggest that the primary focus of DEG is mainly around internal administration of services delivery and efficient public information, through facilitating online services. The scholar thus posits that digitalisation and digitisation have become a necessity for effective service delivery that meets the needs of the modern society of the digital era.

Milakovich (2012) clarifies the difference between digitalisation and digitisation, which people often use interchangeably. His argument is that digitalisation enhances the way work is done as well as how customers and companies interact and engage with each other. It involves changing business processes and activities through integration of digital technologies. In the field of education, in which this study is based, digitalisation can therefore include online applications, e-learning, online library services etcetera. Digitisation on the other hand refers to the automation of existing manual and paper-based processes, from analogue/physical to a digital format; it describes the pure analogue-to-digital conversion of existing data and documents. It is an excellent first step on the road to streamlining a business and indeed improving security of information. Digitisation does not change the business model of an organisation, but can improve the operational efficiency

thereof. It follows from reason that digitalisation and digitisation are key aspects of digital era governance and should be embraced to improve efficiency and effectiveness of services.

2.2.2.1 Key Features of Digital Era Governance Model

According to Dunleavy et al, (2010) and Wojciech, (2017), Digital Era Governance focuses on:

- i. Reintegration - this implies the reversal of the fragmentation caused by NPM by ensuring that government de-silo processes, creating new central government processes to do things once instead of repeatedly, as well as simplifying government services to the greatest extent possible.
- ii. Needs-based holistic practices - a move towards creating client-focused and agile structures for agencies and departments, which are capable of responding immediately to citizens' needs and problems. Public administrators should achieve this through putting in place seamless customer-centric services and one-stop processes.
- iii. Digitalisation – wherever possible, public sector organisations need to adapt, embrace and embed digital and electronic service delivery at the heart of the government business model.

One of the OECD's (2017a) key recommendations for digital government is the establishment of an integrated service delivery design and delivery policy that facilitates development of services with agile methodologies at the same time safeguarding multi-channel accessibility to services and information. The buzz around public sector technology use is in line with the power of digital technologies to transform governments' ways of operating and delivering services to citizens. Governments in the digital governance era need to go beyond simple digitisation of existing processes and services through harnessing the potential of digital technologies to re-image their business models. Digitalisation and the application of new technologies have thus become the key drivers of public sector reform. Digitalisation covers the reworking of the public sector to completely embrace and entrench electronic delivery at the core of the government business model (Margetts and Dunleavy, 2013). The transition from NPM to DEG is illustrated in Figure 2.1 below.

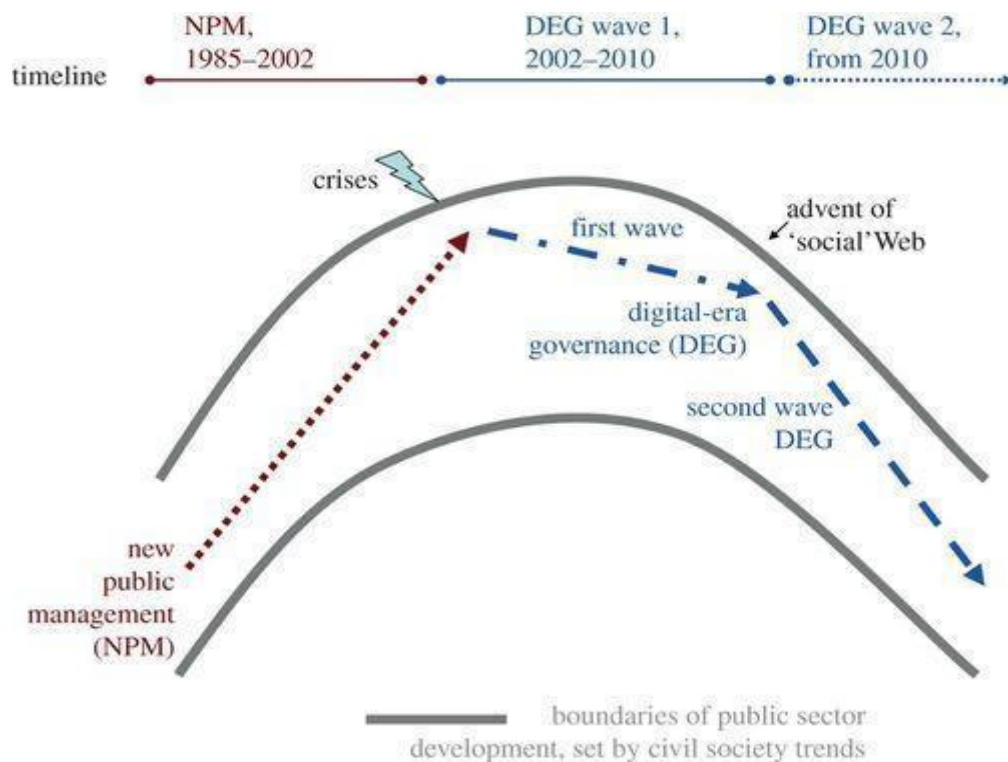


Figure 0.1 *From NPM to Wave 1 and 2 of Digital Era Governance. Source – Dunleavy and Margetts 2010*

Figure 2.1

The illustration above shows that from 2010, social Web developments have contributed to a further bending of the modernization main course away from NPM patterns. Digital changes made feasible by Internet / Web-based technologies and applications have become increasingly vital to government operations. Initiatives advocating for citizen-centric strategies of service delivery, supported by digital governance must be responsive to the multiple challenges facing public organisations. Technologically enabled changes to public sector organisations are not self-evident, but are necessarily altered through the formality of existing institutional practices (Tassabehji et al (2016). Hence, upholding the NPM principles in combination with digital governance should help in reintegration of functions, adoption of needs-oriented service delivery models and progressing digitalisation of administrative processes to meet the requirements of the digital era citizens. Organisations now need to integrate the fundamentals inherited from NPM with current best practices presented by digital era governance (Dunleavy and Margetts, 2010; Milakovich 2012) in a bid to move from reactive to proactive policy-making and service delivery, thus ensuring response to citizens' needs. Currently, public services are increasingly becoming indirect, intangible and complex. Meeting the increasing demand and expectations of experienced digital users, especially digital natives (those born in the era of technology) calls for embracing technology to reinvent the way government departments, particularly higher education departments, do business (Prensky, 2001;

Mdletshe, 2019). Hence, there is a need for innovations that are aimed at improving administrative efficiency in these departments, particularly through ICT integration.

The digital age provides opportunities for work and workplace reinvention as well as allowing people to work and access information from anywhere at any time. Doyle et al (2016), a strong supporter of digital public service, asserts that going digital will make governments far more efficient while the advent of cloud computing and mobility ensures accessibility and easy updating of documents anytime from almost any place. Furthermore, Doyle et al (2016) further argue that digitisation not only frees up citizens' time, but also governments' as there will be less resources and time needed to file, organise and share information. Hence, the hypothesis around DEG is that digitisation comes in to transform services and that it is as captivating for government organisations as it is for the private sector. DEG places a challenge on public administrators to adopt and adapt an administrative set up that is characterised by, simplification, automation of daily bureaucratic work as well as flexibility in delivering services. Protagonists of the DEG model (Margetts and Dunleavy 2013; Hanna, 1998; Milakovich, 2012) therefore view digital governance as the next step public administrators should take to reduce costs, meet customer expectations and achieve goals at all levels. DEG is critical as businesses, both public and private, move toward digital technologies to enhance visibility and eliminate inefficiencies in their operations.

2.2.2.2 Digital Era Governance Shortcomings

Like most of its forerunners, the Digital Era Governance theory has had its fair share of weaknesses. This makes it not suitable to be adopted on its own as a management theory, but rather to be used in conjunction with other paradigms.

Literature reveals that automation of labour intensive tasks in organisations has resulted in reduced workforce and loss of employment (Artley , 2018; Evenstad , 2018). Concerns are often that automation may lead to job losses; hence, it is natural that people wonder about the vulnerability of their jobs in periods of digital transformation. Evenstad, (2018) argues that in the wake of technological change, the lowest skilled lose out while income disparities widen.

Another problem of the theory lies in the availability of digital skills required for provision of and access to digital services. In the UK, a developed country, Barclay's research in 2017 found out that over 40% of the citizens lacked digital skills and were particularly worried about their technology knowledge, especially those of the age of 35 and above. It therefore means employees and citizens (customers of the governments' online services) require

huge programmes of education and training to avoid gross inequalities. The digital divide also plays a negative role in effective implementation of digital governance, which calls for mixed approaches in service provision methods instead of full online services alone.

In this study however, New Public Management is 'not dead' as observed by Dunleavy and Margetts, (2005), but is still a vital public administration theory that requires the intervention of digital governance in order to address pressing challenges of managing complex institutions. We argue that technology on its own does not transform the public sector, but it can be used effectively to redesign public sector ways of doing business with stakeholders, therefore it needs to be at the centre of transformation.

2.2.3 Connectivism Theory and Educational Reform

Ritter (2014) explains a learning theory as an attempt to describe ways people learn. This study referred to Connectivism Theory as a framework for understanding the efficacy of ICT integration in higher education's teaching and learning practices (pedagogy). Developed by George Siemens in 2004, connectivism is an epistemological position that recently emerged and is particularly relevant to learning in a digital society (Bates , 2019). It is a learning theory that explains how internet technologies have influenced people and created new opportunities for sharing knowledge across the World Wide Web and among educators and learners themselves. Siemens (2005) believes that this includes use of email, wikis, online discussion forums, social networks, learning management systems etcetera. With the wonderful opportunities brought by technology to the classroom due to the technology eruption of the 21st century, Ritter (2004) supports connectivism as relevant to the classroom for years to come. Connectivism is thus a new digital era reality in which students are being trained to work in a digital environment. Through the idea of connectivism, learning theories are thus moving into the digital age as technology and connection-making are constantly included in learning activities (Duke et al, 2013; Siemens, 2005).

The Connectivism theory is a justification of the importance of ICT integration in knowledge creation, sharing and delivery as it aims to enhance student collaboration in real-time from geographically diverse locations. Proponents of connectivism (Siemens, 2005; Downes, 2007) thus argue that the internet changes the essential nature of knowledge to a network learning process where connections and the way information flows among people becomes very significant. This suggests that online peer networks like social media sites, search engines and online forums play a vital role in e-learning experiences that characterise the digital era as learners learn from social interactions and collaboration. However, although twenty-first century students have experience in the technical uses of smartphones and

tablets, are they skilled to use them as tools for learning? Undoubtedly, the emphasis of connectivism should be on teaching students how to use technology for learning and as a preparation for the world of work outside of school. Hence, Bates (2019) argues that learning under connectivism guidelines is the ability of learners and instructors to tap into the substantial flows of information facilitated by digital processes. As Duke et al (2013) posit this requires the core skill of seeing connections between information sources and maintaining the connection in order to facilitate continual learning. Stephen Downes (2007) in support of the theory puts across the thesis that knowledge is distributed across a network of connections while learning is the ability to navigate these connections. He further characterises connectivism as a reflection of a society that is changing rapidly in response to changes brought about by the technological explosion of the digital era.

Siemens' and Downes' idea of connectivism qualifies to be a digital age learning theory in this increasingly digital period characterised by a rapidly changing, connected and more complex society that is mediated by increasing advancements in technology. Therefore, it is arguable that connectivism is a theoretical effort to re-examine the implications of the internet and emerging communication technologies for teaching and learning. In Duke et al (2013) line of thinking, the theory of connectivism is undoubtedly a paradigm shift that is an important signal regarding new ways of learning and teaching, with emphasis on continual evaluating of each generation's instructional and curriculum delivery. However, in the absence of adequate skills in using technology for learning, connectivism's potential to be an effective learning theory becomes questionable.

2.3 THEORETICAL FRAMEWORK FOR ICT USE IN HIGHER EDUCATION ADMINISTRATION

Anfara and Mertz (2014) describe a theoretical framework as a structure that describes how a problem comes to be, and provides a guide on solving it. This section presents the theory that framed discussions on ICT adoption and integration in one TVET college and one university in this study.

2.3.1 Diffusion of innovation theory

The Diffusion of Innovation (DOI) underpinned the study in an effort to explore the extent to which higher education institutions are integrating ICTs in their instructional and administrative functions. Rogers (1962, 2003) defines DOI as the method by which innovations are communicated to members of a social system and adopted differently over a period. The theory thus seeks to clarify the process and factors that influence the spread and acceptance of innovations by individuals and groups, where innovations imply any idea or practice (Anfara and Mertz, 2014) that individuals or groups perceive as new. Halton (2021) identifies DOI as a hypothesis that outlines the way new technological and other

advancements diffuse through societies and cultures. While Rogers (1962, 2003) posits that, an individual's or organisation's adoption of an innovation goes through an innovative-decision process that occurs through a series of actions and decisions, Wilson and Conyers (2015) acknowledge that adopters go through the process at varying speeds. This agrees with Rogers' division of the population of adopters into five segments namely; innovators, early adopters, early majority, late majority and laggards as illustrated in Figure 2.2 below.

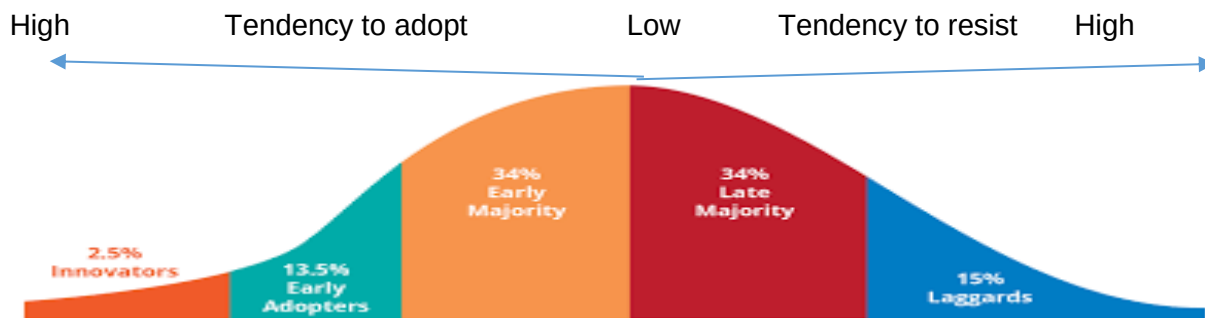


Figure 0.2 Diffusion of innovations adopter categories

- i. **Innovators (2.5%)** – the risk-takers who are creative in developing and trying out new ideas and implements, and regularly talking about them.
- ii. **Early adopters (13.5%)** – ones who take an early leap into adoption once the early signs of an innovation's benefits start to show, taking advantage of the benefits before many people recognise it. As trendsetters, they cause the innovation to “take-off” and what they say about an innovation determines its success or failure.
- iii. **Early majority (34%)** – these are cost-sensitive people who adopt simple, proven and better ways of doing things (Robinson, 2009). They adopt novel ideas or practices based on their successful practical application; hence, they do not rush into adoption without careful analysis of successful factors in the innovation.
- iv. **Late majority (34%)** – they are risk-averse people who are uncomfortable around new ideas. However, they are driven by the need to fit in, thus their adoption of innovations is to follow mainstream techniques and established standards. Such adopters can easily be influenced by laggards' opinions and fears.
- v. **Laggards (16%)** – these people want to maintain the status quo and see high risk in adopting innovations. They are full of criticism of new ideas and create arguments against innovations.

Halton (2021) suggests that the rate of innovation diffusion and adoption is affected by factors namely:

- i. The mix of rural to urban population in society who carry with them different technology literacy and different levels of the digital divide.
- ii. Society's level of education and extent of development.

iii. Cost, accessibility, and familiarity with technology.

The DOI offers insights into qualities that make an innovation spread successfully, the value of effective conversations and peer networks around an innovation as well as the need to understand the needs of different user segments (Robinson, 2009). Studies of technological innovation and diffusion (e.g. Halton, 2021; Wilson and Conyers, 2015, Robinson, 2009), further suggest that the needs and characteristics of the organisation dramatically affect the ways in which technologies are implemented and the extent of their impact. As a result, the theory focuses on reinvention and improvements of innovations to become better fits for individuals or groups. Thus in introducing any new idea, Rogers (1962, 2003) proposes consideration of the five following qualities/ attributes that determine adoption / non-adoption of innovations:

- i. Relative advantage - to what extent do users perceive the innovation as being better than what they are currently using in terms of cost, convenience and satisfaction of needs? The greater the perception of relative advantage, the more rapid an innovation's adoption is likely to be.
- ii. Trialability – Can the users easily experiment with the innovation and get positive results? An innovation that can easily be put on trial presents less uncertainty to the expected adopter.
- iii. Compatibility - Is the innovation in agreement with the values, experiences and needs of the potential adopters? A compatible innovation has high chances of quick adoption.
- iv. Simplicity of use / ease of use perception (PEOU) – To what extent do users perceive the innovation as easy to use and understand? Innovations that require new skills and understanding on the part of users are likely to face resistance.
- v. Observability of results – Is it easier for users to recognise the results of an innovation. The more visible results are the more it is likely to attract attention and adoption.

In terms of this study, innovation refers to the integration of technology for instructional and administrative purposes; therefore, the researcher used it in discussing the rate of instructional and administrative technology diffusion in South African higher education institutions. However, the focus is not on the innovation-decision process but rather on understanding the attributes of innovations that may have influenced adoption or non-adoption of technology by the two higher education institutions under study.

2.3.2 Relevance of the Diffusion of Innovations Theory in this study.

Since this study focuses on ICT innovation and the rate of its adoption in HEIs, the Diffusion of Innovations theory was deemed a relevant framework to guide the study. This theory by Rogers (1962) is influential in explaining adoption and spread of technological innovations and is potentially applicable in examining information technology ideas and practices (Baguma, 2018; Atkin et al, 2015). The DOI models the adoption of technology based on users' perceptions and attitudes, influenced by factors inclusive of the innovation's complexity, observability, relative advantages to users, compatibility with needs as well as its possibility of being experimented with (Wilson and Conyers, 2015). This study sought the perceptions of users on the use of technology and checked factors that affected adoption thereof in higher education practices, hence depended a lot on the framework. In the face of the technological revolution of this digital era, the DOI is still relevant in explaining and predicting innovation diffusion trends despite the fact that it has prevailed over a long period. The fact that technologies need to spread across many users with different perceptions and attitudes to technology makes it relevant for this study since the study also checked integration and acceptance of ICT across different higher education institutions made up of people with varying viewpoints on the use of technology for efficient service delivery. The theory helps to explain the rate at which expected users will adopt new ideas and clarifies reasons for adoption or rejection of proposed innovations. Hence, in this study it is used to assess the likelihood of success or failure of ICT integration in different higher education institutions in South Africa.

2.3.3 Related contexts in the use of the Diffusion of Innovations.

Atkin et al (2015) hypothesise that the DOI has prevailed over time and has proven to be a useful tool for understanding the underlying mechanisms for an innovation to catch on. Therefore, the theory has been used across many disciplines inclusive of marketing, knowledge management, and organisational studies (Mascia and Mills 2018), to establish how, why and for how long new ideas can spread. The theory has also been widely used to explain technology diffusion in higher education. Samarawickrema and Stacey (2007) used the theory to underpin their study on the adoption of a learning management system (LMS) in a multi-campus university in Australia, while Baguma (2018) employed its use when he examined the integration of ICT by academics in their pedagogical practices at a Ugandan university. In the South African context, Moyo (2019) used it to check the adoption of ICT in teaching and learning at the Central University of Technology (CUT). These studies have revealed the applicability of the DOI in innovation studies making it a suitable guiding framework in this current study.

2.4. CONCEPTUAL FRAMEWORK

A conceptual framework refers to a set of principles and ideas derived from relevant fields of enquiry, used in structuring an ensuing presentation or study (Reichel and Ramley, 1987). Such ideas assist the researcher in developing an understanding of the phenomenon under investigation, being a structure that can best explain visually the key concepts in a research study and the relationships between them.

In this study, the conceptual framework highlights major administrative functions falling under information administration and knowledge administration of higher education that can be enhanced through ICT integration (e-administration) resulting in improved administrative efficiency, as supported by various literature on ICT integration in administration. In the framework for this research study below, the researcher assumes that administration in higher education covers all the general day-to-day operational activities of the institutions. Scholars identified these activities and classified them into three major functional areas of information administration namely general administration, staff administration and student administration (Maki, 2008; Meenakumari and Krishnaveni 2011). These three main functional areas are of vital importance to the day-to-day information management of higher education institutions. However, in this study under information administration, the study focused on general information administration and student information administration. Knowledge administration covers acquisition of knowledge by learners (learning) and knowledge delivery (teaching). Hence, central to the administrative efficiency of higher education organisations, should be the involvement of ICT based information administration and ICT-based knowledge administration. Few researchers who undertook studies in ICT integration in administration focused on the functional area of information administration only (e.g. Krishnaveni and Meenakumari, 2010; Jaleel, 2014, Egoeze et al, 2018; Samprathi, 2019). This study focuses on ICT integration in both information administration as well as knowledge administration as they form the core functions of higher education institutions. Figure 2.3 below illustrates two major variables / aspects that are influenced by ICTs within the administration of higher education institutions, and these will inform the study.

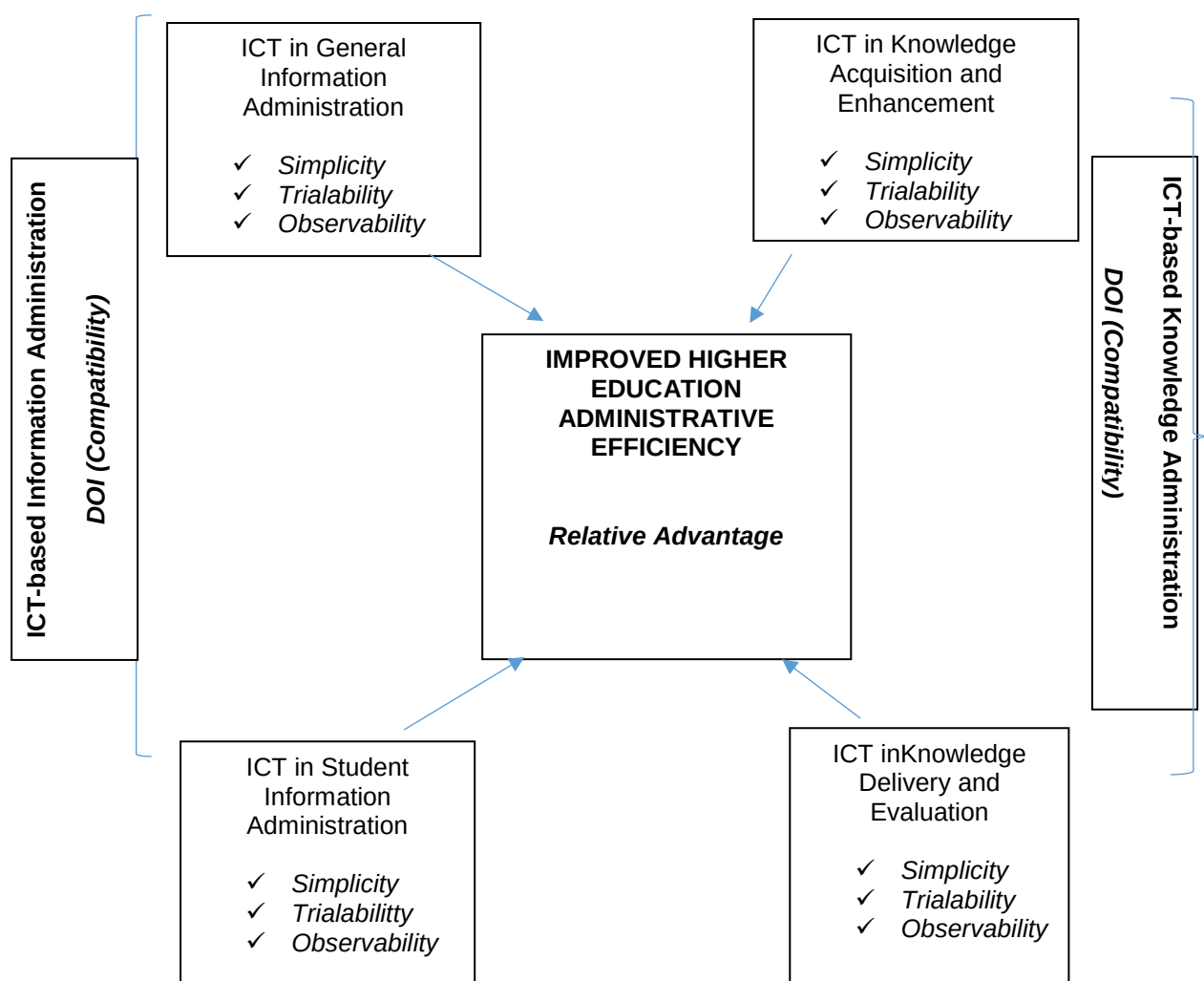


Figure 0.3 Conceptual framework for e-administration.

CHAPTER SUMMARY

This study recognizes the role that information and communication technologies play in the efficiency and effectiveness of administrative systems in educational institutions. In the current century, technology has emerged as the backbone for effective and efficient management and administrative systems globally. The New Public Management and Digital Era Governance theories in this study therefore, both provide contextual frameworks that guide and inform the need for modernisation of higher education administrative systems in this study, in line with requirements of 21st century technology driven environments. Moreover, when it comes to the integration of ICT in teaching and learning, Connectivism Theory has had an influence on modernisation of higher education as it provides justification of the importance of ICT integration in knowledge creation, sharing and delivery as it aims to enhance student collaboration in real-time from geographically diverse locations. However, although ICT offers affordances for higher education institutions to enhance their administrative and pedagogical practices, there is not always uniform acceptance and use of such ICT opportunities in different higher education institutions. The Diffusion of Innovations Theory was therefore used in this study in an attempt to understand the extent to which higher education institutions are integrating ICTs

in their instructional and administrative functions as well as the factors that affect adoption or non-adoption thereof.

The next chapter explores the debates on ICT integration in education in general and higher education in particular, highlighting its different areas of application as evident in extant literature.

CHAPTER 3 ICT INTEGRATION IN EDUCATIONAL ADMINISTRATION: A REVIEW OF LITERATURE

3

3.1 INTRODUCTION

The past decade has seen an increase in research into the relationship between technology and changes in public sector organisations. Technology has penetrated and influenced operations of such organisations with each new technological cycle, prompting more scholars to assert that information and communication technologies (ICTs) can create radical organisational changes and improve organisational efficiency (Adamu et al, 2015; Hashim, 2010; Juma et al, 2016; Maki, 2008). It is nonetheless arguable that technology on its own does not have great influence on efficiency unless it is combined with other elements inside and outside the organisation. Appropriate connection between technology and other elements like work force, processes and the social system of organisations, allows for optimum exploitation of new technological possibilities.

There is no universally acceptable definition of information and communication technology, as many different scholars perceive it in their own ways. However, quite a number of scholars have attempted to coin up a definition that simplifies the concept and clarifies its meaning in the context of this study.

Njoka (2015) summarised ICTs as covering telecommunication equipment and services, media broadcasting, network based information services, e-libraries and documentation, aspects of internet service provision and all other related information and communication activities. ICT is also regarded as technology that supports the creation, manipulation, processing, storage and dissemination of information (UNESCO, 2009; Adebayo, 2013; Opara and Onyije, 2014; Yasak and Alias, 2015). On the other hand, Juma et al (2016) assert that ICTs are not tools for only supporting the creation, storage and dissemination of information, but they also facilitate the possibility of interactive communication. Anwar and Mathew (2014) further posit that ICTs embrace technologies that make it possible for users to receive and send information, making it possible for users to exchange and access information. Baguma (2018) believes that ICTs also includes the internet, blended learning, online learning, social media, cloud computing, flipped classrooms, learning management systems, email, and online learning opportunities. The table below summarises the categories of information and communication technologies:

Table 3.1 Categories of Information and Communication Technologies

ICT CATEGORY	DESCRIPTION	EXAMPLES
Sensing technologies	Equipment that gather and translate data into forms that can be interpreted by computer technology	Scanners, Keyboards, mouse, stylus pens, bar code readers
Display technologies	They are output devices that form an interface between sensing, communication and analysis technologies to display processed and unprocessed data.	Computer/laptop screens, desktop monitors, televisions, DVDs, data projectors, visualisers etc.
Communication technologies	Equipment that facilitates and enables information transfer from source to users. They overcome natural barriers to communication such as speed of information delivery, and distance in communication.	Cell phones, email, internet (world-wide-web) electronic bulletin boards, telephones, social media applications , google teams, zoom software, Microsoft teams, Google forms etc.
Storage technologies	These devices or technologies facilitate efficient and effective storage of processed information in easily accessible ways. Such include virtual storage technologies that allow easy storage and access to information over the internet at any time and place on any internet-connected device.	CDs, memory sticks, cassettes, memory cards, google drive, cloud storage, one drive
Analysis technologies	These facilitate quick investigation, analysis and querying of collected data for use in decision-making.	Spreadsheets, SPSS software, payroll software, etc.

The development of technology has played a significant role in shifting and improving the ways in which human activities are done and services are delivered. The use of ICTs in the past two decades has contributed to an increase in organisations' capacity to deliver / receive content and services. There is a need for the public sector, particularly the education sector, to scout for opportunities that improve their productivity, process efficiency, increase collaboration as well as focus on innovations. Thus, Nogrsek and Vintar (2011) assert that new technologies are well-positioned to:

- Simplify and significantly accelerate processes through vertical and horizontal process integration.
- Improve information management and more complex transactions

- Decrease staff burdening
- Improve public service delivery

The transformational role of the internet in the 2000s brought a fundamental impact on government –citizen relations, hence today, the driving force of ICT is the internet which has positively impacted almost every sector (Wojciech, 2017; Egoeze, 2018). Web 2.0, a second stage of internet development characterised by a change from static web pages to user-generated content and the growth of social media has made possible great changes in the way organisations interact with their stakeholders. Web 2.0 is a term that describes a variety of websites and applications that allow anyone to create and share online material / information (Kooser, 2007). Web 2.0 technologies have positively affected information and communication technologies by enhancing multi-channel communication strategies that have improved communication efficiently and effectively. As a stride in organisational transformation, web 2.0 brings benefits to both private and public organisations based on their rich user- interfaces and their accessibility on any web connected device, not only desktop, hence giving them the power of portability.² Kooser (2007) realised that as communication technology, Web 2.0 technologies are important for the following reasons:

- They are people oriented technologies
- They have ease-of-use as they incorporate social features.
- They enable collaboration.
- They have fast loading applications with high interactivity.
- They provide real-time updates.

Fast technological advancements enabled by the Fourth Industrial Revolution (4IR), are increasingly bringing out the potential benefits of integrating information and communication technologies in both basic and higher education. Quite a number of technology-enhanced teaching and learning benefits are evident in literature (e-Learning Africa Report, 2012; Baguma, 2018; Moyo, 2019; Crawford et al, 2020). The use of technology as an enabler of the education process has become part of international best practice because of the digital revolution of the 21st century, thereby intensifying the wave in educational reform and adoption of ICT in learning, teaching and research.

Integration of ICTs into educational management is also gaining prominence globally, with nearly universal recognition of the need to use ICTs in a globalised world, directly affected by the free flow of information via satellite and the internet. Njoka (2015) asserts that

² www.collestar.org/using-web-2.0-to engage learners

computer technology's tangible advantages in terms of efficiency and effectiveness have led to wide use of computer technology for the operation and management of educational institutions. With the democratisation of education in both developing and developed states, educational institutions are increasingly becoming complex, multi-dimensional organisations that require tremendous input in terms of human, physical and financial resources needed to process large quantities of data that need proper handling as well as the increased demand for quality services by their stakeholders. With these developments, institutions have recently started to see the need to modernise their tools of business to enhance the effectiveness of their management and administration. As Maki (2008) posits, ICTs play a crucial role in supporting powerful educational leadership as well as efficient and effective management and administration. However, in the field of education in most developing countries, online services facilitated through ICT integration have mostly been in the form of portals to link with school websites, limiting the improvement in public sector educational services to mainly the dissemination of information without many changes in interaction and business processes (Amaripuja, 2016).

The International Telecommunication Union (ITU 2014) summarised the development of ICT in the field of education as illustrated in Table 3.1 below:

Table 3.2 ICT Development Phases in Educational Administration

PERIOD	ICT PHASE	DESCRIPTION OF ICT USE
Late 1970s – early 1980s	PROGRAMMING	Computer use focuses mainly on programming and assisting in the development of students' logic, and mathematics skills. ICT use was guided by pedagogical reasons.
Late 1980s - early 1990s	COMPUTER BASED LEARNING	Necessitated by the availability of multimedia computers with graphics and sound applications. Computers started to be used to support learning processes in basic skills like mathematics, reading and writing.
(1) Mid 1990s	(2) WEB-BASED LEARNING	This marked the advent of the World Wide Web (WWW). This era partially addressed challenges posed by the need to regularly update information on CD-ROMs as educational information could be updated and backed up on the web regularly

Late 1990s onwards	E-LEARNING and E-ADMINISTRATION	Brought a combination of computer-based learning and web-based teaching and learning applications that provide for remote interaction between educators and students as well as students themselves. This phase also made it possible to offer administrative tasks and services to stakeholders/citizens online thus reducing administrative complexities posed by the growth in educational institutions.
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Redmond, (2011) and Amin (2016) opine that academic institutions are compelled to develop self-sustaining, learner-centered educational programs to address the changing economic role of higher education and the falling numbers of qualified instructors. With the rapid convergence of ICT, institutions are obliged to adopt new methods of knowledge creation, knowledge management, and knowledge dissemination (Baguma 2018). Like any other industry, higher education is now steered towards globalisation, warranting the need to have a strategic approach to ICT-driven learning and distance learning. Therefore, there is a conviction among researchers that ICT is reshaping the educational landscape in a way that responds to current information needs (Sturko and Gregson 2017; Adeoye 2013, Amin, 2016) thus accelerating the intention by many to utilise ICT to advance educational goals. Furthermore, global developments in ICT are influencing the idea that ICT is not confined to teaching and learning only, but rather plays a pivotal role in reshaping instructional delivery and assessment that befits the landscape of a knowledge-based society.

In the context of this study, the researcher uses the term ICT to refer to all technology and devices that allow people and organisations to interact and transact in the digital world and create networked societies / organisations. ICT therefore includes different forms of devices and applications/software that facilitate information collection, processing, usage, transfer, storage, retrieval and sharing in a digital form. The researcher realises the relevance of critically analysing global and local literature on integration of such technologies in educational administration and its applicability to South African higher education administrative areas and functions, particularly in public TVET colleges and universities.

3.2 ICT INTEGRATION IN HIGHER EDUCATION: THE RATIONALE

The digital era has changed how people communicate, get informed and even how they teach and learn. Riehemann and Jucks, (2017) therefore argue that, higher education

institutions and students are expected to keep up with increasing the pace of technological innovations, with particular attention to the utilisation of digital media, which are a component of ICTs. Thus, the use of digital media is already a part of studying and knowledge delivery (teaching and learning) globally, fitting well into the propositions of George Siemens's Connectivism theory. Though the implications of the 4IR transformations on society are not very clear, it is likely to bring speedy and intense change in almost every aspect of life. Increased adoption of ICTs in the teaching and learning functions of higher education institutions, which are hubs of skills training (Moyo, 2019), cannot be overemphasised to ensure anticipation and preparedness for current and future challenges. The OECD (2017a) further suggests that institutions of higher learning should move from reactive to proactive policy making on service delivery through ensuring rapid response to citizens' needs before a request is made. Therefore, one of their key recommendations, agreeing with Downes (2007) and Siemens (2005), is the establishment of integrated service delivery through development of agile delivery methodologies while safeguarding multi-channel accessibility. The aim is for a shift from e-government to digital government in order to employ more strategic approaches to using technologies and foster more participatory, open and innovative governance of institutions.

Isah and Omari (2015) posit that there is a proliferation of technology in its various forms in colleges and universities, with findings from different research studies revealing a mixed bag of both negative and positive impacts of ICTs. Of importance is knowledge that in this current competitive global economic landscape, even highly developed countries try all means possible to avoid a downward slide in educational trends. Arguably, HEIs worldwide are no longer competing locally in the area of knowledge administration. Globalisation now benchmarks institutions against educational levels and outcomes of higher education providers globally, placing responsibility on HEIs to train a future workforce that fits well in the networked global economy. Thus, the global inclination towards knowledge-based economies is increasingly leading to a growing shift to strong technology-driven higher education institutions (Baguma, 2018; Amin, 2016) advocated for by Siemens (2005) in the Connectivism Theory.

