



The use of digital technologies at TVET colleges in KwaZulu-Natal: A comparative case study

By

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Pietermaritzburg

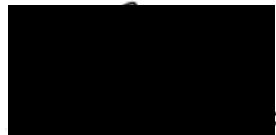
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07 May 2025
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Signature

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ABSTRACT

The adoption of Information and Communication Technologies (ICTs) in Technical and Vocational Education and Training (TVET) colleges is widely recognised as a means of enhancing teaching and learning. However, existing research on ICT integration in tertiary education has primarily focused on universities, with limited attention to the TVET sector. This study addresses this gap by examining the patterns of ICT adoption in TVET colleges in KwaZulu-Natal (KZN), South Africa. The study investigates how institutional factors influence ICT adoption and explores how lecturers utilise ICTs in their pedagogical practices.

The study is situated within the interpretivist paradigm and employs a multi-phase, mixed-method case study approach. Data were collected in two phases: an initial survey of ICT distribution across all nine TVET colleges in KZN, followed by in-depth case studies of three selected institutions. Methods included institutional surveys, semi-structured interviews, focus groups, and document analysis. The study is theoretically grounded in the Diffusion of Innovation (DOI) theory, Affordance Theory, and Institutional Design Theory (IDT), which provide a framework for analysing the institutional and individual factors shaping ICT adoption.

Findings reveal that ICT distribution across KZN's TVET colleges is highly uneven, with urban institutions benefiting from superior infrastructure, stable internet connectivity, and access to service providers, while rural colleges face persistent infrastructural challenges. Institutional decision-making, financial constraints, and policy directives significantly shape ICT adoption strategies, with colleges employing varied approaches such as enhancing wireless capabilities, outsourcing ICT services, and implementing blended learning initiatives. At the individual level, lecturers' adoption of ICTs is influenced by digital literacy levels, workload demands, and institutional support structures, with many educators relying on applications like WhatsApp, Microsoft Teams, and Moodle for instructional delivery.

The study contributes to existing scholarship by demonstrating how the interplay between environmental conditions, institutional structures, and user perceptions shapes ICT adoption in TVET colleges. The findings have implications for policy and practice, underscoring the need for a nationally coordinated ICT strategy, targeted funding for under-resourced institutions, and sustained lecturer professional development initiatives. Future research should explore long-term ICT adoption trends and assess the effectiveness of policy interventions aimed at bridging the digital divide in the TVET sector.

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LIST OF ACRONYMS

2G	Second Generation of Mobile Networks
3G	Third Generation of Mobile Networks
4G	Fourth Generation of Mobile Networks
ADSL	Asymmetric Digital Subscriber Line
AISI	African Information Society Initiative
AU	African Union
CBD	Central Business District
COGTA	Cooperative Governance and Traditional Affairs
COVID-19	Coronavirus Disease
DDD	Digital Development Dashboard
DHET	Department of Higher Education and Training
DOE	Department of Education
DOI	Diffusion of Innovation Theory
DP	Deputy Principal
ETDP SETA	Education, Training and Developmental Practices SETA
GDP	Gross Domestic Product
GSMA	Groupe Speciale Mobile Association
HEI	Higher Education Institution
HoD	Head of Department
HSSREC	Humanities and Social Sciences Research Ethics Committee
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communication Technology
ID	Instructional Designer
IDP	Integrated Development Plan
ILO	International Labor Organization
INK	Inanda, Ntuzuma, KwaMashu
IoT	Internet of Things
IP	Internet Protocol
ITU	International Telecommunication Union
KZN	KwaZulu-Natal
LAN	Local Area Network
LMS	Learner Management System

LTE	Long-Term Evolution [see 4G]
MAN	Metropolitan Area Network
MIS	Management Information System
MOOC	Massive Open Online Course
MPLS	Multiprotocol Label Switching
MPR	Municipal Planning Region
NATED	National Accredited Technical Education Diploma
NCV	National Curriculum: Vocational
NEPAD	New Partnership for African Development
NSF	National Skills Fund
NSFAS	National Student Financial Aid Scheme
OUA	Organisation of African Unity
PANAFTTEL	Pan-African Telecommunications Network
PC	Personal Computer
QM	Quality Manager
RAM	Random Access Memory
SABEN	South African Broadband Educational Network
SANReN	South African National Research Network
SD-WAN	Software-Defined Wide Area Network
SETA	Sector Education and Training Authority
SITA	State Information Technology Agency
SME	Subject Matter Expert
SMS	Student Management System
SOP	Standard Operating Procedure
SSID	Service Set Identifier
TENET	Tertiary Education and Research Network of South Africa
TCCP	TVET Colleges Connection Project
TCP	Transmission Control Protocol
TVET	Technical and Vocational Education and Training
UDP	User Datagram Protocol
UKZN	University of KwaZulu-Natal
UN	United Nations
UNCTAD	UN Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization

UNEVOC	UNESCO International Centre for TVET
UNISA	University of South Africa
UPS	Uninterrupted Power Supply
VLE	Virtual Learning Environment
VPN	Virtual Private Network
VR	Virtual Reality
VSAT	Very Small Aperture Terminal
WAN	Wide Area Network

CHAPTER 1: INTRODUCTION

1.1 Introduction

“I discovered something I had not noticed about technology before. In addition to technology’s ability to satisfy (and create) desires, and to occasionally save labour, it did something else. It brought new opportunities. Right before my eyes I saw online networks connect people with ideas, options, and other people they could not possibly have met otherwise. Online networks unleashed passions, compounded creativity, amplified generosity.” (Kelly, 2010, p. 44)

Historically, the impact of technology on education has often been measured in terms of how many computers, projectors, or other kinds of audio-visual equipment are present in the classroom and how educators utilise them in teaching and learning activities (Hooper & Rieber, 1995). However, with the rapid development of the information and communication technologies (ICTs) market over the last two decades, it has been argued that hardware alone does not constitute the full extent of technology’s impact on education. In order to capture the full extent of how technology shapes education, one has to consider how various technologies (hardware, internet, cloud, apps, virtual reality) are integrated and harnessed to create the most ideal learning environments possible for students (Selinger & Hamilton, 2019; Trucano, 2016). ICTs can potentially transform educational processes, including promoting flexibility in teaching and learning, encouraging enhanced learner engagement with content, offering authenticity in simulated learning environments, and promoting reflection in learning and knowledge creation (Yian & Park, 2017). Fau and Moreau (2018) further argue that educational institutions and teachers should consider the social ecosystem of ICTs holistically, especially the points at which students might interact with ICTs in their daily lives.

Regarding ICTs in TVET, scholars have noted the potential of ICTs to significantly shape innovation in TVET pedagogy, provision, and content development (Fau & Moreau, 2018; Yian & Park, 2017). Developments in ICTs enable TVET institutions to provide more authentic workplace experiences (Fau & Moreau, 2018; Selinger & Hamilton, 2019; Yian & Park, 2017). De Otero (2019) further notes that recent trends in TVET at the global level indicate that innovation driven by ICTs has already significantly transformed TVET provision and practice across different contexts. For the South African context, it may be argued that ICTs can potentially elevate TVET provision, considering the socioeconomic backdrop within which TVET colleges operate. This study aimed to gain insights into the impact of ICTs on teaching and learning at South African TVET colleges and the challenges associated with integrating

ICTs into TVET classrooms.