Similarly, HEIs in African countries are discovering that development and application of ICT in academic practice contribute significantly to the reduction of knowledge and technological gaps between African countries and the rest of the world (e-Learning Africa Report, 2019). This new millennium's digital and knowledge society places demands on academic institutions to shift from traditional pedagogy to novel innovative methods of knowledge creation and delivery (Amin, 2016; Isa and Omari, 2015; OECD, 2017a; Cross and Adam, 2007). For African tertiary institutions, South African in particular, to be able to

stand high and meet up with higher education challenges at global level, they need to upgrade and overhaul their systems, curricula and invent new educational approaches to address and recognise the local social, economic and environmental contexts. This should be done in consideration of the fact that higher education acts as the bridge connecting schooling to the world of work that is also increasingly undergoing technological transformation (Moyo, 2019). Use of digital media is already an important part of knowledge administration through their integration in teaching and learning.

Riehemann and Jucks (2017) observed both lecturers and students in higher education use formal and informal means of digital communication though research has revealed a difference in the use of technology by these groups. Instructors constantly revise and upgrade teaching methods to reflect the rapid technological advances occurring worldwide. In some African states, the use of technology for reinforcement and enhancement of concept formation in classroom instruction is increasingly becoming the rule in colleges and universities (Isa and Omari, 2015). In view of this importance of ICT in education, Baguma, (2018) suggests that HEI management teams need to position their institutions to meet the needs and expectations of technologically well informed students and educators of this current generation and keep abreast with current ICT trends in higher education.

In view of the above arguments, it is arguable that ICT is a vital support tool for the business of educational institutions. Conole (2012), Ben-Zion Barta et al (1995) and Maki (2008) agree that ICTs support the student academic life cycle starting from student enquiries through to graduation, highlighting the following as key areas of ICT importance:

- Student data administration
- Inventory management
- Personnel records management
- Library systems
- Learning management systems (LMS)
- General administration
- Knowledge management

ICT is well renowned for promoting novel means of producing, searching for, storing and sharing information and knowledge. Conole (2012) thus highlighted seven points of ICT importance in education listed below:

- i. ICT improves administrative efficiency and provides institutional infrastructure for managing the teaching and learning environment.
- ii. They facilitate dissemination of teaching and learning materials to students and educators via Learning Management Systems (LMS) or Virtual Learning Environments (VLE).
- iii. ICTs allow access to sources of information from all over the world.
- iv. They can help improve digital skills, literacy and competency of both students and educators.
- v. ICTs provide good examples of good practice and means of sharing ideas through repositories of learning materials.
- vi. They enable students and mentors to collaborate on joint projects
- vii. They are also useful in conducting lessons from remote locations and supporting distance learning.

Properly conducted, integration of technology in education can assist in reducing operational costs; enhance service delivery to the public as well as deepen institution-citizen engagement. With digital technology currently being the driving force behind the change in how governments operate, new media and technologies like social media, cloud computing, webinars, zoom etcetera can successfully complement old media and improve organisational communication and performance. However, Meyer and Gent (2016) posit that technology for the sake of technology has less likelihood of having a positive impact on education. ICT is not a focus on its own, but it plays a significant role in supporting a teaching and learning process and in supporting the business and administration of education.

In recent years, ICT integration into teaching and learning has been high on the agenda for educational reform. The use of ICT is an essential tool for effectively participating in the knowledge society (Khalid an Nyvang, 2014). The basic assumption is that ICT brings revolutionary change to teaching methodologies, particularly in this digital revolution enhanced by the Fourth Industrial Revolution. While ICTs play a supportive role to teaching and learning models, they are also vital in the day-to-day operation of an education system,

a transactional role that enables the system to function economically, efficiently and effectively. Initiatives for the use of ICT applications, the internet, and portable devices to ensure effective management and administration to support principles of good governance and to reinforce relationships with stakeholders are the demand of time in this e-government age (Gupta, Shakya and Marasini, 2015).

In higher education, ICT has shown impact on the practices and procedures of nearly all forms of endeavour within educational institutions. Undoubtedly, ICT has had a great impact on the quality of teaching and learning in universities, with the movement of the world to digital media and content making it vital in higher education in the 21st century drive (Adebayo, 2013; Anwar and Mathew 2014). Moreover, higher education institutions (HEIs) worldwide face tremendous pressure to provide excellent services in an effective and transparent manner, while working under constant resource constraints. Faced with a high demand for higher education, which outstrips the supply side (Khalid and Nyvang (2014), governments and higher education institutions are increasingly turning to the use of ICTs to bridge the resource and access gap. Khalid and Nyvang, (2014) thus categorised the professional use of ICTs as:

- i. Supportive use – ICT use in preparation of activities for the classroom.
- ii. Management use – ICT for conducting management tasks (planning, leading controlling and coordinating activities) and administrative tasks (distribution of information, receiving and sending correspondence et cetera)
- iii. Use in increasing access to education – ICTs have the capability to go beyond time and space to allow access to education whenever and wherever someone is. It creates the opportunity for offering distance learning and online resources for higher education students 24/7 and across physical boundaries.

The rapid pace of ICT development paves new methods of making higher education learning more flexible, accessible and in many cases effective (DHET, 2017). It is further arguable that in order to increase access to higher education and training, then technologies that extend the availability of opportunities to more potential learners need to be utilised (ibid).

Though much has been said about the integration of ICTs in classrooms (teaching/learning), the role of ICTs in administration needs to get more attention as well. This is because ICT continues to play a lofty role as a change agent for service delivery. For sustainable development in higher educational establishments, ICTs should become

an integrative aspect of all-round business of the institutions, not only the teaching and learning aspect. The spread of technological advancements in the 21st century globally should take most if not all organisations towards advancement of their administrative structures (Nanbam et al, 2018). Combining flexible administration with cost-effective technology is essential for institutional efficiency, especially for large organisations that have many stakeholders and large data volumes that need proper handling. Christina Maki (2008); Nanbam et al (2018) and Krishnaveni and Meenakumari (2010) identified administrative subsystems that are crucial to effective administration of HEIs as personnel administration, general administration, student administration, financial administration and resource management. Integrating ICTs in such subsystems should go a long way to reduce administrative complexities and enhance efficiency of institutions. Thus Bhatnagar and Agarwal, (2014) positively argue that integrated higher education systems is a concept that has the potential to empower governing bodies to better serve stakeholders and administer progress of educational plans. Information and communication systems have changed the nature of higher education, especially in developed states, making possible information transfer storage, processing and retrieval by workers, students and all those who interact with the institutions.

Arguing on the effectiveness of ICT in the administration of higher education, Nanbam et al (2018) highlight the following areas of ICT use for active higher educational supervision:

- General administration
- Institutional portal staff and student database
- Library database
- Inventory management

ICTs are thus renowned for promoting effective communication, internally and externally, hence, they bring about a worthy communication structure in higher education systems. They create and facilitate management of large and complex institutions that are capable of functioning with increased efficiency as well as user-friendliness.

Studies in the use of ICTs in higher education have mostly addressed teaching and learning at university level. However, numerous studies have proven their application in the administrative services of HEIs as the need of the hour. Pohekar (2018) speculates that the 21st century has witnessed far-reaching developments in the administrative systems of higher education due to tremendous advancements in technology. The table below shows

some of recent studies carried out on the application of ICTs in various functional areas of higher education institutions.

Table 3.3 Recent studies in ICT application in higher Education

SCHOLAR/S	STUDY DESCRIPTION
Crawford et al, (2020)	Covid-19: 20 countries' higher education intra-period pedagogy response
Moyo, R. (2019)	Adoption of ICT in teaching and learning at a south African university
Pohekar (2018)	Role of ICT in universities administrative services and management- India
Egoeze et al (2018)	Impact of ICT on administrative services and Management of student records – Nigeria
Andugo (2017)	Effect of technological strategies on organisational effectiveness: study of U.S. International University- Africa
Chidobi (2015)	Application of ICT in student record management in Nigerian public universities
Bagarukayo and Kalema (2015)	Study of e-learning usage in South African universities: a critical review
Adebayo (2013)	Impact of the application of ICT in the administration of polytechnics in Ogun State - Nigeria
Jaleel (2014)	Administration of information in higher education – role of ICT
Krishnavenni and Meenakumari (2010)	Usage of ICT for information administration in higher education institutions.
Saud et al (2011)	Effective integration of ICTs in technical and vocational education and training (TVET)

A common observation made by the above scholars is that ICTs do extend transparent and easy ways/opportunities to supervise, coordinate and control daily administrative activities of academic institutions regardless of type. A closer look at the scholars above portrays Nigeria as one African country showing more effort towards understanding the importance of technological interventions in higher education administration.

Research in the area of ICT application in administrative functions of higher education institutions is, however, not very evident in the South African context. Few research studies done have focused on the classroom level importance of ICTs in university institutions without much attention to the other HEIs. Moreover, ICTs play a vital role in education as tools for teaching and learning, and their deployment should be in support of best value

creation (Meyer and Grant, 2016). It is of great concern however, that regardless of being the second largest economy on the continent after Nigeria, South Africa has not really set a role model in seizing opportunities offered by ICTs in all the institutions of higher learning (Moyo, 2019). Nevertheless, through the country's e-Strategy code named "Digital Society South Africa", the South African government aims to position the country as a significant player in the development and utilisation of ICTs and to accelerate its uptake in all sectors. The South African government recognises ICT as an enabler of speedy service delivery, an intelligence builder and a creator of novel ways of learning, sharing and engaging (DHET, 2017). In spite of this recognition, implementation of ICT strategies and policies is slow and implementation capacity thereof is also limited according to observations made by Moyo (2019) and Meyer Grant (2016).

3.3 HIGHER EDUCATION PEDAGOGY IN THE DIGITAL AGE: THE ROLE OF ICT

The ICT revolution of this new millennium is bringing changes that demand innovative solutions to numerous business, environmental, economic, social and technological issues. Therefore, the present day challenges and continuous changes require learning methods that are flexible enough to adapt to the ever-changing world, as the future will require an innovative workforce made up of lifelong learners (Adeoye, 2013; Amin, 2016; Pheeraphan, 2013). Through engaging in ICT-rich learning contexts students are equipped with skills and new ways of thinking, as well as creative problem solving that enhance collaborative work to solve multi-disciplinary challenges (Baguma, 2018). For this current generation of learners to remain competitive and relevant in the evolving world, ICT has to be at the centre of their day-to-day interactions and learning activities. Various online learning programs, high-tech media, mobile devices, and social media applications have prompted changes in teaching practices and revolutionised the academic world. Moyo (2019) and Patzer (2010) argue that when correctly used, ICT improves the quality of learning, increases access to instructional tools and programmes, and enhances students' technological skills. Undoubtedly, ICT has the potential to turn around instructional processes and facilitate students' learning in a variety of ways, some of which are briefly described below:

3.3.1 ICT and instructional delivery

Scholars believe that ICT for teaching and learning facilitation is rooted in four main functions mainly dynamic content presentation, interaction and reflection, creation and sharing as well as information access.

i. Dynamic content presentation

Isa and Omari 2015) explain instructional delivery (content presentation) as the process where educators employ a range of instructional approaches to communicate and interact with students around academic content while supporting student engagement. This is when ICT is used to deliver knowledge using multimedia, in the form of sound, animations, text, pictures etc. Examples of such use are in PowerPoint presentations and Keynote coupled with classroom discussions, demonstrations, group work, and simulations. In their study on how much teaching and learning is digitised, Riehemann and Jucks (2017) found out that students preferred more digital media in their studies and students identified its advantage in supporting tutorials, learning success, communication and cooperation. Of late, the use of data projectors and document cameras has become a norm in content presentation during large lectures, evidence of the efficacy of ICT in content delivery. Pheeraphan (2013) posits that this content delivery function promotes learner engagement thus, making them active learners, thus reducing the banking concept of education which views lecturers as depositors and learners as inactive depositories of knowledge (Isah and Omari, 2015).

ii. Interaction and reflection

This function involves using technology in a way that encourages relationships between educators and students. It makes use of various formats ranging from text, pictures and voice, to public contact through chat rooms, social media apps, google classrooms etc. The interactive function facilitates both public and private contact with a possibility of one to one, one to many as well as many to many interactions (Pheeraphan, 2013). The advantages of ICT in this function are in its ability to provide room for immediate feedback between educators and students as well as real-time interactions that happen online. Today direct communication happens through interactive tools namely Skype, Zoom, Microsoft Teams, Google Classroom, e-mail among other tools that enable fast and direct exchange of ideas and opinions. Other standard tools of technology used in instructional delivery include hyper-links, interactive boards, chatrooms, social media platforms, and e-attachments that all facilitate interactive engagements between educators and students. The more interaction between educators and learners, the more actively involved the learners become in their learning.

iii. Knowledge creation and sharing

Use of ICT for the creation and distribution of knowledge by both lecturers and students. This distribution can happen internally among members of the institution or same programme or externally to the public. Such knowledge creation and sharing includes research papers, presentations, slideshows on different topics, videos uploaded on YouTube or other platforms. ICT thus creates opportunities for the creation of knowledge and open resources that are accessible to anyone via various search engines and databases. Thus, Isah and Omari, (2015) are of the view that students in this ICT-driven

era should be digitally productive rather than docile recipients of content from professors. Therefore, while in the process of learning the students become co-creators of knowledge and solutions to address present day challenges.

iv. Information access

In this digital era, students require access to knowledge not only from their lecturers, but also from various other knowledge sources globally. Hence, ICT plays a role in enabling student and lecturer access to information through searching, exploring, analysing and evaluating information from global sources. Understanding of the various search engines (Yahoo, Google, Firefox, and Microsoft Edge etc.) becomes a vital aspect of ICT importance for access to information. ICT in this regard helps students and lecturers to explore ideas, select information, evaluate and use knowledge, which in turn helps to foster significant teaching and learning experiences.

Arguably, modern and future economies require people who can adapt and contribute to organisations and processes, possessing aptitudes for continuous learning while adjusting to change. In this regard, students should possess skills in communication, technology, media and collaboration, which they can enhance through ICT use. Hence Kilfoil (2015) opines that bring your own device (BYOD) practice in HEIs will continue to become popular within the next few years, as mobile and online learning become more prevalent. In view of this assertion, Pheeraphan, (2013), Isa and Omari, (2015) and Moyo, (2019) all agree that ICT integration pedagogies do not only enhance learning but also have the capability of transforming learning. The four functional areas of ICT integration in teaching and learning discussed above highlight that integrating ICT is envisaged to empower teachers to focus on:

- Student-centred approach, thereby avoiding the banking concept of education that was discouraged by Isah and Omari, (2015)
- Active interactive teaching and learning
- Development of critical thinking rather than rote learning
- Connecting with learner experiences and needs

3.3.2 The e-learning concept in higher education

Today's educational landscape is going through a revolution unlike any we have ever seen before. The digital revolution is fast taking over the teaching and learning landscape, with digital/ or e-learning becoming the order of the day in most countries (Baguma, 2018) driven by the global inclination towards knowledge based economies. Ozkan and Koseler (2009) describe e-learning / digital learning as the use of electronic devices for learning, inclusive of delivery of content via electronic methods like the internet, audio / video, satellite broadcast etc. In the same vein, Moyo (2019) perceives e-learning as referring to the

delivery of information/content on digital devices like mobile phones, computers, DVD, to support teaching and learning while Sife, Lwoga and Sanga (2007) posit that it involves delivery or enabling of instructional content and learning experiences through electronic technologies. However, Zhou et al (2020) argue that the “e” in e-learning is not limited to electronic lesson delivery alone, but rather explains the concept of evolving, enhanced, extended, experimental, efficient and effective learning through the use of educational technologies. The above argument clearly shows that the concept of e-learning is not restricted only to classroom instructional processes, but to the numerous ways in which technology enhances and enables learning and teaching seamlessly. E-learning continuums range from using technology in the classroom to blended learning that combines face-to-face and online instruction (Sife et al, 2007; Fawareh, 2013). Furthermore, they include synchronous and asynchronous distance learning delivered electronically to a remote audience. Hence, e-learning involves identifying ways of appropriating technologies to achieve meaningful learning. Furthermore, according to the e-Learning Africa Report (2012), e-learning represents more of that kind of learning, training, knowledge sharing or creation that cannot happen effectively in the absence of internet access, hence connectivity is the key defining factor. E-learning in this study focuses on two models namely:

i. Supplemental Model

This is when ICTs are used to complement traditional learning experiences. Instructors physically deliver lessons in a contact classroom environment, with the occasional use of technology to enhance delivery and learning. Such technological support includes PowerPoint presentations, use of graphics, multimedia simulations, audio and video content. This may also involve blending physical instruction with web-based (online) activities like online assessments, quizzes etc. The key fact is that in the supplemental model, technology does not replace traditional teaching and learning practices but supports them.

ii. Distance online learning model

E-learning is conducted solely online in the absence of contact classes. It happens through synchronous and asynchronous interactions between instructors and students.

However, some forms of e-learning do not have to take place online, but they are considered types of e-learning nonetheless. Tamm, (2019) therefore identifies different types of e-learning and classifies them into two broad categories namely computer-based

e-Learning and internet-based e-Learning. Below is an explanation of the different types of eLearning in the categories.

3.3.2.1 COMPUTER-BASED e-LEARNING

These types of e-learning do not necessarily happen online; hence, they are not influenced by internet connectivity for them to be effective. These include:

i. Computer Managed Learning (CML)

This is also called computer-managed instruction (CMI), in which computers are used for management and assessment of learning processes. Computer managed learning systems operate via databases containing information that students need to learn, coupled with ranking parameters which determine the level at which the students have achieved their learning goals, resulting from the two-way communication between the student and the computer. Furthermore, the computer managed learning system enables institutions to store and retrieve educational information like training materials, lecture information, curriculum information, course schedules, among other important educational information.

ii. Computer Assisted Instruction (CAI)

Often called computer-aided learning, this type of e-learning pools interactive computer software for students with traditional methods of teaching. A combination of multimedia like videos, graphics, text and sound is used to facilitate learning. Tamm (2019) believes that the value of CAI lies in its power to create interactivity and allow students active involvement in their learning.

iii. Fixed E-Learning

In this type of e-learning, content shared by lecturers to students is 'fixed', meaning it does not change from its original state. The same information that is always predetermined by the educator is shared with all students; hence, there is no individualised content for learners. It is rooted in the standard traditional methods of teaching and it does not create a good e-learning environment.

iv. Linear E-Learning

This type of e-learning promotes linear information communication from sender to receiver, limiting opportunities for two-way communication. Though still relevant, it is becoming less significant due to the availability of more interactive technologies. Examples of linear e-learning types include sending of learning materials via e-learning channels on radio and

television. The Gambia, South Africa and Rwanda are some of the countries effectively using this type of e-learning especially as a response to Covid-19 challenges (e-Learning Africa, 2020), thus ensuring that while school is out, class is on (Zhou et al, 2020).

3.3.2.2 INTERNET BASED e-LEARNING

This is an online type of e-learning requiring internet connectivity. It does not involve a physical face-to-face approach but rather learning and teaching happens in a virtual environment. Some of the internet-based e-learning forms are briefly described below:

i. Synchronous Online Learning

This is a form of internet-enabled learning which enables students to participate in learning activities as groups and in real-time from different places around the world. In other words, it is an approach to online learning based on the rapid evolution of computer networks and online learning technologies. Such methods of e-learning make use of technological tools that facilitate large group interactions in real time. Of late common tools under use are Web 2.0 technologies like WhatsApp, Facebook live, Zoom, Microsoft Teams, Skype, Google classroom, among other modern interactive technologies. Tamm (2019) argues that synchronous online learning is one of the fastest growing and most popular types of e-learning and often involves real-time online chats, teleconferencing and video conferences.

ii. Asynchronous Online Learning

This involves independent online studying by multiple students at different locations and times, in the absence of real-time communication. Such methods are more student centred and allow students flexibility in learning times, especially those with tight schedules (working students). Since students are not obliged to learn at the specified times, they can set their own timeframes, that is, self-paced learning.

iii. Interactive Online Learning

This is an effective two-way e-learning approach that enhances interaction between teachers and students and vice-versa. It effectively applies in both synchronous and asynchronous e-learning types as it allows both real-time chats as well as flexible accommodation for students to chat with lecturers privately at their own time.

iv. Individual Online Learning

This involves individual learning, where students study the learning materials online by themselves (individually), and they are expected to achieve learning goals on their own.

This is most applicable to distance education learners as it largely focuses on students learning independently, without communication with other students. However, this form of e-learning thwarts the development of communication and teamwork skills in the learners using it.

v. Collaborative Online Learning

Several students work together to achieve their learning objectives through teamwork in order to achieve their common objectives. This e-learning method magnifies the idea that knowledge effectively develops within a group of people who can interact and exchange ideas with one another. In a higher education setting, this can work well for collaborative projects and research.

vi. Blended Learning

This is when technology used for communication and education outside the classroom supplants face-to-face work thereby reducing the actual time spent in a classroom. Learning is regarded as blended when there is a combination of face-to-face classroom instruction and technology-enhanced instruction (Kilfoil, 2015; Baguma, 2018, Moyo, 2019; UNESCO, 2020). In blended learning, lecturers can manage teaching environments better in virtual learning environments by collecting assignments, automatically marking quizzes, and providing instant feedback to students, thus allowing early intervention to minimise student dropout risk. The good thing about blended learning is that it does not totally do away with contact/face-to-face learning but provides for expanded avenues of instructional delivery that can happen virtually. Physical presence is a prerequisite, along with student control over time, place, path, or place (Kilfoil 2015). However, this type of learning often has to consider common challenges like time management by students, increased workload, social, economic and technical factors.

3.2.3 The place of learning management systems (LMS) in instructional processes

ICT innovations have been used for educational purposes in many ways. These comprise computers, the Internet, broadcasting technologies, telephony among others. Of late, the use of electronic learning management systems (LMSs) has attracted notable consideration in higher education systems globally. Al-Azawei et al (2016) and Agaci (2017) define LMS as a web-based technology/software application that educational institutions use to plan, implement access and interact within a specific learning process. Learning management systems serve as one-stop platforms for learning and development, providing

a way to easily deliver e-learning options like online courses as well as means of tracking their progress online. Fawareh (2013) argues that LMSs are useful tools for managing educational resources ever since Web 2.0 technology started causing changes in computer hardware and software. The term 'learning management system' is synonymous with a virtual learning environment (VLE), a knowledge management system (KMS) or a course management system (CMS).

Learning management systems play a significant role in bringing benefits to both learners and instructors in facilitating e-learning (E-learning Africa 2020; Baguma 2018). Successful LMSs should present opportunities for interactive learning that promotes blended-learning, where contact classes are supplemented by e-learning tools. Hence, LMSs in this study are seen as supplementary tools for enhancing face-to-face teaching and learning, not a total replacement thereof. Researchers (Tamm, 2019; Al-Azawei et al, 2016) have revealed that teachers reap the following benefits by using LMS:

- i. Learning management systems enable instructors to create teams and assign courses to them
- ii. They make provision for uploading, presenting storage and management of learning content.
- iii. Instructors can remotely track learner activities and assess learner knowledge on the system.
- iv. It also facilitates real-time reporting and keeping students up-to-date about the courses

Students equally benefit from the use of learning management systems. These benefits include accessing content anytime, anywhere; ability to upload and download assessments for review; remote interaction with peers and educators as well as obtaining real-time feedback especially for those in full-time distance learning (Kasim and Khalid, 2016; Lopes, 2014, Tamm, 2019). In view of the above therefore, a learning management system is a technology that can improve learning, make it productive, cost-effective, and trackable.

3.3.1.1 TYPES OF LEARNING MANAGEMENT SYSTEMS

Organisations can choose from several types of LMSs depending on their level of need. LMSs range from enterprise vs individual LMS, free vs commercial, SaaS vs licensed product, cloud-based vs on premise as well as integrated systems³. A brief description of some types that are more relevant for this study is given below:

³ For more explanations of the LMS types visit <https://www.valamis.com/hub/what-is-an-lms>

i. CLOUD-BASED LMS vs ON-PREMISE LMS

A cloud-based LMS is one that is virtual, and can be accessed anywhere at any time. It does not require any specific hardware or software to be installed but is accessed via a web-portal using login credentials supplied by the organisation (Agaci, 2017). This is vital for continuing education and training as well as distance learning due to their easy accessibility through computers and mobile devices.

On-premise LMS on the other hand is a licensed product installed on a server to the specifications of the organisation. Limitations lie in the fact that on a large-scale, it requires the use of many servers (Tamm, 2019).

ii. ENTERPRISE GRADE LEARNING SOLUTION

This is a highly scalable learning solution customised for large companies with employees ranging from 500 and above. New courses can be added as the organisation grows and it can be cloud-based.

iii. SOFTWARE-AS-A-SERVICE (SaaS) LMS

Cloud-based, ready-to-use, out-of-the-box software that the service provider hosts centrally and licenses on a subscription basis (Agaci, 2017). It is a perfect solution for growing organisations because it is scalable over time.

iv. OPEN - SOURCE LMS

Technology creators make the source code available for any user to modify. While it is license-free, it is not very free as costs are involved in downloading the software. It is suitable for organisations that need to customise the code to suit their e-learning needs and services but avoiding on-going license costs (Kasim and Khalid, 2016; Agaci, 2017). An example of such is Moodle, an open source software used by many educational institutions globally.

v. COMMERCIAL VS FREE LMS

The use of LMSs can be free or commercial. A commercial platform offers 24/7 support, but also costs money based on the features required by the organisation (Agaci, 2017; Lopes, 2014; Kasim and Khalid, 2016). Since they require regular updating, commercial LMSs can offer an ever-growing range of features at the same time ensuring that an organization uses the most up-to-date e-learning platform.

Most scholars above have observed that institutions of higher learning are mostly using open-source software like Moodle and Sakai due to their ability to integrate with other platforms. Moreover, besides not requiring license renewal costs, institutions can modify them to suit their own requirements. Hence, they can add a variety of activities on one platform ranging from chats, assignments, databases, assessments, lessons etcetera (Lopes 2014).

3.2.4 The influence of Web 2.0 technologies on learning and teaching

The ICT revolution of this millennium is bringing changes that demand innovative solutions to numerous business, environmental, economic, social and technological issues. Thus, present day challenges and regular changes require a learning model that is flexible enough to adapt to the ever-evolving world, as the future requires an innovative workforce made up of life-long learners (Amin, 2016; Pheeraphan, 2013). Through engaging in ICT-rich learning contexts, students are equipped with skills and new ways of thinking, as well as creative problem solving that enhances collaborative work (Baguma, 2018). For this current generation of learners to remain competitive and relevant in the evolving world, ICTs need to be at the centre of their day-to-day interactions and learning activities. A variety of online learning programmes, high-tech media and social media applications have brought about modifications in teaching practices and transformed the academic world. Moyo (2019) and Patzer (2010) argue that when correctly used, ICT improves the quality of learning, increases access to instructional tools and programmes; enhances students' technological skills.

Gachago et al (2013) observed that the use of educational technology in the form of formal LMSs has been on the rise among higher education students, most of them being emerging technologies that are characterised by real-life connections and a focus on collaboration. Emerging technologies, commonly known as Web 2.0 technologies, refer to a variety of websites and applications that allow creation and sharing of information/created materials (Rowe, Bozalek and Frantz, 2013; Baguma, 2018). Web 2.0 technologies facilitate platforms for interactive learning and innovative responses to teaching and learning; provide real-time updates and enable collaborative learning. These platforms include instant messaging services like WhatsApp, Skype and Facebook, also known as social computing tools (Ng'ambi Bozalek et al (2016). Currently, most of the applications provide for video conferencing, video chats and calls that enable real-time discussions among people. Thus, they have power to enhance distance learning, distance supervision and support for disengaged students

Gachago et al 2013 and Bozalek et al (2016) however, aver that South African higher education institutions are struggling to comprehend the affordances of Web 2.0 technology, thereby making decisions that hinder their adoption of the technologies. Nonetheless, the fact that almost all students today own mobile devices, are socially connected, and have access to free digital content (Mpungose, 2019), emerging technologies should shape higher education's response to educational transformation requirements of the digital era. Rowe, Bozalek and Frantz (2013) postulate that regular student protests, which often disrupt campus activity in South Africa over extended periods, should highlight the importance of rethinking alternative communication and collaboration channels between students and staff. Furthermore, the increasing demand for online learning under the Covid-19 challenges necessitates the designing of new, flexible approaches and focus on how to exploit what students already use to transform teaching and learning practices. Thus, extant literature shows agreement that the advent of mobile technologies and ubiquitous wireless internet makes a shift to more active learning and collaborative knowledge production enhanced by Web 2.0 tools (Baguma, 2018, Bozalek et al, 2013). Mpungose, (2019) also observed that while traditional LMSs struggle to incorporate social connectivity features, interactive emerging technology platforms are becoming popular in higher education systems. Examples of these emerging platforms include Emodo, Google Classroom, Google Drive, and SkyPrep among many other new platforms. With the technology explosion of the Fourth Industrial Revolution, students are enabled to engage in shared learning experiences that extend beyond classroom walls (Rowe, Bozalek and Frantz (2013). The correct integration of Web 2.0 tools is therefore envisaged to provide ways of extending seamless learning across barriers that currently impede participatory correspondence.

Despite the numerous benefits brought by Web 2.0 technologies to teaching and learning, Faizi, Chiheb and El Afia (2015) are quick to indicate the need to be wary of their potential disadvantages. They argue that educators usually feel that these tools can create distractions to students' learning activities when students digress and end up checking irrelevant content like browsing videos, having social chat, thus reducing actual time spent on learning activities. Social networks may also have a negative impact on the students' communication skills when they spend too much time on online communities and less on face-to-face interactions thereby affecting their socialisation. Therefore, as educators engage their students via such channels they need to instil the culture of self-discipline that should characterise online learning, as the students will not have close supervision from instructors.

3.4 LEARNING WITH TECHNOLOGY IN THE SOUTH AFRICAN CONTEXT: FINDINGS FROM LITERATURE

Most developing countries face the challenge of large numbers of people entering higher education to pursue different programmes with most of them having diverse educational and socioeconomic backgrounds. Literature reveals this as a recent phenomenon in the South African context, which started in the early 90s due to the democratisation of education (Mpungose, 2020). This has seen South African HEIs grappling with the effects of protests by students regarding funding, housing, etc., which in turn affect timely and quality teaching and learning. Such challenges compel institutions of higher learning to move towards adoption and integration of e-learning platforms to deliver curriculum content (Barak, 2018; Collins and Halverson, 2018).

3.4.1 Blended learning

Mdletshe (2019) investigated the effect of integrating blended learning in creative design for fashion in the Fashion and Textiles department at the Durban University of Technology (DUT). This study (Mdletshe, 2019) revealed the possibility of achieving collaborative learning spaces that inspire self-agency through integrating social media platforms and the Blackboard learning management system used as a formal learning platform at the university. The lecturer managed to create an online class with her students and made use of social media platforms namely Instagram and Pinterest to enhance teaching and learning.

Van Der Merwe et al (2015) posit that there are varieties of blended learning approaches at different universities in South Africa. These approaches include flipped classrooms, using mobile devices, e-mentoring et cetera. They argue that blended learning is no longer a novelty in South African HEIs but has rather become a norm in many institutions. Gachago, et al (2013) however, are of the opinion that more research should now focus on HEIs not represented a lot in most studies, seeing that most studies revolve around universities. Van Der Merwe et al (2015) further identify some of the strategies for blended learning as:

- i. Email and messaging
- ii. Online coaching, tutoring and mentoring
- iii. Accessing published resource materials (e-library)
- iv. Moving assessment online

Through Mdletshe's (2019) study, the following challenges on use of formal and informal e-learning platforms were revealed:

- i. Most students, especially first year students, require induction / training sessions on the use of the LMS (Blackboard) for them to perform at their best when learning with technology.
- ii. Connectivity issues affect the effective use of the platforms as the DUT Wi- Fi often loses signal sometimes resulting in loss of learning documents.

Because of the above challenges, Mdletshe (2019) found out that students still find having a lecturer present valuable because they have a need to engage constantly and ask questions. This proves that technology need not replace the physical presence of instructors, but should complement face-to-face sessions (blended learning).

3.4.2 Use of formal and informal e-learning platforms / learning management systems

Literature further reveals that many South African universities make the use of formal e-learning platforms / LMSs compulsory for both students and lecturers (Mpungose, 2019; Mdletshe, 2018; Gachago et al, 2013). For instance UKZN, UCT, UNISA adopted Moodle as their formal e-learning platform while the North West University's LMS (eFundi) is powered by Sakai. Both platforms above are open source software customised to the needs of each institution. Van Der Merwe et al (2015) identified Blackboard as the most used commercial e-learning platform used in most universities in South Africa, while Moodle and Sakai are the most adopted open source products.

However, research has also revealed that the use of formal LMSs in South African HEIs is often impeded by access challenges as not all students have home access to the internet and devices (Kilfoil, 2015; Gachago et al, 2013; Thinyane, 2010; Mdletshe, 2019). Though access to digital devices by students is becoming increasingly diverse, not all first year students arrive at SA HEIs with sufficient access to ICTs and basic computer literacy. Hence, it is difficult to achieve smoother teaching and learning, as students often struggle to use the formal LMS (Mpungose, 2019). Furthermore, the studies above found out that student experiences, digital competencies and backgrounds, most of which are disadvantaged backgrounds, usually influence e-learning platforms when addressing content knowledge needs. Mpungose (2019) and Thinyane (2010) argue that such discrepancies make students hesitant to use formal e-learning platforms. Hence, they recommend the use of informal e-learning platforms powered by Web 2.0 technologies, (e.g. WhatsApp, Facebook, and YouTube) in conjunction with formal ones since most students are more exposed to such. The argument is that most students entering higher education are usually competent users of mobile phones with very good networking skills acquired through experiential learning (Kilfoil, 2019). This blended use of formal and

informal platforms is therefore envisaged to give students options to use e-learning platforms based on their experiences. Nonetheless, such experiences and capabilities are usually not validated or in synchronisation with the practices of most institutions (ibid). Hence, Gachago et al (2013) suggest that higher education institutions in South Africa should develop governance structures and strategic plans for the infusion of emerging technologies into institutional life.

A further problem common to some of the studies above, is that lack of managerial support, incentives and supportive infrastructure environments limit the possibility of widespread uptake of technologies into mainstream higher education in South Africa (Mpungose, 2019; Mdletshe, 2019, Gachago et al, 2013). Thus, they recommended the availability of more computer labs and internet connectivity for use by students outside of class times. They also suggested equipping classrooms with smart teaching and learning devices, better computers and any other relevant technologies that create a suitable support for technology-driven learning and teaching.

Mpungose (2020) further argues that the use of e-learning platforms gets influence from experiences and backgrounds, with most students having more exposure to informal platforms like WhatsApp, YouTube or Facebook. Sharing the same line of thought, Gachago et al (2013) observed that quite often, more lecturers are prompted by their students to use for formal teaching and learning, social media applications and mobile technologies, which they use and are well-accustomed to in their social lives. This sums up a conclusion that although not all students entering higher education may not necessarily be digital natives, South Africa seems to have more mobile learners ('M' learners), who have a higher preference for mobile technologies. Bozalek and Ng'ambi (2015) therefore, push the argument in favour of emerging technologies and their enhancing effect on pedagogical practice in SA higher education teaching and learning environments through their capability to promote prompt feedback, collaboration and student-lecturer/student-student interaction. Higher education leaders and policy makers are thus urged to let the environment of the South African higher education sector inform their review of the teaching-with-technology landscape from a policy perspective.