1.2 Background and context of the study

The study explored the phenomenon of digital technology adoption at TVET institutions in KwaZulu-Natal (KZN); it drew on scholarship focusing on the proliferation of ICTs in educational institutions. The literature reviewed for this study highlights the global distribution trends of ICTs, the impact of ICTs on educational processes, and the changes in the provision of education at various levels as a consequence of phenomena such as massification and digitisation. The study utilised the themes highlighted in digital technology scholarship to frame an investigation into the adoption of ICTs at TVET institutions and their responses to the integration of ICTs into their classrooms. The study highlights how access to ICTs – and the quality of the access – at TVET institutions influenced institutional approaches to teaching and learning, the choices institutions made regarding their physical teaching and learning spaces, the skills required from educators, and how they deliver the curriculum.

i. *The impact of ICTs on educational processes*

As ICTs become an increasingly ubiquitous part of everyday life and access to the Internet approaches universal levels, it begs the question: How do educational institutions remain relevant in the digital age? If the Internet provides almost universal access to information and knowledge, what is the role of educational institutions in a technology-centric society? UNESCO believes that the best approach to this question begins by considering educational institutions as sites where individuals can acquire “digital skills”. UNESCO argues that digital skills should be approached with a broad and holistic understanding of the daily interactions between individuals and ICTs. The purpose – Fau and Moreau (2018) argue – of digital skills is to empower individuals to solve complex problems, process and evaluate information critically, and apply precise techniques to produce or access internet content. Similarly, Selinger and Hamilton (2019) and Trucano (2016) argue that developments in the technology sector necessitate that curricula focus on “21st-century competencies”. These 21st- century competencies include using ICTs, critical thinking, creativity, complex problem-solving, group work, collaboration, and teamwork (Selinger & Hamilton, 2019; Trucano, 2016). In terms of the specific role of ICTs in education, UNESCO declared that; “ICT[s] must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision” (UNESCO, 2018, p. 13). Thus, to develop effective teaching and learning approaches for the digital age, UNESCO

advocates for institutions and educators to consider the social ecosystem of ICTs and the lived experiences of their students (Fau & Moreau, 2018).

For education institutions, these emerging trends necessitate that institutions reconsider the design of their teaching and learning spaces and develop teaching approaches relevant to students in the digital age (Fau & Moreau, 2018; Latchem, 2017b; UNESCO-UNEVOC, 2020). Beyond the infrastructure and the hardware, ICTs provide opportunities for institutions to create new teaching and learning environments that potentially transform traditional education models. Additionally, educational institutions can update their curricula to harness the potential of ICTs (Selinger & Hamilton, 2019). Historically, famous examples of technologies that institutions have adopted have included incorporating virtual learning environments (VLEs), electronic smart boards, digital student management systems (SMS) and massive open online courses (MOOCs) into institutions' teaching and learning offerings (Selwyn, 2013; Selwyn & Facer, 2014). These technologies allowed institutions to augment their physical spaces with digital capabilities, linked them to online resources, and allowed asynchronous access to teaching and learning content (Pandey, 2019). However, Escueta et al. (2017) note that many institutions have underutilised the technologies at their disposal in favour of the traditional contact teaching mode.

At the classroom level, ILO (2021); Latchem (2017b); UNESCO-UNEVOC (2020); UNESCO (2018) note that ICTs have the potential to allow educators and educational institutions to operate in “borderless” and “edgeless” ways, they also enable students to engage with educational opportunities in ways that are relevant and convenient to them. This potential creates an environment where the classroom walls are no longer a barrier to learning opportunities as ICTs enable new ways of learning, communicating and collaborating. This sentiment is echoed by Selinger and Hamilton (2019), who argue that through ICTs, teaching and learning are no longer limited by time and space. ICTs are providing people with access to education in their homes, libraries and internet cafes; ICTs also provide content flexibility where one can decide what they want to learn, when they want to learn, as well as how they want to learn (Pandey, 2019; Trucano, 2016). ICTs have become more than a mere classroom accessory; they are now being used as an essential tool to extend access to education to populations – or sections of populations – who would otherwise not have access to it (Conole, 2013; Selwyn & Facer, 2014). Technologies such as virtual reality (VR) integrated with existing ICT infrastructure are extending the classroom's reach and capacity; this enables people of all ages to have access to education on their terms (Pandey, 2019).

In light of all these trends, the role of the educator in an environment augmented with ICTs is brought into question. Should it be fundamentally different from current teaching and learning practices? Historically – according to Hooper and Rieber (1995) – there has been no fundamental difference between teaching with technology and teaching in general. They theorise that effective technology-based teaching can only be achieved through the teachers' ability to construct lessons using robust pedagogical principles rather than relying on technology to teach (Hooper & Rieber, 1995). Brenton (2009) argued that an experienced, intelligent, and creative practitioner is needed for effective e-learning to take place. For educators, the benefits of integrating technology into their practice include flexibility in teaching and learning activities (not restricted by time or location), encouragement of new approaches to delivering content and broadening the repertoire of skills of the teacher (Brenton, 2009; Kukulska-Hulme, 2012; Price & Oliver, 2007). Thus, effectively integrating ICTs into the classroom requires an experienced educator who knows their curriculum material, has the digital skills to create relevant learning content, and can facilitate lessons across physical spaces and digital platforms.

ii. *Massification, digitisation and the transformation of TVET provision*

In the past, TVET provision consisted primarily of direct face-to-face teaching of occupational theories and simulated workshop demonstrations; in a few cases, this would be augmented by a situated learning experience for the student. However, this type of provision is increasingly becoming obsolete with the transition from the 'Industrial Age' to the 'Knowledge Age' and the integration of ICTs into every aspect of the world of work (Yian & Park, 2017). As TVET provision has become increasingly intertwined with technological innovation, several scholars have noted the potential of ICTs to significantly shape innovation in TVET pedagogy (Fau & Moreau, 2018; Yian & Park, 2017). Recent innovations in ICTs enable TVET institutions to provide more authentic workplace experiences (Fau & Moreau, 2018; Selinger & Hamilton, 2019; UNESCO, 2017; Yian & Park, 2017). De Otero (2019) further notes that recent trends in TVET at the global level indicate that innovation driven by ICTs has already significantly transformed TVET provision and practice across different contexts.

Beyond institutional and national objectives, the demand for increased TVET provision is nested within the massification of education phenomenon. Historically, the spread of massification has had a significant impact on educational institutions at all levels (de Otero, 2019; Jaffer et al., 2007; Park, 2009). According to Hornsby and Osman (2014), higher education institutions (HEIs) – in particular – are affected the most by massification; issues

such as larger class sizes, strained physical infrastructure, and increased dropout rates have become the norm. In 2015, UNESCO drafted the Framework for Action to address the challenges and shortfalls of massification (Wheelahan & Moodie, 2016). One of the recommendations made by the Framework for Action is to position TVET institutions as viable alternative destinations for students (Wheelahan & Moodie, 2016). The framework aims to strategically raise the public profile and attractiveness of TVET amongst all public stakeholders and to outline the strategic targets that UNESCO has set for the TVET sector (de Otero, 2019; Wheelahan & Moodie, 2016; Yian & Park, 2017). The UNESCO position is that there is a need for a fundamental shift in the conceptualisation, governance, funding, and organisation of TVET globally to ensure that the sector is capable of responding effectively to the many economic, equity and sustainable development challenges of the 21st-century world (Latchem, 2017a). UNESCO's ultimate goal is to encourage governments to develop, transform and expand TVET provision within their national systems to address their numerous education and training needs (Wheelahan & Moodie, 2016).

iii. *Access to ICTs for education in the South Africa TVET sector*

According to Balliester and Elsheikhi (2018) and the World Bank (2016), ICTs and the economic benefits that come with them are likely to be distributed unequally between developing and developed economies. Developing economies will likely lag behind developed economies due to inadequate infrastructure and high Internet access costs (World Bank, 2016). Despite the challenges, South Africa has made considerable progress towards the digital age. Unfortunately, due to the challenges facing South Africa's economy, the country's ICT sector has struggled to grow at a globally competitive rate (Gillwald et al., 2018). According to ICASA (2018) and Statistics South Africa (2016) figures, the ICT sector constituted approximately 3% of the country's GDP in 2014; this figure had increased to approximately 8% by the end of 2022 (ICASA, 2023). Even though the South African government has continuously emphasised the importance of ICTs in promoting equitable growth since 1994, the various macroeconomic policies and legislation adopted since then have largely failed to deliver on the promises of equal ICT access for all (Gillwald et al., 2018). Although there has been an increase in the adoption of ICTs over the last decade, access to ICT remains unequal. Studies indicate that access to ICTs is divided along class and racial lines (Akande & Van Belle, 2013; Gillwald et al., 2018).