The South African HE landscape has been enhanced by the emergence of new technologies, which present multiple opportunities for individual academics and students to shape their own learning and teaching contexts (Bozalek, 2015; Cross and Adam, 2007; Mpungose 2020). Reporting in the e-Learning Africa Report, 2012, a South African educational technologist commented on how ICTs are bridging the distance between students and educators through delivery of virtual lessons as well as reducing textbook costs using e-books, which are accessible via computers and mobile technology at

anytime, anywhere. Nevertheless, a marked difference clearly exists between resource-constrained and resource-rich HEIs in their utilisation of ICTs in pedagogical practices, with resource-constrained institutions usually depending more on traditional classroom practices. To reduce this disparity in ICT use by HEIs, higher education administrators in SA need to understand the context and available technologies for the majority of students, as a useful point of departure when planning learning with technology.

3.5 ADVANTAGES AND POTENTIAL CHALLENGES OF ICT-ENHANCED / E-LEARNING

This section presents common advantages and common challenges of the e-learning concept identified in literature, with particular attention to higher education.

3.5.1 Advantages

According to E-Learning Africa Report, (2019), the four A's namely accessibility, affordability, ability (skills) and appetite for local content should be addressed through investing in education. Digital transformation is an enabler of sustainable climate to achieve the four A's. E-learning has value in addressing the Sustainable Development Goal (SDG4) of the UNDP, which targets achievement of universal access to quality education for all by 2030. Digital/e-learning is significant in providing such opportunities for equal access to those who cannot attend full time due to other obligations like work, geographical location and family responsibilities (Thompson , 2017; Tamm, 2019), thereby ensuring that no one is deliberately "left behind". For effective quality educational opportunities, distance education done in real-time is also necessary, as education is an essential service. Below, is a summary of advantages created by internet-based e-learning as observed by scholars namely Tamm (2019); Kisanga and Ireson (2015), Al-Azawei et al (2016) and Pheeraphan (2013):

- i. Students can find Massive Open Online Courses (MOOCs) of their choice from any place in the world. ICTs reduce the distance between students and educators as learners can virtually attend live delivery sessions.
- ii. Information accessibility: Students can access learning content at any time and from anywhere, while technology serves the special needs of various learners. The development of electronic library management systems together with online institutional repositories enable access to reading materials remotely, making learning much more accessible to all registered members of an institution and the academic community at large. Of late
- iii. Moving from physical classrooms to electronically enhanced learning tools reduces costs in learning materials through provision of e-resources. Furthermore, e-learning

reduces travel expenses to contact centres as well as to libraries as library information can be accessed remotely via learning management systems (LMSs). Today's students are of a new generation where electronic communication and electronic access to materials has become a habit and a way of living.

- iv. E-learning can provide additional and alternative interaction opportunities outside of campus and normal work hours, thus promoting efficient and effective interaction.
- v. E-learning functionalities can be exploited to integrate pedagogical theories and make lessons more interactive, thereby promoting teaching and learning quality.
- vi. LMSs manage and track learner activity through rich log files that track learner activities within the system.
- vii. A learning management system can improve collaboration and cooperation by offering communication tools such as chat, and assigning learners into different groups to work together.
- viii. Educational institutions see digital learning as a way of rejuvenating numbers of student enrolments, thus increasing access to higher education. Thus, through technological innovation, e-learning takes organisations/states closer to democratisation of knowledge.
- ix. Teachers and learners choose the most appropriate method to deliver and receive learning content through adoption of synchronous and asynchronous delivery modes for different activities.
- x. Digital learning makes provision for a flex model of learning that allows people to learn on their own time and from the comfort of any affordable internet-enabled device.

3.5.2 Common challenges to e-learning

Al-Azawei (2016) argues that unlike in developed countries, e-learning implementation is still in its infancy stage in most developing countries. Research studies have revealed that developing states have not yet made effective adoption and use of LMS technology (Kisanga and Ireson, 2015; Al-Azawei, et al 2016; Ssekakubo et al, 2011; Tarus et al, 2015; E-Learning Africa Report 2019; Mpungose, 2020). The reason is, despite observed lucrative benefits, e-learning has its fair share of challenges that have been observed to be common. Recently, a plethora of literature has emerged; with researchers analysing and pinpointing issues that can affect successful implementation of e-learning in higher education institutions, especially in developing countries.

Research done by Moyo, 2019, Kisanga and Ireson, 2015, E-Learning Africa, 2020 and Al-Azawei et al 2016 highlight some of the common challenges that are preventing successful

implementation of e-learning. We classify these challenges as institutional and personal factors/challenges.

i. INSTITUTIONAL FACTORS

These are issues relating to the organisation at large, which can hinder successful adoption and practice of e-learning. Challenges falling into this category include:

- Poor infrastructure – this involves things like communication links, sources of power supply that support internet – based e-learning, inadequate hardware and software, lack of devices among other relevant infrastructure. Poor communication infrastructure usually creates and widens inequality gaps between rural and urban HEIs, thus affecting educational outcomes in such areas.
- Lack of ICT policy – not having a proper roadmap to guide the institution members in terms of the institution's ICT vision, the approaches to achieve the vision and drive for change, development of ICT capability etc. If an institution lacks the document that sets out how to use ICT in teaching, learning and throughout the wider context of the organisational functions, there will be minimal in trying to implement technologically driven change in the teaching and learning environment. (Hilkemeijer, (2020)
- Lack of managerial support – if institutional managers do not provide adequate support in terms of purchasing the ICT equipment; paying for training costs, incorporating ICTs into the teaching and learning landscape; capacity development and lack a positive attitude regarding the use of technology platforms, it becomes difficult for e-learning environments to be created and utilised.
- Financial constraints – an organisation may have a good ICT policy and supportive management teams, but without finances to support the vision, most implementations fail to take off from the ground. This is usually the case in developing countries where institutions operate under very meagre and constrained budgets.
- Lack of ICT support staff

ii. PERSONAL FACTORS

Barriers to successful e-learning are also associated with personal factors like teachers' understanding of e-learning, shortage of technical experts, digital incompetence of stakeholders, resistance to change among other factors.

● Teachers' Understanding of E-learning

If educators lack knowledge of the impact of e-learning on education, they are likely to resist it or avoid its use (Kisanga and Ireson, 2015) resulting in its failure to be adopted. Usually, teachers who are too accustomed to traditional models of instruction find it difficult to fit into

a newer model. Furthermore, teachers may have a reluctance to put courses into electronic format as they may lack the expertise or find it time-consuming despite accessibility to newer technologies (Kisanga, 2015; Sife et al, 2007). Integration of ICTs not only brings in new technology to the teaching and learning environment. It also involves the adoption of new roles and the changing of ICT behaviour by both trainers and students alike. Hence, Sife et al (2007) suggest the need for training and workshops as a continuous process to improve skills in line with current technological environments.

- **Shortage of technical experts**

If technical experts are few or non-existent to support the community of e-learning users in HEIs, this may affect the adoption of the e-learning model. Sife, Lwoga and Sanga (2007) argue that in most developing countries, there are few technical experts to implement and maintain ICs. Hence, they further argue that ICTs have not permeated a lot in many HEIs due to their socio-economic and technological statuses. The integration of ICTs in learning and teaching should take place along with recruitment, training, and retention of relevant staff to support installation, maintenance, network administration and operations.

Digital incompetence of stakeholders

Most system stakeholders are non-technical people (Fawareh, 2013). Hence, according to E-learning Africa, (2020), failure to adopt e-learning may be a result of lack of ICT skills. Some teachers lack computer knowledge and are sometimes unable to convert print-based material into digital format, thus affecting the uptake of e-learning negatively. Sife, et al, (2007) also discovered that the general division between older and younger teachers in responding to e-learning opportunities has a bearing on its adoption where the older digitally illiterate staff out-number the young staff.

- **Resistance to change**

Negative perception of e-learning as an extra load often makes people resist its use. Furthermore, any new way of doing things may bring fear of the unknown to those who are supposed to implement it (E-Learning Africa Report, 2019). This fear is associated with the anxiety about disclosing one's ignorance, old age, fear of new technology, maintenance of the status quo, poor mind-set and low attitude among other reasons for resistance. Where many of the stakeholders exhibit such fears, adoption of e-learning is likely to be resisted. Sife et al (2007), Kisanga (2015) and Moyo (2019) agree that positive attitudes toward ICTs are essential for effective ICT adoption and implementation. Hence Sife et al (2007) suggest the importance of awareness programmes, visits to institutions with best ICT practices, short training as a way of building awareness and positive attitudes.

3.6 RECOMMENDATIONS FOR EFFECTIVE ADOPTION OF TECHNOLOGY-BASED EDUCATION FOUND IN LITERATURE

It is important to note that nothing comes without a challenge; hence, these challenges need not deter HEIs from utilising the e-learning model. As a result, scholars and researchers namely Baguma (2018), Al-Azawei et al (2016), Kisanga and Ireson (2015), E-Learning Africa (2020), Sife et al (2007) and Kilfoil (2015) highlight certain recommendations for successful technology-based education as summarised in the section below.

- i. Institutions in developing countries must not simply copy first world countries, but their ICT integration must be context based.
- ii. Reviewing communication networks, the cost and availability of connections to the internet, with the focus on expanding online educational provision.
- iii. Through subsidies, the government should reduce the cost of personal technology like devices, Wi-Fi, and data.
- iv. Promotion of teacher training and curriculum reviews to suit 21st century learning.
- v. Creating an enabling environment through collaborating with infrastructure providers in order to promote affordability of services e.g. the internet. The argument is that when communities access affordable, high-speed internet, it becomes easy for adoption of distance learning technologies, platforms and systems to take place (E-learning Africa 2020). Hence, governments are encouraged to collaborate with internet providers to provide free or discounted access to all educational sites.
- vi. Increase funding for ICT-based education and start by embracing blended learning before going fully online.

3.7 CHAPTER SUMMARY

Information and communication technology (ICT) has revolutionised all spheres of higher education globally, with its use in teaching and learning increasingly becoming common. Extant literature reveals that the two decades have witnessed the growth of ICT integration in higher education institutions with noticeable affordances in both knowledge administration and information administration. Information and communication technologies are key to supporting powerful, efficient management and administration in the education sector, with technology used from teaching and learning, student administration (i.e., student records management) to general administration activities in an education institution (Maki, 2008; Krishnaveni and Meenakumari, 2010). On the knowledge administration side, ICT has brought transformations to teaching and learning, leading to quality enhancements. ICT integration in higher education is hailed for its potential to make

the current generation of students and academics remain relevant in the evolving world of the digital age. The increasing demand for e-learning in the 21st century teaching and learning places ICT at the centre of pedagogy. Increased adoption of ICTs in the teaching and learning functions of higher education institutions, which are hubs of skills training (Moyo, 2019), is essential to ensure anticipation and preparedness for current and future education challenges.

Literature also reveals that integrating ICT in higher education functions holds both advantages and disadvantages. On the positive side, literature identifies advantages in form of improvement of efficiency, enabling of interactivity and collaboration, improved connectedness and easy access to and sharing of information (Thompson, 2017; Tamm, 2019; Al-Azawei, 2016; Baguma, 2018; Mpungose, 2019). However, research also reveals the potential of ICT to widen the knowledge gap between students from affluent backgrounds and the under-privileged as the latter are likely to travel on the digital slow lane (Al-Azawei 2016; Crawford et al, 2020; Gray et al, 2021; E-Learning Africa, 2020). Employment of ICT may also be regarded as a replacement of staff, hence may face resistance in higher education institutions if not properly explained. However, regardless of these potential disadvantages, the benefits that ICT brings to higher education institutions still outpace the disadvantages. The future of education in the digital era cannot be envisaged in the absence of ICT, as online learning has become buzzwords and the new normal globally.

The following chapter examines in a comparative manner, the extent of technology integration in the knowledge administration (teaching and learning activities) of two higher education institutions of South Africa.

CHAPTER 4: THE LEVEL OF INNOVATION IN SOUTH AFRICAN HIGHER EDUCATION KNOWLEDGE ADMINISTRATION: THE ICT FACTOR

4

4.1 INTRODUCTION AND BACKGROUND

The use of information and communication technology (ICT), driven by pedagogical and socio-economic factors, is fast changing the organisation and instructional delivery of higher education institutions (HEIs). Change has been happening at an uneven pace in the higher education sector driven by tremendous advancements in technology that are seeing far-reaching developments in administrative systems. Hence, scholars believe that information and communication technologies (ICTs) play a crucial role in enhancing the efficiency of management systems in higher education administration (Bhatnagar, 2014; Maki, 2008, Krishnaveni and Meenakumari, 2010, Baguma, 2018). In the past few decades, communication and information systems have changed the nature of higher education, improving the quality of planning and monitoring of institutions' core functions (Moyo, 2019; Bhatnagar, 2014). The diffusion and use of technology as an enabler of the education process has become part of international best practice because of the digital revolution of the 21st century. This has led to one key conclusion by the scholars and researchers that ICT utilisation has become one necessity for higher education administration.

Technology advancements made possible by the Fourth Industrial Revolution are increasingly making information and communication technologies (ICTs) an integral part of both basic and higher education. Literature points to several benefits of integrating technology into teaching and learning (E-learning Africa Report, 2012; Baguma, 2018; Moyo, 2019; Crawford et al, 2020). The digital era has changed the way people communicate, obtain information, and how they learn and teach. Therefore, Riehemann and Jucks (2017) argue that higher education institutions and students should keep up with ICTs' rapid pace of technological innovation, paying particular attention to digital media. Globally, digital media and communication have thus become a part of studying and delivering knowledge. In spite of the uncertainty surrounding the impact of the 4IR transformations on society, nearly any aspect of life, including education, is likely to undergo rapid and intense changes. Thus, incorporating ICTs into the teaching and learning functions of higher education institutions, which are a hub for skill development (Moyo, 2019), is important to ensure anticipation and preparedness for current and future challenges. Furthermore, the OECD (2019) states that institutions of higher learning should move from reactive to proactive policy making on service delivery by anticipating citizens' needs before they ask for service. Hence, one of the OECD's (2019) key recommendations

is the establishment of integrated service delivery methods that ensure accessibility of services and information across multiple channels and methods. Higher education managers should aim for a shift from e-government to digital government in order to employ more strategic approaches to using technologies and foster more participatory, open and innovative governance of higher education institutions.

As digital technology has become more accessible in South Africa, it is necessary to incorporate it into the effective running of all higher learning institutions. However, Yasak and Alias (2015) argue that most studies attempted in the area of ICT application in TVET are mainly theory based without much empirical evidence. Although numerous studies have been carried out on the application of ICT in universities (Nanbam et al, 2018; Chidobi , 2015; Juma and Raihan, 2016; Guma et al, 2013 ; Council on Higher Education (CHE), 2006; UNESCO 2009), there is little / scarcity of literature on the application of ICT in TVET college knowledge administration (Saudi et al 2011). This avenue still requires research attention if ICTs are to bring benefits equally to both universities and TVET institutions.

As Ajayi (2008) observed, *“today’s schools in developing countries are organised around yesterday’s ideal, yesterday’s needs and yesterday’s resources”*. With the arrival of the 4IR, it is imperative that the focus of today’s higher education be in line with the demands posed by current technological advancements and the ever-changing needs of citizens. It is important to note that the current population of students in higher education institutions mostly consists of a cohort of learners who have grown up surrounded by technology. According to Prensky, 2001 and Thinane, 2010, these learners are digital natives, greatly affected and influenced by the arrival and rapid spread of digital technology during the final decades of the 20th century. Such natives have a fluency in the language of technology, computers, video games, the internet and social media interaction, hence do adapt easily to technological changes. As a result, advancements in technology should give the South African higher education sector an opportunity to rethink current service delivery models (SDMs) in order to address service delivery challenges and other social challenges affecting South African communities and students at present and in the future. Internal organisational environments that are capable of delivering on their mandates and increasingly improving their processes to the delight of customers are now a prerequisite for public organisations so that they are responsive to the dynamic external environments (Singh and Karn, 2012). Effective ICT adoption and online service is the way to go for the enhancement of administrative efficiency and meeting the needs of a dynamic and digital society.

Nonetheless, while UNESCO (2009) emphasises the importance of ICT integration in universities, the question to ask is, what role is ICT application playing in other higher

learning institutions other than universities in South Africa? Are TVET colleges, which also fall under the higher education scope in South Africa, equally tapping into the benefits of ICTs in their administration? Saud et al (2011) recognised the scarcity of literature on the application of ICTs in the TVET sector in developing countries. They argue that the area of ICT application in this sector has attracted few scholars of advocacy, with a few contributions from TVET professionals like Kotsik (2009), Basu and Majumdar (2009), and Yasak and Alias (2014).

Seemingly, research in the area of ICT application in administrative functions of a variety of higher education institutions is not very evident in the South African context. Few research studies done have focused on the classroom level importance of ICTs in university institutions without much attention to the other HEIs. Meyer and Grant, 2016 purport that ICT has relevance within education as a tool to support teaching and learning, and its deployment should be in support of best value creation. However, Moyo, (2019) is concerned that regardless of being the second largest economy on the continent after Nigeria, South Africa has not really set a role model in seizing opportunities offered by ICTs in all the institutions of higher learning. Nevertheless, through the country's e-Strategy code named "Digital Society South Africa", the South African government aims to position the country as a significant player in the development and utilisation of ICTs and to accelerate its uptake in all sectors. The South African government recognises ICT as an enabler of speedy service delivery, an intelligence builder and a creator of novel ways of learning, sharing and engaging (DHET, 2017). In spite of this recognition, implementation of ICT strategy and policies is slow and implementation capacity thereof is also limited according to observations made by Moyo (2019) and Meyer Grant (2016).

In the South African context, not many researchers and scholars have studied the application of ICTs in the TVET sector, except for a few like Dzvapatsva, Mitrovik and Dietric, (2014) who focused on studying how social media platforms could improve academic performance at a Further Education and Training (FET) college in South Africa. The TVET sector therefore, seems to have less research attention in the area of ICT integration in its activities, both in terms of teaching and learning and its information management, as studies tend to focus more on basic education and universities. These gaps in literature on ICT usage in TVET colleges need research attention so that TVET institutions do not continue to lag behind in their uptake of technology and improvement of their administrative efficiency. There is a need for more probing into the potential uses and benefits of ICTs in both universities and TVET instructional processes, thus steering the whole Post School Education and Training (PSET) sector in tune with the 21st century drive ushered in by the Fourth Industrial Revolution.

The key objective of this chapter was to determine the level of ICT use in the teaching and learning (instructional) practices of different higher education institutions in South Africa. Furthermore, the study sought to establish factors influencing the adoption of ICTs or non-adoption thereof in the teaching and learning process of the institutions, based on Rogers (2003) innovation adoption factors. This was done through analysing the extent of ICT use in the teaching and learning processes of one TVET college and one university in the Gauteng province. This study chapter sought to answer the following key questions:

- i. In what ways are higher education institutions using ICT in promoting effective knowledge administration (teaching and learning)?
- ii. What factors influence the ICT adoption levels in higher education practices?

4.2 RESEARCH METHODOLOGY

The study incorporated a case study of one university (North West University, Vaal Triangle Campus) and one TVET institution (Sedibeng TVET, Lekoa and Vanderbijlpark Campuses) in order to enable an investigation of a phenomenon within its real life context through an empirical inquiry. A case study allows exploration and analysis of a social unit where inferences from the study may be applied to other units from similar backgrounds. The researcher purposively sampled students and academic staff of the two institutions and recruited them via email, WhatsApp and telephonically. Heads of Departments, senior lecturers and programme coordinators were also conveniently targeted / sampled. The totals for the samples were 150 students for the quantitative survey and 18 respondents for the qualitative study, made up of nine students and nine academic staff. In this section of the study, only lecturing staff and students were respondents to the survey questions, hence not all 27 staff members indicated in the original staff sample were involved. This makes the total sample size to be 168 respondents. The number of campuses per institution from which the samples were derived determined the number of participants, hence there were more TVET participants than university ones in both the quantitative and qualitative samples. The researcher used mixed methods, exploratory sequential design to collect quantitative and qualitative data. Caruth (2013) posits that in this approach the researcher first gathers quantitative data and follows up with gathering qualitative data to enhance on the quantitative findings. The researcher collected quantitative data during the period July and November 2020 using literature study, website analysis of the two institutions' e-services and a structured survey questionnaire shared with students. The questionnaire was distributed online during the Covid-19 pandemic, Alert Levels 5, 4 and 3 in South Africa, owing to challenges posed by the Covid-19 pandemic on contact research. Telephone and in-person semi-structured interviews were conducted with knowledge instructors (lecturing staff) and students sampled from the three campuses from which the study was conducted, that is, NWU Vaal Campus, Sedibeng TVET Lekoa Campus and

Sedibeng TVET Vanderbijlpark Campus between January and February 2021 as follow-up on the quantitative survey findings. Interview questions were derived from the quantitative data. The qualitative sample was independent of the quantitative sample, as participants were not derived from the quantitative sample. The researcher applied the following codes to easily identify the interview respondents:

- i. UNL1 = university lecturer 1
- ii. UNS1 = university student 1
- iii. TVL1 = TVET lecturer
- iv. TVS1 =TVET student 1

4.3 DATA ANALYSIS AND PRESENTATION

The researcher used IBM SPSS Software version 27 to analyse and present the questionnaire data particularly using simplistic descriptive statistics. The empirical findings were based on simple statistical analysis, displayed in frequency tables and graphs. The data from interviews was analysed using thematic analysis. The researcher, triangulated data from the literature study, the quantitative survey, interviews and website analysis to corroborate the emerging themes from the quantitative and qualitative data. Triangulated data informed the study findings and discussion insofar as the integration of technology in higher education institutions knowledge administration is concerned. Descriptive theme categories based on Roger's (2003) innovation characteristics of relative advantage, complexity, compatibility, trialability and observability were drawn and discussed in the presented findings.

4.4 CURRENT LEVEL OF ICT USE IN HIGHER EDUCATION INSTITUTIONS' KNOWLEDGE ADMINISTRATION: DISCUSSION OF FINDINGS

This section presents and discusses the empirical findings of the study done on the use of ICTs for knowledge administration (teaching and learning) by one TVET college and one university in South Africa. Table 4.1 presents students' opinions on the availability of specific online service facilities in their institutions.

Table 4.1 Availability of online service facilities

		TVET COLLEGE			UNIVERSITY		
		YES	NO	TOT AL	YES	NO	TOTAL
E-learning portal availability	Count	70	15	85	64	1	65
	Percentage	82.4 %	17.6 %	100%	98.5 %	1.5%	100%
Online internal assessments	Count	2	83	85	62	3	65
	Percentage	2.4%	97.6 %	100%	95.4 %	4.6%	100%
Online distance learning and exams	Count	7	78	85	61	4	65
	Percentage	8.2%	91.8 %	100%	93.8 %	6.2%	100%

Online library Services	Count	0	85	85	65	0	65
Percentage		0.0%	100%	100%	100%	0.0%	100%

i. Availability of E-learning Management Portals

Learning management systems synonymously known as e-learning portals play a significant role in bringing benefits to both learners and instructors in facilitating teaching and learning (E-learning Africa 2020; Baguma, 2018). The quantitative surveys checked if the institutions had functional e-learning portals that enabled student-student and student-educator interactions at all times. Results (Table 4.1) revealed that both the university and TVET College had in place an electronic portal, which can facilitate online teaching and learning since they are both connected to the internet. Of the 85 TVET college respondents to the questionnaire, the vast majority (42.67%) acknowledged the presence of an e-portal for use by students and lecturer interaction while 21% stated its absence or were not sure of its presence. Most of the university students on the other hand (64 participants), confirmed the presence of the e-learning portal except for one who said it did not exist.

Findings from the website analysis done by the researcher also revealed that both institutions have electronic portals/learning management systems to facilitate teaching and learning, thus corroborating survey findings above. Nonetheless, there are slight differences in the nature of the institutions' Learning Management Systems. The University institution makes use of an open source software eFundi, powered by Sakai while the TVET College makes use of an on premise, licensed product, Sedibeng Online, which is installed on the organisation's server to the specifications of the organisation. Both systems are however remotely accessible even when one is outside the institution's network as they are cloud-based. Both require registered students and staff to have login credentials that give them access to the portal. Analysis of the learning management portals shows that they enable uploading and downloading of teaching and learning materials, support text, graphics as well as audio-video resource sharing. They also provide gateways for both staff and students to upload assessments and download feedback however, with no facility for real-time interaction between users, for example chat room facilities.

In response to the same question during the structured interviews, the majority of students from both the university and TVET College also confirmed having an e-learning portal. UNS2 was quoted saying:

There is an online portal for our institution (eFundi) where we can access uploaded resources and assessments from our lecturers. We also submit our tasks through the same portal; we do not necessarily have to submit paper-based assessments.

One of the TVET respondents (TVS4) also responded thus:

I followed instructions on the website to create passwords that enable us to log into the e-learning portal where we can access information uploaded for us by our lecturers. There we can get assessments and upload them for our lecturers to mark. Furthermore, on the same platform are links that we can click to download YouTube videos and links to support materials from Future Managers where I often look for Exam question papers and memoranda.

TVL4 and UNL3's responses showed agreement on the components of the portal. Their responses in the interviews indicated common e-learning tools on the university and TVET College's portals namely; a notice board, online assessment, teaching and learning resources, evaluation and progress recording tools. This is an indication that both institutions have a positive idea of utilising ICTs for effective on-campus and remote teaching and learning.

ii. ICT Use in Internal Assessments

Another question in the survey checked if institutions were making use of online assessments. In Table 4.1, the majority of TVET students (97.6%) confirm that their institutions do not use online assessments. On the other hand, the majority of university students (95.4%) acknowledged the presence of online assessment services in their institution. Generally, the overall results show that electronic assessment is very common in the university and non-existent in the TVET College showing that the TVET institution still relies on manual processes of assessments regardless of the benefits presented by technology in this area of educational practice.

Mooney et al (2020) suggest that in this era of digital influence, online assessment presents greater advantages to both students and staff. They argue that though online assessments are accessible via a variety of devices ranging from iPad, mobile cell phones, laptops etcetera, with which most of today's generation is familiar. Moreover, such assessments are deemed economic in terms of human logistics (invigilators) and costs associated with organising venues, as students do not need to assemble in large classrooms to take the test. If institutions can take advantage of technology for assessments, then it would go a long way to reduce costs inclusive of printing costs for question papers and answer books as everything will be electronic.

In the face of the Covid-19 challenges affecting the education landscape, Mukhtar et al (2020) opine that online assessments present advantages for education continuity. The absence of paper exchange between learners and lecturers and the non-gathering of students in exam venues also means reduced risks of infection by the virus. These multi-fold advantages of online assessments among others should influence the transition to

online modes in the TVET College in order to comply with requirements of the digital era and Covid-19 pandemic on education.

Nonetheless, it is important to note that certain factors might be affecting the college's move to online assessments. For instance, challenges of technology adoption by expected users and infrastructural barriers (Fatonia, 2020) may have a bearing on the capacity of an institution to employ technology in its assessment practices. Therefore, before labelling the TVET institution as a laggard in technology adoption, research is needed on the preparedness of all types of HEIs in South Africa for effective integration of technology, an issue that is addressed in chapter 7 of this study.

iii. Option for Online Distance Learning and Online Exams in the Institution

This study aimed to determine whether the two institutions had an option for online distance learning as well as conducting exams online for off-campus students as a way of extending access to higher education through virtual classes. Results presented in Table 4.1 revealed that 93.8% of university respondents acknowledged the existence of online distance learning and examinations in their institution, while 91.8% TVET participants indicated that there was no option for online distance learning and examination in their institution.

Through the website analysis, the researcher found out that the university offers distance-learning programmes, thus corroborating quantitative findings. There is a link to open distance learning (ODL) on the website (<https://distance.nwu.ac.za>) and a list of programmes offered is accessible under this link. The site also shows links to distance learning support in the form of

- Student resources
- Lecturer recordings
- Gateway to the university's LMS (eFundi) which provides distance learners with access to the online library, indirect interaction with lecturers as well as links for uploading internal assessments.
- Exam Timetables

The information on the website reveals that the university has learner support centres used for online classes across South Africa and Namibia, thus offering expansion of access to learning opportunities to both local and international students online. The university also has 104 distance learning examination centres used for conducting paper-based exams. The TVET College website however, does not show the availability of distance learning facilities. This indicates that the TVET institution has not yet harnessed the power of technology to expand access to higher education and administer knowledge through online

tuition and distance learning. In other words, the university provides both contact and online access to teaching and learning services while the TVET institution still depends largely on face-to-face pedagogy to fulfil its mandate.

Sustainable Development Goal (SDG4) of the United Nations Development Programme (UNDP) targets the achievement of universal access to quality education for all by 2030. In line with this goal, higher education should ensure noticeable progress towards ensuring provision of equal access to education (E-learning Africa Report, 2019) through creation of online learning opportunities. Universities in South Africa use e-learning in a variety of ways, from email provision, online journals, to creative software solutions for managing information in teaching, research and administrative systems (Bagarukayo and Kalema, (2015). Sadly, the increasing use of ICT in South African higher education has not automatically tipped over into curriculum changes and pedagogical practices in the TVET institution under study. Results of the quantitative survey agree with findings of the website analysis done by the researcher in that they reveal the university as having opportunities for expansion of higher education access through online distance learning, something that is not used by the TVET college. The TVET sector as one of the skills development sectors needs to embrace online distance learning to cater for people who may have limited access, for example the disabled and employed people whose time-schedules cannot allow them to have contact classes. Hence, Cross and Adam, (2007) appraise the potential of ICTs to deliver knowledge flexibly and on a large scale, thus addressing the demand for knowledge economies for a skilled work force and improved access to higher education. The study proposes that TVET management teams consider the importance of online distance learning to extend training opportunities beyond physical boundaries of campuses, thereby helping meet the SDG4 indicated above.

iv. Availability of Online Library Facilities

One aspect of an effective higher education system lies in its ability to maintain a good library management system. The digital age makes this possible by incorporating technology in the management of library systems to make library resources and information available to users 24/7. One of the questions the students were asked was whether their institution had an online library system that enabled remote access to library resources. All the TVET college questionnaire respondents (Table 4.1) indicated the non-availability of an online library in their institution while all university students agreed that an online library was available and accessible for students and lecturers both on campus and remotely.

The researcher checked the website for information that suggests the existence of remotely accessible library services in both the TVET College and the university. The results

indicated that the university has a gateway/ link to the institution's library <https://library.nwu.ac.za/>. The portal/gateway gives monitored access to library, information services, providing both students and staff with links to among other things

- Catalogues which allow searching for journals and books available on the library collection.
- Online book renewals
- Lists of electronic databases like Emerald Insight Journals, Boloka, and Google scholar. In total, the library has 320 databases that are accessible to both staff and registered students anytime.
- Libguides where resources are arranged according to subjects.

This proves that apart from the traditional/physical library on campus, library resources can be accessed remotely via the internet enabling lecturers and students 24/7 access to the library through logging in to the off-campus database. This facility is available to registered students and staff by use of login credentials provided by the university. This proves the ability of distance learning students to access library services anywhere at any time, thus reducing the hassles of having to travel to the campus.

On the TVET website on the other hand, no evidence exists of an internet-accessible library. However, under the college's gateway to academic services, there are links to additional online resources from two book publishers, Future Managers (<https://www.futuremanagers.com/lecturer-support/>) and MacMillan (<https://www.macmillan.co.za/tvet-downloads>). The two publishers provide links to lecturer and student support where they can download materials like lecturer guides, past exam papers, YouTube videos from different courses etc. Nevertheless, these additional resources mainly cover lower levels in the Engineering Department and do not cater for all programmes offered at the college. This means only few people benefit from the link to resources on the website. This generally means TVET students rely mostly on physical library resources, if any, thus they cannot have 24/7 access and resources in digital format (e-books, articles, and other database resources) like their counterparts in the university regardless of being higher education students too. Follow up interviews revealed mixed feelings about the nature of the institutions' library services. One of the students (UNS1) during the structured interview stated:

One good thing is that we access library resources 24/7 through a link provided on the website. As long as one has internet access, there is no need to visit the library daily.

Responding to the same question on the nature of library found in their institution, TVET Student 1 (TVS1) had this to say:

Whenever we need library resources, we have to visit the campus library, which does not have many books, especially modern ones. Most of the books are old and sometimes they have no content covered in the curriculum. I have never accessed the library remotely for the two years I have studied here.

Another student TVS3 was even shocked to hear that a library can be accessed remotely. He only knew that a library was found on the premises of the college as a building with many books. His comment was:

This is the first time I have heard of an internet-accessed library. Is it not that a library is a building where we can find a variety of reading materials that can help us in our studies? If this type of library depends on the internet, I do not think I will benefit from it a lot because internet data is expensive.

This response from TVS3 revealed that the student may represent a number of students who are still uninformed about the possibility of accessing library resources at any place and time through an electronic library system, something a higher education student should be well versed with in order for them to enhance their knowledge acquisition skills. Furthermore, it reveals the digital divide that still prevails among our students as not all have internet connection capability due to data costs that are unaffordable for some. Still on the issue of the nature of the library system, all TVET college staff indicated the absence of remote access to library resources in the institution, agreeing with the students' perception of the institution's library. On the other hand, all staff and students of the university institution confirmed the remote accessibility of an online library in their institution.

The findings from both the questionnaire and interviews corroborated the findings from the website analysis, which revealed the existence of a link to an online library on the university's website with many services ranging from online reservations, access to electronic databases; research support etc., while there was no evidence of such on the TVET College website. Clearly, all the results show that the TVET College has not yet integrated ICTs in the library system therefore; it still depends on physical / traditional library resources for the benefit of its students and staff unlike the university institution. Hence, Omori (2015) emphasises the need for tertiary institutions to upgrade and overhaul their systems to stand up and meet challenges at global level through technological innovation. An upgrade to the institution's LMS to one that can accommodate more features is probably a possible solution to the TVET College's improvement in ICT integration in the library

system. The college can benefit by learning from the university's best practice in ICT managed library system, as the university is just four kilometres from the TVET institution. Considering that TVET students enrol in semester and trimester courses that have short timeframes for completion, an online library would go a long way in enhancing their studies as they would be able to make use of library resources anytime and anywhere.

v. Frequency of e-Learning Portal Use

Amin (2016) observed that the new digital and knowledge society of this millennium demands that academics move from traditional teaching and learning methods towards more innovative ways of instructional delivery. The researcher was therefore interested in finding out if the staff and students of the two institutions were actually using the innovative e-portals frequently as well as the number of e-learning tools on the portals that they actually use, in order to determine their level of use of the portals. Quantitative results were analysed by checking the perceptions of students on the frequency of e-portal use per institution as illustrated in Table 4.2 below.

Table 4.2 e-Portal use frequency per institution and frequency of internet use in studies

	University				TVET College			
	Never	Sometimes	Often	Always	Never	Sometimes	Often	Always
1. Portal use frequency	0	5	38	22	77	8	0	0
	0.0%	7.7%	58.5%	33.8%	90.6%	9.4%	0.0%	0.0%
2. Frequency of internet use in studies	0	4	21	40	5	40	32	8
	0.0%	6.2%	32.3%	61.5%	5.9%	47.1%	37.6	9.4

The question of the tools on the portal that respondents actually use and the frequency of use revealed wide disparities in the level of use of the e-learning portals by university and TVET College respondents. University staff and students indicated using around four of the tools on the portal (eFundi) namely, noticeboard, assessments, learning resources, online library and course guides. UNS3's comment was:

I personally use the portal almost every time I want to submit my tasks to the lecturers for assessment. It is not as if we have a choice, our college policy makes

it compulsory for all students and lecturers to use the portal, especially now that we do not have contact classes due to Covid-19.

Another student (UNS2) mentioned that he regularly checks the noticeboard for announcements from lecturers, upload assessment tasks for marking, check feedback (participation marks), check uploaded resources and link to the library via the e-portal. All of the university students representing 43.33% of the whole student questionnaire sample indicated that staff and students in their institution do use the portal frequently for teaching and learning interaction. One university lecturer also confirmed this when they said:

We have always used the system of online assessments even before the Covid-19 pandemic. University policy requires staff and students to make use of e-Fundi as it enables us to connect remotely. It also allows uploading and downloading of assessments and resources at one's convenient time. With our fully equipped computer labs and offices as well as fast Wi-Fi on our premises, the use of the portal does not pose many challenges to both staff and students.

In view of the responses above, it is evident that the university largely makes use of its e-learning portal, e-Fundi and has yielded benefits from its use for a long time now. University policy coupled with availability of resources seems to be a driving force behind the high adoption of the e-learning portal by both staff and students. TVET respondents however, showed a very limited use of the electronic portal (Sedcol Online) in their teaching and learning practices despite its availability. The majority of TVET participants (90.6 %) hinted that staff and students never use the online learning portal for teaching and learning activities. Generally, the data gives evidence of the unpopularity of the online teaching and learning initiatives in the TVET College as compared to the university. Data in Table 4.2 above shows that the majority of TVET students never connect to the online learning portal while only eight of them sometimes access the portal. This further agrees with the comments by TVS6 who during the interview responded to the same question. When asked how often the students and staff use Sedcol Online, the college's e-learning portal, one student from the engineering department (TVS6) said:

I would be lying if I say the portal is used for teaching and learning. Most of the students just heard about it for the first time when we came back to campuses in June after the hard lockdown. This portal was recently introduced and those without internet connection and WhatsApp groups with their lecturers did not get to know about it during the lockdown break. Even when we came back to campus, lecturers never posted anything on this portal. It seems like it is not functional, I am not sure if in other departments and campuses they are using it.

During one of the interviews with TVET lecturers, TVL3 had this to say:

The only use I ever make of the portal is when I access the Future Managers' link to lecturer support materials. Apart from that, all the other tools are just like window-dressing. It is frustrating to use them seeing that most students complain of having no internet access, hence they never open anything I posted, thus I gave up.

The TVET institution's participants made very little use of the LMS because they felt it was not clearly explained to them. Moreover, it required internet access all the time which most students did not have therefore it was not worth the effort. This supports the observation by Sahin and Thompson (2006) and Rogers (2003) that an LMS implementation requires substantial preparation and convincing users of the innovation's benefits in order for them to embrace it.

One of the questions checked if the students made use of the internet in their studies. Out of all the students who participated in the quantitative survey, only five constituting 3.3% of the sample indicated never using the internet in their studies. A cumulative percentage (96.6%) of the total sample indicated using the internet for study purposes, though at different frequencies as shown in Table 4.2. This is evidence that non-use of the portal is not because students cannot use the internet, but rather an expression of other reasons like not realising its relative advantage (Rogers, 2003). In the Diffusion of Innovations theory, Rogers (2003) argues that the extent to which expected adopters of an innovation perceive the innovation as having more advantages than the current system under use determines its adoption. TVET participants do not seem to have noticed any difference that using the portal brought to their teaching or learning; therefore they did not see the need to change from their usual methods.

According to Rogers (2003), the attributes of an innovation as perceived by its target users/adopters play a significant role in its adoption rate. One such attribute is whether the innovation is compatible with the beliefs, values, past experiences and needs of the adopters. This is because the diffusion of innovations takes place within a social system where expected behaviours and needs can be enablers or barriers to the diffusion of the innovation (Bozalek et al, 2013; Wilson and Conyers, 2015; Rogers, 2003). As administrators and educational leaders think of new approaches to pedagogy, the question to consider is whether the use of educational technology is well matched with the existing experiences and expectations of both staff and students in the institution.

Responses from TVET staff and students thus indicated that they mainly use one tool, the link to staff and student support, which enables them to access limited resources from two book publishers namely Future Managers and McMillan. From the website analysis, the researcher nonetheless, picked up the fact that the resources uploaded on these links do

not cover all courses and levels, although they do provide a narrow extension to resources found in the library for the few programmes that are fortunate to have information. This therefore means there is a great possibility that some of the students and staff do not use the portal at all. It is evident that the TVET e-learning portal, Sedibeng Online will remain more of a “White elephant” until expected users start using it and yielding more benefits from it. Thus, Baguma (2018) emphasised the need for higher education management teams to be prepared to handle increasing demands and expectations of tech-savvy students and staff, especially in these current times of Covid-19 pandemic challenges that render traditional teaching methods ineffective.

vi. Use of emerging digital technologies in teaching and learning

The surveys also checked staff and students’ engagement with specific emerging technologies during teaching and learning practices. The list of emerging/digital technologies checked was populated through findings from literature reviewed on common digital platforms used by staff and students in supporting pedagogy.

Both samples (qualitative and quantitative) were asked about the software / technology they use to enhance teaching / learning. As indicated by Figure 4.1 below, both TVET and university students use WhatsApp on a regular basis for educational purposes.

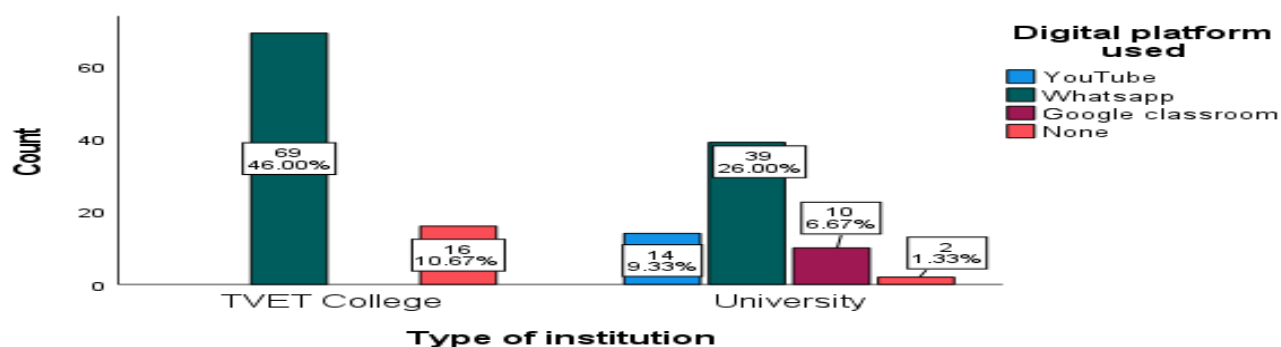


Figure 4.1 Digital platforms used to enhance teaching and learning

The findings in the quantitative survey indicate that TVET students primarily use WhatsApp in the institution to enhance teaching and learning while university students use other platforms namely YouTube (9.33%) and Google classroom (6.67%). TVS5’s comment was:

Most of the time our lecturers send us information via WhatsApp. That is the only technology we can afford as students since data costs are killing most of us. At least most of us have mobile phones and are familiar with this app; it is easier to access information on WhatsApp than on the college portal with its complicated login

processes and the need for more internet data. If the problem of internet access for students is addressed, I think we would also benefit from YouTube videos, Zoom and all other internet-based forms of communication that can benefit us especially during this difficult time of the Covid-19 pandemic. We are losing a lot of learning time due to these reduced class sizes and I don't see us really completing the syllabus.

During the interview, both TVET and university staff indicated using mainly PowerPoint presentations and WhatsApp to supplement their usual face-to-face teaching methods. TVL4 commented saying:

This thing of technology is not very user friendly for some of us who did not have great exposure while growing up. Hence, for me, creating YouTube videos or organising Zoom meetings with my students is something I have never attempted. In addition, where do I get the time seeing that I first need to learn the use of technology and at the same time I need to cover up for lost time and make students ready for the exams?

Another lecturer, UNL1 mentioned that he prefers to use PowerPoint slides to summarise content for his students. He also indicated not using much of the Web 2.0 technologies, as they required lots of time, which they did not have, to put the content together. This agrees with Rogers (2003) who observed that the complexity with which users perceive an innovation influences their rate of adopting. Lecturers in the study perceived the use of emerging technologies as time consuming thus, their preference for PowerPoint. This finding on lecturer preferences in technology use also agrees with findings by Riehemann and Jucks (2017), who observed that while lecturers prefer conventional methods like e-mail, PowerPoint and the institution's LMS, students are more interested in using social media tools (YouTube, WhatsApp, Zoom, Facebook etc.) that fall under the Web 2.0 technologies. Most students being digital natives perceive Web 2.0 technologies as user-friendly based on their day-to-day experience with the technology, which influenced them to adapt them into their learning practices. As such, there is a need to consult with and seek the opinion and perception of both educators and students about the use of technology in knowledge management in a bid to inform future best practices in digital media use in education.

Both findings from the quantitative and qualitative surveys suggest that students are mainly interested in using emerging technologies, based on the number of applications they use compared to lecturers. Most students have turned to the informal e-learning platforms powered by Web 2.0 technologies, (e.g. WhatsApp, Facebook, YouTube, Google search

engines) in conjunction with formal platforms since most students are more exposed and knowledgeable in such informal platforms. Bagarukayo and Kalema (2015) observed that such technologies could act as pedagogical agents that allow learners to identify the people and resources they need to solve problems and add them to their social networks since information spreads fast creating opportunities for networked learning. This finding agrees with Riehemann and Jucks, (2017) who also observed that students identified advantages of digital media in supporting tutorials, learning success, communication and cooperation, implying that it has a higher relative advantage. Hence, Gachago et al (2013) and Mpungose, (2019) suggest that South African higher education institutions should develop governance structures and strategic plans for the infusion of emerging technologies into institutional life. An interesting finding that both TVET and university students are using WhatsApp and YouTube regularly in their studies supports Mpungose (2020) in his argument that South Africa seems to have more mobile learners ('M' learners), who have a higher preference for mobile technologies. This study thus pushes the argument in favour of emerging technologies and their enhancing effect on pedagogical practice in SA higher education teaching and learning environments through their capability to promote prompt feedback, collaboration and student-lecturer / student-student interaction.

The limited number of technologies used by lecturers as compared to students is a reflection of lecturers' divisive attitude towards integrating ICT into pedagogy since lecturers should be the ones to teach and promote e-learning tools. This agrees with innovation scholars (Moyo, 2019; Sife et al, 2007; Kisanga and Ireson, 2015; Fawareh, 2013) who cited the lack of technology adoption by knowledge instructors as a hindering factor to effective e-learning adoption. The findings above however, point to a poor ICT adoption rate among TVET respondents, which can generally be true to the whole institution. From these findings, it is arguable that students, some of whom may be digital natives, are possibly being deprived of embracing technology for efficient and effective knowledge acquisition through the negative attitude shown to technology by knowledge instructors. Conversely, digital immigrants among lecturers and students, i.e., those born before or suffering from the digital divide (Prensky, 2001) may find it difficult to switch between traditional and technological teaching and learning methods. This calls for effective capacity building for ICT use for both staff and students in order to change negative attitudes shown towards the integration of technology in teaching and learning.

4.5 CHAPTER SUMMARY

Although ICT does offer affordances for HEIs to enhance their pedagogy (Prensky, 2001; E-learning Africa Report, 2019; OECD, 2020; Kilfoil, 2015), it is not always readily acceptable by all institutions. While the South African environment offers a lucrative

foundation for ICT integration in higher education, particularly e-learning, not all higher education institutions have effectively integrated technology in their teaching and learning practices. Higher education in South Africa faces the challenge of a diverse range of institutions with different levels of readiness for ICT enhanced practices. A gulf is widening between the technologies used by university and TVET stakeholders, those used by educators and those provided by students. This study sought to determine the extent of ICT integration in the pedagogical practices of one university and one TVET College in South Africa.

Findings of this study revealed wide disparities in the two institutions' adoption and utilisation of ICTs, particularly those that promote an e-learning environment. While the university institution has shown great strides in its use of technology by both students and staff, the TVET institution is seen to be lagging behind in efforts to harness technology for teaching and learning. Generally speaking, there is not much use of the college's e-learning portal (Sedcol Online) by lecturers and students alike, with both of them preferring WhatsApp as a learning and teaching platform. Assessments are still done face-to-face and the TVET institution still depends largely on a traditional library system. Hence, it can be concluded that while the university institution is largely using technology to enhance knowledge administration, the TVET College is more in its infancy stages concerning technology integration in teaching and learning practices. The use of technology is minimal, with a stronger reliance on traditional methods of knowledge administration.

A close analysis however, shows that this limited utilisation of technology among the TVET sector participants should not deem them as foot-draggers according to Rogers, (2003), as this is perpetuated by a variety of factors that are not equally affecting the university. Institutional constraints are shown to influence user willingness and ability to adopt emerging technologies in their practice. These impeding factors in the TVET institution range from poor ICT infrastructure in the campuses, inadequate computer labs for out-of-class use, lack of internet access by most students off-campus, inadequate ICT literacy for staff and students as well as unequal ICT support for staff and students. Given this scenario, although the TVET institution is not showing great strides in their use of technology for knowledge administration, it will be unfair to label the institution as a laggard in the diffusion and adoption of technological innovations. According to Rogers (2003), factors namely complexity, compatibility, relative advantage, observability and trialability of innovations greatly affect the rate of diffusion and adoption of innovations. In this study, the factors of innovation complexity and compatibility played a more negative role on the uptake of e-learning technology in the TVET College than in the university as revealed in quantitative and qualitative findings. Tackling the above-mentioned challenges that

contributed to complexity and incompatibility of innovations in the TVET institution could bring more fruitful outcomes of ICT integration, lest the gap between universities and TVET institutions' use of technology will continue to widen despite them falling under the same higher education sector in South Africa. As a result, the researcher agrees with Moyo (2019) that private-public partnerships are necessary for the acquisition, utilisation, and introduction of technology in teaching and learning, especially in TVET. Furthermore, the implications of this study centre on both students and staff in order for them to have better appreciation of technology and remain relevant in this era of digital governance worldwide. We observe that training and reskilling of educational instructors and students in using state of the art and modern Web 2.0 technologies and other relevant learning management platforms should be made compulsory at all institutions of higher learning. Only then can we realise the effective integration of ICTs in higher education pedagogy.

This chapter mostly checked the level/extent of ICT use in one TVET and one university in their teaching and learning practices. The next chapter sought to examine the different responses of the two institutions to the challenges posed by the Covid-19 pandemic at the same time enabling continued teaching and learning.

CHAPTER 5: SUSPENDING CONTACT WITHOUT STOPPING LEARNING: HIGHER EDUCATION'S TECHNOLOGICAL RESPONSE TO THE COVID-19 PANDEMIC CHALLENGE IN SOUTH AFRICA.

5

5.1 INTRODUCTION AND BACKGROUND

As higher education institutions (HEIs) have been repeatedly affected by disasters and emergencies in the past few decades (Sullivan, 2012), emergency management should be at the centre of higher education administrative activities. The current Covid-19 Pandemic is one such emergency that has left higher education administrators faced with a dilemma in which they have to save lives while saving their academic years through non-disruption of educational programmes. This has called on the attention of higher education sectors worldwide to act quickly in a brisk effort to curb the spread of Coronavirus while maintaining learning and teaching (Crawford et al., 2020). The pandemic is a typically adaptive and transformative challenge requiring educational leaders to design responses that mitigate the challenge with consideration of specific contexts in mind (OECD, 2020). UNESCO (2020) observed that this pandemic has affected 91% of the world's student population and educators, with almost 9.8 million African students experiencing disruptions in their studies. Crawford et al (2020) also agree that the Coronavirus 2019 pandemic has had such a broad effect on the higher education sector worldwide.

Higher education institutions worldwide took diverse responses in a bid to handle the challenges through a variety of pedagogical developments after suspension of on-site classes. A quick desktop analysis by Crawford et al (2020) revealed a variety of higher education provider responses on how to manage the intra-period in a bid to save the academic year, with most of the countries having considered innovation in online education models. Daniel (2020) postulates that many governments ordered a stop to contact tuition at most education institutions, requiring them to move almost overnight to online teaching and virtual learning. In South Africa, the Higher education minister, Dr Nzimande, ordered the closure of all HEIs from March 2020 on an adjusted Alert Level 5 lockdown, encouraging institutions to use digital and online teaching methods to support programmes during and after the strict lockdown (Government SA, 2020; Chothia, 2020). There was however, a need for higher education administrators to ensure the non-disruption of learning programmes at the same time preventing the spread of the virus by ramping up their ability to teach remotely (Daniel, 2020; Chothia, 2020, Crawford et al, 2020; Ali, 2020). Hence, faculties had to rush to adopt online teaching and learning environments, being

mindful of technologies and websites that staff and students could easily access. Wu (2020) believes that this pandemic brought with it a test of organisational agility, with many including South African universities taking initiatives to move content and pedagogy to online environments.

The effects of the plague on Africa's higher education institutions cannot be ignored. In their study on Africa's challenges, apprehensions and responses to the COVID-19 threat, Tamrat and Teffera (2020) found out that going online has not been easy on a continent where only 24% of the population have internet access, marred by poor connectivity, excessive costs, and frequent power interruptions. Nevertheless, reaching out to millions of marginalised students through alternative means and approaches should be a national priority in such trying times (Pinto and Leite, 2020; Ali, 2020; Tamrat and Teffera 2020), so that no student is left behind.

Zhang et al (2020) observed that this transition to new modes of delivery was not a walk-in-the-park for all types of higher education systems, but rather had a huge impact on poorly resourced institutions and on socially disadvantaged students as limited access to technology and the internet negatively affected their ability to engage in an online environment. Daniel (2020) and Zhang et al (2020) have observed the need for institutions, instructors and students of this time, to continue looking for flexible means of fixing damages caused by disruptions to learning trajectories, warning that this pandemic emergency is not a time for implementing institutional plans for distance learning that meant to be implemented over years or months. Daniel (2020) therefore advises teachers to work with what they understand and know; most importantly adjusting real-time classroom teaching by taking advantage of asynchronous teaching and learning. Expansion of online education is likely to increase across all higher education institutions with new waves of infections on the increase (Petronzi and Petronzi, 2020). While they argue that society needs flexible education systems, as it is clear that we face an unpredictable future, scholars like Houlden and Veletsianos (2020) however, questioned higher education's preparedness for the forthcoming digital era learning ushered in by this pandemic. Literature exists on university institutions' responses to the Covid-19 challenges; however, very few studies have been undertaken on how TVET colleges in developing economies are responding to the same Covid-19 imposed challenges on teaching and learning. This chapter sought to determine how the two institutions in this study technologically responded to the Covid-19 pandemic lockdown challenges and how they are managing knowledge administration after the hard lockdown considering that new waves of the viral infections are being reported.

5.2 RESEARCH METHOD

This chapter explored through a comparative study, the methodological responses of one South African university and one TVET college in one province in the face of the Covid-19 pandemic. A descriptive research design making use of a mixed method approach to data collection was used in this study. The population for the study consisted of all staff and students of one university and one TVET college selected for this study, that is, North West University, Vaal Campus and Sedibeng College's Vanderbijlpark and Lekoa Campuses respectively. The sample consisted of 150 student respondents to the survey questionnaire, nine student and nine lecturing staff respondents for the interviews, all selected from the two institutions and making a total sample of 168 participants. The sample excluded administrative staff members as it was only made up of people directly involved in teaching and learning. The two institutions under study were conveniently sampled as they are within close range of the researcher. The researcher also used purposive sampling to develop the quantitative and qualitative samples of both students and lecturing staff whose characteristics are defined for a purpose that is relevant to the study (Andrade, 2021). A self-designed questionnaire collected quantitative data from 150 student participants. A follow-up through structured interviews collected qualitative data from 18 participants comprising nine lecturing staff and nine students from both institutions. Frequency counts and percentages were used in data analysis, calculated by use of SPSS Version 27 to bring out descriptive data. The researcher used thematic content analysis to analyse data from interviews. Finally, research findings of the study were informed by triangulated data from literature study, quantitative and qualitative surveys. The following codes were applied to easily identify the interview respondents:

- v. UNL1 = university lecturer 1
- vi. UNS1 = university student 1
- vii. TVL1 = TVET lecturer1
- viii. TVS1 =TVET student 1

5.3 RESEARCH FINDINGS AND DISCUSSION

5.3.1 Higher education teaching and learning under the covid-19 pandemic in South Africa

i) Lockdown teaching and learning methods per institution

One of the survey questions asked about the service delivery methods adopted by higher education institutions to ensure the continuation of teaching and learning despite the closure of learning institutions during the lockdown. Based on literature reviewed on international practices during the pandemic (E-Learning Africa 2020; Crawford et al, 2020;

Zhang et al, 2020; Zhou et al, 2020), the participants were expected to choose between face-to-face, online, blended methods of teaching and learning. Table 5.1 shows agreement by all TVET college staff members that no teaching and learning took place in the TVET institution during the hard lockdown between March and June 2020 in South Africa.

Table 5.1 Covid-19 lockdown service Delivery methods

		Fully online services	Face-to-face	Blended services	None	
Type of institution	TVET College	Count	0	0	0	17
		% within Type of institution	0.0%	0.0%	0.0%	100%
	University	Count	10	0	0	0
		% within Type of institution	100.0%	0.0%	0.0%	0.0%

In Figure 5.1, TVET student responses corroborated the staff responses in 56.67% representing all TVET students indicated having no teaching and learning activities during the hard lockdown.

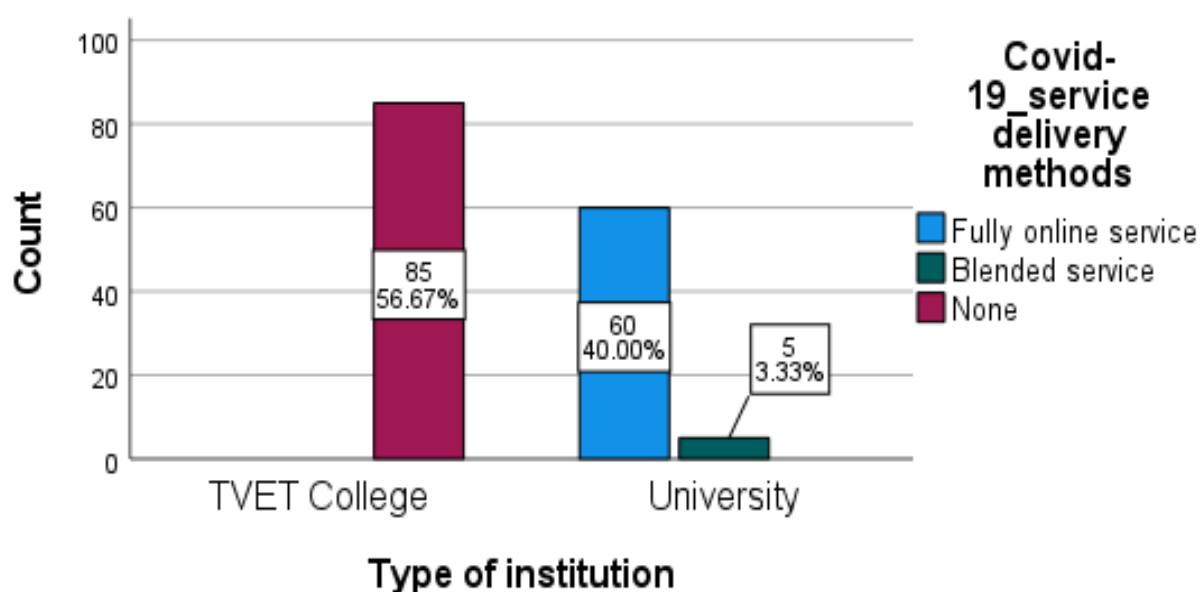


Figure 5.1 Service delivery methods during Covid-19 lockdown: Students' responses

Interview participants corroborated the quantitative findings. TVS1 said:

We did not have any form of teaching and learning but just read our books at home. Yes, a portal for e-learning was introduced during the lockdown, not all of the students heard about it. I regularly logged in but no lecturer posted anything

on that portal for us. Also, it needs students to have an internet connection for us to access it, which most of us cannot afford regularly.

On the other hand, 100% of university staff in Table 5.1 and 40% of university students (Figure 1) indicated that the institution continued with online teaching and learning during the same period. University students (40%) indicated using fully online classes while 3.33% had blended learning. UNS3 confirmed continuity of classes in the university regardless of the lockdown. She said:

We did not have much disruption, only that we had to immediately switch to online learning. We finished all our assessments online and our lecturers continued interacting with us on e-Fundi as well as on WhatsApp.

In Figure 5.2 university students (40.67%) confirmed that the university moved both exams and internal assessments online, making it possible for local and international students who are off-campus to continue with their assessments and write exams in real time. However, TVET students (52%) indicated the absence of online assessments in their institution, meaning exams and assessments could only be done in contact environments.

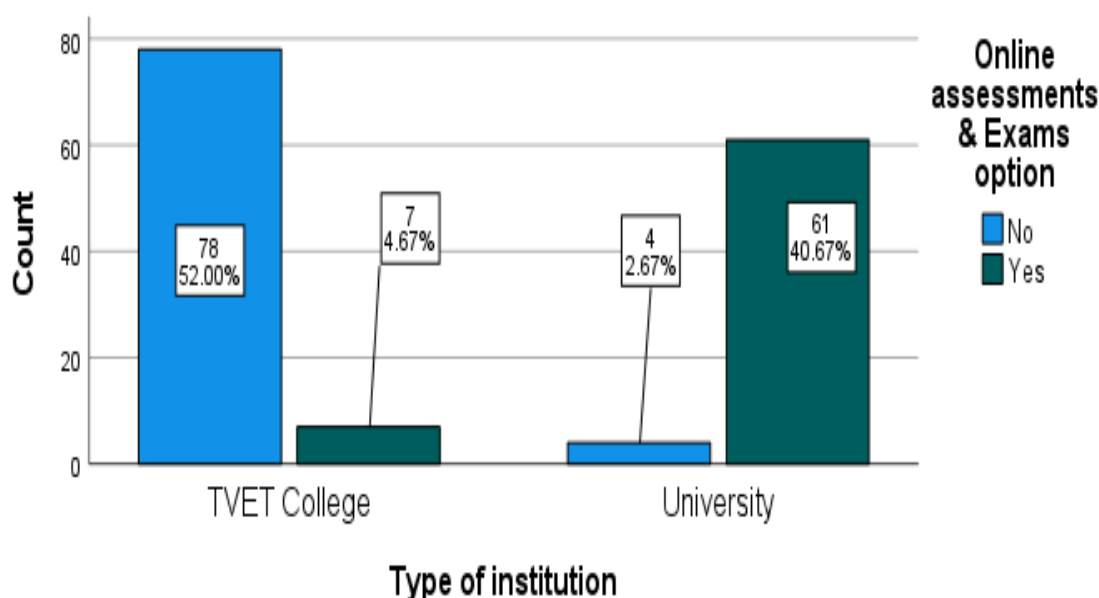


Figure 5.2 Nature of assessments and exams per institution

Suspension of classes did not mean suspension of learning and teaching for the university, but an opportunity for exploring new pedagogy avenues to facilitate uninterrupted teaching and learning. The fact that the university was already using the e-Fundi portal before the lockdown and the availability of internet access is likely the reason why switching to online classes and assessments proved easy for the university staff and students. The recent introduction of the Sedcol Online portal and absence of such supportive factors like quality

internet in the TVET institution contributed to their lack of technological interventions as the institution lacked digital readiness at the onset of the pandemic. These findings agree with Tamrat and Teffera (2020) who observed that, while the need for distance learning was clear from the beginning of the Covid-19 pandemic in most African countries, achieving effective reach to students has proven to be more complex. This is true in this study as the TVET institution could not reach students during this break due to reasons of resource limitations and lack of a readily available e-learning portal highlighted in some responses above. As the pandemic continues to worsen, TVET institution managers need to start thinking of intervention strategies that will enable remote learning to avoid such disruptions to tuition should the country face yet again a lockdown of this nature.

ii) Post-lockdown service delivery methods per institution

What methods were adopted for teaching and learning after easing of lockdown rules? 96.5% of the TVET college students in Table 5.2 and 52.9% of TVET staff in Table 5.3 indicated the return of face-to-face classes after the relaxation of lockdown rules to lockdown rules to Level 3, despite the pandemic still being a threat.

Table 5.2 Teaching and learning methods post-lockdown per institution: Students' responses

		Online method	Face-to-face	Blended services	
Type of institution	TVET College	Count	0	82	3
		% within Type of institution	0.0%	96.5%	3.5%
	University	Count	60	0	5
		% within Type of institution	92.3%	0.0%	7.7%
Total	Count		60	82	8
	% within Type of institution		40.0%	54.7%	5.3%

However, 3.5% of the TVET students and 47.1% of the TVET staff indicated that they were relying on blended services. This shows that some of the staff members, though few, have probably started exploring extra means of enhancing pedagogy in a bid to cater for reduced contact times. It is also possible that some of the staff members who mentioned blended

services (Table 5.3) are administrative staff who attend on a rotational basis, hence sometimes work from home. Of importance is the fact that neither staff nor students indicated the use of online teaching, meaning the college is yet to explore this avenue to enhance pedagogy.

Table 5.3 Post-lockdown teaching and learning methods: Staff responses

			Fully online services	Face- to- face	Blende d service s	Total
Type of institution	TVET College	Count	0	9	8	17
		% within Type of institution	0.0%	52.9 %	47.1%	100.0%
	University	Count	7	0	3	10
		% within Type of institution	70.0%	0.0%	30.0%	100.0%
Total		Count	7	9	11	27
		% within Type of institution	25.9%	33.3 %	40.7%	100.0%

On the other hand, 92.3% of the university student participants in Table 5.2 indicated that the university mainly remained on online service delivery methods after the lockdown, with blended services used for the other 7.7% of the participants. About 70% of the university staff responses in Table 5.3 corroborated the students' views that teaching and learning continued to be online, while 30% indicated that blended services were adopted. Explaining use of blended services, UNS1 said:

Some programmes that require use of laboratories and other specific resources on-campus combine contact classes with online learning. Contact classes for such is only during the practical sessions and practical assessments, while all theory work is done online.

Results above reveal a wide gap in the university and TVET institutions' use of technology for teaching and learning to address the pandemic challenges. The TVET College is still heavily relying on-site classes and examinations while the university has taken advantage of technology to facilitate blended and remote activities in its pedagogy. As Ali (2020) argues, it is high time the institution rethinks its pedagogy, as it is evident now from recurring waves of Covid-19 infections that remote learning is rapidly becoming the new normal. It is time now that the South African higher education department realises that investing in educational technology in all types of institutions has become too important to ignore for the sustainable future of quality education.

iii) Most preferred service delivery method

Considering the challenges faced during the hard lockdown and into post-lockdown, 56.67% of the total student sample (Figure 5.3), indicated their preference for blended services, in which face-to-face instruction is complemented by technology-based instruction. Another 22.7% of the students indicated the preference for face-to-face instruction only and 20.67% preferred fully online services.

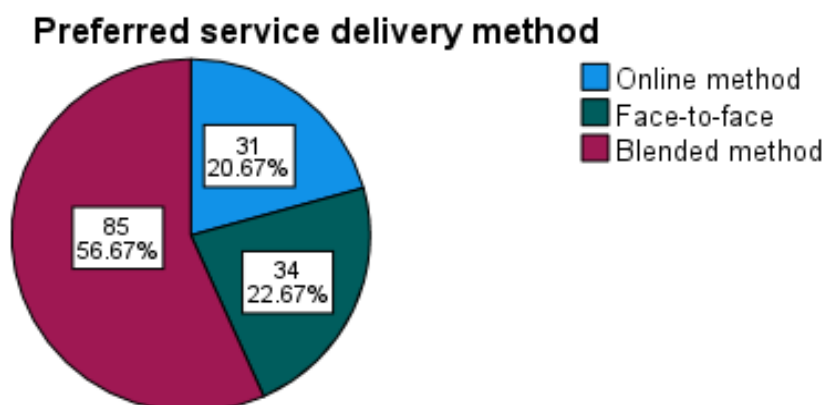


Figure 5.3 Students' most preferred method of service delivery

Staff responses (Figure 5.4) revealed a common preference for blended services by the majority (88.9%) of the participants. Only 11.1% preferred fully online service delivery, two of them being non-academic staff.

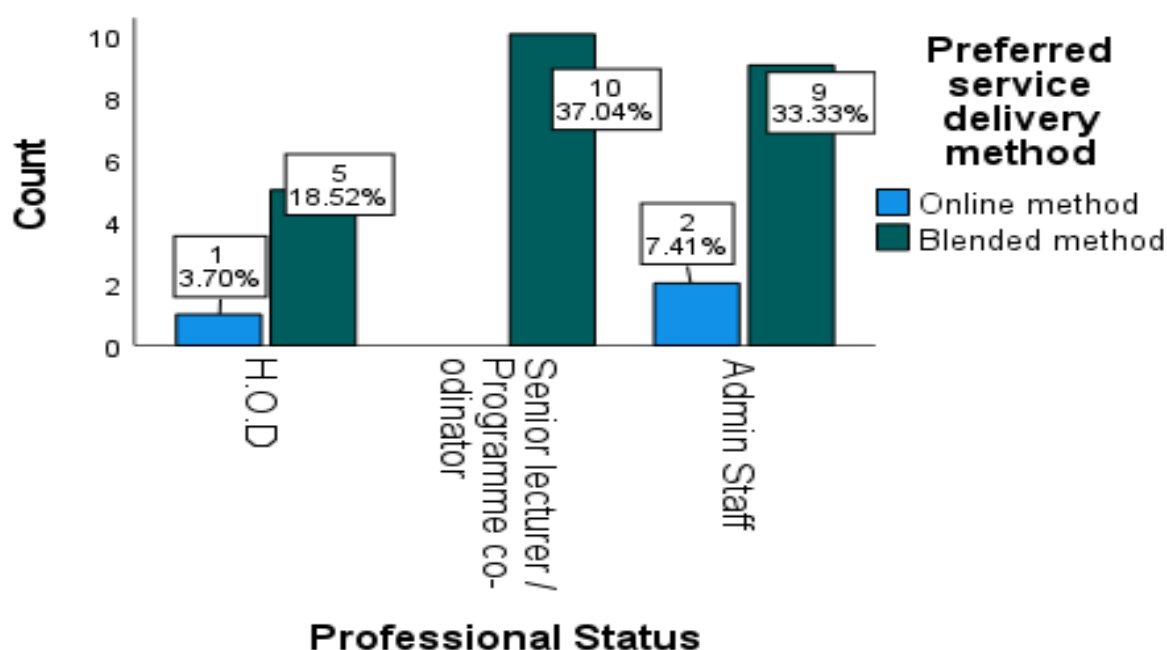


Figure 5.4 Most preferred service delivery method by staff's professional status

The results in figures 5.3 and 5.4 therefore showed that preference for blended services is most common in both institutions among both staff and students, a sign that the presence of an instructor is still of importance when ICTs are integrated into pedagogy. Hence, UNS3 argued:

I prefer blended learning than fully online services; at least it allows me physical engagement with the lecturer when I need clarification on certain issues. Fully online services that do not enable one-to-one engagement leave students in the lurch if they don't understand work posted.

Further analysis of the students' preferred services per institution in Figure 5 however; revealed TVET students as the majority (34%) of those who preferred blended services followed by the university with 22.7%, while 20.7% considered online methods.

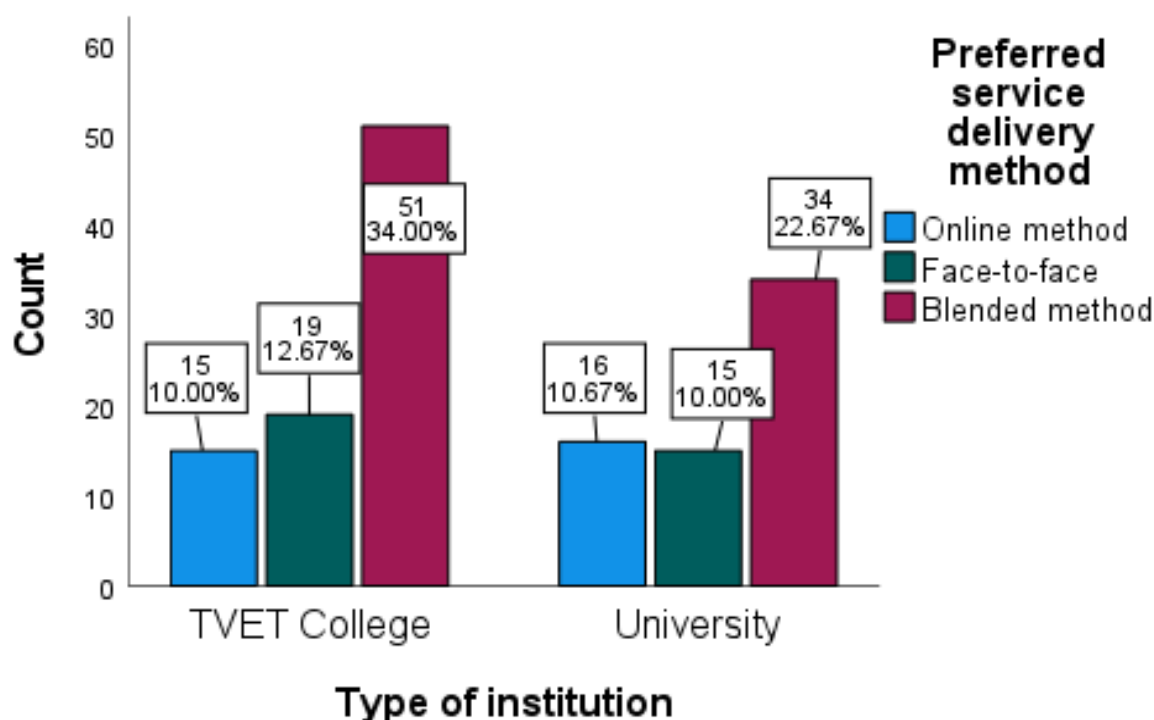


Figure 5.5 Students' most preferred service delivery method per institution

Blended learning is an approach to education that combines online educational materials and opportunities for interaction online with traditional place-based classroom methods. Findings agree with Mine de Klerk, (2013) who posits that blended learning involves contact hours that are carefully fused, (but not replaced), with educational technologies, meaning teaching strategies in blended learning are augmented by effective value-adding ICTs. It therefore requires the physical presence of both teacher and student, an observation also made by the student participants when they showed more preference for blended learning.