Historically, the most considerable criticism of the South African government's ICT approach is that the government has failed to address growing issues related to the digital divide (Akande & Van Belle, 2013). The digital divide is the difference in the availability, access, and utilisation of electronic forms of knowledge by members of different groups and societies. The digital divide also represents the division of those who cannot benefit from access to ICTs from those who have access to ICT in a society (Akande & Van Belle, 2013; Gillwald et al., 2018; ICASA, 2018). Survey findings by Gillwald et al. (2018) indicate that technological forms of exclusion are a reality for significant portions of the South African population and that digital exclusion reinforces and deepens the existing social inequality. Digital exclusion is most prevalent in sections of society with low income, high unemployment, poor education and geographic isolation (Akande & Van Belle, 2013; van Dijk, 2020; World Bank, 2016). Furthermore, the data show that while the digital gap between men and women is diminishing, it persists between urban and rural dwellers; approximately 40% of rural dwellers have access to the Internet, and only 39% of urban residents are unconnected. Due to the unequal distribution of Internet and broadband infrastructure, 57% of Internet users access the web via mobile devices (Gillwald et al., 2018; ICASA, 2018). By 2022, the coverage for 2G, 3G and 4G/LTE Internet had increased to 84% for rural areas and 98% for urban areas (ICASA, 2022, 2023).

South Africa's TVET sector consists of 50 multi-campus public TVET colleges, which provide education and training programmes at more than 264 campuses and delivery sites (ETDP SETA, 2020). Over the years, South Africa's public TVET system has been pressured to increase enrolments and produce the relevant skills required for a rapidly changing economy and society (Council on Higher Education, 2016; DHET, 2017, 2020; Jaffer et al., 2007). The demand for increased enrolments in the TVET sector is also alluded to in policy papers such as the White Paper for Post-School Education and Training (White Paper), where the Department of Higher Education and Training (DHET) stipulates a target of 2.5 million TVET enrolments by 2030 (DHET, 2013; ETDP SETA, 2020). This policy directive indicates DHET's intent to transform the TVET sector and generate renewed interest in the programmes offered at TVET colleges (Akoojee, 2016). Given enrolment targets stipulated in multiple sector policies, DHET (2017, 2020) has identified the potential of ICTs to elevate TVET provision in South Africa. One of the interventions undertaken by the DHET to bolster this policy position is the TVET Colleges Connection Project (TCCP). TCCP is an ICT infrastructure development initiative spearheaded by DHET; the project is funded through a National Skills Fund (NSF) grant and

aims to connect TVET college campuses to the South African National Research Network (SANReN) (Hugo et al., 2021).

Implementation of TCCP is overseen by the South African Broadband Educational Network (SABEN) (Hugo et al., 2021). SABEN was established as part of an initiative within the Tertiary Education and Research Network of South Africa (TENET) to develop and manage the connection of the TVET colleges to SANReN, which provides high-speed connectivity for universities and research councils. The purpose of TCCP is to solve ‘bandwidth poverty’ at South Africa’s TVET colleges by connecting them to the SANReN, thereby enabling them to contribute to meeting the goals of a developmental state (Hugo et al., 2021). SANReN is a purpose-built network entirely separate from the commercial Internet. It provides high-speed connectivity to its users and is designed for the needs of the most demanding internet users in the country: scientists, teachers, academics and researchers. The network primarily caters for large data transfers and collaboration between users and the international research, teaching and learning community. It is engineered to support high-quality services that remain consistent regardless of the number of users on the network and can accommodate sudden spikes in traffic. The network connects SANReN to computer labs and provides Wi-Fi for students and TVET lecturers. This connection is a crucial component of the intervention because many students from townships or previously disadvantaged areas often do not have or cannot afford data bundles to access the Internet (Hugo et al., 2021).

Ultimately, providing SANReN access to TVET colleges and their campuses facilitates access to comprehensive information, research and educational resources to help education institutions manage their current capacity shortfalls more effectively. Moreover, it may be argued that the combination of access to SANReN and installation of ICTs at TVET colleges potentially offers flexible, customised education which can be made available to anybody, regardless of time or location. Through these kinds of digital installations, TVET colleges have the potential to extend access to learning opportunities to students from a variety of socioeconomic contexts, which fulfil the various strategic and policy objectives set out by DHET for the TVET sector (Blignaut et al., 2010; Council on Higher Education, 2016; ETDP SETA, 2020; Wheelahan & Moodie, 2016).

1.3 Statement of the problem

The integration of Information and Communication Technologies (ICTs) in education has generated extensive global research, particularly in higher education contexts, where digitalisation is often positioned as a driver of improved access, pedagogy, and institutional efficiency (Kirkwood & Price, 2014; Selwyn, 2021). However, less attention has been given to how these processes unfold in Technical and Vocational Education and Training (TVET) institutions, despite international policy advocacy for ICT use in this sector (UNESCO, 2016; ILO, 2020). Unlike universities, TVET colleges operate under distinct pedagogical imperatives, institutional contexts, and socioeconomic conditions, making them structurally and functionally different (Hassan et al., 2021). In South Africa, TVET institutions face mounting pressure to align with digitalisation trends driven by shifting labour market demands, national policy imperatives, and a broader agenda to modernise vocational education. However, the pattern of ICT distribution across TVET colleges remains uneven, resulting in disparities in access and infrastructure that limit equitable adoption across the TVET sector. This raises a critical empirical gap: understanding how ICTs are distributed spatially and institutionally within the South African TVET landscape. This study addresses this gap by documenting ICT distribution patterns across TVET colleges in KwaZulu-Natal; it draws on Diffusion of Innovation (DOI) theory to explore where ICTs have been adopted – and where they are not – and how TVET colleges are utilising them.

Beyond physical access, the adoption of ICTs in TVET colleges is shaped by a complex interplay of institutional factors. While much of the literature on ICT adoption presents challenges as primarily technical or infrastructural, there is growing recognition that the institutional environment, comprising governance practices, resource allocation, managerial culture, and policy interpretation, critically influences how digitalisation unfolds (Selwyn, 2021; van der Ross & Tsibolane, 2017). In the TVET context, where colleges operate with limited autonomy and uneven capacity, institutional arrangements can either facilitate or obstruct the integration of digital tools. The current literature does not sufficiently explain how these internal dynamics affect adoption outcomes. This study uses Affordance Theory and Institutional Design Theory (IDT) to investigate how TVET colleges interpret and act upon the technology affordances within their unique organisational structures. In doing so, it shifts the analytical focus from technology availability and access to institutional agency – examining why some TVET colleges make more effective use of ICTs than others, even under similar policy conditions.

At the level of teaching and learning, ICT adoption in TVET presents a distinct set of challenges and opportunities. Unlike university lecturers, TVET lecturers often teach practice-based subjects and face constraints in aligning ICTs with industry-driven curricula (Hassan et al., 2021).

Moreover, the pedagogical use of ICTs is not merely a function of access, but of how lecturers engage with digital tools to support specific vocational learning outcomes. Existing studies have mainly overlooked this pedagogical interface, particularly in resource-constrained settings in the Global South. This study addresses this theoretical and empirical gap by exploring how TVET lecturers use available ICTs in their daily teaching practice. It applies concepts from DOI and Affordance Theory to examine how user agency, technological properties, and institutional context interact to shape teaching strategies in digitally mediated environments.

By disaggregating the problem into these three interrelated but distinct dimensions – hardware and infrastructure distribution, institutional influence, and pedagogical use – this study advances a more holistic understanding of ICT adoption in TVET colleges. It contributes to current scholarship by foregrounding the systemic, organisational, and user-level dynamics that mediate ICT adoption. Furthermore, the study offers policy-relevant insights for improving equity in ICT access and effectiveness in ICT adoption strategies across South Africa's TVET system.

1.4 Research questions

This study is guided by an overarching research question and three sub-questions, each linked to a distinct dimension of the research problem. Together, these questions seek to explain why ICT adoption in South African TVET colleges remains uneven and what institutional and pedagogical dynamics underpin this trend.

Main Research Question

What are the patterns and impacts of ICT distribution and utilisation on the adoption processes and teaching practices in TVET colleges throughout KZN?

This broad question was broken down into three sub-questions, each aligned with key theoretical concepts from DOI, Affordance Theory, and IDT:

1. Research Question 1: What is the distribution pattern of ICTs across TVET colleges in KZN?

This question responds to the empirical gap identified in the literature (paragraph one of the problem statement), where the uneven distribution of ICTs is emphasised as a key barrier to equitable ICT adoption at the institutional level. Despite policy efforts to modernise South Africa's TVET sector, there is limited data on how ICT infrastructure is actually deployed across TVET colleges in KwaZulu-Natal (KZN). Addressing this question provides a foundational understanding of the material conditions that shape the ICT adoption strategies of TVET colleges across the province.

2. Research Question 2: Which institutional factors influence the ICT adoption process in TVET colleges, and why?

This question responds to digital divide literature (paragraph two of the problem statement), which highlights the need to move beyond technical explanations and explore institutional dynamics that shape ICT adoption. It focuses on internal organisational factors – such as leadership practices, resource allocation, and strategic priorities – that shape how TVET colleges interpret and implement ICT policies. The aim is to uncover why some colleges are able to integrate ICTs into teaching and learning while others struggle, even under similar policy frameworks.

3. Research Question 3: How do lecturers use the ICTs available for teaching and learning?

This question addresses individual responses to ICT integration and focuses on the pedagogical practices of individual educators in vocational settings (paragraph three of the problem statement). While ICT use in higher education is well-researched, less is known about how TVET lecturers – operating in occupation-oriented and resource-constrained environments – integrate digital tools into their teaching. This question focuses on the day-to-day realities of educators, exploring how technology is adapted or resisted in the classroom.

1.5 Research objectives

To address the research questions, this study pursued three core objectives. Each objective responds to a specific gap outlined in the problem statement and aims to provide a focused contribution to understanding ICT adoption in South African TVET institutions.

1. To document the distribution of ICTs across TVET colleges in KZN

This objective responds to the empirical gap discussed in the first paragraph of the problem statement, which highlights uneven ICT distribution as a critical factor limiting equitable access to digital tools across the TVET sector. While national policy frameworks advocate for modernisation, there is limited empirical data on where ICTs have been adopted and how they have been implemented across TVET colleges. By mapping these patterns, the study provides baseline evidence on the extent of ICT infrastructure diffusion, informing future planning and resource allocation.

2. To investigate the institutional factors that inform the ICT adoption process at the colleges

This objective addresses the second paragraph of the problem statement, which identifies institutional factors – such as leadership, governance, and policy interpretation – as underexplored but potentially decisive factors in shaping ICT adoption outcomes. While existing research tends to focus on technical barriers, this study responds to the need for a deeper understanding of how internal organisational structures, capacities, and decision-making processes condition the success or failure of ICT initiatives in TVET settings.

3. To interrogate how ICTs are integrated into teaching and learning activities

This objective aligns with the third paragraph of the problem statement, which outlines a gap in understanding how pedagogical practice is shaped by the interaction between technology and vocational education. In contrast to universities, TVET colleges face unique challenges in aligning technology use with industry-driven, practice-oriented curricula. This objective aims to explore how lecturers engage with digital tools in their daily teaching and how their practices are shaped by both technological affordances and institutional constraints.

By grounding each research objective in a clearly defined gap in scholarship, the study ensures conceptual clarity and relevance to the current challenges facing ICT adoption in TVET education. In linking these objectives to the theoretical frameworks of Diffusion of Innovation (DOI), Affordance Theory, and Institutional Design Theory (IDT), the research adopts a multidimensional perspective that integrates systemic, organisational, and pedagogical lenses. This theoretically informed approach not only enhances the study's analytical depth but also positions it to make a meaningful contribution to the evolving body of scholarship on ICT adoption in vocational education, particularly in resource-constrained and policy-driven contexts such as South Africa's TVET sector.

1.6 Significance of the study

This study is situated at the institutional level, examining the dynamics that shape how three TVET colleges in KwaZulu-Natal (KZN) navigate digital technology adoption. By focusing on the institutional processes, environmental constraints, and policy frameworks that influence ICT integration, the study offers a nuanced understanding of how TVET colleges develop digital technology strategies in response to both external demands and internal capacities.

From a theoretical perspective, the study advances discussions on Diffusion of Innovation (DOI) theory, Affordance Theory, and Institutional Design Theory (IDT) within the context of TVET colleges. While much of the existing research on ICT adoption in education has focused on higher education institutions, this study extends the application of these theories to TVET settings. It interrogates how institutional decision-making structures, the perceived affordances of ICTs, and the diffusion process collectively shape the institutionalisation of ICTs in vocational education. This contributes to a more contextually grounded understanding of digital transformation in post-secondary, skills-based education environments.

In terms of practical significance, the study provides empirical insights into how TVET colleges are adopting, adapting, or struggling with ICTs within diverse geographic and socioeconomic conditions. It highlights the barriers and enablers of ICT integration, including infrastructure constraints, curriculum alignment, lecturer digital literacy, and institutional governance structures. These insights are critical for institutional leaders, digital education practitioners, and ICT service providers seeking to enhance the efficacy of digital learning in TVET institutions.

At the policy level, the study's findings have the potential to inform national and institutional strategies for ICT adoption in the TVET sector. By identifying systemic inequalities in ICT access, the study underscores the need for a more equitable distribution of digital resources, targeted funding mechanisms for under-resourced colleges, and structured capacity-building programmes for lecturers. Additionally, the study highlights the importance of aligning TVET curriculum frameworks with digital competencies and industry needs, ensuring that digital adoption supports both pedagogical innovation and workforce readiness.

Situated within the broader educational and technological landscape, this study responds to global shifts toward digital transformation in vocational education. As international organisations such as UNESCO, the ILO, and the World Bank advocate for ICTs in TVET to enhance employability and lifelong learning, this study provides context-specific evidence on how these global imperatives manifest at the institutional level in South Africa. By bridging the gaps between theory, policy, and practice, this study contributes to ongoing debates on digital inclusion, institutional adaptation, and the future of vocational education in the digital age.

1.7 Overview of methodology

The study was located within the interpretive paradigm and set out to understand the TVET college's institutional environment from the perspective and experiences of the individuals who occupy that space (Shah & Al-Bargi, 2013). Conceptually, interpretive research attempts to understand a social phenomenon through the meanings that individuals linked to the phenomenon assign to it (Deetz, 1996). The study was concerned with gaining insight into the institutional processes, structures, and factors that informed the strategies TVET colleges applied when adopting ICTs and how individuals within these institutions integrated ICTs into their work. The study's design was based on a comparative case study approach, which allowed the study to explore the ICT adoption process as it transpired at each TVET college and the impact of contextual factors on the institutional strategies applied by each college. The comparative case study approach was selected for the study's design as it allows the researcher to observe phenomena across multiple contexts and processes where they have limited control over how those processes unfold or how they are experienced by the individuals within those contexts (Goodrick, 2014).

The study's sample was drawn from the nine TVET colleges in KZN; the decision to locate the study in KZN was based on practical considerations as the researcher was located in KZN. The TVET colleges selected for participation in the study were selected purposively based on the geographic and socioeconomic profiles of the areas where they are located. This approach is consistent with DOI's emphasis on the environment as crucial in determining ICT adoption for individuals and institutions (Rogers, 2003). The selection process began with creating a geographic profile of each TVET college; these profiles included the location of the colleges' campuses, a description of each college's geographic zone, and the college's proximity to the surrounding residential areas. Once the geographic profiles of each college were established, the researcher focused on compiling the socioeconomic profiles of the areas where the TVET colleges are located. The socioeconomic profiles included the main economic activities surrounding the college, household and individual income for residents, and employment and unemployment rates. Once both profiles were complete, the researcher selected three TVET colleges with the most diverse geographic and socioeconomic profiles. The TVET colleges selected for the study have campuses across two or more settlement zones: rural, urban, and township, with economic activities that vary from manufacturing to agriculture. The individual participants selected at each TVET college were sampled purposively according to their role within the college. The individual participants included the deputy principals (DPs) for academic services, ICT managers, and lecturers.