Of importance, there is evidence in Figure 3, of 22.67% of students from both institutions who still prefer face-to-face teaching and learning despite the challenges they faced during the lockdown period. During the follow-up interview, TVS5 commented:

Considering the challenges of devices, lack of internet access on-campus and at home, we have to continue having face-to-face learning. At least we are sure that we will not miss a lot of learning since our lecturers will be available to help all the time. Otherwise, if everything goes online, a number of us will be left behind.

Blended learning is an approach to education that combines online educational materials and opportunities for interaction online with traditional place-based classroom methods. Mine de Klerk, (2013) posits that this type of learning involves contact hours that are carefully fused, (but not replaced), with educational technologies. Teaching strategies in blended learning are augmented by effective value-adding ICTs. It therefore requires the physical presence of both teacher and student. Lack of exposure to resources in the form of suitable electronic devices and internet access is likely the reason for some students' hesitation to accept technology-based education and online learning on its own. Thus, Tamrat and Teferra, (2020) encourages institutions to vary alternative means and approaches to teaching and learning to ensure that students with limited access to technology are not left behind, emphasising the importance of blended learning.

Generally, the university institution is far ahead in its plans to combat challenges imposed by the Covid-19 pandemic on teaching and learning than the TVET College. Regardless of recurring waves of infections, teaching and learning is likely to continue as long as staff and students continue to be supported with relevant infrastructure and resources that facilitate digital communication and online learning. The TVET institution on the other hand looks to be struggling in efforts to adjust to the new requirements of teaching and learning under the unpredictable future posed by the Covid-19 pandemic. Daniels (2020) noted there is a need to pay more attention to the needs of TVET institutions, whose practical nature makes remote learning particularly challenging. This practical nature of the TVET curricula calls for teaching and learning methodology that blends traditional classroom instruction for practical work, with synchronous video classrooms to support theory presentations. Researchers have also observed that online learning on its own often creates social isolation (Lynch, 2020; Thompson, 2017). Hence, it is important to include synchronous teaching and learning that allows real-time discussions between instructors and students or peer discussions. Thompson (2017) further advises institution managers adopting technologies to improve upon their educational offerings to look more and more to blended learning.

5.3.2 Factors hampering effective remote teaching and learning of higher education institutions during the covid-19 pandemic.

Table 5.4 presents a summary of the common challenges highlighted by the interview participants from both the university and TVET College in their use of e-Fundi and Sedcol Online portals respectively during and after the hard lockdown.

Table 5.4 Staff and students' perceptions of the institutional LMS

ITEM	UNIVERSITY (N=4)		TVET COLLEGE N=6	
	Students' Responses (N=4)	Staff Responses (N=6)	Students' Responses(N=6)	Staff responses (N=3)
1. Does our institution have a student and staff online portal?	Yes	Yes	Yes	Yes
2. What e-tools are available on e-portal?	- Announcements/ Notice board - Assessments -Evaluation - Resources - link to online library -Course tools - Participation marks (progress records)	- Announcements / Notice board -Assessments -Evaluation - Teaching and learning resources - link to online library -progress recording - Course tools	-Notice board - Online assessments -Progress records - Resources - links to book publishers' resources	- Notice board - Online and feedback assessments -Progress recording - Resources - Student / Lecturer Support
3. Which tools do you use most on the portal?	- Announcements - Online assessments - Resources - Link to the online library - Course tools	- Announcements - Online assessments and evaluation - Online library link - Teaching and Learning resources - Progress records	- Link to Learning resources from book publishers	Lecturer Support link

4. What challenges do you face in using the portal?	-Posted notes are not explained -Lecturers often delay posting work on the portal -Sometimes network errors prevent timeous submission of assessments -No chance to ask questions directly to instructors	-Tiresome process of preparing and marking online assessments.	-Poor internet connection on campus -Inability to connect from home due to lack of internet access. -Lecturers not posting any work on the portal -Lack of sufficient training on use of portal -No computer labs for out of class use -It is not possible to ask questions and get answers from other students and lecturers as questions can be asked on email.	Students complaints of not having internet access at home - Poor internet connection on campus - Inadequate computers for students on campus - Inadequate training on use of the portal - Preparing and marking online assessments is time consuming -Students do not respond to work posted, they do not want to use the portal
5. Which Software / applications do you use to enhance teaching / Learning?	-PowerPoint - YouTube -E-Books - E-library - WhatsApp - Microsoft teams - Zoom meetings	-PowerPoint -Microsoft Teams -Google Classroom	- WhatsApp - PowerPoint - YouTube	-WhatsApp -PowerPoint presentations
6. Which modes of instruction/ learning would you prefer to use?	- Online classes - Blended learning	Online learning Blended learning	-Face-to face classes - Blended learning	Face-to-face classes Blended learning
7. Which benefits do you perceive from using online technology in teaching and learning?	-24/7 access to learning resources and library - non-disruption	- Fast and wide access to resources - creates opportunities for	-Learning can continue off campus especially during Covid-19 pandemic.	Improved access to updated resources

	of learning during strikes and other disturbances - Easy sharing of resources and virtual discussions .	distance learning -useful during crisis times, little disruptions to learning	-Wide access to resources at any time and place.	-speedy exchange of information
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i) Lack of direct contact with instructors and peers online.

Most students lamented problems with unexplained notes posted by lecturers; delayed / no posting of work by lecturers and sometimes network errors affecting submission of tasks especially when one is off-campus. Notably, both university and TVET students mentioned the absence of direct interaction opportunities with lecturers on the portals as a contributing factor to the above problems. UNS1 had this to say:

The problem with the portal is that it does not give us a chance to ask the lecturers for clarity directly when one does not understand the notes posted. It would have been more meaningful if it created possibilities of real time connection with our peers and lecturers through live videos or chats so that we can help each other on the platform.

Rogers (2003) believes that innovations that lack compatibility with user needs and previous systems lead to lack of user interest in adopting the innovations. A common compatibility concern from both university and TVET students is the inability of e-learning portals to facilitate direct interaction between lecturers and students. Mpungose (2019) who observed that while formal e-learning platforms are mostly good at disseminating module content, they lack the necessary social-communication features to allow students to interact with one another and share ideas with their instructors echoes this concern. Mdletshe (2019) opined that students still find the presence of a lecturer valuable, as they need to engage constantly and ask questions. Findings from the quantitative and qualitative surveys therefore, revealed Web 2.0 technologies as more compatible with students' communication values, norms, needs and experiences. Students in both institutions indicated their high interest in using technologies like WhatsApp, YouTube, Google Search and Facebook Live as compared to the formal LMS of the institutions. These technologies are mostly accessible via mobile cell phones and other mobile technologies, which are relatively cheap and common for students. The argument is that most students entering higher education are usually competent users of mobile phones with very good networking

skills acquired through experiential learning (Kilfoil, 2019). Thus, the use of WhatsApp and other Web 2.0 technologies is evidently more compatible with the socio-communicative needs of new generations of students in the digital age, making them more acquainted with these informal e-learning platforms than formal learning management systems.

The students' need for direct interaction with peers and lecturers online concurs with Tamm (2019) who advocates for a combination of asynchronous and synchronous online learning, which often involves real-time online chats, teleconferencing and video conferences. Although e-learning has tangible benefits to teaching and learning, it should not be a total replacement of the instructor but rather an enhancement to pedagogy. However, these two institutions' e-learning portals remove the instructors' physical presence which makes them not to offer both synchronous and asynchronous online learning which Tamm (2019) posits as one of the quickest growing and most popular types of e-learning that often involves real-time online chats, teleconferencing and video conferences. Furthermore the findings above suggest the need for higher education institutions to adapt and implement blended e-learning platforms that combine informal platforms offered by Web 2.0 technologies (e.g. WhatsApp, YouTube, Zoom, Skype), with their formal learning management systems (LMS). This study therefore proposes the integration of social media platforms in formal learning platforms of institutions to enable both staff and students to interact and learn through their lived experiences. The TVET institution may better address the slow uptake of ICTs if the institution puts in place proper ICT policies, infrastructure, compatible and flexible e-learning platforms.

ii) Poor internet infrastructure and inadequate computers

Corroborating findings from students and staff responses in Table 5.4 revealed institutional challenges that include poor internet connection on campus and lack of adequate networked computers as factors hindering effective use of the TVET College's online portal as well as the general use of ICTs in their educational practices. One of the lecturers interviewed from the Engineering department (TVL4) commented thus:

It may look like we do not want the initiative to use the portal but such an initiative needs to be supported by the presence of a good internet connection for both staff and students. With our campus' very poor internet connection, the motivation to use the portal wanes off each time you try to connect only to face network errors. Yes lecturers have mobile routers and data, but what about the students with whom we should connect?

TVET students also shared the same sentiments about the issue of internet connectivity in their campuses. TVS1 was quick to say:

I can't really say we have Wi-Fi connection that benefits us on this campus. There is one spot where all students gather when they want to access the internet. The network is often not strong enough to allow us to download educational resources. We would be glad if this Wi-Fi is upgraded for our benefit.

The findings from the interviews agreed with those from the quantitative data (Table 5.5) in that 52.9% of TVET students perceived the internet connection quality of their campuses to be very poor while 66.2% of university students generally showed satisfaction with their institution's internet quality.

Table 5.5 Internet connection quality per institution

			Very poor	Average	Good	Total
Type of institution	TVET College	Count	45	35	5	85
		% within Type of institution	52.9%	41.2%	5.9%	100.0%
	University	Count	3	19	43	65
		% within Type of institution	4.6%	29.2%	66.2%	100.0%
Total	Count		48	54	48	150
	% within Type of institution		32.0%	36.0%	32.0%	100.0%

This difference in perceptions of internet quality may be because of the differences in the types of internet used by the institutions. A Ghanaian ICT specialist in the E-Learning Africa (2020) report hinted that poor internet infrastructure and inadequate resources are factors that widen the gaps in the adoption of technology by different institutions in the same country, thus affecting educational outcomes. This seems to be the situation affecting different adoption levels by the university and TVET College in this study. TVL5 mentioned that the portal could be a good initiative that could help in addressing the problem caused by reduced contact time with learners due to the covid-19 pandemic. However he was quick to point out how this challenge to students;

Students are usually the ones to suffer, as we do not have supportive Wi-Fi to enable internet access. Moreover, the college's student centre does not have adequate computers for out-of-class use. This coupled with poor or no internet connection on campus poses a big challenge to effective utilisation of the portal.

Furthermore, accessibility of the internet at home by students often determines their adoption of digital technologies for learning. 54.7% of all the students (Table 5.6) confirmed

using mobile network data at home, 16.7% use Wi-Fi while 22% have the privilege of both mobile data and Wi-Fi for internet access. However, 6.7% indicated having no form of internet connection sources at home, all of them being TVET Students.

Table 5.6 Students internet connection sources at home

Type of institution			Mobile network data	Wi-Fi	Mobile internet data and Wi-Fi	No ne	Total
TVET College	Count		61	9	5	10	85
	% within Type of institution		71.8%	10.6%	5.9%	11.8%	100.0%
University	Count		21	16	28	0	65
	% within Type of institution		32.3%	24.6%	43.1%	0.0%	100.0%
Total	Count		82	25	33	10	150
	% within Type of institution		54.7%	16.7%	22.0%	6.7%	100.0%

Findings so far reveal that the challenge of internet access and inadequate computers did not hamper the university's adoption of ICTs as it did in the TVET institution. At an institutional level, challenges of infrastructure and resources did not feature a lot among university participants, indicating the presence of a well-supported environment for technology integration in educational practices in the university. TVET institution management however, needs to ensure that students and staff remain relevant in the 21st century education environment by focusing on the development of sustainable digital infrastructure and other relevant resources that promote a move to ICT integration in the institution's pedagogy. E-Learning Africa (2020), Tamrat and Teferra (2020) and Pinto and Leite (2020) thus recommended creation of an enabling environment through collaborating with internet service providers in order to promote affordability of services in order to make remote learning and teaching a success. This is particularly important especially in

developing countries which are experiencing the infancy of e-learning and need a lot of infrastructural support (Sife et al 2007).

Kilfoil (2015), Gachago et al (2013), Thinyane (2010) and Mdletshe (2019) in their different studies also observed that the use of formal LMSs in South African higher education institutions is often impeded by access challenges as not all students have home access to the internet and devices. On a continent with poor connectivity, high data costs, and only 24% of the population having internet access, online education is tough (Tamrat and Teffera 2020). The high costs of mobile network data across many network providers in South Africa add to the challenge, as many students cannot afford it. University participants however, did not mention this problem as they indicated receiving support in the form of mobile data from their institution. This has contributed a lot to the high uptake of technology-aided teaching and learning in the institution.

A further question asked students about the sufficiency of computers for out-of-class use in their institutions (Table 5.7). Only a few students (9.2%) from the university disagreed that the institution had sufficient computer labs while 47.7% strongly agreed that the university had sufficient computers for students. 43.1% of the university students however, partially agreed that the computers were sufficient, showing their partial satisfaction.

Table 5.7 Students' perceptions of the sufficiency of networked computers

			Disagree	Partially agree	Strongly agree	Total
Type of institution	TVET College	Count	25	38	22	85
		% within Type of institution	29.4%	44.7%	25.9%	100.0%
	University	Count	6	28	31	65
		% within Type of institution	9.2%	43.1%	47.7%	100.0%
Total		Count	31	66	53	150
		% within Type of institution	20.7%	44.0%	35.3%	100.0%

University students who stay in off-campus residences agreed with those who partially agreed to the sufficiency of computer labs to work in while off-campus. UNS3 stated:

Computers at our off-campus residence are not sufficient as compared to the number of students in residence, but half a loaf is better than nothing. Yes on campus, we really have sufficient labs that are open 24/7, which is a good thing.

In the TVET institution, students from mainly the business studies department agreed that their campuses had sufficient computer labs, agreeing with 25.7% of TVET students in Table 5.7 who indicated that they had enough computers. This was because all programmes in business studies have a computer-related subject; hence, most of the students believed computers were available for everyone. TVS2's comment on the sufficiency of computer labs was:

I can agree partially that we have many computer labs; we only have access to the computer labs for one hour per day during the computer practice lesson, as they have to be used throughout the day in lessons with other students from different programmes. The student centre where we can do our personal study has very few computers; I do not think they reach thirty in number on a campus that has more than 2000 students. They are just not enough at all.

Interviews with TVET engineering students however revealed a completely different perception of the availability or sufficiency of computer labs to cater for self-study and research. TVS6 had this to say:

We do not have access to computers where we can do our research on campus, especially us engineering students. If only our student centre could be equipped with computers for students where we can watch videos of some of the things we learn in class and download extra resources.

These comments from the engineering students are the reason why in the quantitative survey, there were 25 participants who totally disagreed that there were sufficient labs for students on the TVET campuses. Thus, it is arguable from the indications above that more computers need to be made available on TVET campuses for out-of-class use. In South Africa, Kilfoil (2015) observed that many households do not have computers and internet access, so having more computers available on campuses would cover the digital gap between those who have and those without resources. Moreover, research has revealed that groups of first year students in South Africa arrive at higher education institutions with limited access to ICTs and computer illiteracy (Mdletshe, 2019; Kilfoil, 2015, Mpungose, 2019). Given this scenario, it is therefore important that all course offerings at higher education level incorporate a computer related subject at least in the first year in a bid to boost the computer and digital skills of all students.

The adoption rate of innovations depends a lot on the possibility of the innovation to be experimented with by its expected adopters before they can fully adopt it (Wilson and Conyers, 2015; Rogers, 2003; Robinson, 2009). Where an innovation can be easily experimented with revealing its potential benefits, there is bound to be less uncertainty on

the part of the expected users to adopt it. The trialability of a technological innovation, particularly an internet-based one is however, influenced by a variety of factors. For instance, the issue of poor/lack of internet access among TVET respondents grossly affected the trialability of the Sedcol Online tools and other technologies, thus discouraging both students and staff from using the portal and other e-learning channels on an accrual basis. Where users lack access to the internet and internet-compatible devices, trying out new technological approaches is problematic, which in turn affects its adoption. For the innovations to be experimented with in a way that arouses the interest of users to adopt them permanently therefore, institution managers need to ensure the availability of supportive resources and infrastructure that make it possible to try out the innovations. These include internet facilities, computers, and skilled trainers among other relevant resources.

iii) **Resistance to change**

Interviews with six TVET lecturers on their strategic interventions towards challenges posed by the recurring waves of the Covid-19 pandemic revealed that most lecturers planned to use WhatsApp if they were to work from home. Only one lecturer indicated plans to use the college portal and Microsoft teams to reach her students. She said:

I have been experimenting with the use of Sedcol Online and Microsoft Teams and I feel they are user-friendly platforms for e-learning. If students have resources like internet bundles and devices, I think this is what I will fall on to reach my students even now when we are affected by reduced contact time due to reduced class sizes.

Regardless of the college having in place a formal teaching and learning platform (Sedcol Online) as well as the availability of other relevant platforms like Teams, Google Classroom, Zoom etcetera, results show that lecturers have not developed favour for adoption of such technologies but rather prefer using WhatsApp which they are familiar with. Various scholars observed that fear of new technology, exposing ignorance, poor mind-set and low attitude towards technology often made educational instructors resist changes brought by technology integration in their work (Moyo, 2019; Sife et al, 2007; Kisanga and Ireson, 2015; Fawareh, 2013). However, if lecturers do not spearhead the use of the college portal, there is no way it will gain the support and appreciation of learners. A positive mind-set to change is important on the part of the lecturing staff in order for the institutions to make progress towards adoption and better diffusion of technology in educational practices.

iv). Inadequate training of staff and students on the use of the e-learning portal

For institution-wide effects of pedagogical changes to be achieved through integration of educational technologies, the dissemination of such technologies into teaching and learning must be understood by their intended users. Rogers (2003) therefore argues that the perceived ease of use of technologies determines their adoption or rejection by users. The issue of inadequate training of TVET College portal users surfaced during interviews, agreeing with the findings from the quantitative survey in Table 5.8. It revealed that 95.3% of TVET students and 76.5% of staff felt that no training was offered to both staff and students on the use of the portal. A further 4.7% of participants from the same institution partially agreed that training was done.

Table 5.8 Staff and students' perception of the online portal use training

			Disagree	Partially agree	Strongly agree	Total
STUDENTS	PERCEPTIONS					
Students	TVET College	Count	81	4	0	85
		% within Type of institution	95.3%	4.7%	0.0%	100.0%
	University	Count	8	28	29	65
		% within Type of institution	12.3%	43.1%	44.6%	100.0%
STAFF PERCEPTIONS						
Staff	TVET College	Count	13	4	0	17
		% within Type of institution	76.5%	23.5%	0.0%	100.0%
University		Count	2	3	5	10
		% within Type of institution	20.0%	30.0%	50.0%	100.0%

Lecturers interviewed on the challenges of e-learning pointed out training as a contributing factor to its non-use in the TVET College. TVL4's comment was:

No person received real training on the use of this portal apart from videos posted on the website. The portal was rolled out during the lockdown hence, staff and students alike had to find their own way around its use. Some of us who were born before technology just got lost and gave up.

On the other hand, the majority of university staff and students (50% and 44.6% respectively) strongly agree that training is offered. Therefore, generally, university members have some better degree of training to understand the use of the portal while in

the TVET College there is no evidence of sufficient training except for training videos posted on the college website. This most probably contributes to the minimal use of the TVET College portal as users lack the confidence in using something they do not properly understand.

Both qualitative and quantitative findings of this study indicated the importance of adopters' understanding of the innovation before they can fully embrace it. Diffusion scholars (Rogers, 2003; Wilson and Conyers, 2015) posit that new ideas with less / no complexity tend to be adopted faster than innovations requiring users to develop new skills. Hence, in introducing any innovation, one needs to check the degree to which the users perceive the innovation as easy to understand and use (which compares with perceived ease-of-use in the Technology Adoption Model), most likely through pilot testing.

In this study, the researcher picked up findings from both qualitative and quantitative surveys, revealing the importance of training expected users of any technological innovation in order for them to be able to use it without many challenges. Both TVET staff and students voiced the issue of inadequate training on the use of the formal e-learning platform, resulting in them not using the platform in their teaching and learning. Lecturers also reported preparation and conducting of online assessments to be cumbersome, hence they chose not to use it. This reinforces the observations made by Kisanga and Ireson (2015), that if teachers lack expertise in using e-learning tools, they are most likely to resist or avoid using them. Capacity building through training goes a long way to motivate expected users of an innovation to adopt it.

It is evident that inadequate training of users may have made TVET staff and students develop cold feet about technology use in the TVET College. Teaching innovation must be flexible and easy to understand. Therefore, it would be a good thing if formal training and workshops were organised for both staff and students to boost their confidence in using the portal and other relevant digital technologies to suit digital era learning. Buthelezi (2018) also observed the need for reskilling and upskilling of TVET lecturers to keep abreast with latest technological developments and deliver blended learning using digital technologies. The researcher found out through website analysis that the TVET institution provided training videos for both staff and students, with systematic guidance on the use of the online / e-learning portal; ranging from creating user credentials, uploading tasks, downloading tasks and resources, provision of feedback to learners, recording of progress marks as well as how to upload YouTube links for videos. Prensky, (2001) and Thinyane, (2010) however, observed that most of the staff in the institutions may be digital immigrants who still find it difficult to navigate computer systems and applications, thus becoming hesitant when it comes to using technology; this may be applicable in this study too. Probably, if training

were done on a face-to-face basis, more users would appreciate and adopt the new pedagogy of online teaching in the TVET College. The OECD, (2020) suggested that education leaders needed to swiftly design responses to pedagogical challenges posed by the Covid-19 pandemic, with specific contexts in mind as the pandemic runs its course; and encouraged institutions to support the continuation of teaching and learning through use of online learning resources. The study therefore suggests the need for capacity building through training and workshops as a continuous process to improve instructional leaders' and students' skills in line with current technological environments ushered in by the Fourth Industrial Revolution. In doing so, the perceived ease-of-use of technological innovations will be high, leading to improved diffusion and adoption of innovations in the teaching and learning landscape.

It is also evident in previous chapters that learners who have computer-related subjects as part of their curriculum stand a better chance of quickly adopting and using technology than those whose programmes do not expose them to computer studies. Therefore, if all programmes could incorporate a computer related subject, students from disadvantaged backgrounds will also become relevant in this new era of technologically driven teaching and learning.

5.4 CHAPTER SUMMARY

The Covid-19 pandemic has posed challenges to higher education institutions' teaching and learning programmes. With the onset of the pandemic in South Africa, there has been a paucity of research on how tertiary institutions, particularly TVET Colleges, are responding to the challenges and coping with continued student engagement during and after lockdowns. The South African university and TVET College in this study have been observed to be responding very differently to the challenges posed by the Covid-19 pandemic. Results reveal that the university institution has managed the challenges through adoption of online pedagogy while teaching and learning came to an abrupt stop during the period March to June 2020 in the TVET College. Post-lockdown, the college still largely depends on traditional modes of instruction (face-to-face contact) regardless of the increasing threats from the pandemic. Inadequate digital infrastructure and resources, lack of training in ICT use and resistance to change by some staff members is hindering effective use of ICT and online platforms for teaching and learning in the TVET College context. However, the study revealed that despite these challenges, both university and TVET college participants showed a common preference for a move to blended teaching and learning, showing their appreciation and understanding of the importance of technology integration in pedagogy as a new normal to handle the ever-increasing challenges of the pandemic. Nevertheless, adoption of online being both a technical and pedagogical challenge, this study proposes upskilling of TVET lecturers through training in online

delivery modes. In the meantime, TVET lecturers are encouraged to explore multimode (blended and remote) teaching and learning approaches as a support for continued teaching and learning during crisis periods so that TVET students do not fall behind.

To improve staff and student access to internet services, the study recommends institutions and governments establish partnerships with network and ICT service providers. The Department of Higher Education and Training should, in its budget, allocate more money to TVET colleges to provide ICT facilities and infrastructure as well as revise curricula to match demand in the digital era. It is also important to incorporate a computer related subject in all course offerings of the colleges in order to increase computer and digital literacy skills of all students so that they fit well in the 21st century technologically driven education and training. Limitations of the study are however in the fact that it was conducted on two institutions only, hence findings cannot be generalised. However, it creates a foundation for further study of South African higher education's response to Covid-19 on a wider scale.

In the next chapter, the study examines the extent of ICT integration in the information administration of the university and TVET College under study.

CHAPTER 6: THE EXTENT OF ICT USE IN HIGHER EDUCATION GENERAL AND STUDENT INFORMATION ADMINISTRATION IN THE DIGITAL COVID-19 ERA: A COMPARATIVE STUDY

6

6.1 INTRODUCTION AND BACKGROUND

Higher education as an entity of the public sector, is aimed at ensuring the delivery of quality and responsive educational services to all citizens in most developing states since the overall prosperity of a nation depends highly on the quality of its higher education system (Krishnaveni and Meenakumari, 2010). Both developing and developed states are thus experiencing tremendous growth in their higher education sectors, which is beginning to make administration (that is day-to-day management of operational activities of the institutions) a mammoth task. Administration is becoming more complex each day due to large quantities of data that need proper handling as well as the increased demand for quality services by higher education stakeholders. The principal factor determining the smooth running and attainment of higher education institutional goals thus lies in the institution's efficient and realistic administration. Literature has, however, revealed the capacity of ICT to enhance administrative efficiency of higher education institutions in such times, making it an indispensable tool for higher education administration.

In the past few years in South Africa, service delivery protests have been rife in most public institutions of higher learning. Angry students, prospective students and sometimes employees often take to the streets in remonstrance against what they feel is poor performance and poor service delivery in the institutions of higher learning. Of late, the TVET and universities as subsystems of the South African higher education system are increasingly recording more incidents of protests, with employees, current and potential students often expressing dissatisfaction with the level of services they are receiving. Central to their grievances are delays in payment of NSFAS funds / allowances, registration hassles, lack of access to higher education among other service delivery challenges. Noruwana (2015) posits that most unrest by citizens extensively reported across the country are results of failure by government or its agencies to deliver information and services efficiently and effectively, that is, administrative inefficiency.

The advent of the Covid-19 pandemic in South Africa in March 2020 nonetheless, added to already existing administrative challenges in the higher education environment. As higher education institutions (HEIs) have been repeatedly affected by disasters and emergencies in the past few decades (Sullivan, 2012), emergency management has to be at the centre of higher education administrative activities. The current Covid-19 global pandemic is one such emergency that has left higher education administrators faced with

the need to devise creative and innovative emergency management tools to address sudden challenges the pandemic imposed on higher education mandates and affecting their administrative efficiency (Crawford et al, 2020; Daniel 2020; Zhou et al, 2020; Zhang et al, 2020). Administrators face a dilemma in which they have to save lives at the same time ensuring efficient, effective and responsive academic and administrative services to staff, students and the public. A central aim of Batho Pele (People First), the guiding framework for public service delivery in South Africa, is to provide a framework that manages the provision of public services to all, and rectifying inequities within existing services. Immediate measures therefore need consideration to lessen the effects of the pandemic on provision of services and information in the most efficient and convenient ways despite the challenges of the pandemic (Agasisti and Soncin, 2021).

Literature reveals that most HEIs globally, including in South Africa, immediately shifted to online pedagogy almost overnight (Daniel, 2020; Tesar 2020, Crawford et al, 2020) in response to the challenges ushered in by the pandemic on educational activities. The South African higher education minister immediately ordered the closure of all institutions in March 2020, encouraging higher education administrators and lecturers to consider using online and digital teaching methods to support programs during the intra period, which later extended into months (Government SA, 2020; Chothia, 2020). However, it is worth noting that higher education functions do not centre only on teaching and learning, but also administrative services for the smooth running of activities. No clear indications were given on how to manage administrative activities in these uncertain situations that faced TVET institutions and universities, which are the major components of higher education in South Africa. Physical distancing and social isolation policies under the Covid-19 era adversely affected student support services and other administrative services, as administrative offices totally closed in most institutions. Originally envisaged to last three months, the pandemic has now extended beyond 18 months in SA, as for how long it will last, remains unknown. The pandemic thus, has become a typically adaptive and transformative challenge that calls for educational administrators and staff to design responses that mitigate both academic and administrative challenges for the present and bleak future ahead (Schleicher, 2020) with consideration of specific institutional contexts in mind. It has brought with it a test of organisational agility to adjust to changing circumstances and enable non-disruption of services through identification of different adaptation strategies.

Various studies conducted prior to the pandemic have however, revealed that the integration of Information Communication Technologies (ICTs), goes a long way to reduce the administrative inefficiencies and enhancing overall administration of higher education institutions in this digital age (Anwar and Matthew, 2014; Krishnaveni and Meenakumari,

2010; Barta et al, 2013; Hashim et al, 2010, Solomon et al, 2016). UNESCO (2009) defines ICT as technologies that assist in the creation, propagation and exchange of information. ICTs should thus play a significant role in supporting efficient, powerful management and administration in this Covid-19 era and beyond, with technology used from student administration, personnel administration to resource administration in any institution (Juma et al, 2016; Maki, 2008; Chisholm, 2009). Higher education institutions should use digital technologies where possible to promote access, improve communication with stakeholders and optimise service provision. Institution managers/administrators are expected to make right and timely, highly responsive and transparent decisions to the current needs of the citizens/clients (Nanbam, Ringim and Ringim 2018) therefore; they should recognise the power of ICTs to enhance their administrative processes despite the pandemic imposed challenges on daily processes and tasks. Gil-Garcia (2018) thus argues that ICTs have become ubiquitous in every public sector organisation as mobile applications, social media, organisational networks and the Internet of Things are rapidly entrenched in the working environment, implying the focus and move towards Digital Government. Consequently, the concept of digital government is increasingly broadening in scope under this digital era of the 21st century, from simple use of ICTs in administration to a perception that ICTs have a pronounced influence on administration and management. (Milakovich, 2012; Gil-Garcia, 2018). The dream of any institution should be an effective and efficient managerial process that leads to quality goal realisation (Shaikh, 2009; Juma et al, 2016) even amid the pandemic challenges. The advent of the Fourth Industrial Revolution (4IR) presents opportunities for higher education administrators to take advantage of the rapid explosion of technologies to provide reliable, innovative multi-channel access to information and essential services as per citizen expectations (Badimo 2019). If effectively used, ICT can help address and respond to challenges of expansion in education, information communication internally and externally, together with addressing the increasing demand for improved educational service quality (Chua, 2004; Voss et al, 2007; Pereda, et al, 2007). In view of this ICT value, there is a need for more focus on technological reforms in higher education administration to mitigate challenges on information administration and to meet the citizens' changing demands brought about by the extraordinary Covid-19 era. With this in mind, both TVET College and university administrators should aim to achieve cost-effective, efficient and responsive service delivery by combating the administrative inefficiencies posed by the continuous use of traditional information and service delivery modes. They need to ask themselves, 'In what ways can we use ICT integration to enhance the achievement of improved administrative efficiency across all our institutional processes?'

Solomon et al (2016) observed that despite ICTs having shown their presence in the higher education sector, their impact has not been very extensive in the functions of different types of higher education institutions other than universities. Moreover, it is argued that ICT integration in higher education tends to incline more towards knowledge administration (teaching and learning) and to be minimally applied in the everyday operations / administration of the institutions (Meenakumari and Krishnaveni, 2011; Saud et al, 2011; Nanbam et al, 2018; Andugo, 2017). With the expanding demand for Higher Education (HE) against an increasingly challenging pandemic in South Africa, the role of ICTs in improving access, quality as well as minimising costs in the administration function institutions therefore needs attention and thorough examination in all different types of HE institutions, not universities only.

Affected by the Covid-19 pandemic, digital transformation in HEIs took a sharp turn with remote work, virtual care, and digital learning becoming part of the new normal. Since Covid-19 is a new occurrence, higher education research during the Covid-19 pandemic in South Africa has been centred mostly on the quality of service in universities (Kele and Mzileni, 2021; Mhlanga and Moloi, 2020; Mncube et al, 2021). There seems to be no work that has investigated the rollout and adoption of online administrative platforms in both universities and TVET colleges. Not much has been done to assess and compare the extent of ICT usage for administrative functions by these institutions. To what extent are administrators of both TVET Colleges and universities going to ensure improvement of administrative efficiency through use of digital technologies in South Africa in this era affected by the Covid-19 pandemic? What role are ICT tools playing in facilitating continuous delivery of administrative services despite challenges posed by the pandemic? This avenue still requires comparative research studies to ascertain if these higher education institutions are equally benefitting from affordances of ICT integration in their administrative functions and processes. Such studies will help identify ICT integration issues/challenges in various institutions of higher learning and address them so that no institution remains behind in embracing technology for improved administrative efficiency, now and in the unforeseeable future of the Covid-19 era.

Given this background, studies on the role of ICT integration in administrative functions of South African public higher education institutions during the Covid-19 pandemic are essential to cover these identified literature gaps. There is a need for further exploration of TVETs' extent and level of requirement for ICT integration as compared to universities since no such research is evident. This study aimed to assess and compare the extent to which one university and one TVET college in South Africa are using ICT to enhance their administration of general information and student information during this Covid-19 era.

6.2 RESEARCH METHODS

The study employed a descriptive survey using a quantitative data collection approach. The study was conducted in one university and one TVET College namely North West University (NWU) Vaal Triangle Campus and Sedibeng TVET College (Vanderbijlpark and Lekoa campuses) respectively. The sample consisted of 27 staff members (senior management and administrative) as well as 150 students from both institutions making the total sample of 177 participants. The instruments for data collection were two self-designed questionnaires for students and staff with questions that sought to gauge the participants' opinion on the extent of ICT use in the general and student information administration of their institutions. The researcher also conducted a website analysis of online services available in the two institutions under study to supplement data collected through the survey questionnaire. Survey data was triangulated with data collected through Website analysis and literature study supporting the value of electronic administration in order to inform the study findings.

6.3 FINDINGS AND DISCUSSION

This section presents and discusses the empirical findings of the study.

6.3.1 THE EXTENT OF ICT APPLICATION IN GENERAL ADMINISTRATION OF INSTITUTIONS

i. Use of institutional websites for information communication

A website as a communication tool provides a quick and easy way of communicating information between an organisation and various internal and external stakeholders. Table 6.1 presents participants' perception of the nature of the institutions' websites. The data indicate that both institutions have functional websites that are used to disseminate information to the public and market the institutions' activities and programmes. The majority of participants (50% of the sample) strongly agree that the websites are regularly updated, 44.7% of the participants partially agree while only 5.3% do not agree that the websites are regularly updated.

Table 6.1 Nature of Institutional Websites

			Disagree	Partially agree	Strongly agree	Total
Type of institution	TVET College	Count	5	46	34	85
		% within Type of institution	5.9%	54.1%	40.0%	100.0%
	University	Count	3	21	41	65
		% within Type of institution	4.6%	32.3%	63.1%	100.0%
Total	Count		8	67	75	150
	% within Type of institution		5.3%	44.7%	50.0%	100.0%

Results from website analysis corroborated both quantitative and literature findings on the use of websites for general information administration by the two institutions. The researcher noticed that both institutions' websites provide both static information and an interactive platform through provision of hyperlinks to internal and external services. For example, both institutions' websites provide links to online applications, employment/jobs portal, returning student registration portals, bursary application links and gateways to academic portals for staff and registered students. Therefore, ICT in the form of websites and the internet, have proven to be an important aspect in ensuring the online presence and interactions of both institutions.

North West University and Sedibeng TVET College both use ICT to display general institutional information on their websites. This information includes the institutions' contact details, programmes offered, general notices to staff and students, academic services among other important information. In general, both institutions value the benefits of sharing institutional information via their websites to reach many stakeholders via the internet, and this in itself corroborates their use of ICT in the administration of general information. Haigh (2014), also emphasises the importance of the internet and corporate websites for public relations. However, it is important to keep in mind that disseminating static information alone cannot do a lot towards relationship building for organisations. While static information like contact information, company products and services, vision and mission of an organisation helps stakeholders understand what an organisation is about, relationships with the public are built through the interactivity of the website and the

public. The development of customer-centred websites is an essential component of many organizations' overall management information systems. Hite and Railsback (2010) thus argue that higher education institution websites attract a variety of external and internal stakeholders, therefore they should provide vital interactive information for on-campus and off-campus users who include registered students, prospective students, donors and parents. However, analysis of the college website revealed that information is not up-to-date, agreeing with 54.1% of college students who partially agreed that the website is updated regularly. On trying to check the college calendar and exam dates the researcher only found information about the previous semester instead of the current semester. TVET administrators can do more to improve the website's functionality by making sure that it receives regular updates while enabling/creating more interactive links for knowledge administration and remote services. Websites should provide an easier way to handle customer service and information dissemination, especially at a time when face-to-face services are limited due to Covid-19 restrictions and policies. For example, if a link is added that connects students to electronic library services, distance education as well as DIY (do it yourself services) it will make the website to be more customer-centred and improve convenience in stakeholder services and online communication.

ii. ICT use in expansion of access to higher education

Studies have revealed that demand for higher education often outstrips supply in most countries (Sarkar, 2012; Adebayo, 2013) and South Africa is not spared. Although access to higher education in the Covid-19 era has become a challenge due to limited spaces under pandemic restrictions and policies, the Covid-19 pandemic presents an opportunity to deploy technologies to enhance access to higher education. The use of ICT in online distance education provision has the power to bridge the access gap in higher education that currently affects the country. Analysis of the websites of the university and TVET College revealed that the university has extended HE access opportunities through offering online distance learning opportunities to the public. The university website has a portal for online distance learning that facilitates admissions, registrations, access to course materials, student-lecturer interactions as well as online examinations for registered distance education students. This means that despite challenges posed by the pandemic, access to education is possible, making programmes to continue running smoothly. Distance learning opportunities are, however, not available in the TVET institution as evidenced by absence of information on distance learning on the website. The TVET institution should consider adopting online platforms that make distance education possible to create access opportunities for those whose circumstances cannot allow for on-campus classes, like those with comorbidities that may expose them to the risks of virus infections

if they attend face-to-face classes. Institutions offering online distance learning extend educational opportunities to those who cannot enrol on campus for certain reasons even though they have a hunger for higher education. UNESCO (2009) thus opined ICT to handle geographical limitations for the intake of students and to facilitate cross-border higher education. Should the TVET consider offering online distance education, this may help in addressing challenges of access to people like the employed, physically challenged, international applicants affected by lockdowns, thereby expanding the college's sphere of influence and meeting the educational needs of citizens.

iii. ICT use for internal electronic communication

Table 6.2 presents perceptions of participants on the use of electronic announcements (SMS, Email, Electronic notice boards etc.) in their institutions. 83.1% of university student participants and 53.3% of TVET student participants, both representing the majority of the sample, strongly agreed that their institutions make use of electronic message systems. This shows the institutions' acknowledgement of the power of technology to improve speed of information delivery, agreeing with Egoeze et al (2018), and to handle challenges presented by paper communication. However, 23.3% of the sample partially agreed that electronic communication is used while 5.3% mostly made up of TVET participants, totally disagreed with the existence of such communication in their institutions.

Table 6.2 Students' perceptions of electronic announcements in the Institutions

				Partially agree	Strongly agree	Tota l
		Disagree				
Type of institution	TVET College	Count	13	25	47	85
		% within Type of institution	15.3%	29.4%	55.3%	100.0%
	University	Count	1	10	54	65
		% within Type of institution	1.5%	15.4%	83.1%	100.0%
Total		Count	14	35	101	150
		% within Type of institution	5.3%	23.3%	67.3%	100.0%

The fact that 15.3% of the TVET students disagreed with the effectiveness of electronic communication in their institution may be an indication that the communication methods used do not reach all students. The methods therefore need to be evaluated to see where they are falling short. It is also clear that electronic communication is not the only method of communication in both institutions as evidenced by 23.3% of the sample who partially agreed. This may mean other non-electronic means of communications like paper-based

and oral methods are still integrated in the information management of the institutions. Considering the fact that the Covid-19 virus is known to spread through contact with infected surfaces, it would be better if the institutions make use of more electronic channels of communication. Administrators should take advantage of the technology explosion of this digital era to provide more electronic and multi access channels of communication that enhance speedy delivery of information to large groups of stakeholder, like emails, SMS, electronic notice boards to mention a few. Since the Covid-19 pandemic began, social media has become a vital tool for information generation, dissemination, and service delivery in most organisations. Higher education can tap into the benefits of Web 2.0 technologies like WhatsApp and Facebook to reach both students, staff and the public at large. By a shift to more electronic channels of communication, institutions stand to cut costs while improving efficiency in their communication processes with both internal and external stakeholders.

iv. ICT use in Student Financial Administration

Table 6.3 presents participants' opinion of the use of ICTs by finance teams in the general administration of student finances. In Table 6.3, the majority of university and TVET participants (83.1% and 55.3% respectively) strongly agree that their institutions practise online bursary processing and fees payment, with 31.3% of the total sample partially agreeing and 7.3% disagreeing with the statement.

Table 6.3 Online bursary and fees processing

				Partially agree	Strongly agree	Total
				Disagree		
Type of institution	TVET College	Count	9	22	54	85
		% within Type of institution	10.6%	25.9%	63.5%	100.0 %
	University	Count	2	25	38	65
		% within Type of institution	3.1%	38.5%	58.5%	100.0 %
Total	Count		11	47	92	150
	% within Type of institution		7.3%	31.3%	61.3%	100.0 %

These results show that both organisations value the power of ICT to ensure secure, speedy financial transactions and reduce challenges posed by handling hard cash at the campuses. The findings are in full agreement with Gómez-Sierra and López-Bustamante (2019) who argue that with just a few clicks from a laptop or smartphone, electronic payment methods make processing of requests much easier, more efficient, user-friendly

and transparent for the end users. Therefore, traditional payments and transactions processes in these higher education institutions have started to be replaced by the use of gateways to online payment services appropriate for this era of digital governance. However, those who partially agreed to online bursary applications may represent some people who are not yet fully capable of completing online transactions due to low digital literacy levels. There is a need to capacitate all students on use of digitally enhanced transactions through use of various ICT tools, from use of mobile banking to electronic transfers, by providing training particularly to new students who may not have used the systems before. This in turn will help fit them in the digitally driven environments that characterise the uncertain future under the Covid-19 era. Online financial transactions also go a long way to reduce the work of finance teams in institutions as well as ensuring transparency in handling of finances, as accounts are reconciled and consolidated electronically, with fewer chances of mistakes than when manual processes are used. The more institutions employ ICT in financial administration, the easier financial reporting and accountability becomes.

v. The Influence of ICT on access control on campuses

A critical factor for campus security is the need to control people coming in and out of the institutions' premises. Access control is one aspect that is key to the administrative functions of institutions with ICT playing a vital role in managing and controlling physical access into institutions' premises (Andugo, 2017). According to Norman (2017), electronic access control systems have benefits in their potential to increase the overall security in both the physical and virtual sphere of an organisation as they provide complete control over who can access restricted areas and when they can. Tables 6.4 and 6.5 present results of participants' opinions on the nature of access control in the two institutions in this study.

Table 6.4 Perceptions on the use of electronic campus access control

			Disagree	Partially agree	Strongly agree	Total
Staff Responses	TVET College	Count	10	5	2	17
		Percentage	58.8%	29.4%	11.8%	100.0%
	University	Count	0	0	10	10
		Percentage	0.0%	0.0%	100.0%	100.0%
Student Responses	TVET College	Count	39	23	23	85
		Percentage	45.9%	27.1%	27.1%	100.0%
	University	Count	1	7	57	65
		Percentage	1.5%	10.8%	87.7%	100.0%

In Table 6.4 above, results show a university with highly controlled access of people to the campuses. All the university staff (100%) and the majority of university students (87.7%) strongly agreed that access is controlled electronically for anyone wishing to enter the university campus premises. This means the university has a strong system of ensuring authorised entry of both internal and external stakeholders onto its premises thus determining the legality of a subject on the territory of the educational campus at any given time. On the other hand, the majority of TVET staff and students (58.8% and 45.9% respectively) pointed out the absence of electronic campus access control in the institution. 27.5% (made of staff and students) partially agreed to the existence of electronic access while 24.5% strongly agreed. These differences in responses are an indication of inconsistencies in the way access is controlled on TVET college campuses, hence, suggest campuses where there is no uniform and strict control of entry and exit of people at all times. Dlamini and Olanrewaju (2021) however, advise that in the wake of various safety threats on South African HEI environments lately, there is a rising need for institutions to intensify safety measures on campuses for students, staff and security personnel through more restrictive measures to physical access control. Manual systems of access control that include body searches and temperature checks for Covid-19 symptom assessment can easily be replaced by biometric scanners, electronic sanitisation and temperature booths, thus reducing contact between security personnel and anyone entering the premises. Institution managers should put in place proactive rather than reactive safety and security strategies to guarantee the physical and health safety of both people and property.

Table 6.5 Use of electronic access to offices labs, workshops and libraries: Staff responses

				Partially agree	Strongly agree	Total
Disagree						
Type of institution	TVET College	Count	13	3	1	17
		Percentage	76.5%	17.6%	5.9%	100.0%
	University	Count	0	1	9	10
		Percentage	0.0%	10.0%	90.0%	100.0%
Total	Count		13	4	10	27
	Percentage		48.1%	14.8%	37.0%	100.0%

Voon et al (2016) further emphasise the need to limit access to sensitive areas and protect resources in various locations inclusive of classrooms, labs, workshops and offices on campuses. However, results in Table 6.6 show different views by university and TVET staff and student participants on the nature of physical access control into different locations within the campuses.

Table 6.6 E-access to workshops, classroom, labs/workshops and library: Students responses

				No	Yes	Total
Type of TVET College institution	Count	82	3	85	96.5%	3.5%
	Percentage	96.5%	3.5%	100.0%	96.9%	3.1%
University	Count	2	63	65	3.1%	96.9%
	Percentage	3.1%	96.9%	100.0%	96.9%	3.1%

Results reveal that the university strongly monitors what happens on its premises electronically, as the majority of staff and students (100% and 96.9% respectively) affirmed the use of electronically controlled access to classrooms, workshops, labs, offices and library. Apparently, the majority of TVET staff and students (76.5% and 96.5% respectively) indicated lack of electronic access control measures to the same spaces on their institution campuses. These results are an indication that access to most campus properties is not electronically controlled in the TVET College, thus allowing entry by many people to different areas without strict controls. This probably means the college largely depends on traditional access control measures in the form of on-site security personnel/guards, locks and keys for handling physical access control. Research has however revealed increasing threats to institutional safety and security posed by a variety of factors ranging from increasing Covid-19 infections among students and staff, strikes, thefts, vandalism, gender-based violence in South African HE environments (Dlamini and Olanrewaju, 2021; Devitsyna et al, 2019 ; Adisa et al, 2019). One wonders whether it is still relevant to depend on the presence of security guards only to maintain safety and security. There is need for preventative rather than reactive strategies to enhance safety and security of TVET campus stakeholders and property. Institutional administrators should ask themselves how safe their environments are and what systems they should put in place to improve physical access control and ensure health safety, considering their location, demographics and security budgets. Devitsyna et al (2019) and Voon et al (2016) therefore hint at the importance of incorporating the application of biometric identification methods or multifunctional smart cards for access control in different areas of the campuses, thus improving systems for ensuring safety and security of campus people and property. Making such decisions should be based on the hypothesis that the more electronic access control systems are used, the safer the stakeholders and property of the institution become. In this digital era supported by technological advancements, both university and TVET institution

managers should realise the power of technology enhanced security systems to improve campus access control and security.

6.3.2 ICT APPLICATION IN STUDENT INFORMATION ADMINISTRATION

The nature of higher education information administration is rapidly changing due to the penetration of communication and information systems that allow information transfer, storage, retrieval and processing by almost all who work or interact with institutions of higher education. This is in turn influencing student administration, which is an integral part of information administration involving all activities in the student's academic life cycle (Augustine Kasozi, 2012; Maki 2008). With the increase in demand for higher education, despite the Covid-19 effects on teaching and learning, online admissions and registration, online exam timetabling, as well as online academic delivery of transcripts as part of student information administration, have become an essential solution for higher education administrators. Data in Tables 6.7 – 6.12 presents findings of the extent to which Sedibeng TVET college and North West university administrators are applying ICT in student information administration.

i. Use of networked computer systems and electronic databases.

Computer networks as technological applications that enable the flow of information across boundaries (Yang, 1991) consist of electronic systems inclusive of word processors, database management systems and spreadsheets that are capable of processing and storing large amounts of data/information. In Table 6.7, results indicate agreement by the majority of TVET staff (58.8%) and university staff (80%) on the extensive use of networked computers in administrative duties in the two institutions.

Table 6.7 Use of networked computer systems

				Disagree	Partially agree	Strongly agree	Total
Type of institution	TVET College	Count	1	6	10	17	
		Percentage	5.9%	35.3%	58.8%	100.0%	
	University	Count	0	2	8	10	
		Percentage	0.0%	20.0%	80.0%	100.0%	

This suggests that both TVET and University administrators realise the affordances of ICT in enhancing administrative efficiency through sharing of information on electronic databases, making administrative processes to be performed with less to no duplication of work. Juma et al (2016) posit that such efficiency is achieved through the organisation of information into easily accessible digital formats and increased coordination among administrative staff enabling timely, structured and efficient sharing of information. The Covid-19 requirements for workers to work from home has exposed weaknesses in many paper-based processes. Used properly, online computer networks facilitate access to student and staff information online, therefore reducing duplication of data and tasks, and promoting paperless offices that suit the current Covid-19 world. However, although networked computers are used for administrative functions, there are some staff members from both the university and TVET college (29.6%) who showed partial agreement that they are extensively used. This shows that there is still a need for improving information management and sharing in both institutions in a way that makes all staff members satisfied. Hence, Abratiguin (2021) opine administrators to lay good groundwork for efficient institutions through a shift from manual to automated tasks. Necessary action should be taken to ensure that the influence of ICT is recognized across all administrative services and functions for maximum administrative efficiency. Establishing reliable electronic databases is essential to ensure seamless data transfer across all functions of institutions, thus improving on data sharing and workflow.

ii. ICT use in student admission and registration processes

One area of citizens' rising expectations is a change to custom service delivery models that ensure accessibility, convenience and efficiency of services (Kosorukov, 2017). With the advent of the Covid-19 challenges on higher education, queuing at South African institutional premises during the admission and registration periods is no longer advisable in the face of increasing infections and new variants of the virus. These gatherings are potential super-spreaders if not properly managed. In streamlining services, most higher education are turning to online admission processes to ensure expanded access to education, ensuring health safety while bringing educational services to citizens for their convenience.

Findings in (Table 6.8) reveal the extent of ICT use for admission processes of the university and TVET College in this study. The majority of TVET participants (90.6%) indicated that there is no use of online application for admissions into the college while 2.4% who partially agreed confirmed some existence of online application use for admissions. Seemingly, the TVET College has not fully appreciated the efficiency ICT brings to admission and registration processes under the strict Covid-19 restrictions. It also

seems TVET campuses are not using the same systems of admission, as 7.1% strongly agreed they use online applications. Follow-up on raw data showed the Engineering students as ones who used the system of online applications. The university on the other hand has revealed effective use of ICT in facilitation of its admission processes as 92.3% strongly agreed to online application use in the institution.

Table 6.8 Use of online application/admission system only

			Disagre e	Partially agree	Strongl y agree	Total
Type of institution	TVET College	Count	77	2	6	85
		Percentage	90.6%	2.4%	7.1%	100.0%
	University	Count	0	5	60	65
		Percentage	0.0%	7.7%	92.3%	100.0%

Similarly, in Table 6.9, data shows that registration processes in the TVET institutions are still done on-site as indicated by the majority 100% of TVET participants disagreeing that registrations are done online. The majority of university participants (80%) however, strongly agreed that registrations are completed online, 12.3% partially agreed and 7.7% totally disagreed that registrations are online.

Table 6.9 Online registrations for returning students

			Disagree	Partially agree	Strongly agree	Total
Type of institution	TVET College	Count	85	0	0	85
		% within Type of institution	100.0%	0.0%	0.0%	100.0%
	University	Count	5	8	52	65
		% within Type of institution	7.7%	12.3%	80.0%	100.0%

Research has nonetheless shown that ICT helps reduce queueing on higher education campuses during admission and registration periods, as well as improving turn-around times for services (Egoeze, et al, 2018; Juma et al, 2016; Jaleel, 2014). Conversely, its application in TVET College admissions and registrations is still very low as indicated in the findings above. Administrators in the TVET institution should consider harnessing the power of technology through cloud hosting services to enable convenient and efficient

admission and registration processes. Apart from challenges of the Covid-19 pandemic, manual registrations have a tendency to take long, often extending into teaching and learning time thus reducing the time meant for tuition. With online applications, processes of capturing applicant data and responding back to applicants are faster, reducing the workforce needed for data capturing. Therefore, administrators in the TVET institution should appreciate the power of ICT to make admission and registration processes more flexible, convenient for stakeholders and less time-consuming, thus making their academic programmes start at the scheduled times. With cutting-edge scanning technology, completed documents are easily captured in seconds, facilitating accurate data entry and easy admissions and registration for students.

iii. Use of electronic examination timetables and progress report

With the advent of technology, most higher education institutions value the power of ICT in delivering examination information to both staff and students. ICT is renowned for its efficiency in conveying speedy information to many people at the same time; hence, electronic timetables are fast replacing paper-based ones. In Table 6.10 however, the majority (97.6%) of TVET student participants indicated not receiving electronic timetables and progress reports in their institution. The possibility of losing printed timetables is high, but with electronic timetables students have access to them at any time and place. The college can tap into the use of emails or placing such information on the LMS for convenience's sake.

Table 6.10 Use of electronic class timetables, exam timetables and progress reports

				Partially	Strongly		
				Disagree	agree	agree	Total
Type of institution	TVET College	Count	83	2	0	85	
		Percentage	97.6%	2.4%	0.0%	100.0%	
	University	Count	0	4	61	65	
		Percentage	0.0%	6.2%	93.8%	100.0%	
Total		Count	83	6	61	150	
		Percentage	55.3%	4.0%	40.7%	100.0%	

The majority (93.8%) of university participants on the other hand strongly agreed that the college provides electronic timetables and progress reports. Analysis of the university website showed that students have access to such documents via the gateway for registered students or via the services of the Student Academic Life-cycle Administrative

(SALA) department, making it easy for students to access the documents at any time. If TVET administrators consider including such tools on the website or student portals. This may also help resolve problems of paper-based communication in the Covid-19 era.

iv. Online accessibility to results, and academic transcripts

Concerning accessibility of academic results and transcripts, 68.2% of TVET participants and all university students (100%) strongly agreed that they are easily accessible online. However, 16.5% of TVET students still find it impossible to access results and transcripts online, meaning they rely on queuing at campuses to receive such documents.

Table 6.11 Easy Access to Results and Academic Transcripts Online

				Partially	Strongly		
				Disagree	agree	agree	Total
Type of institution	TVET College	Count	14	13	58	85	
		% within Type of institution	16.5%	15.3%	68.2%	100.0 %	
	University	Count	0	0	65	65	
		Percentage	0.0%	0.0%	100.0%	100.0 %	
Total	Count		14	13	123	150	
	Percentage		9.3%	8.7%	82.0%	100.0 %	

Generally, the results in Table 6.11 show that both the university and TVET institution have in place student information systems (SIS) that enhance management of students' academic records. However, analysis of results revealed that students from university can access their academic records and stamped academic transcripts online without travelling to the institution whereas transcripts and stamped results are not accessible online in the TVET institution. Stamped academic results are only accessible at the administration offices for TVET graduates. With travel restrictions under the pandemic, the placement of such documents online allays the stress, fear and costs that comes with having to travel, sometimes through international borders to institutional offices. Abratiguin (2021) speculates that current educational consumers living in technologically driven environments want to experience the same convenience and efficient services they are getting from industry and other private sector organisations. Such experience of efficiency and conveniently provided services is still not realised in the TVET, thus calling for

administrators' attention to improving on the service/information delivery models to suit the digitally driven society's needs for convenience and efficient services.

v. Use of ICT in student invoicing systems

Results in Table 6.12 below show that the university uses mainly an electronic invoicing system for its students, with the majority of both staff and students (70% and 93.8% respectively) strongly agreeing that the institution distributes electronic financial statements. However, from the TVET staff and students' responses, 88.2% of the staff respondents and 97.6% of the students representing the majority of TVET participants, disagreed with receiving electronic statements in their institution. This clearly shows that the TVET institution still largely uses paper-based financial statements for communication of financial accounts to students and guardians or an absence of invoicing systems.

Table 6.12 Use of Electronic Financial Invoices/Statements for Students

			Disagree	Partially	Strongly	Total
			e	agree	y agree	
Staff Responses	TVET College	Count	15	2	0	17
		Percentage	88.2%	11.8%	0.0%	100.0%
	University	Count	0	3	7	10
		Percentage	0.0%	30.0%	70.0%	100.0%
Students Responses	TVET College	Count	83	2	0	85
		Percentage	97.6%	2.4%	0.0%	100.0%
	University	Count	0	4	61	65
		Percentage	0.0%	6.2%	93.8%	100.0%

Using paper-based financial statements may be a time-consuming procedure for administrative staff to print and distribute such to all students. Chances of some students not getting their financial statements, more still, of spreading infections through paper-based invoices, are high as some may be absent or ill on the day printed statements are distributed. One can also imagine the frustration staff and students have to go through to distribute and receive heaps of papers that could be shared electronically. Gómez-Sierra and López-Bustamante (2019) posit that for a good reason, financial management is steering away from the old days of paper-based, manual processes and into an increasingly digital world. Abratiguin (2021) also hinted that automation of such processes improves the

efficiency of institutions by reducing lots of paperwork, repetitive workflows and data processing mistakes. Financial teams in the TVET institutions are therefore encouraged to innovate and device changes in order to fully exploit the opportunities offered by technology and optimize their billing systems to match the digitally driven era of financial administration. This will in turn reduce the staff loads and improve the expediency and convenience of services.

6.4 CHAPTER SUMMARY

Findings of the study have revealed that the university and TVET College under study appreciate the use of ICT as a tool for general and student information administration. The two institutions' investment in LMSs, website development for information communication and financial administration, as well as investing in ICT infrastructure for networked computer systems, is an indication of their shared belief in ICT as tools for better institutional performance and efficiency. Literature has also shown that ICT has extensive administrative affordances and great potential to enhance the administrative efficiency of higher education institutions in South Africa. Application of ICT in administrative services is valued for redefining workflow activities, enhancing student records management and information communication with internal and external stakeholders, thus making administrative processes more flexible, less time-consuming and cost-effective especially in this era grossly affected by the Covid-19 pandemic challenges.

Nonetheless, the institutions are not equally harnessing the power of technology to enhance both general and student information administration in response to the pandemic. Results show that the university is demonstrating great appreciation for ICT in both general and student information administration as technology is used extensively across all administrative functions, from student admissions, registrations, information communication to academic records management. Despite the Covid-19 challenges, administrative services are still delivered with efficiency and conveniently to stakeholders. The TVET College is nevertheless lagging behind in adopting digital technology in most of its administrative functions. The benefits of ICT are not evident in the following areas of the TVET College's administrative processes: student admissions and registration processes, provision of expanded access to higher education through online distance learning, student invoicing systems, effective physical access control and academic information communication (exam information, results and transcripts). This suggests that the institution is still highly dependent on manual administrative processes, a practice that is increasingly becoming incompatible with the current digitally driven society, the Covid-19 era requirements and the needs of digital natives, (the population born in the era of technology) who make up most of today's HEI students. With the consistent lockdowns and

increased Covid-19 restrictions, this means service delivery is grossly affected, leaving stakeholders with unsatisfied needs and requests. The study proposes that TVET institution managers learn from best practices of the university that is just closer to them in order to improve its use of technology for improved administrative efficiency. The high demand for HE and the ever-widening skills gap worsened by the challenges of the Covid-19 pandemic in South Africa requires TVET institution administrators who are innovative and embrace technology as part of solutions to the growing need for access to HE and efficient services. A move to online admission processes and online distance course offerings may be an essential solution for TVET administrators in managing student intake at the same time addressing requirements of Covid-19 policies and the higher education access gap during the pandemic. Furthermore, we suggest more integration of ICTs across all administrative functions to fit both administrative staff and students into the digital environment that characterises work and learning spaces of the 21st century. Therefore, the study concludes that although ICT brings solutions to administration problems and positively influences the administrative efficiency of higher education institutions, not all types of institutions have embraced and fully utilised ICT for administration purposes. While North West University is demonstrating effective use of technology, Sedibeng TVET College must still make more effort towards innovating processes by a shift to the digital administration paradigm.

The objective of the next chapter is to examine the challenges affecting smooth integration of ICT in South African higher education pedagogy and learning activities

CHAPTER 7: DIGITAL TRANSFORMATION PATHWAY TO E-PEDAGOGY AND E-LEARNING: ASSESSING CHALLENGES TO ICT INTEGRATION IN SOUTH AFRICAN HIGHER EDUCATION

7

7.1 INTRODUCTION AND BACKGROUND

The competitiveness of a country in the global economy is dependent on the quality of its higher education system. As such, the accelerated demand for higher education globally is forcing governments and higher education institutions (HEIs) to look for ways to make higher education more accessible as well as improving the programs courses offered. Globally, trends in research and educational policy are increasingly appraising the importance of innovating higher education (HE) pedagogy and administrative functions by a shift from traditional paradigms (Hossain et al, 2016). Reform areas in higher education environments are often described within concepts like building knowledge and information societies, addressing 21st century skills, and emerging pedagogies. UNESCO (2009) and UNESCO, (2020) place emphasis on the need for institutional and national policies to support the use of ICTs and check their part in reinforcing the developmental role of Higher Education Institutions (HEIs) in their communities. As a result, institution managers are under pressure to modernise their systems and practices by turning to ICT for solutions to administrative and pedagogical reforms.

The 21st century demands, exacerbated by the current challenges imposed by the Covid-19 pandemic on education and training globally have therefore seen traditional pedagogy and service delivery of HEIs increasingly converted into online and virtual environments (Daniel, 2020). In light of the increasing concerns about the digital age affecting all spheres along with the Covid-19 challenge posed on teaching and learning, a flexible and resilient education system that can withstand threats posed on teaching, learning and administrative functions of institutions is necessary. Digital pedagogy, implying the use of multimodal teaching and learning, e-learning, blended learning and remote/ hybrid pedagogy (Crawford et al, 2020; Gray et al, 2021; Thaba-Nkadimene 2020) has become a hot topic widely debated in the higher education fraternity of late. The debates aim to transform teaching and learning practices to suit the demands of the digital age using technology and the internet. Technology has, as a result, become an integral part of teaching and learning plans making integration of ICT into higher education inevitable (Meenakumari and Krishnaveni, 2011). ICT is promoting more independent and student-led models of learning, particularly in the face of the Covid-19 pandemic, making traditional paradigms of the teacher who deposits knowledge in empty student minds irrelevant. Within the current digital age, worsened by the occurrence of the Covid-19 pandemic the use of electronic

tuition is highlighted at all levels, from basic through to higher education. Hence, new learning theories like Connectivism are currently developing and guiding the transformation of educational institutions' pedagogy.

The higher education sector is diverse in both developed and developing countries and so are their challenges. While a turn to technology-based education is the new normal presenting numerous benefits and solutions under the prevailing conditions of the digital era and the Covid-19 pandemic (Crawford , 2020; Daniel , 2020; Gray et al, 2021), there are numerous challenges for higher education decision-makers to be aware of when thinking of introducing technology changes. The E-learning Africa (2020) report revealed that while the need for a move to online and distance learning has become a necessity in this era, achieving effective reach to students is still more complex in some HEIs than in others.

Higher education in South Africa is currently experiencing major changes in terms of pedagogy, with more focus on technologically driven teaching and learning. These transformations are highly influenced by the advent of the digital age, compounded by the global Covid-19 pandemic challenges on education. Although teachers are the main agents of ICT use for instruction, students play a key role in the teaching and learning process. However, optimal adoption of digital pedagogy in South African higher education seems to be presenting profound challenges for many students. Recently, there has been an upsurge of ICT integration in South African higher education pedagogy, particularly in universities (Hossain et al, 2016; Queiros and de Villiers, 2016; Thaba-Nkadimene, 2020). Different types of HEIs have taken e-learning and online learning at varying degrees of success, with different implementation challenges often observed (Naidoo and Israel, 2021). Various challenges present obstacles to effective integration of ICT into the different higher education pedagogical practices. This is evident in the current situation, where some universities smoothly shifted to online pedagogy in response to the Covid-19 challenges with fewer challenges while most TVET Colleges could not proceed with their educational programmes remotely during the strict lockdown that saw the prohibition of face-to-face classes between March and June 2020. Numerous barriers to ICT adoption are widening the technology gap between universities and TVET colleges. Extant literature cites inadequate infrastructure and technology, affordability, student and staff ICT skills, and connectivity issues as barriers to the adoption of technology-based pedagogy in educational institutions of many developing states (E-learning Africa, 2020; Pheeraphan, 2013; Moyo, 2019) and they are not unusual in South Africa. According to Kisanga and Ireson (2015) such impediments are institutional challenges, personal challenges or a combination of both. They argue that factors like lack of understanding of the new

technology, resistance to change, poor infrastructure, and lack of managerial support can lead to low uptake of ICT in different institutions, thus affecting the progress towards migration to e-learning environments. Recent studies (Al-Azawei, 2016; Crawford et al, 2020; E-learning Africa (2020); Thaba-Nkadimene, 2020) identify the following common challenges to adoption and use of digital technologies in developing states:

- i. Lack/shortage of technical experts to support to support e-learning environments
- ii. Lack of access to technology
- iii. Lack of teaching and learning experience outside the classroom. By instructors and students
- iv. Lack of appropriate online and distance education training. Unsuitable home learning environments
- v. Poor infrastructure, electricity shortage, and internet connectivity.

The non-acceptance of e-learning by both academics and students has also been observed to be a hindering factor to ICT integration, especially in underprivileged institutions and among students from poor backgrounds (Thaba-Nkadimene, 2020; Moyo, 2019; Baguma, 2018).

South Africa, like many developing countries, is investing heavily in higher education in order to address skills gaps, address inequalities and of late, to respond to the Covid-19 pandemic imposed challenges on teaching and learning. In March 2020, the South African higher education minister Dr Nzimande encouraged all higher education institutions to explore digital (multimodal) and online delivery methods for teaching and learning to support programmes under the new normal of online and distance teaching and learning posed by the pandemic (Government SA, 2020; Chothia, 2020). Although there is no doubt that society needs flexible education systems in the face of changing educational environments, scholars like Houlden and Veletsianos (2020) however, questioned higher education's preparedness for the forthcoming digital era learning ushered in by these 21st century demands and the sudden Covid-19 pandemic. To ensure successful migration to ICT-based pedagogy, it is important to explore the existing opportunities and the challenges in using ICT in higher education teaching and learning practices. Empirical investigation is therefore vital to establish the preparedness of different HEIs in South Africa for a shift to more online teaching strategies.

Given this background, researchers need to pay attention to adoption barriers to ICT integration in HEIs in the South African context, particularly in this era when e-learning has become a necessity due to Covid -19 pandemic requirements and changing needs of the current generation of digital natives (Prensky, 2001), implying those born in the digital age.

While usage of ICTs in South African university pedagogies has been evident in various research (Baguma, 2018; Mpungose, 2020; Thinyane, 2010), there is little evidence of research undertaken to investigate their adoption and use in TVET institutions. This chapter entitled “Digital Transformation Pathway to South African Higher Education Pedagogy: Opportunities and Challenges in the Digital Era” aims to examine opportunities and challenges influencing effective integration of ICT in the pedagogical practices of a TVET college and a university in South Africa. Focus was on establishing their state of e-readiness for digitally driven educational practices and identifying the factors influencing effective ICT integration in their pedagogy. The chapter also sought to highlight challenges affecting effective technology integration in the pedagogy of the two institutions of higher learning. Framed within the Diffusion of Innovation (DOI), the study described factors/challenges affecting the effective adoption in higher education teaching and learning.

7.2 METHODOLOGY

The study employed a descriptive research approach using a mixed method exploratory sequential design to collect data through literature study, a survey questionnaire and semi-structured interviews. The design was appropriate because the study involved collection of descriptive data from respondents on their opinion of their institution’s state of digital readiness as well as their perceptions of ICT integration challenges thereof. The conveniently chosen study sample consisted of 159 students from both institutions, three university lecturers and six TVET College Lecturers, making a total sample of 168 participants. One hundred and fifty (150) students participated in the online quantitative survey questionnaire while nine students and nine lecturers were interview respondents. The qualitative sample was purposively sampled independently; it was not derived from the quantitative sample in order to ensure more validity of findings. The number of campuses per institution determined the number of participants from each institution. The sample consisted of students and lecturing staff who are directly involved in e-learning and teaching, hence administrative staff were not involved in this section of the study.

Following an exploratory sequential approach, the researcher collected quantitative data between July and November 2020. Semi-structured interviews followed telephonically and physically between January and February 2021, probing more on the findings of the quantitative survey data. The interviews involved nine lecturing staff and nine students selected purposefully sampled from the two institutions. Data collected through the questionnaire was analysed through simplistic analysis using SPSS statistical analysis software version 27, to derive descriptive data in form of frequencies and percentages. Interview data was analysed through content analysis and discussions. Data from the survey questionnaire, interviews and literature study was triangulated to ensure validity of

the findings. The following codes were used to identify semi-structured interview participants:

- i. TVS1-6 = TVET Student 1-6
- ii. UNS1-1-3= University Student 1-3
- iii. TVL1-1-6 = TVET Lecturer 1-6
- iv. UNL1-3 = University Lecturer 1-3

7.3 FINDINGS AND DISCUSSION

This chapter sought to determine the challenges affecting effective transition from traditional to modern teaching and learning practices of higher education institutions through the integration of ICT in their pedagogies. This section presents findings from a mixed method survey done with students and lecturing staff of two institutions within the South African higher education department.

7.3.1 Inadequate / lack of internet infrastructure

The study sought to establish whether the institutions had adequate infrastructure to support smooth transition to electronically and digitally driven instructional processes. The majority of TVET and university students in Table 7.1 (70.6 and 98.5 % respectively), confirmed the availability of internet connectivity for staff and students on campuses. This presents a good foundation for a move to digitally driven teaching and learning. However, a substantial number of TVET students (29.4 %) indicated absence of internet connectivity on their campuses. This implies that the state of internet infrastructure varies on campuses. As such, the differences leave some campuses of the college "Travelling in the digital slow lane" according to Leaton Gray et al, (2021). This implies a lack of uniformity in how technological resources are distributed among campuses, which in turn affects ICT adoption intentions of the campuses.

Table 7.1 Staff and students' internet access on campuses

		No	Yes	Total
TVET	Count	25	60	85
	Percentage	29.4%	70.6%	100.0%
University	Count	1	64	65
	Percentage	1.5%	98.5%	100.0%

The quality of internet connection further influences the possibility of ICT-based pedagogy and learning. Fox and Jones (2016) observed that successful digitally driven education depends on robust broadband for equitable internet access for both staff and students.