The data for the study was collected over two phases; phase one consisted of a technical survey, and phase two was an institutional case study. The objective of the technical survey was to compile an inventory of the ICT infrastructure and hardware at the TVET colleges and map the distribution of ICTs across the TVET sector in KZN. During this phase, the researcher utilised technical data from the TVET colleges to compile an inventory of the ICTs available at each college and to document how the colleges are utilising them. The objective of the institutional case study was to investigate and analyse the institutional factors that inform ICT adoption processes at selected TVET colleges and to highlight the strategies applied by the TVET colleges to integrate ICTs into their teaching and learning approaches. During this process, the researcher probed various college officials, staff members, and lecturers about the institutional dynamics that shape and inform their approach to ICTs.

The data gathered for the study was analysed using the framework analysis approach; this approach utilises a five-step process to identify, sort, and interpret themes that emerge from the data. During the analysis process, the researcher reviewed the transcripts from the semi-structured interviews and focus groups and cross-checked them against the audio recordings; identified emerging themes from the interview and focus group data by cross-checking the text from the transcripts with descriptions of the concepts from DOI; sorted the interview and focus group data into categories using DOI's adoption model; compiled a colour-coded spreadsheet to arrange the data from each TVET college into separate institutional case study reports; and finally compiled technology and institutional profiles for each TVET college based on the categories identified through DOI's adoption model. These profiles were structured to provide insights into the distribution of ICT resources across the TVET sector, the institutional design of the TVET college and its impact on the colleges' responses to ICTs, and the impact of the institutional culture on individual responses to ICTs.

1.8 Overview of the theoretical framework

The study was framed by the Diffusion of Innovation theory (DOI). DOI articulates how an innovation spreads through a population over time and the various social factors that affect how a population adopts, adapts to, or rejects a particular innovation (Rogers, 2003).

According to DOI, the process by which an individual adopts an innovation consists of four components: innovation, communication channels, social system and time (Rogers, 2003; Straub, 2009). This study used DOI intending to understand how the institutional dynamics within each TVET college shape the college's approach to ICT adoption. The DOI theoretical framework informed the development of research questions to drive the study and the design of research tools to explore and analyse the institutional processes and structures involved when TVET colleges decide to adopt and integrate ICTs.

1.9 Structure of the thesis

This thesis documents the scholarship that informs the study, provides an overview of the study's design and related methodology, presents the technical survey and institutional case studies findings, and discusses the mechanisms underpinning the ICT adoption trends observed for TVET colleges in KZN. According to the technical survey and institutional case study findings, the technical capabilities of the hardware were not the sole factor that determined TVET colleges' approach to selecting ICTs. Beyond the technical functions of the hardware and infrastructure, TVET colleges also had to consider their operational environment's internal and external conditions when deciding on their infrastructure configuration. The technical considerations included the local and regional ICT infrastructure network, intermittent power outages, and the college's basic infrastructure. The non-technical considerations included the college's organisational structure, the ICT's compatibility with the curriculum, the level of ICT skills amongst the lecturers, and the college's ICT implementation policies. The study's findings are limited to the three TVET colleges selected for the institutional case study, and the researcher would recommend a sector-wide ICT adoption study – either at the provincial or national levels – that will explore the extent to which TVET colleges are equipped to formulate ICT strategies that are responsive to the needs of their operational environment for future research. The contents of this thesis are structured as follows:

Chapter 1: Introduction. This chapter introduces the study by outlining its background and presenting an overview of its design. The first section of the chapter discusses the global and national trends in the digital technology and education sectors that informed the study's conceptualisation. This section highlights the impact of ICTs on educational processes, the relationship between massification, digitisation and the transformation of TVET provision, and the trends in access to ICTs for education in the South Africa TVET sector. The following section articulates the problem statement of the study. The problem statement describes the global and national factors underpinning the growing demand for integrating ICTs into teaching and learning spaces across the TVET sector. The section highlights some of the teaching and learning advantages of ICTs. After the problem statement, the chapter focuses on the study's design; this section states the research questions, presents the research objectives, and discusses the significance of the study. Finally, the chapter introduces the theoretical framework that underpins the study and how the theoretical framework will be applied in the design and

execution of the study.

Chapter 2: Literature review. This chapter explores the scholarship on the distribution of ICTs across South Africa's TVET colleges and their impact on teaching practices. The discussion explores the ICT distribution trends at the global, regional and local levels; the contextual factors that shape the proliferation of ICTs at the local level with emphasis on trends within the TVET sector; and the factors that influence adoption trends amongst TVET colleges. The chapter provides an overview of the global ICT distribution patterns over the past two decades and a summary of the factors that shape those distribution patterns; a conceptual review of the scholarship on the 'digital divide' and a historical overview of the phases of digital divide scholarship; a historical review of the development of the ICT development in Africa: infrastructure, policy and implementation; and a discussion on the development of South Africa's ICT sector and the adoption of ICTs by education institutions in the country.

Chapter 3: Theoretical Framework. This chapter outlines and discusses the Diffusion of Innovation theory (DOI), which engages the process involved when an innovation (in this study, digital technology) spreads through a social system (in this case, the TVET sector) over time. The theory frames the processes involved in the proliferation of an innovation across society and describes how individuals and institutions adopt innovations. The chapter describes the four diffusion elements that shape ICT adoption at the TVET colleges. These elements provide a framework for understanding how individuals and institutions choose innovations and why some innovations are adopted faster than others. The descriptions in the chapter outline the mechanisms that drive ICT decision-making and the factors that shape ICT selection and integration at the three TVET colleges. The chapter also provides an overview of how the DOI framework was applied in the design and implementation of the study.

Chapter 4: Methodology. This chapter provides a detailed overview of the study's design, objectives, and methodology for collecting, analysing and verifying data. The study utilised a two-phase design to explore the phenomenon of ICT adoption at TVET colleges in KZN. Phase one consisted of a technical survey of the ICT systems at the TVET colleges, and phase two consisted of institutional case studies of three TVET colleges. During the research process, the study probed various college officials, staff members, and lecturers on the institutional dynamics that shape and inform their approach to ICTs. The chapter discusses how the underpinning concepts of the theoretical framework were incorporated into the study's design. Additionally, the chapter outlines the criteria and processes used to determine the data

collection method, design the data collection instruments, select and sample individual and institutional participants, and analyse the findings. The chapter also discusses how the data were verified and secured during the different stages of the study.

Chapter 5: Findings of the ICT survey (Phase 1). This chapter documents the distribution of ICT hardware and infrastructure amongst TVET colleges across the province, discusses the institutional factors that influence the distribution of ICTs across TVET colleges in KZN, interrogates the technical and environmental factors that inform the decision-making processes of TVET colleges when adopting ICTs. It describes the strategies the TVET colleges utilise to integrate ICTs into their classrooms. The chapter presents an inventory list of the hardware available at each college, the infrastructure that connects the colleges' networks to the Internet, Wi-Fi access, the LMS brand, and off-campus interventions utilised to extend Internet access to students beyond the campus. The chapter articulates how the TVET colleges utilise these various technologies at their disposal, how each TVET college configures its ICT networks and provides a technical description of computer networks and the various technologies cited by the participants. Additionally, the chapter discusses the affordances that shape how individuals within the TVET colleges interact and work with ICTs. This discussion describes how the properties of the physical environment, the technologies and the users informed the network configuration adopted by TVET colleges and the ICT strategies they applied.

Chapter 6: Findings of the institutional case studies (Phase 2). This chapter presents the findings of the institutional case studies of the three TVET colleges selected for this study (KZN TVET B, KZN TVET D, and KZN TVET F). The chapter discusses the institutional processes, factors and dynamics underpinning these colleges' ICT approaches. The chapter provides an overview of each TVET college, its socioeconomic profile, history and the various policies associated with ICT adoption at the college. The chapter then discusses the various components of the TVET colleges' ICT implementation strategies on infrastructure and hardware, e-learning, ICT skills, and curriculum challenges. The discussion highlights the strategies used by the TVET colleges to filter or process the various factors – such as external and external environments, stakeholder interests and relationships, pedagogic objectives, policy directives and institutional culture – that may inform their decisions regarding which ICTs to adopt and how the colleges responded to those factors.

Chapter 7: Discussion and analysis of findings. This chapter analyses the findings from the technical survey (Phase 1) and institutional case studies (Phase 2). The discussions in this chapter are framed by concepts from the Diffusion of Innovation (DOI) theory and draw on concepts from institutional theory to articulate the institutional mechanisms that drive ICT adoption at the three TVET colleges. The discussion focuses on the institutional design of the TVET colleges and analyses how the design influences the rate and manner by which those institutions adopt ICTs. The chapter maps the institutional design features of the three TVET colleges selected for this study. It describes how the TVET colleges' organisational structure and culture drive decision-making and operations processes at these colleges. Additionally, the chapter discusses the role of institutional leadership in the adoption process, the various structures responsible for implementing the college's adoption strategy, and the institutional culture that arises from the college's institutional design.

Chapter 8: Conclusions and Recommendations. This chapter summarises and reflects on the study's design and findings and concludes this thesis. The chapter begins by providing an overview of the whole thesis and presents the synopsis of the content of each chapter. A reflection on the theoretical contributions of the study follows the synopsis. This section considers the catalysts for ICT adoption at the TVET colleges based on the diffusion of innovation theory; these include the TVET college's institutional design, leadership, and communication networks. In this section, the chapter also reflects on the impact of the ICTs' functional attributes on the ICT choices made by TVET colleges and lecturers. The theoretical reflections section is followed by a reflection on the institutional factors that TVET colleges consider when they make decisions concerning ICT selection. These institutional factors are grouped into three categories: environmental factors, ICT factors, and user factors. A reflection on the methodology follows this section and provides recommendations for future studies. The chapter closes with concluding remarks on the study.

1.10 Conclusion

Chapter 1 provided a synopsis of the thesis, an overview of the study's design, and an outline of the background that informed the study. The discussions in the chapter highlighted the growing influence of ICTs on educational processes, the trends that inform institutional approaches to ICTs, and the programmes initiated by DHET to support the integration of ICTs into TVET teaching and learning spaces. The chapter articulated the significance of the study and how this thesis aims to contribute to the broader understanding of the institutional factors that influence the approaches utilised by TVET colleges in South Africa to determine their selection of ICTs. The Chapter also provided an overview of the study's research objectives and research questions. Chapter 2 presents the literature reviewed for this study; this literature includes scholarship on the global distribution trends of ICTs, the digital divide – definitions and phases of scholarship, and the development of the ICT sector in Africa and South Africa.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Chapter 1 provided the study's background, the problem statement, an overview of the study's design, and an outline of the study's research objectives. As outlined in Chapter 1, the study explores how developments in the Information and Communication Technologies (ICT) market influence the teaching and learning technologies adopted by the Technical and Vocational Education and Training (TVET) institutions, including the lecturers' experiences with managing the transition from analogue to digital teaching systems and the institutional strategies accompanying ICT integration. Chapter 2 reviews the literature relevant to the use of ICTs in TVET, with a particular focus on the South African context and the dynamics shaping ICT adoption in KwaZulu-Natal (KZN) colleges. The literature review serves three key purposes: first, to establish how ICT use is conceptualised in vocational education contexts; second, to identify and analyse the components and dimensions of technology use that are relevant to TVET institutions; and third, to locate this study within the broader scholarly and policy conversations on digitalisation in post-school education.

Although the integration of ICTs into education has received widespread attention globally, much of this scholarship is focused on the basic and higher education sectors. In contrast, digitalisation in vocational education – and particularly in African TVET systems – remains under-researched, despite policy efforts by organisations such as UNESCO, the African Union, and the South African Department of Higher Education and Training (DHET) to promote ICT-based transformation. Where research does exist, it often emphasises technical access or the digital divide, while offering limited insight into the institutional, pedagogical, and systemic conditions that shape the use of digital tools for teaching and learning.

This chapter adopts a layered approach to reviewing the literature. It begins by defining digital technology use in the context of TVET (Section 2.2) and identifying the key components that enable or constrain its implementation (Section 2.3). It then explores the dimensions of technology use, including institutional commitment, educator readiness, student digital fluency, and infrastructure accessibility (Section 2.4). The review proceeds to examine existing empirical research on ICT use in vocational education, including thematic focus, methodologies, theoretical

framing, and geographic distribution (Section 2.5). From this review, the chapter identifies key research gaps across three dimensions: issue-based, conceptual, and contextual (Section 2.6). These gaps are then mapped onto the objectives and design of the current study in Section 2.7, which illustrates how the research intends to contribute to filling these gaps. The chapter concludes with a synthesis of the literature and a rationale for the study's methodological choices, which are detailed in the following chapter (Section 2.8). By systematically engaging with the literature, this chapter lays the conceptual foundation for the study and positions it within a broader academic and policy discourse on educational digitalisation. It also establishes the analytical framing and empirical focus necessary for investigating the patterns, challenges, and opportunities of ICT use in the TVET sector in KZN.

The subsequent sections build on this foundation by progressively unpacking the key components, dimensions, and systemic influences shaping ICT adoption in South African TVET institutions. This layered review ensures that the study engages not only with policy directives and access issues but also with the lived realities of technology use, contextual constraints, and educator agency.

2.2 Definitions of ICT use

The term “ICT use” in education has evolved beyond its early associations with access and connectivity to encompass a more complex set of interactions between users, tools, and learning environments. In the context of TVET, ICT use extends beyond infrastructure access – it is a pedagogically situated and institutionally regulated process that determines how technology interacts with teaching objectives, disciplinary constraints, and institutional capacity (Aina & Ogegbo, 2022; van Dijk, 2020). Unlike broad educational technology frameworks, TVET ICT adoption is shaped by sector-specific industry alignment, where digital integration must support technical training, workplace simulations, and competency-based assessment models (Hugo et al., 2021; Maseko, 2020). While the digital divide remains an enduring concern, particularly in South Africa's post-school education and training (PSET) sector, Aina and Ogegbo (2022) argue that understanding how educators and students engage with digital tools provides deeper insights than merely assessing access levels. Similarly, van Dijk (2020) and Warschauer (2003) emphasise that digital inclusion extends beyond infrastructure availability to encompass patterns of use, pedagogical application, and systemic constraints.

Selwyn (2012; 2021) critiques instrumentalist interpretations of educational technology, arguing that the presence of ICTs does not inherently lead to innovation or improvement. Rather, ICT use must be understood within sociotechnical systems – adoption contexts shaped by economic structures, institutional norms, and the agency of educators and learners. This is particularly salient in the South African TVET sector, where disparities in institutional capacity, digital skills, and resource allocation influence not only who uses technology but how and to what effect (Brown & Czerniewicz, 2010; Hugo et al., 2021).

The indication from education literature is that definitions of ICT use have ranged from basic operational interactions – such as accessing course content or submitting assignments – to more complex models of integration. The Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006) is among the most widely adopted. It defines effective technology use as the dynamic intersection of three domains: technical knowledge, content expertise, and pedagogical competence. However, applying TPACK to vocational contexts requires adaptation. As Mbele (2021) argues, vocational educators often teach within environments where practical, hands-on training must be aligned with digital platforms and tools not originally designed for TVET purposes. This requires lecturers to extend beyond TPACK's generalist assumptions and localise their digital pedagogy within sector-specific constraints.