Their argument is that bandwidth capacity determines the instructional material and applications that staff and students can use effectively on and off-campus. A good / strong internet connection is therefore a prerequisite for effective institutional adoption of e-learning. Findings of this study in Table 7.2 however, revealed different perceptions of university and TVET students on the quality of internet connections. The majority of university students (66.2 %) rated the institution's internet as good while 4.6 % perceive it as very poor. On the contrary, 52.9 % of the TVET students rated the internet quality as very poor, with only 5.9 % rated it as good. Around 41% and 29 % of university and TVET students respectively indicated the connectivity as average, implying partial satisfaction with quality.

Table 7.2 Campus internet connection quality

		Ver y poo r	Averag e	Goo d	Total
TVET College	Count	45	35	5	85
	Percentage	52.9%	41.2%	5.9%	100.0%
University	Count	3	19	43	65
	Percentage	4.6%	29.2%	66.2%	100.0%

Qualitative results also indicate a low bandwidth and speed in the TVET College, making it a challenge for students to access learning materials online even on campus. TVS1 corroborated these findings thus:

Although the campus sometimes has Wi-Fi connection, its quality is not so good. From time to time, we fail to download any materials sent to us by lecturers using WhatsApp.

This agrees with findings of the E-learning Africa Report (2020), Kisanga and Ireson (2015) and Moyo (2019) who observed that poor communication infrastructure and bandwidth capacity often widen the e-learning gap in different HEIs, thus affecting their educational outcomes. The widening e-learning gap between universities and TVET Colleges seems to be the case in this study since the latter is most affected by poor internet quality issues leading to less use of technology in teaching and learning practices. Chisholm (2009) observed that ICT integration in TVET teaching and learning is still in its infancy stages in

South Africa thus, the cost of rapidly acquiring, installing and maintaining ICT infrastructure is often high for such institutions. Higher education department leaders and institutional administrators should therefore consider affordable but strong bandwidth requirements for effective student information systems, learning management systems to ensure that their students and staff smoothly operate both on and offline. Since these two institutions are in urban and suburban environments, tapping into the benefits brought by high-speed fibre networks like Megasurf and Openserve that are increasingly expanding coverage in these areas could improve the accessibility and quality of the internet in the institutions.

7.3.2 Low Students' Technological Self-Efficacy

ICT knowledge has become the demand of time in HEIs in the digital age, compounded by the global Covid-19 pandemic. While the move to online and hybrid learning has become a necessity, the demand for both computer and internet self-efficacy among staff and students is equally increasing. However, how technologically affluent are the HEI students to be able to stand up to this current demand for ICT knowledge? This study aimed to establish the level of students' computer and digital literacy in both the university and TVET College. Findings in Table 7.3 showed a cumulative majority of university and TVET students (100 and 95.3 % respectively) as computer literate though at different literacy levels while 4.7% of TVET students indicated possessing very poor literacy. Still in Table 7.3, the majority of participants from both institutions indicated internet skills ranging between average and excellent. However, 3.5 % of TVET students representing two % of the sample confirmed having no internet skills.

Table 7.3 Students' technological efficacy rating

		Very poor	Average	Good	Excellent	Total
1 Personal computer literacy	TVET Count	4	17	39	25	85
	Percentage	4.7%	20.0%	45.9 %	29.4%	100%
	University Count	0	8	28	29	65
	Percentage	0.0%	12.3%	43.1 %	44.6%	100%
2 Personal internet skills	TVET Count	3	13	45	24	85
	Percentage	3.5%	15.3%	52.9 %	28.2%	100%
	University Count	0	3	23	39	65

	Percentage	0.0%	4.6%	35.4 %	60.0%	100

The results above indicate that most students in both institutions have the potential to use computer technology for their daily activities, thus positively influencing their e-learning capabilities. This agrees with Prensky (2001) who believes that most of the generation born in the era of technology are digital natives who easily adjust to the use of technology as their lives revolve around use of technology. However, as Thinyane (2010) observed, not all students are digital natives considering that they come from different economic and social backgrounds. This is evident in this study, as 4.7 % and 3.5% of the TVET students indicated having very poor computer literacy and internet skills respectively. Generally, although most of the students from both institutions have some form of computer technological literacy in the use of computer technology and the internet, a bigger number of them fall in the category of those with average literacy, meaning they may not be fully confident to use technology. This agrees with Fred Davis (1989) who observed that perceived ease of use and perception of an innovation's usefulness is usually a result of ICT illiteracy which leads to ICT anxiety, and ultimately to non-adoption of technological innovations. Literature further stresses that an individual's confidence to perform tasks well electronically (computer self-efficacy) and their skill in using internet/online tools (online self-efficacy) greatly influences their appreciation of the instructional value (usefulness) of technology (Queiros and de Villiers, 2016). In view of this, those who lack technological self-efficacy are likely to have problems adjusting to e-learning, which is fast becoming a new normal in most HEIs.

Though the number of people without computer literacy and internet skills looks small due to the sample size used, one needs to ask how many of such students we have across all the campuses of these institutions. In different studies, Mdletshe (2019), Mpungose, (2019), Thinyane (2010) and Queiros and de Villiers (2016) also observed that many new South African HE students are exposed to e-learning environments with low/no computing and digital skills due to disadvantaged socio-economic backgrounds, causing them anxiety and fear of e-learning strategies. TVL1 supported this finding by saying:

Teaching engineering students remotely is difficult as most of them lack computer competencies compared to their counterparts in Business studies courses who have computer related subjects in their curricula'. Moreover, most of our students are from townships and rural backgrounds where exposure to technology and the internet is

often minimal. Such students are likely to fall behind hence, I use approaches that accommodate all my students.

Observations made above are likely to influence the TVET institution's acceptance of and adaptation to e-learning and other hybrid teaching and learning methods negatively, thereby drawing back the pace of diffusion and adoption of technology instruction. More technologically proficient students usually prefer and cope with e-learning. Therefore, it is arguable that computer and online self-efficacy of TVET students is a challenge that may affect effective ICT integration in educational practices. This supports the statement by a Ghanaian ICT specialist in the E-Learning Africa Report (2020), that e-learning is likely to contribute to the widening digital divide as poor learners may not afford devices and may be unskilled in using them. This calls for more attention towards addressing the challenges of the needy students so that in the transition to more technological driven teaching and learning, none of them remains behind. It is important to ensure capacity building through inclusion of at least one computer-related subject in all course offerings so that all students gain in improvement of their technological self-efficacy. In doing so, user perceptions of the ease-of-use and usefulness of innovations would become more positive, thus motivating them to adopt ICT in their teaching and learning practices.

7.3.3 Lack of prior training and experience in e-learning

Data revealed differences in levels of training and experience in e-learning between university and TVET college students. The majority (95.3 %) of TVET students in Table 7.4 indicated not receiving any form of training on the use of their student portal while only 4.7 % partially agreed that they received training. Of the university students, 84.6 % strongly agreed that they receive portal use training. Although there is evidence of ICT training in the university, not all students are satisfied with the level of training as evidenced by 15.4 % who showed partial agreement.

Table 7.4 Students' portal/ICT use training

					Partial y agree	Strongl y agree	Total
Type of institution	TVET College	Count	81	4	0	85	
		Percentag e	95.3%	4.7%	0.0%	100.0%	
	University	Count	0	10	55	65	
		Percentag e	0.0%	15.4%	84.6%	100.0%	

Interview responses on the same matter revealed more on this issue of training.

TVL3: *Both staff and students never received actual training on use of MySedcol portal except for videos placed on the website when the portal was introduced during the lockdown. Hence, we find it difficult to use.*

TVS4: *I only knew about the portal through my friends when we returned to campus after lockdown and we were not trained to use it. Even the lecturers never talked to us about it.*

UNS2: *First year students always get training on the use of eFundi at the beginning of the year and there are training workshops organised regularly. We find it easy to work around the portal.*

In their Technology Acceptance Model (TAM), Venkatesh and Davis (1996) also observed that the degree to which an expected user perceives a new technology as easy/difficult to use determines whether they will adopt and use the technology. Lack of e-learning skills often results in the perception of the technology as complicated leading to resistance/avoiding use of formal online portals and other technologies by staff and students alike. The findings above point to the fact that university students have a positive perception of the ease of use of formal learning portals because it has been made easy through training. On the other hand, lack of training in the TVET institution largely influences the users' perception of the portal negatively resulting in them not adopting and using it for teaching and learning. Sife et al (2007) thus argue that as ICT integration in pedagogy involves staff and students adopting new ways of teaching and learning, training workshops are important to improve their skills. Capacity building for effective e-learning through adequate technology use training is therefore necessary, particularly in the TVET institution so that staff and students embrace the college's LMS and change their perception.

7.3.4 Unequal Access to electronic devices and home internet connectivity

Fox and Jones (2016) posit that equity of internet access outside of school premises is important if e-methods of learning are to succeed. The study found that 54,7% both university and TVET college students (Table 7.5) have problems accessing the internet at home because they are dependent on mobile internet data, which is very expensive across most network providers in South Africa and often having poor signal strength in some areas affecting internet connection speeds. Broadband internet availability is limited, as only 16.7 % of the sample have access to Wi-Fi at home. Seemingly, a substantial number of TVET students constituting 6.7 % of the sample have no source of home internet connectivity at all while all university students have home internet access.

Table 7.5 Students' internet connection sources at home

				Mobile networ k data	Wi- Fi	Mobile internet data and Wi-Fi	None	Total
Type of institution	TVET College	Count	61	9	5	10	85	
		Percentag e	71.8%	10.6 %	5.9%	11.8%	100. 0%	
	University	Count	21	16	28	0	65	
		Percentag e	32.3%	24.6 %	43.1%	0.0%	100. 0%	
Total		Count	82	25	33	10	150	
		Percentag e	54.7%	16.7 %	22.0%	6.7%	100. 0%	

Table 7.6 further shows 100 % of university students as having internet enabled devices ranging from laptops, tablets and smartphones, with the majority (56.9 %) using laptops/computers. Of the TVET students, 85.9 % depend on smartphones and 3.5 % have no internet-enabled devices to use at home. This presents a stark difference between university students and TVET students in terms of access to resources.

Table 7.6 Internet connection device used

				Lapto p / comp uter	Tabl et	Smart phone	None	Total
Type of institution	TVET College	Count	7	2	73	3	85	
		Percentage	8.2%	2.4 %	85.9%	3.5%	100.0 %	
	University	Count	37	2	26	0	65	
		Percentage	56.9%	3.1 %	40.0%	0.0%	100.0 %	
Total		Count	44	4	99	3	150	
		Percentage	29.3%	2.7 %	66.0%	2.0%	100.0 %	

Findings of the qualitative inquiry corroborated the quantitative findings regarding accessibility to home internet connection and internet-enabled devices. The following comments came out in the structured interviews:

TVS1: I use mobile network data. It is not easy for me as data bundles are expensive. I do not for studies a lot but only access resources sometimes sent via WhatsApp.

UNS1: The 20GB mobile data I get from the university does not last long especially when I use it to search for information online, but at least it's better as I have some form of internet connection at home.

TVS6: I stay in a place that has very poor network signal for cheaper networks like Cell C and Telkom such that when I am at home I rarely connect to the internet successfully

UNL3: Some of our students who do not stay in college residences often depend on 20GB of mobile data provided by the institution which they usually consume in a short time because it is used for all their subjects.

Both quantitative and qualitative data show a widening technology inequality gap between university and TVET students, which in turn affects their ICT adoption rates. This agrees with Kilfoil (2015) who observed that only very few homes in South Africa have computers and quality internet access, therefore most students use mobile phones and mobile data. This is true mostly among TVET students, 85.9 % of whom depend on smartphones for internet connectivity. Studies by Baguma 2018, Leaton Gray et al (2021), Mdletshe (2019) and Moyo (2019) also revealed that differential access to devices and internet connectivity among South African students is negatively affecting the e-learning efforts of some HEIs.

According to Rogers, (2003) innovation qualities as perceived by expected users/adopters have an effect on the rate at which the innovation is adopted. For instance, expected adopters check whether the innovation is compatible with their needs, experiences and expectations. This is because the introduction and adoption of innovation takes place within a social system where expected behaviours and needs can be enablers or barriers to the diffusion of the innovation (Bozalek et al, 2013; Wilson and Conyers, 2015; Rogers, 2003). As administrators and educational leaders think of new approaches to pedagogy, the question to consider is whether the use of educational technology is well matched with the existing experiences and expectations of both staff and students in the institution.

In as far as infrastructure, software and technological teaching methods are concerned, quantitative and qualitative findings corroborate each other in revealing a high compatibility of technological innovation in e-learning with the values, beliefs, and experiences of university students and staff. Hence, there is a high usage of different technologies in the teaching and learning practices of the university institution. This high compatibility is due to a supportive infrastructure in the form of high-speed internet connections on campus, sufficient computer labs, institutional support for off-campus online activity through provision of mobile data and gadgets to both staff and students. This is the possible driver for the high rate of technology acceptance and adoption by the university, hence it can be concluded that the university has largely embraced the power of technology in enhancing its practices.

However, ICT innovations in the TVET institution seem to be incompatible with the infrastructure and pedagogies as revelations by both staff and students on the inadequacy of computers for out-of-class use, poor Wi-Fi connections and non-availability of internet access for most students off-campus came out of both the quantitative and qualitative findings. These impediments could be the reasons that discourage the staff and students from using the institution's e-learning platform (Sedcol Online/ MySedcol) and other e-learning technologies that require the use of the internet. Despite most students having mobile smartphones with the possibility of internet connectivity, most of them complain of not having the ability to access online services at home too. The survey findings indicated that only staff members received institutional ICT support in the form of mobile data and electronic gadgets while students did not get any support in this area of need. Therefore, even if staff members may have the interest in using the formal e-learning platform (Sedcol online) and other relevant digital learning platforms like Microsoft Teams; this is hampered by the fact that students have limited access to the internet and suitable devices for connectivity. These findings reinforce findings by Al-Azawei et al (2016), Moyo (2019), Baguma (2018) and E-learning Africa (2020) who also hinted at infrastructural and innovative pedagogical impediments as well as lack of sufficient ICT support as having effect on the perceived compatibility of innovations with the teaching and learning needs of expected adopters. Gachago et al (2013) echoed the same sentiments that the lack of digital support, incentives and a supportive infrastructure environment is incompatible with technology adoption capacity of most South African higher education institutions. These impediments have resulted in most students and staff opting to use Web 2.0 technologies like WhatsApp groups as informal e-learning platforms that are relatively cheaper and easily accessible for the students to use. Therefore, in view of these findings, there seems to be an issue of incompatibility of technological innovations with the expectations and

needs of the TVET institution resulting in a low or slow uptake of technology to facilitate teaching and learning. The amount of challenges faced therefore point to the reason why the TVET institution seems to lag behind in adoption of technology. If the college addresses these issues, it is likely that we will gradually realise an increase in the appreciation and adoption of educational technology in the institution. As a result, the external variables of technology accessibility and individual differences among students requires urgent attention for TVET College students to bring them at par with their university counterparts and make them equally benefit from the transition from traditional to digital pedagogical practices of the current age.

7.3.5 Inequitable Institutional Support for E-learning

The study also sought to determine the nature of institutional support that students from the two institutions were getting towards promoting a successful transition to e-learning activities. Data in Table 7.7 shows disparities in the level of e-learning support provided in the university and TVET College to students. The university is providing support in the form of internet data and electronic devices to students to enable off-site learning to continue. About 76.9 % received either one or both forms of support while only 23.1 % did not receive support. On the other hand, 96.5 % of TVET students indicated not receiving any form of support for them to work online during the same lockdown period. Mac Cullum and Jeffrey (2014) opine that ICT anxiety resulting from inequitable access to resources has been shown to have a negative effect on adoption of new technology by expected users, in this case, students.

Table 7.7 Technology support from institution

Type of institution	TVET College	Count	Electronic device	Internet connection data	Electronic Device and internet data	Non	Total
			1	1	1	82	85
		Percentage	1.2%	1.2%	1.2%	96.5 %	100.0%
	University	Count	8	36	6	15	65

Percentage	12.3%	55.4%	9.2%	23.1%	100%
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In the interviews, one of the respondents, UNS3 revealed the following, clarifying reasons for the wide disparity in support given to students of the two institutions:

Most students covered by National Student Financial Aid Scheme (NSFAS) got laptops through the NSFAS scheme during Alert Level 5 lockdown, the university supported few disadvantaged learners with laptops and all students with 20 GB connectivity data monthly since the beginning of the lockdown.

Although NSFAS also caters for TVET students, the scheme did not extend to them the same technological support (laptops) that the university students got during the same period. TVL3 and TVL4 indicated that the institution had not yet given support for students though lecturers had received laptops, routers and data.

The differential support for universities and TVET institutions from the Department of Higher Education and Training (DHET) and institutional administrators is mostly the reason for the disparity in students' access to devices and the internet mentioned above which affected their use of e-learning initiatives. This supports the observation by Thaba-Nkadimene (2020) that access to educational technology and internet connectivity by underprivileged institutions and students greatly affects the pace of ICT integration in teaching and learning. Therefore, Kisanga and Ireson (2015) argue that the successful migration to digitally driven pedagogy and learning requires strong managerial support in terms of ICT training costs, home internet access for staff and students, as well as investing in infrastructure purchase and maintenance. This needs to be considered urgently if both university and TVET institutions are to fit well in the digital transformation pathway to HEI teaching and learning. Otherwise, it is arguable that such inequities may present TVET institutions as inferior to universities, something that may discourage many from enrolling in TVET institutions. Despite the majority of TVET students depending on smartphones as shown in Table 7.6, many TVET students in Table 7.8 (81.2 %) still require devices and data support to operate online as compared to universities with 21.5 % requiring the same support.

Table 7.8 Support still needed

						Both devic e and data	Non e	Total
Type of institution	TVET College	Count	4	11	69	1	85	
		Percenta ge	4.7%	12.9%	81.2%	1.2 %	100. 0%	
	University	Count	9	18	14	24	65	
		Percenta ge	13.8%	27.7%	21.5%	36.9 %	100. 0%	

Interviews revealed that although most students have smartphones, not all the phones are very efficient to use for e-learning due to differences in storage and random access memory capacity, therefore even students with smartphones may still require electronic devices that suit the purpose of e-learning. TVS5 observed:

I use a Mobitel smartphone with a storage capacity of just 4GB and the memory is always full, I cannot download a lot of information on it.

Both literature and survey findings in this study therefore reveal the persistence of the digital divide among university and TVET College students in this digital era, with the latter being the most affected since not all students have access to devices and internet. It is clear that ICT integration in the TVET institution is in its infancy stage, thus the need to mobilise more support for TVET students for them to be better prepared for the new normal of online pedagogy and learning facing the higher education fraternity now and in future. Hilkemeijer (2020) therefore argues if education managers do not provide adequate support in terms of ICT equipment and internet access for staff and students, it becomes difficult for e-learning environments to be established and effectively used. Success in addressing this challenge may come through more partnerships with network providers and ICT manufacturing companies to create accessibility to devices and the internet.

7.4 CHAPTER SUMMARY

ICT integration in higher education pedagogy has become inevitable in the digital age, compounded by challenges posed by the global Covid-19 pandemic on teaching and learning. As a result, HEIs are rethinking pedagogy on the run, with different institutions facing e-learning/online learning implementation challenges. Although all HEIs in South

Africa are being urged to transform their pedagogies to ICT-based ones, they are doing so amid a variety of challenges.

E-learning Africa (2020) observed that TVET institutions' challenges in ICT integration differ widely from those of universities. Likewise, this study revealed that TVET college students in this study still face more ICT integration challenges compared to their counterparts in university. Challenges affecting them include lack of adequate internet infrastructure on campus and at home; low technological self-efficacy, unequal access to resources as well as inequitable institutional support for e-learning. Monitoring such challenges and addressing them is vital to influence a smooth transition from traditional pedagogy that is characterising these institutions, to more digitally driven pedagogy befitting the digital age. Based on the above findings and discussion, this study proposes the following as possible ways of addressing ICT integration challenges in the institutions of higher learning, particularly TVET Colleges, to bring them into the mood of digital era teaching and learning. Institutions should build ICT capacity through ICT training workshops for staff and students. Including a computer-related subject in all course offerings may help improve students' technology self-efficacy and fit them in the digital drive. Administrators are also encouraged to tap into the benefits offered by fibre network connectivity to improve the accessibility to and quality of internet on campuses, considering the increasing number of fibre network providers in South Africa. Moreover, DHET should work to leverage more partnerships with mobile network providers to make data more affordable for students in order to improve home internet access. There is a need for DHET to improve on equitable distribution of electronic devices to both university and TVET students; tablets with expandable memory for TVET students may go a long way in covering the gap in access. As a policy issue, the government should consider concentrating on ICT infrastructure support through promoting seamless broadband access to all types of HEIs.

The Department of E-government is encouraged to speed up the rollout of the Gauteng Broadband Network (GBN) project to provide public Wi-Fi hotspots and bridge the digital gap between urban and township/rural-based students.

In the next chapter, the researcher summarises the key findings of the study, locates findings within the theoretical frameworks of the Diffusion of innovation (DOI) and concludes the study with recommendations for effective ICT integration in institutions, highlighting suggestions for future research.

CHAPTER 8: SUMMARY, CONCLUSION AND RECOMMENDATIONS

8

8.1 INTRODUCTION

This chapter summaries key findings of the study with reference to the research questions and theoretical frameworks that guided the study. The chapter further puts across a set of recommendations that practice and policy makers can use to improve ICT integration, especially in TVET institutions, which have shown to lag behind in ICT particularly in the TVET institution, which has shown to be lagging behind in terms of ICT use. The study was placed within one TVET College and one university in South Africa, seeking to explore the level of ICT use in their knowledge administration (teaching and learning) and information administration functions. The primary research question, “What role is ICT playing as an agent for improved administrative efficiency in South African higher education institutions?” Based on the primary question, four research questions were derived to guide the four empirical chapters of the study; analysed through a mixed method approach to data collection that involved a quantitative survey and semi-structured interviews. The summary of findings presented below is on the basis of the objectives of the study.

8.2 SUMMARY OF KEY FINDINGS

8.2.1 Extent of ICT use in knowledge administration

In response to the first research question, findings reveal a wide gap in ICT adoption and integration in teaching and learning between the university and TVET College despite them being under the higher education department in South Africa. The university has shown great strides in the use of the formal learning management system (LMS) by both on-campus and online distance learning students. This has enabled the institution to incorporate online assessments, exams and online library services to provide convenient services for both fulltime and part time students. This supports Fawareh (2013) proposition that a learning management system should be a one-stop platform for deploying e-learning options like online courses, monitoring and tracking of student progress, managing assessments, library services etcetera. The study revealed that this high adoption and use of technology is because of the university's ICT policy that makes the use of the LMS compulsory for both staff and students. Both staff and students indicated use of other proprietary software like YouTube, Google Classroom, PowerPoint to enhance their practices, a sign that they appreciate ICT as a tool for improved knowledge acquisition and delivery.

Findings however, show the TVET College to be in its infancy stage regarding use of technology in pedagogy and learning. Despite having a LMS in place, the students and staff rarely use it. Extant literature on ICT integration instructional activities reveals that staff and students in resource-constrained institutions in South Africa end up abandoning the use of ICT if they find themselves confronted with unfavourable conditions or challenges (Baguma, 2018; Kilfoil, 2015; Thaba-Nkadimene, 2020). This is true in this study as most TVET participants indicated lack of resources, poor internet infrastructure and lack of adequate knowledge of e-learning as hindering factors to the adoption of ICT in their institution. Such impediments have resulted in them having a negative perception of ICT, thus leaving them in the “digital slow lane” (Gray et al 2021). Therefore, Shaikh and Khoja (2011) also argued that lack of access to ICT resources and ICT knowledge is the most significant barrier to ICT adoption by both staff and students.

The digital era has brought about a variety of tools that staff and students can use to facilitate teaching and learning on digital platforms. The study revealed the passion for students to adapt Web 2.0 technologies as informal learning platforms. They showed more preference for social media applications like WhatsApp, Facebook, and YouTube, which allowed them real-time interaction with each other and with staff unlike the LMS, which they viewed as mainly one-way communication. These findings support the students' need for interactivity during e-learning. This confirms the observation by Mpungose (2019) who found out that students at a South African university he investigated preferred the use of WhatsApp as an e-learning platform than the imposed institutional platform, MOODLE. Mdletshe (2019) concurred with the findings by identifying the current generation of students as high end users of emerging technology such as mobile devices and applications, which they are using to address challenges of student-student interactions to enhance learning. However, findings reveal the opposite of what literature says on the lecturer's appreciation of mobile applications in pedagogy. In his study, Riehemann and Jucks (2017), also observed that while lecturers prefer conventional methods like e-mail, PowerPoint and the institution's LMS, students are more interested in using social media tools (YouTube, WhatsApp, Zoom, Facebook etc.) which they are familiar with as they use them daily in their social lives. On the contrary findings showed the majority of TVET lecturers indicating use of WhatsApp to send learning materials platforms to their students since it was the most affordable and easy means for students to get information online. Furthermore, findings revealed that most students have smartphones, making it much easier for them to use social networking tools for communication and collaboration. This collaborates with Mpungose's (2019) suggestion to integrate formal and informal platforms of content dissemination like social media applications so that students learn through their

experiences. Gachago et al (2013) however, pinpointed a lack of understanding of emerging technologies' effects on teaching and learning, as well as the preparedness of HEIs to use them in the South African context. He therefore urged HEI administrators and staff to explore more ways of fitting such pedagogy to cover the widening gulf between technologies used by students, educators and those offered by the institutions.

8.2.2 Higher education institutions' response to the Covid-19 pandemic challenge

The Covid-19 pandemic has created significant challenges for higher education institutions globally, bringing with it a test of organisational agility to handle the challenges through a variety of pedagogical developments (Wu, 2020; Crawford et al, 2020). This study found out that the university and TVET College in question responded differently to the same challenges. While the university managed to push classes and content online, enabling continuation of teaching and learning, the TVET College teaching and learning came to an abrupt standstill. Use of the formal LMS e-Fundi facilitated smooth transition to online pedagogy almost overnight in the university as the platform had already been in use prior to the pandemic. Extant literature indicates that in South Africa, the use of formal e-learning platforms was already compulsory in most universities (Gachago et al 2013; Mdletshe, 2018; Mpungose, 2019) hence university staff and students did not find it very difficult to adapt to the new normal of online learning. However, lack of a functional LMS prior to the pandemic, aggravated by lack of internet access and lack of suitable devices for e-learning among the TVET stakeholders stalled the institution's efforts to use technology in response to the pandemic. These findings merit Houlden and Veletsiano's (2020) question on the preparedness of higher education for the imminent digital era of learning posed by the pandemic. These two institutions' different responses are an indication of the need to upgrade TVET systems to match the requirements of the digital learning era. The wide disparity between the institutions' responses to the pandemic was worsened by differences in ICT support given to students. While university students immediately got support in terms of devices and internet data, TVET students did not receive such support, thus they remained behind in their studies. Hence, Tamrat and Teffera (2020) opined that while online distance learning was evidently necessary from the onset of the pandemic, ensuring effective reach to students in most African countries was more complex.

Although the university has embraced online classes, students lamented the absence of interactivity or direct contact with lecturers, leaving them with many unanswered questions from their studies. Tamm (2019) who advocates for a combination of synchronous and

asynchronous online learning to enable real-time chats between students and their lecturers or peers supports this need for direct interaction.

Faced with an unpredictable future under the ever-increasing Covid-19 pandemic however, the majority of university and TVET students have shown their collaborative preference for blended teaching and learning, with few opting for continuation with face-to-face classes due to their socio-economic background that could not enable them to learn online. This call for blended learning reveals the students' perception that technology should not replace the physical presence of the instructor but rather enhance the learning process. This is in agreement with Lynch (2020) and Thompson (2017) who observed that online teaching often creates isolation, hence Thompson (2017) advises institution managers adopting technology to look more towards blended learning.

8.2.3 ICT use in general and student information administration

There is widespread acknowledgement of ICTs as tools that have the capacity to enhance the administrative efficiency of higher education institutions particularly in this digital era where information flows fast through the internet. Existing literature reveals the power of ICT to reduce administrative complexities, improve service responsiveness, reduce turnaround times for service delivery, (Anwar and Matthews, 2014; Krishnaveni and Meenakumari, 2010; Barta et al, 1995; Hashim et al 2010; Solomon et al 2016), thus enhancing the overall administrative efficiency of institutions.

In answering the third research question, this study revealed efforts of the higher education institutions in this study towards embracing technology in their general and student information administration, though to varying degrees. Findings indicate institutions as having functional websites that facilitate information administration, with interactive tools and links on the home pages to internal and external services, making the websites the virtual face of the institutions to the online world (Meyer and Jones, 2011) inclusive of potential and current students and other important stakeholders. This finding agrees with Hite and Railback (2020) who argue that higher education websites attract external and internal stakeholders; therefore, they should provide vital interactive information for both.

HEIs are currently under pressure to reduce costs at the same time increasing efficiency and quality of services to students and staff as current education consumers seek to experience the same convenience they are getting from industry (Abratiguin, 2021). Findings of the study indicate that the university has taken strides to make services convenient for current and potential students by expanding education access through online distance learning, automating student financial administration systems, and moving

to electronic internal communication via use of emails for fast and efficient message delivery. ICT use is also evident in student academic record management and deployment of ICT in the student admission and registration processes of the university. Both university and TVET administrators have shown appreciation of the power of ICT to facilitate timely and efficient processing and sharing of information in real time leading to coordination between departments and reduction of data / task duplication (Juma et al (2016). Hence, the institutions have employed the massive use of networked computer systems for clerical duties, cloud hosting services and information for easy access by both administrative staff and other users at any place and time. This supports the view by Adebayo (2013) who recommended polytechnic proprietors to increase the investment in ICT facilities and equipment that enhance efficiency and effectiveness of their administrative functions. This also agrees with Abratiguin, (2021) who posits that running institutions with lots of paperwork, repetitive workflows and data, like enrolments, and financial operations, requires automation to improve these processes.

Although the TVET institution has started using electronic internal communication through the SMS system and electronic payments, the institution is yet to automate its invoicing systems which are still paper-based. Distance online learning is not yet available at the TVET institution, evidence of falling behind in efforts to increase access to vocational training, which is one cornerstone of TVET institutions. Moreover, student admission and registration processes are still done physically, something that ICT could facilitate effectively in this digitally driven environment of the 21st century. Abratiguin (2021) and Augustine Kasozi (2012) oppose this manual admission system by arguing that employing technology in admission processes enables auto-replies and follow-up of prospective students, thus reducing the tedious process of going through heaps of application forms manually. The TVET institutions therefore need to understand the benefits of streamlining more services online for improved efficiency.

8.2.4 Challenges of ICT integration in teaching and learning

The road to ICT integration has not been a smooth one for all HEIs in the South African higher education landscape. Research reveals serious challenges inhibiting effective ICT integration in higher education (Moyo, 2019; Kisanga and Ireson, 2015; e-learning Africa 2020). This study observed that ICT integration is not happening at an equal pace between university and TVET institutions in the study. Challenges hampering smooth transition to e-pedagogy and e-learning include inadequate / lack of supportive ICT infrastructure for both institutions and individuals, low technological self-efficacy among students, lack of proper knowledge or training for ICT use and e-learning; unequal access to home internet

access and suitable devices for online learning as well as inequitable institutional support for e-learning.

i. Unequal Access teaching and learning technologies.

Findings of the study indicate that limited access to necessary resources like internet connection data and devices inhibited staff and students' enthusiasm to adopt ICT in their instructional practices. The majority of TVET students confirmed that not having home internet access and suitable devices for e-learning played a major role in their reluctance to use the college's LMS to interact with their lecturers. This also explains why some of the lecturers did not put more effort towards using the portal since expected recipients of the online services (students) lacked tools to participate in online learning. This is consistent with findings by Mumtaz (2006b) who observed that lack of ICT resources limited lecturers / academics from integrating ICT into their pedagogical practices.

ii. Inadequate /lack of supportive ICT infrastructure

Participants of this study hinted at poor internet connectivity resulting from poor bandwidth in some campuses, mostly TVET campuses as a hindrance to ICT appreciation among students. Lack of out-of-class-use computers for students exacerbated the institutional negativity towards ICT use in teaching and learning practices of the college. This challenge echoed findings from existing literature on ICT integration challenges in developing countries (Al-Azawei, 2016E-Learning Africa, 2019; Kisanga and Ireson, 2015). Therefore, UNESCO (2009) observed that with poor internet penetration in most African countries, any institution aiming to use technology for academic practice needed to first address issues of connectivity for both staff and students.

iii. Lack of prior e-learning training

The success of e-learning initiatives depends on the level of skill that expected users of the system have in order for them to use the initiative effectively. Study findings show that staff and students were not confident enough to adopt use of the college's portal as they lacked sufficient knowledge of how the system works. Most staff and students complained of a system that they never received training on, which made it appear to be a complex initiative to accept. This argument from the college stakeholders corresponds with observations by Rogers (2003) that user perceptions of an innovation's complexity and relative advantage influence their rate of adopting it. Davis (1989) supported this notion by putting forth the perceived ease-of-use and perceived usefulness of an innovation as factors that influence behavioural intention to adopt a new way of doing things. Furthermore, some students

indicated having poor technological self-efficacy (computer and digital illiteracy) which in turn affected their appreciation of technology driven learning, meaning we should not treat all students as digital natives as they come from different socio-economic backgrounds. Therefore, these findings are also consistent with Karaseva et al (2015) who found out that appropriate training helps technology users to overcome doubts about adopting instructional technologies. Therefore, results of the study reflect that although training videos were placed on the website, they did not offer adequate training to address specific challenges that staff and students face in using technology. Thus, Sife et al (2007) argued for consideration of proper training workshops for instructors whenever an institution plans to bring technology into pedagogy to improve their ICT skills.

iv. Inequitable Institutional Support for E-learning

Extant literature posits that where there are deficiencies in ICT support, people tend to abandon ideas of e-learning and any other forms of digitally driven teaching and learning practices (Crawford, et al, 2020; Mpungose, 2020; Kisanga and Ireson, 2015). The study found out that students in the two institutions did not get equal support to enable them to adjust smoothly to the new online learning environments, especially at the beginning of the current global Covid-19 pandemic. Participants from the university indicated receiving assistance in the form of laptops for those funded under the National Student Financial Aid Scheme (NSFAS) while the university organised data for all students on a monthly basis. However, DHET did not extend the same help to TVET students regardless of the majority of them being higher education students under the same NSFAS bursary. This created a big access gap, which greatly affected the TVET students' ability to work online. As Thaba-Nkadimene (2020) observed, lack of access to educational technology and internet connectivity by underprivileged institutions and students greatly affected the pace of ICT integration in teaching and learning. According to Hilkemeijer (2020), if education managers do not provide adequate support to less privileged institutions and students in the form of ICT equipment and creating easy internet access, it becomes difficult for e-learning environments to be established and effectively used in all HEIs.

8.3 LOCATING FINDINGS WITHIN THEORETICAL FRAMEWORKS

This study explored the use of ICT knowledge and information administration of two HEIs in South Africa namely North West University and Sedibeng TVET College. The researcher attempted to understand their level of ICT usage and challenges affecting smooth transition to digitally driven teaching and learning. To understand the participants' perceptions and beliefs regarding ICT use in their activities, the study employed the Diffusion of Innovation as the theoretical framework underpinning the study.