Moreover, the literature increasingly recognises that use cannot be separated from the user's context and intention. The theory of affordances positions technology as neither neutral nor deterministic. Instead, digital tools present different possibilities for action, depending on how users perceive and enact them within institutional and disciplinary boundaries (Gibson, 2015; Norman, 2013). This relational view of technology is echoed in the work of Ngimwa and Wilson (2012), who find that educators in Kenya and South Africa engage with digital libraries in ways shaped by institutional priorities, infrastructural limitations, and professional cultures.

In South Africa, ICT use in TVET must also be situated within broader policy and development goals. The Department of Higher Education and Training [DHET] (2020), Kana and Letaba (2024), and international frameworks such as the African Union's TVET Strategy (2024) all emphasise the strategic importance of digital transformation in preparing students for the Fourth Industrial Revolution (4IR). Yet, as Denhere and Moloji (2021) note, policy ambitions often exceed institutional readiness. Lecturers continue to report insufficient training, fragmented support, and limited access to TVET-relevant digital resources (Maseko, 2020; Mbatha, 2024).

This mismatch between national-level digitalisation policies and local implementation practices renders the concept of “use” highly variable across TVET institutions.

Within this study, ICT use is not defined in terms of hardware or software presence alone, but as a pedagogical and institutional process. Drawing on both international and local literature, three interrelated dimensions are used to conceptualise ICT use in TVET contexts, these dimensions include: intentionality, context mediation, and pedagogical application.

Intentionality refers to the motivations, beliefs, and pedagogical objectives behind an educator’s use of digital tools. ICT use is not automatic; it reflects decisions about relevance, usefulness, and appropriateness for particular teaching tasks. Mbatha (2024) shows how teacher agency – shaped by both professional development and local constraints – determines whether educators engage with technology innovatively or conservatively. In the TVET sector, where practical training is central, intentionality is often aligned with perceived labour market relevance or the desire to replicate industry environments digitally.

Contextual Mediation addresses the structural and organisational factors that influence technology use. These include institutional strategies, resource allocation, infrastructure reliability, and the presence of supportive leadership or peer networks (DHET, 2020; Papier et al., 2024). Hugo et al. (2021) find that even when internet access is available, the lack of coordinated institutional approaches limits effective usage. Furthermore, institutions vary in their responsiveness to national policy mandates, and as a result, digital practice is shaped less by top-down policy than by local leadership, culture, and capacity.

Pedagogical Application refers to how technology is used in classroom settings to support teaching and learning. This includes the design of lessons, choice of digital tools, methods of assessment, and engagement with students. In the TVET context, pedagogical application must integrate theoretical knowledge with practical skills training. For instance, Abdul Razak et al. (2022) note that lecturers may use simulations or industry software to mimic workplace environments, but often these applications are superficial or limited by the generic nature of available platforms. The challenge, as highlighted by Holler et al. (2023), is to move beyond digitising content to transforming pedagogy – something that remains underdeveloped in many South African TVET colleges.

Taken together, these dimensions support a nuanced and context-sensitive understanding of digital technology use. They allow this study to examine not just whether ICTs are present, but how they are integrated, mediated, and enacted by lecturers in TVET institutions. In contrast to more deterministic accounts of digitalisation, this approach foregrounds the agency of educators, the constraints of institutions, and the pedagogical implications of digital practices. This definition is also intended to frame the subsequent analysis (Chapters 5 – 7). The study explores how these dimensions unfold in different institutional settings across KwaZulu-Natal (KZN), offering insight into the lived realities of ICT adoption in vocational education. By focusing on ICT use as a process shaped by intention, context, and pedagogy, this chapter lays the foundation for the theoretical and empirical discussions that follow.

2.3 Key Components of ICT use

The effective use of ICTs in education is the product of an interplay between several interdependent components. These components do not function in isolation; rather, they converge to shape how technology is interpreted, appropriated, or resisted within specific institutional and pedagogical contexts. While early models of ICT integration focused primarily on the availability of infrastructure, the growing literature on digital transformation in education – particularly in the Global South – emphasises that access is a necessary but insufficient condition for meaningful use (Norris, 2001; Pick & Sarkar, 2015; van Dijk, 2020; Warf, 2013). The following subsections outline five critical components of digital technology use in TVET, each of which contributes to or constrains pedagogical innovation and institutional digital readiness.

2.3.1 Infrastructure: The foundation for digital learning environments

Infrastructure remains a fundamental prerequisite for digital engagement. This includes stable electricity, internet connectivity, hardware – such as desktop computers, laptops, mobile devices – and software applications relevant to curriculum delivery. In the context of South African TVET colleges, infrastructural disparities are well documented. Aina and Ogegbo (2022) note that while national efforts have increased the availability of ICT infrastructure, its distribution remains uneven across urban and rural campuses. Many institutions struggle with outdated equipment, inadequate internet bandwidth, and frequent power outages, all of which undermine consistent and effective technology use (Makgato, 2019).

Hugo et al. (2021), in their audit of South African TVET colleges, found that while most institutions reported having internet access, only a minority had sufficient digital infrastructure to support blended or online learning models at scale. These infrastructural limitations not only limit access but also shape educator attitudes and confidence, leading to pedagogical conservatism. This dynamic signifies the need to move beyond simplistic metrics of access and instead examine how infrastructural conditions affect daily teaching practices.

2.3.2 Digital learning platforms: Expanding access and engagement

Digital learning platforms – such as Moodle, Blackboard, and Google Classroom – play a central role in facilitating content delivery, learner engagement, and assessment. However, their efficacy is mediated by institutional support, staff development, and contextual alignment with vocational learning outcomes (Moyo, 2019; Nkula & Krauss, 2015; van Wyk, 2012; Haßler & Haseloff, 2022). In South African TVET settings, the adoption of digital platforms remains uneven and often superficial (Ramoroka, 2021). Denhere and Moloji (2021) observe that lecturers frequently default to basic tools such as PowerPoint or WhatsApp due to limited familiarity with more complex learning management systems (LMS), time constraints, and a lack of ongoing pedagogical support.

The challenge is compounded by the mismatch between available platforms and the nature of vocational education. Many generic platforms are ill-suited to the practical, skills-based learning that characterises TVET programmes (Nkula & Krauss, 2015; Ramoroka, 2021; van der Ross & Tsibolane, 2017). Maseko (2020) reports that lecturers often find it difficult to integrate simulations, technical demonstrations, or competency-based assessments into existing digital tools. Consequently, platforms are often used as content repositories rather than as environments for dynamic teaching and learning. This limited engagement suggests a need to re-evaluate the design, training, and support structures underpinning platform use in the vocational sector.

2.3.3 Educator engagement: Facilitating digital pedagogy

Educator engagement is arguably the most critical human component of digital technology use. It encompasses digital competence, pedagogical beliefs, attitudes toward technology, and willingness to experiment with new teaching strategies (Nkula & Krauss, 2015; Ramoroka, 2021; van der Ross & Tsibolane, 2017). Research across the South African PSET system consistently finds that educators' readiness and confidence are pivotal to technology adoption (Abdul Razak et al., 2022; Mbatha, 2024). However, engagement is often constrained by factors such as inadequate

training, heavy workloads, unclear institutional priorities, and a lack of incentives for innovation.

Mbatha (2024) highlights that even when professional development opportunities are offered, they are often generic and poorly contextualised, failing to address the specific challenges faced by TVET lecturers. The result is a pattern of selective engagement, where educators adopt only those tools they find intuitive or immediately useful. This leads to a narrow band of usage that does not reflect the transformative potential of educational technologies. Moreover, Mbele (2021) notes that applying the TPACK framework in vocational settings requires greater attention to contextual realities, including the dual requirement of teaching theory and facilitating hands-on training.

These findings reinforce the need for a more nuanced understanding of educator engagement – one that recognises the intersection of digital skill, pedagogical purpose, and contextual mediation. Without this alignment, ICTs are likely to be used in ways that reinforce existing practices rather than transform them.