According to Rogers (2003) innovation is any idea or practice that individuals or groups of people view as new. Integrating technology in teaching and learning is one such practice regarded as an innovation in the higher education landscape of developing countries, particularly those employing ICT use for the first time. Rogers (2003) believes that the way an expected user perceives an innovation in comparison with the existing system in use is an important influence on their adoption or rejection of the innovation. This study examined the adoption and appreciation of ICT integration in HEIs considering the innovation's qualities/elements from the perspective of staff and students as its expected users. These qualities are relative advantage, complexity, trialability, compatibility and observability of the innovation

8.3.1 Relative advantage / perceived usefulness

Rogers (2003) defines relative advantage as the extent to which users perceive an innovation as more effective than the practice it replaces. This is in agreement with what Fred Davis (1989) calls perceived usefulness, the extent to which users perceive an innovation as being helpful / beneficial in their performance. Common between the two scholars is the idea that for an innovation to be easily adopted it should prove to have more benefits or advantages than the system in current use. In this study, students showed interest in inclusion of social media tools in teaching and learning activities as they offered interactivity, as opposed to the formal LMS. They found these platforms to be more appealing to their need for fast and interactive dialogue online hence; they indicated preference for WhatsApp, Facebook, YouTube and blogs as their technology of choice. Extant literature argues that Web 2.0 technologies are already popular among the South African student communities making them a better reinforcement and alternative to LMSs and other learning approaches (Gachago, et al 2013; Mpungose, 2019; Thaba-Nkadimene, 2020; Thinyane 2010). In periods of off-campus online instruction, such platforms help students not to feel isolated but have a sense of belonging through networking, collaboration and channels for quick feedback. This shows that this type of technology has a high relative advantage, which influenced its appreciation and adoption by students and staff alike. Therefore, in planning instructional technology, it is important to involve expected users and check their instructional needs.

8.3.2 Complexity of innovations

Rogers (2003) explains complexity as the extent to which users perceive the new initiative as easy or difficult to understand and carry out. Different levels of complexity for university and college users influenced ICT integration in this study. TVET Lecturers and students reported high levels of complexity in using the college's LMS. Having received no adequate

training on its use prior to its rollout, both staff and students lacked confidence in using the platform, perceiving it as difficult and time consuming. Therefore, Rogers (2003) avers that the more complex an innovation appears, the less likely it is to be adopted. This study reveals participants' appreciation of social media platforms that they perceived as less intricate and more relevant to their lived experiences with the platforms. Being mostly available in mobile versions, these platforms reduce the complexity of the digital classroom as students could access information on the go via smartphones and other mobile devices. Fred Davis (1989) concurs with Rogers (2003) by viewing ease-of-use of innovations as important to the adoption of innovations or non thereof.

Lecturers highlighted the element of complexity when they indicated the tiresome process of changing information to digital format, as well as the time required to upload, download and mark online assessments. Therefore, their slow uptake of technology could be due to their perceptions of technological innovation as more complex than what they used to do. The TVET participants claimed that the LMS was not user friendly plus it had just been introduced with minimal training and adaptation time for them to become familiar with its features.

8.3.3 Compatibility

The extent to which an innovation is perceived to be consistent with the users' needs, values and experiences determines whether they will adopt it or not (Rogers, 2003). When expected users feel that an innovation is compatible with their needs, the process of adopting it can be fast. This study revealed that the university students quickly adopted e-learning at the onset of the Covid-19 pandemic as it matched well with the institution's values as well as staff and students' needs. However, for the majority of TVT participants, requirements for online were incompatible with their needs and experiences, where most students did not have the required resources to go digital on short notice. This influenced their choice of traditional teaching and learning methods that could accommodate everyone regardless of background. The use of social media applications (WhatsApp) matched well with their need for affordable and interactive tools for enhancing teaching and learning. It is therefore arguable that findings of the study point to the need for HEIs to consider promoting 21st century skills of critical thinking and collaboration, creativity and real-time communication as they plan for ICT integration in their academic and administrative practices. A move from technologies that only promote content dissemination to those that support interaction and engagement should be a pivotal change in pedagogy.

8.3.4 Trialability

The more an innovation is capable of being successfully tested with positive outcomes, the more meaningful it becomes to users. Rogers (2003) refers to trialability as the extent to which an innovation can be tested. The study revealed that TVET participants did not have enough opportunity to understand the LMS functions, as they did not have resources that enabled its testing. The LMS' trialability was affected by factors ranging from lack of suitable ICT resources, poor internet infrastructure on campuses, coupled with inadequate e-learning training. However using the most available resource (smartphones) the participants tested the possibility of social media use and found out that it was more responsive to both staff and students' needs for remote sharing of information. Students responded more to WhatsApp than to the LMS.

The Diffusion of Innovation theory assumes that users form beliefs about what an innovation can do or achieve through trials, and consequently adopt or reject it based on findings of the trials. It is therefore important that users are able to try out technological innovations before their full implementation.

8.3.5 Observability

Rogers (2003) argues that innovations whose results are visible to others have great influence on adoption decisions. Having used technology over a period of time, the construct of observability was evident among university participants who easily mentioned the positive influence of technology on assessments, admission practices and remote library accessibility. This encouraged them to adjust to the new normal of digitally driven teaching and learning. On the contrary, observability of ICT integration results was not evident in the TVET institution, which left participants with negative imaginations of technology integration as being a complex exercise. Had they experimented with technology under a supportive ICT environment and observed its results, they would have probably recognised potential benefits and fully embraced the LMS and its various tools.

8.4 IMPLICATIONS OF FINDINGS FOR PRACTICE AND POLICY

8.4.1 Implications for practice

For successful ICT integration to happen across all types of HEIs, institutions should design professional development plans/initiatives, tailored in line with the needs of staff to enhance their online performance. Such initiatives should be promoted throughout higher education to create better pathways for recognition of ICT value in work performance. Therefore, institutional managers should think of putting in place flexible and sustainable training

schedules and derive lessons from best practice of other institutions, in this study, the university. Lecturers are encouraged to experiment with emerging technologies in their teaching activities and create communities of practice to offer each other support in integrating ICT into pedagogy. Rogers (2003) believes in the importance of communicating innovations across all expected users to promote its adoption. Therefore, for all institutional staff and students to come on board, any ICT intervention needs to be exposed to all members, with regular reminders through ICT workshops.

On the part of management, it is important to have an institutional SWOT analysis to determine the institution's strengths, weaknesses, opportunities and threats in the digital environment. This helps to determine / guide the institution's preparedness for smooth infusion of technology into its functions. Furthermore, the quality of ICT infrastructure and accessibility of resources to end users determine the quality of an institution's e-learning programme. This implies the need to plan for ICT infrastructural developments / upgrades, as well as addressing staff and students' ICT needs before embarking on the journey to ICT integration. Such planning included creating partnerships with network providers to make internet accessibility possible on and off-campus for internal stakeholders.

Not all current generation learners are digital natives regardless of them being born in the digital age. To curb ICT anxiety created by the fusion of technology in teaching and learning, building students' ICT capacity through adequate training is important, particularly upon their entry into the institution. To enable students to fit well into the 21st century digitally driven learning environment, it is necessary to incorporate computer related subjects in all higher education course offerings to boost students' technological self-efficacy.

8.4.2 Implications for policy

There is a need to set up suitable ICT driven environments across all types of higher education institutions through uniform upgrades to ICT infrastructure and bandwidth quality. Policy frameworks need to be put in place that make the use of technology in higher education institutions compulsory so that students remain relevant and competitive in a digitally driven society. Institutional ICT support by the government needs to be equalised across all types of higher education institutions, lest people perceive TVET institutions as inferior to universities consequently discouraging them from enrolling in TVET. Higher education institutions should aim to develop ICT policies that align with goals of building knowledge societies and digital era teaching and learning.

8.4.3 Contribution to knowledge

This study is critical and timeous for Public Administration, particularly in this advent of the Fourth industrial Revolution. The study illustrates through the lenses of the Diffusion of Innovations and public administration theories namely the New Public Management and the Digital Era Governance theories, how institutions can improve administration efficiency in the digital era through the integration of ICTs in both their administrative and academic functions. It therefore demarcates a current topical and evolving question in Public Administration scholarship. Today, the use of ICTs in higher education is envisaged to bring change and efficiency and this study primarily demonstrates the different impact of ICT currently experienced in one university and one TVET college in South Africa.

Although ICT use in higher education is reflecting changing models of teaching, administration and communication globally, outcomes of this study reveal a wide gap in the level of technology use by the university and TVET college studied. Do these findings reflect a true picture of the ICT gap between universities and TVET institutions in South Africa? What factors contribute to the existence of such technology gaps? This study lays a groundwork for further scholarly, explorative and comparative studies on a large scale to have a broader picture of the current state of ICT use in different institutions of higher learning in the country.

The study may also give insight to policy makers on the need to review policies on ICT funding for all HEIs, with particular focus on upgrading ICT capacity of higher education institutions other than universities. Such review of funding policies is envisaged make help make TVET institutions to be more recognised as institutions of choice by prospective students, thus bringing them to the same level of stakeholder appreciation as the universities.

8.5 CONCLUSION

This major objective of this study was to assess and appraise the role of ICT integration as a change agent for administrative efficiency in public higher education institutions, with a focus on the extent of ICT use in academic and administrative functions. The study explored how two different HEIs in South Africa are integrating technology in their key functions of knowledge administration and information administration. Four research questions were used to explore the phenomenon. The study findings helped to clarify the extent of ICT integration within a university and TVET context as well as highlighting factors affecting effective ICT integration in some higher education institutions in South Africa. Findings revealed a widening gap in the level of ICT use by the university and TVET College in the study, with the latter seemingly lagging behind in adoption of technology mostly in its

academic practices. A myriad of challenges affect the TVET College's capacity to smoothly integrate technology into its practices ranging from inadequate ICT support, poor ICT infrastructure and lack of access to resources by most students. This has shown a growing digital divide between university and TVET students as the challenges above are not equally affecting the university institution. The study has revealed that higher education institutions in South Africa seem not to be equally benefitting from the affordances of technology in this era driven by technology use as we are faced with institutions that are more privileged than others in terms of ICT capacity. This study is significant in that it has highlighted the need for further comparative studies between universities and other PSET institutions in order to bring all higher education institutions at par with the ever-changing demands of digitally driven education and training.

As adoption of instructional technology continues to create debates among scholars and researchers, it is important to monitor its use and benefits across all types of HEIs in South Africa. Undoubtedly, ICTs provide affordances in education and training for both staff and students in terms of creating flexibility, enhancing collaboration, promoting remote interactive dialogue and effective information sharing (Crawford et al, 2020; Peeraphan, 2013; Sakar, 2012). However, despite this upward trend toward fully digital learning environments, higher education managers need not forget that accessibility and affordability of technological resources is not uniform across all institutions and students of different socio-economic backgrounds. In the South African context, we are not yet at a point where every young person is a digital native (Gachago et al 2013; Mdletshe, 2019; Thaba-Nkadimene, 2020; Thinyane, 2010). University and TVET colleges still experience a wide technological gap that requires immediate attention. It is important therefore, to address the digital divide that is still evident across different types of HEIs, among staff and learners of different backgrounds, to improve ICT efficiency and make all higher education products relevant in the digital society.

This study's findings however, cannot be generalised across all South African HEIs as it was conducted in two institutions only. Since convenient and purposive sampling was used to establish the sample, results can only be generalised to the sub-population from which the sample was derived, in this case Sedibeng TVET College and North West university. The study recommends further research on wide-scale investigations into the use of technology in different higher education institutions to get a clearer picture of what is happening in more institutions and identify best practices that can help other institutions to adapt technology in their critical functions.

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LIST OF ANNEXURES

ANNEXURE 1: Questionnaire for students

Student questionnaire: ICT innovation for higher education administration_ Student Questionnaire

You are kindly invited to participate in research I am carrying out on Information Communication Technology (ICT) innovation for higher education administration. This is a survey to assess and appraise the extent / level of ICT use for information and knowledge administration by higher education institutions in South Africa.

Basic Social Sciences Research Ethics Committee (BaSSREC) of the North West University approved this study. Sedibeng TVET college Principal and NWU gatekeepers granted permission for this study to be conducted in their institutions. You qualify to participate if you

- Are 18 years of age or above
- Are a registered TVET or University student at Sedibeng college or NWU OR
- Are an academic or administrative staff member of the TVET college or University institution above OR
- Are part of the middle management in a TVET / University institution

Your input into the study is very important as it will provide me with current data and perceptions on the role ICTs are playing within the higher education sector. Such data will contribute valuable information that can enhance both management and organisational use of Information and Communication Technologies leading to improved administrative efficiency in higher education. The information will be treated with the appropriate confidentiality and ethical considerations as stipulated by the University.

I would greatly appreciate it if you submit the completed questionnaire back to me as soon as possible as I hope to finalise the study in October of this year.

It should take approximately five minutes to complete the questionnaire.

For more information, e-mail me at dsikoya@gmail.com or call me on 0746978597

Thanking you in advance for your contribution

Regards

Dorothy Kanyemba dsikoya@gmail.com 0746978597

* Required

INFORMED CONSENT

I understand that I may complete the questionnaire once and that my participation in the research is voluntary.

1. Herewith I give my consent to participate in the research (insert your initials / student number below) *

A: Biographical Information

2. Age range in years *

Mark only one oval.

- ☐ 18-30
☐ 31-42
☐ 43-54
☐ 55 and above

3. TYPE OF INSTITUTION *

Mark only one oval.

- ☐ TVET College University

4. Study Programme / Department *

Mark only one oval.

- ☐ Business Studies Engineering Studies Other
☐
☐

9. Applicants check application status over the internet (online) without going to queue at campuses *

Mark only one oval.

☐ Yes

☐ No

10. Returning students complete registration processes via internet (online) eliminating / reducing the number of people of physically queuing at campuses during registration periods. 1=(Never), 2= (Sometimes), 3=(Always) *

Mark only one oval.

11. It is possible to access academic transcripts and results on the internet (online) without going to the university / college records office. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

12. Classes and subjects are electronically allocated for staff and students at our college/university *

Mark only one oval.

☐ Yes

☐ No

13. Students in our institution receive financial invoices, exam timetables and academic progress reports electronically (via email or on the website). 1=Disagree 2=Partially agree 3= Strongly Agree * *(Mark only one oval.)*

	1	2	3	
Disagree	☐	☐	☐	Strongly Agree

14. Important information and announcements are communicated to Students electronically via SMS or E-mail at all times instead of using paper-based noticeboards.(1=Disagree, 2=Partially agree, 3=Strongly Agree) *

Mark only one oval.

1	2	3
☐	☐	☐

15. Gates / entrances are opened using student / staff electronic cards access to enter or exit institution. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

1	2	3
☐	☐	☐

16. Payments of fees and bursaries are processed online reducing handling of hard cash at the institution. (1= Disagree, 2= Partially agree 3=Strongly Agree) *

Mark only one oval.

1	2	3
☐	☐	☐

17. Students use electronic access cards / codes to enter and exit computer labs, workshops and the library. *

Mark only one oval.

☐ Yes
☐ No

c: ICT USE IN KNOWLEDGE ADMINISTRATION

18. Our institution has an electronic library system which allows both staff and students access to library services via the internet when they are away from the campus. *

Mark only one oval.

☐ Yes
☐ No

19. Students and staff benefit through Open Educational Resources (free) provided electronically via the library's internet /online database . (1= Disagree, 2= Partially agree, 3=Strongly Agree) *

Mark only one oval.

1	2	3
☐	☐	☐

20. There is a link to an e-learning and internal communication portal on the institution's website for staff and students *

Mark only one oval.

☐ Yes
☐ No
☐ Not sure

21. All students and staff are given training on the use of the institution's e-learning portal and can use it without much problems. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly Agree

22. How often do lecturers and students interact and exchange knowledge via the internet /online learning system. (eg online lessons, videos, sharing notes etc). 1=(Never), 2=(Sometimes), 3= (Quite often, 4=(Always) *

Mark only one oval.

1		2	3	4
☐		☐	☐	☐

23. On a scale of 1=(very poor), 2=(Average), 3=(Good), 4=(excellent) rate your opinion of the use of the e-learning portal by students and staff in your institution *

Mark only one oval.

1		2	3	4
☐		☐	☐	☐

24. Indicate the online / digital platform used MOST for teaching and learning in your studies *

Mark only one oval.

- ☐ YouTube
- ☐ WhatsApp
- ☐ Google classroom
- ☐ None of the above

25. Internal assessments are done electronically allowing freedom to submit and obtain feedback at any convenient time and place. *

Mark only one oval.

- ☐ Yes
☐ No
☐ Not sure

26. The option for online distance learning and online examinations is available in the institution. *

Mark only one oval.

- ☐ Yes
☐ No

27. During the Covid-19 pandemic full lockdown, what method of service delivery (i.e, teaching, learning and administration) was used in your institution *

Mark only one oval.

- ☐ Fully Online classes
☐ Face-to-face / contact classes Blended Teaching and Learning None
☐
☐

28. How are you doing your studies and receiving administrative services currently *

Mark only one oval.

- ☐ Online
☐ Face-to-face
☐ Blended teaching and Learning
☐ None

D: STATE OF E-READINESS

29. Does your institution have an internet connection for both students and staff *

Mark only one oval.

☐ Yes
☐ No

30. Rate the quality of internet / Wi-Fi connection in your institution 1=(poor quality), 2=(Average quality), 3 Excellent Quality *

Mark only one oval.

	1	2	3	
Poor	☐	☐	☐	Excellent

31. The institution has sufficient network computers to allow both staff and students to access the internet while on campus. 1=(Disagree), 2=(Partially Agree), 3=(Strongly agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly Agree

32. Rate your computer literacy skills. 1=(Very poor), 2=(Average), 3=(Good), 4=(Excellent) *

Mark only one oval.

1	2	3	4
☐	☐	☐	☐

33. Rate your level of skill in using the internet. 1=(Very poor), 2=Average, 3=(Good), 4=(Excellent)

*

Mark only one oval.

1		2	3	4
☐		☐	☐	☐

34. How often do you use the internet in your studies *

Mark only one oval.

☐	Never
☐	Sometimes
☐	Quite often Always
☐	

35. Which internet connection sources do you have for you to operate online at home

*

Mark only one oval.

☐	Mobile network data
☐	Wi-Fi
☐	Mobile network data and Wi-Fi
☐	None

36. Indicate the device you use MOST at home to access the internet *

Mark only one oval.

☐	Laptop / Computer Tablet
☐	Smart phone
☐	None

37. What support have you received from your institution to be able to access online services from home. *

Mark only one oval.

- ☐ Electronic device Internet connection data
- ☐ Electronic devices and data
- ☐ None

38. What support do you still need to be able to operate online effectively *

Mark only one oval.

- ☐ Electronic device Internet data
- ☐ Both device and data
- ☐ None

39. Recommend your MOST preferred method of receiving both learning and administrative services from your institution *

Mark only one oval.

- ☐ Online method
 - ☐ Face-to-face
 - ☐ Blended method
-

ANNEXURE 2: Staff online questionnaire

ICT innovation for higher education administration_ Staff Questionnaire

You are kindly invited to participate in research I am carrying out on Information Communication Technology (ICT) innovation for higher education administration. This is a survey to assess and appraise the extent / level of ICT use for information and knowledge administration by higher education institutions in South Africa.

Basic Social Sciences Research Ethics Committee (BaSSREC) of the North West University approved this study. Sedibeng TVET college Principal granted and NWU gatekeepers permission for this study to be conducted in their institutions. You qualify to participate if you

- Are 18 years of age or above
- Are a registered TVET or University student at Sedibeng college or NWU OR
- Are an academic or administrative staff member of the TVET college or University institution above OR
- Are part of the middle management in a TVET / University institution

Your input into the study is very important as it will provide me with current data and perceptions on the role ICTs are playing within the higher education sector. Such data will contribute valuable information that can enhance both management and organisational use of Information and Communication Technologies leading to improved administrative efficiency in higher education. The researcher will treat all information with the appropriate confidentiality and ethical considerations as stipulated by the University.

I would greatly appreciate it if you submit the completed questionnaire back to me as soon as possible as I hope to finalise the study in October of this year. It should take approximately five minutes to complete the questionnaire. For more information, e-mail me at dsikoya@gmail.com or call me on 0746978597. Thanking you in advance for your contribution
Regards

Dorothy Kanyemba dsikoya@gmail.com 0746978597

* Required

1. I understand that I may complete the questionnaire once and that my participation in the research is voluntary. I give my consent to participate in this research study (insert initials OR staff code below) *
-

A: Biographical Information

2. Age range in years *

Mark only one oval.

- ☐ 18-30
☐ 31-42
☐ 43-54
☐ 55 and above

3. Type of institution you belong to *

Mark only one oval.

- ☐ TVET college University
☐

4. Your Status. *

Mark only one oval.

- ☐ HOD
☐ Senior Lecturer / Programme Coordinator Administrative Staff
☐

5. Number of years you have been in the institution *

Mark only one oval.

☐

1-2 years

☐

3-4 years

☐

5 years and above

B: ICT USE IN GENERAL INFORMATION AND STUDENT INFORMATION ADMINISTRATION

Choose the response that mostly apply to your university/ college. Please read the questions carefully and be as truthful as possible in your responses.

6. Information and services of the organisation are displayed and regularly updated on the website making it easy to showcase the institution to the general public. (1 Disagree, 2 Partially Agree , 3 Strongly Agree) *

Mark only one oval.

1

2

3

Disagree

☐☐☐

Strongly agree

7. In my institution, both application for space and student admissions are done on the internet (online) only to minimise queuing at the campuses. (1 Disagree, 2 Partially Agree , 3 Strongly Agree) *

Mark only one oval.

1

2

3

Disagree

☐☐☐

Strongly Agree

8. Returning students complete registration processes on the internet (online) at the beginning of each year or semester thus eliminating/ reducing queuing at campuses during registration periods. (1=Never, 2= Sometimes, 3= Always) *

Mark only one oval.

	1	2	3	
Never	☐	☐	☐	Sometimes

9. All staff and students' information is electronically stored on an online database accessible to all administrative and management staff *

Mark only one oval.

Yes	☐
No	☐

10. Networked / internet connected computers are extensively used for accounts related, clerical, student registration and general administration duties in our institution. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly disagree

11. It is possible for management, administrative, academic staff to access institutional records via password protected login and work online without being in the campus and at any time (remote access). (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly agree

12. Digital / electronic notice boards are used to display important information and announcements in the institution. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly agree

13. Important information and announcements are communicated to students electronically via SMS or E-mail at all times instead of using physical noticeboards. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly agree

14. Gates / entrances are opened using student / staff electronic cards access to enter or exit institution. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly agree

15. Students and staff use electronic access cards / codes to enter and exit computer labs, workshops and the library. 1= Never, 2= Sometimes, 3= Always *

Mark only one oval.

1	2	3
☐	☐	☐

16. Students in our institution receive financial invoices, exam information electronically. 1=Disagree 2=Partially agree 3= Strongly Agree *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly agree

17. Payments of fees and bursaries are processed online reducing handling of hard cash at the institution. (1= Disagree, 2= Partially agree 3=Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly Agree

18. Exam timetables and academic progress reports are send electronically / online to all students. *

Mark only one oval.

Yes ☐

No ☐

C: ICT USE IN KNOWLEDGE ADMINISTRATION

19. Our institution has an electronic library system which allows both staff and students online access to library services when they are away from the campus. *

Mark only one oval.

Yes ☐

No ☐

20. Students and staff benefit through Open Educational Resources (free) provided electronically via the library's online database . (1= Disagree, 2= Partially agree, 3=Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly Agree

21. It is possible for students and staff to access our institution's library online even when one is not on the campus (remote library) *

Mark only one oval.

Yes	☐
No	☐

22. There is a link to an e-learning and internal communication portal on the institution's website for staff and students *

Mark only one oval.

Yes	☐
No	☐
Not Sure	☐

23. All students and staff are given training on the use of the institution's e-learning portal and can use it without much problems. (1= Disagree, 2= Partially agree= 3 Strongly Agree) *

Mark only one oval.

	1	2	3	
Disagree	☐	☐	☐	Strongly Agree

24. On a scale of 1=(very poor), 2=(Average), 3=(Good), 4=(excellent) rate your opinion of the use of the electronic communication portal by students and staff in your institution *

Mark only one oval.

	1	2	3	4	
Very poor	☐	☐	☐	☐	Excellent

25. Internal assessments are done electronically allowing freedom to submit and obtain feedback at any convenient time and place. *

Mark only one oval.

Yes	☐
No	☐
Not sure	☐

26. The option for online distance learning and online examinations is available in my institution. *

Mark only one oval.

Yes	☐
No	☐

27. During the Covid-19 pandemic full lockdown, what method of service delivery (administrative services, teaching and learning) was used in your institution *

Mark only one oval.

☐	Fully online services	Face-to-face
☐	Blended services (combination of face-to-face and online)	
☐	None of the above	

28. How is the institution offering administrative, teaching and learning services in this current lockdown level *

Mark only one oval.

- ☐ Fully online services Face-to-face
- ☐ Blended services (combination of face-to-face and online)
- ☐ None of the above

D: INSTITUTION STATE OF E-READINESS

29. Does your institution have an internet connection for both students and staff *

Mark only one oval.

- Yes ☐
- No ☐

30. Rate the quality of internet / WiFi connection in your institution 1=(poor quality), 2=(Average quality), 3 Excellent Quality *

Mark only one oval.

- 1 2 3
- Poor Quality ☐ ☐ ☐ Excellent

31. The institution has sufficient network computers to allow both staff and students to access the internet while on campus. 1=(Disagree), 2=(Partially Agree), 3=(Strongly agree) *

Mark only one oval.

- 1 2 3
- Disagree Strongly agree
- 

32. Rate your computer literacy skills. 1=(Very poor), 2=(Average), 3=(Good), 4=(Excellent) *

Mark only one oval.

1		2	3	4	
Very poor	☐	☐	☐	☐	Excellent

33. Rate your level of skill in using the internet. 1=(Very poor), 2=Average, 3=(Good), 4=(Excellent)

*

Mark only one oval.

1		2	3	4	
Very poor	☐	☐	☐	☐	Excellent

34. How often do you use the internet in your work? *

Mark only one oval.

☐	Never	☐	Sometimes	☐	Quite often	☐	Always
☐							
☐							

35. Which internet connection sources do you have to operate online at home. *

Mark only one oval.

☐	Mobile network data
☐	Wi-Fi
☐	Mobile network data and Wi-Fi
☐	None

36. ^{*} Indicate the device you use MOST at home to access the internet and work online

Mark only one oval.

- ☐ Laptop / Computer Tablet
- ☐ Smart phone None
- ☐

37. What support have you received from your institution to be able to access online services from home. ^{*}

Mark only one oval.

- ☐ Electronic device (eg computer, laptop, tablet) Internet connection data
- ☐ Electronic devices and internet data
- ☐ None

38. What support do you still need to be able to operate online effectively ^{*}

Mark only one oval.

- ☐ Electronic device Internet data
- ☐ Both device and internet data
- ☐ None

39. Recommend your MOST preferred method of delivering both learning and administrative services in your institution ^{*}

Mark only one oval.

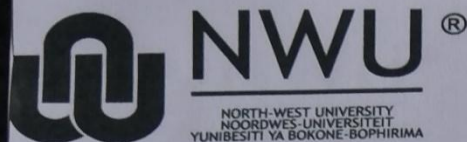
- ☐ Online method Face-to-face
- ☐ Blended method (a combination of face-to-face and online service)
- ☐

ANNEXURE 3: Interview Protocol

ICT INTEGRATION FOR IMPROVED HIGHER EDUCATION TEACHING AND LEARNING SEMI-STRUCTURED INTERVIEW PROTOCOL

QUESTION	PURPOSE	CONTENTS	ANSWERS
Opening	Provide interviewee details of study and seek consent to participate	Introduction to the interview, face-to-face or telephonically	Record participant's consent to participate
1	To investigate the current state of ICT use in the institutions' teaching and learning.	Does your institution have an e-learning portal? If yes, what e-learning tools are available on the portal? How often do you use the portal in your work/studies, using which tools? Is the use of the portal compulsory or voluntary for staff and students? What motivates or demotivates your use of the portal?	
2	To assess participants attitudes towards integration of technology in pedagogy and learning	Apart from the portal, which other technologies (software or applications) do you use to enhance teaching/learning What method of teaching /learning did you use during the Covid-19 hard lockdown?	
3	To identify challenges in integrating technology in teaching/learning	What do you perceive as challenges to the use of technology in teaching/learning (portal and other technologies)	
4	To check participants understanding of the value of digital technology in teaching and learning	What do you think are the advantages of online teaching/learning technology?	
5	To check participants preferred teaching and learning methods	Given a choice what would you prefer as teaching/learning methods and why; (Face-to-face, blended method, online method)	

ANNEXURE 4: Title Approval Letter



PO Box 1174, Vanderbijlpark
South Africa, 1900

Faculty of Humanities
Humanities Research Management Committee
Tel: (016) 910-3662
23991437@nwu.ac.za
Date: 18 November 2019

Ms Kanyemba

Student no: 23232676

Research title as approved by the HRMC committee:

ICT INNOVATION FOR PUBLIC HIGHER EDUCATION ADMINISTRATION IN SOUTH AFRICA: A COMPARATIVE STUDY

Dear Ms Kanyemba

This letter serves to confirm that your PhD research proposal has been approved by the Humanities Research Management Committee.

The ethics application is referred to the:

* Research Ethics Committee- BaSSREC: X.

* Research Ethics Committee-HHREC: _____.

You will find the details on the procedure that you will have to follow to submit to the Ethics Committee on the NWU-website. For the HRMC-records, please inform Ms Precious Nale as the responsible person when your submission has been successfully completed and approved (Precious.Nale@nwu.ac.za).

Yours sincerely

A handwritten signature in black ink, appearing to read 'Hofisi', is written over a faint, larger signature.

Prof C Hofisi
Chairperson: Humanities Research Management Committee

ANNEXURE 5: Ethics Approval letter



PO Box 1174, Vanderbijlpark
South Africa 1900

Tel: 016 910-3111
Fax: 016 910-3116
Web: <http://www.nwu.ac.za>

Faculty of Humanities
Tel: 016-91003441
Email: Chrizanne.vaneeden@nwu.ac.za

10 June 2020

Dear Ms Kanyemba and Prof Hofisi,

ETHICS APPLICATION APPROVED

This letter serves to inform you that your ethics application was approved by the Ethics Committee for Basic and Social Sciences (BaSSREC) of the NWU.

ETHICS APPLICATION NUMBER: NWU-HS-2020-0004
STUDY SUPERVISOR: Prof C Hofisi
APPLICANT: Ms D Kanyemba
PROJECT TITLE: ICT innovation for public higher education administration in South Africa: A comparative study.
DURATION: 10 June 2020 to 10 June 2021. An annual monitoring report is required.
ETHICS APPROVAL DATE: 10 June 2020

Your acceptance of the reviewers' recommendations is appreciated and your research will be conducted in line with such recommendations. However, in the last round of BaSSREC consultation about your study, a concern was mentioned about the reliability and validity of the Likert scale measurement that you plan to use. It was strongly recommended that you consult with a NWU statistical consultant about the appropriateness of this scale for your study.

Since the Likert scale issue is not an ethical matter, your application for ethics approval was approved by BaSSREC on the 10th June 2020 and this REC wishes you well with your study.

Yours sincerely

Prof C Van Eeden
Chair: BaSSREC

ANNEXURE 6: Sedibeng TVET College Permission Letter



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA



SEDIBENG TVET COL
"GROW WITH THE FLOW"

www.sedcol.co.za

E-mail: info@sedcol.co.za

CENTRAL OFFICE:

Tel: (016) 422-6645/8

Fax: (016) 422-6646

37 VOORTREKKER ST

VEREENIGING

PRIVATE BAG X020

VEREENIGING 1930

SEBOKENG:

Tel: (016) 988-1276/1287

Fax: (016) 988-1288

4 SAMUEL ST

SEBOKENG

PRIVATE BAG X085

VEREENIGING 1930

VAN DER BIJLPARK:

Tel: (016) 933-5644/5

Fax: (016) 931-9406

2 FRIKKIE MEYER BLVD

PRIVATE BAG X05

VAN DER BIJLPARK 1900

VEREENIGING:

Tel: (016) 421-1150/51

Fax: (016) 422-0746

33 VOORTREKKER ST

VEREENIGING

PRIVATE BAG X015

VEREENIGING 1930

DR MG Mothapo
Principal/ CEO

To: Mrs D Kanyemba

From: Dr MG Mothapo
Principal/ CEO

Date: 15 January 2020

Re: **Approval to conduct research at Sedibeng TVET College.**

The above matter refers.

Kindly note that the Executive Management of the College has carefully perused your application to conduct research at Sedibeng TVET College.

Your application has been granted and your research will take place at **Vanderbijlpark, Vereeniging and Sebokeng Campus** respectively.

As the researcher you are required to distribute and collect questionnaires as the College does not have the resources to do so.

You are therefore required to submit a detailed schedule on how the research will be taking place in order for the Executive Management to be able to inform the Campus Management. Regarding the time and personnel needed for you to complete your research.

It is required that upon completion of your research the following should be submitted to the Executive Management of the College for records purposes:

1. Detailed summary of the questionnaires received.
2. Recommendations according to the outcome of your research.

I hope that you will find the above in order.

Regards

ANNEXURE 7: North West University Permission Letter



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: +2718 299-1111/2222

Web: <http://www.nwu.ac.za>

Research Data Gatekeeper Committee

NWU RDGC PERMISSION GRANTED / DENIED LETTER

Based on the documentation provided by the researcher specified below, on 14/07/2020 the NWU Research Data Gatekeeper Committee (NWU-RDGC) hereby grants permission for the specific project (as indicated below) to be conducted at the North-West University (NWU):

Project title: ICT innovation for public higher education administration in South Africa: A comparative study.

Project leader: Prof C Hofisi

Researcher/Project Team: D Kanyemba

Ethics reference no: NWU-HS-2020-0004

NWU RDGC reference no: NWU-GK-2020-036

Specific Conditions:

- Due the COVID-19 pandemics the Committee would like to advise the researcher to practice the necessary caution and adhere to the National Covid-19 Guidelines when conducting research with participants.

Approval date: 14/07/2020

Expiry date: 13/07/2021

General Conditions of Approval:

- The NWU-RDGC will not take the responsibility to recruit research participants or to gather data on behalf of the researcher. This committee can therefore not guarantee the participation of our relevant stakeholders.
- Any changes to the research protocol within the permission period (for a maximum of 1 year) must be communicated to the NWU-RDGC. Failure to do so will lead to withdrawal of the permission.
- The NWU-RDGC should be provided with a report or document in which the results of said project are disseminated.

Please note that under no circumstances will any personal information of possible research subjects be provided to the researcher by the NWU RDGC. The NWU complies with the Promotion of Access to Information Act 2 of 2000 (PAIA) as well as the Protection of Personal Information Act 4 of 2013 (POPI). For an application to access such information please contact Ms Annamarie De Kock (018 285 2771) for the relevant enquiry form or more information on how the NWU complies with PAIA and POPI.

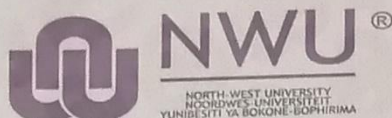
The NWU RDGC would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the NWU RDGC for any further enquiries or requests for assistance

Yours sincerely

Prof Marlene Verhoef

Chairperson NWU RDGC

ANNEXURE 8: Title Registration



Private Bag X6001, Potchefstroom
South Africa, 2520

Tel: (018) 299-1111/2222
Web: <http://www.nwu.ac.za>

Higher Degree Administration

Tel: 0722152076
Email: craigoboy@gmail.com
Enquiries: MR CG FREEMAN

8 October 2021

Dear MRS KANYEMBA
University number: 23232676

REGISTRATION OF TITLE

At the recent meeting of a relevant committee meeting of the NWU Faculty of Humanities your title was approved as follows:

ICT innovation for public higher education administration efficiency in South Africa: A comparative study

The above-mentioned title may under **no circumstances** be changed without consulting your supervisor and obtaining the approval from the relevant committee in the mentioned faculty, in regard of which this office must be furnished with the latest approved title.

In the instance that you wish to submit for examination, please inform your supervisor/promoter accordingly. *Also ensure absolute adherence to the prescripts of A Rule 4.10 for the submission of a Master's study and of A Rule 5.10 for the submission of Doctoral thesis.*

Upon approval of your supervisor/promoter, please ensure that the Notice of Submission form is submitted THREE months in advance to this office.

Note that the Notice of Submission form is available on the [NWU DIY portal](#).

For ease of reference, herewith a reference to the following useful resources:

- [General Academic Rules \(A-reëls\)](#);
- [Manual for Higher Degree Studies](#);
- [Policy on academic integrity](#);

We wish you a pleasant and successful period of study.

Kind regards

Registrar