2.3.4 Student adoption and digital literacy: Navigating accessibility and skill development

Students' ability to participate meaningfully in technology-enhanced learning depends on both access and digital literacy. Many TVET students in South Africa come from economically marginalised backgrounds, with limited exposure to digital tools prior to enrolment (Jita & Munje, 2020; Saal et al., 2020; Holler et al., 2023). Jita and Munje (2020) and Aina and Ogegbo (2022) observe that such inequalities persist despite increased investment in infrastructure and device provision. These disparities manifest in students' varying abilities to navigate online platforms, interpret digital content, and manage self-directed learning.

Furthermore, studies by Holler et al. (2023) indicate that student success in digitally mediated environments is closely tied to socio-technical support mechanisms, including mentoring, access to on-campus labs, and embedded digital skills curricula. Where such support is lacking, ICT use can exacerbate existing achievement gaps. This reinforces van Dijk's (2020) and the World Bank's (2016) models of the digital divide as comprising not only access but also skills and usage levels. Papier et al. (2024) argue that addressing these challenges requires deliberate curricular intervention to build students' digital fluency alongside their vocational competencies. Without this dual focus, efforts to digitise learning environments risk excluding the very learners they are intended to benefit.

2.3.5 Institutional policies and support Structures: Governance and ICT adoption

Institutional policy and governance structures play an enabling or disabling role in technology use. Policies that prioritise digital transformation, allocate resources, and support professional development tend to foster more sustained and pedagogically meaningful use of ICTs (African Union, 2020; Corrigan, 2020; DHET, 2020). Conversely, in colleges where digitalisation is pursued inconsistently or where policies are not translated into implementation frameworks, technology use remains peripheral.

The African Union's Continental Strategy for TVET (2024) and Kana and Letaba (2024) both stress the need for coherent institutional strategies that align infrastructure investment, staff training, and curriculum development. However, Hugo et al. (2021) note that South African TVET colleges often lack detailed institutional ICT plans and suffer from fragmented leadership structures. This results in inconsistencies between policy rhetoric and classroom realities, undermining the scalability of digital innovation.

Institutional support mechanisms – such as IT departments, teaching and learning centres, and peer mentoring systems – are also unevenly distributed. Without these structures, individual educators are often left to navigate digital tools independently, which can lead to frustration and disengagement (Nkula & Krauss, 2015; Ramoroka, 2021; van der Ross & Tsibolane, 2017). In this context, policy frameworks must not only mandate digital transformation but also create the institutional capacity to realise it effectively.

Taken together, these five components illustrate that ICT use is not merely a question of equipment or software but is shaped by institutional capacity, educator readiness, student context, and systemic support. Understanding how these components interact provides the foundation for analysing the patterns, challenges, and opportunities of ICT use in TVET colleges – this is the task that this study undertakes in the chapters that follow. While the previous section identified the critical components influencing ICT adoption, understanding how these components translate into actual patterns of use requires deeper analysis. The following section explores these qualitative dimensions, examining institutional commitment, educator readiness, student digital fluency, and infrastructure accessibility as core drivers of effective technology engagement.

2.4 Dimensions of ICT use

While the components of technology use describe the enabling conditions and elements involved in digital engagement, the dimensions of use refer to the qualitative and functional patterns through which technology is adopted, interpreted, and operationalised in TVET settings. These dimensions help us move beyond the binary of use versus non-use by revealing how ICTs are used, for what purposes, and with what implications. They also provide insights into the institutional, pedagogical, and socio-technical factors that give rise to different types of engagement with ICTs.

The literature on educational technology indicates that there is a growing body of research that has emphasised the need to explore not just the presence of technology but the ways it is integrated into teaching and learning practices (Lupač, 2018; Millard, 2015; Selwyn, 2021; van Deursen & van Dijk, 2010). This section outlines four dimensions of technology use particularly relevant to TVET contexts: institutional commitment, educator readiness and pedagogical integration, student digital fluency and learning outcomes, and infrastructure and digital accessibility.

2.4.1 Institutional commitment to ICT adoption

Institutional commitment refers to the degree to which colleges prioritise, resource, and strategically lead digital transformation. Commitment is reflected in a variety of ways: dedicated budgets for ICT development, inclusion of digital innovation in strategic plans, leadership support for professional development, and regular evaluation of digital teaching practices (Selwyn, 2021). Studies conducted in the South African TVET sector suggest that while national policy frameworks have strongly advocated for ICT integration (DHET, 2020; Kana & Letaba, 2024), commitment at the institutional level remains uneven.

Hugo et al. (2021) report that many TVET colleges lack formalised institutional ICT strategies or fail to align them with teaching and learning objectives. This results in a disconnect between policy and practice, where infrastructure may be acquired but is not effectively embedded into pedagogical or curricular planning. The African Union (2024) strategy echoes this concern at a continental level, urging member states to ensure that institutional leadership in TVET colleges is equipped to oversee and sustain digital transformation. Where such commitment is absent, digitalisation efforts often depend on individual champions or short-term projects, leading to fragile and unsustainable innovations.

This gap between policy rhetoric and implementation is not unique to South Africa. International research on institutional ICT adoption highlights the risk of what van Dijk (2020) refers to as “symbolic policy compliance”, where institutions adopt surface-level digital strategies to align with national priorities but do not substantively integrate them into core institutional functions. Similarly, Millard (2015) warns that in many public education systems, digital transformation initiatives are either reactive or externally driven, resulting in a lack of internal ownership and strategic coherence.

Institutional commitment also intersects with broader issues of digital inequality at the organisational level (Selwyn, 2021). According to van Deursen and van Dijk (2010), institutional digital divides emerge when some institutions have the capacity to transform ICT inputs into meaningful educational outputs, while others remain stuck at the level of access or compliance. In the South African context, this often results in a two-tiered system: some colleges innovate and embed digital tools into their pedagogical cultures, while others struggle to maintain basic ICT services (Moyo, 2019; Nkula & Krauss, 2015; van Wyk, 2012; Haßler & Haseloff, 2022). This problem is further compounded by limited institutional data systems. As the World Bank (2016) and Norris (2001) have noted, many public institutions lack the capacity to systematically monitor, evaluate, and learn from their digital initiatives. Without robust internal feedback loops, leadership cannot effectively assess the impact of digital tools on teaching quality or student outcomes, resulting in stagnation or drift. In turn, this weakens institutional confidence and long-term investment in digital transformation.

The literature suggests that institutional commitment is not simply about resource allocation but about establishing a culture of digital innovation (Selwyn, 2021). As Lupač (2018) and Pick and Sarkar (2015) argue, successful integration of ICTs requires sustained organisational learning, cross-departmental collaboration, and clear governance structures. Where this is absent, digital initiatives remain fragmented and often fail to scale. Ultimately, institutional commitment acts as a mediating structure that determines whether national digital strategies translate into pedagogical practice. Without it, the other dimensions of technology use – such as educator readiness and student engagement – are unlikely to gain traction. For digital transformation in TVET to be both equitable and impactful, commitment must extend beyond strategic plans and become embedded in the everyday governance, planning, and resourcing of vocational education institutions.

2.4.2 Educator readiness and pedagogical integration

Educator readiness is a central factor in determining whether digital technologies are used meaningfully or merely symbolically within the classroom. It encompasses not only technical proficiency but also pedagogical knowledge, confidence, willingness to innovate, and alignment with both institutional priorities and curriculum goals. Without adequate support for lecturer development, infrastructure and platforms are likely to remain underutilised, resulting in minimal pedagogical transformation (Selwyn, 2021).

In the South African TVET sector, research consistently highlights the uneven levels of digital competence among educators (Chigona et al., 2014; Jita & Munje, 2020; Saal et al., 2020; van der Ross & Tsibolane, 2017; Holler et al., 2023). Abdul Razak et al. (2022) found that many lecturers possess only basic ICT skills and tend to use digital tools for administrative or content transmission purposes – such as uploading PDFs or projecting slides – rather than integrating them into interactive or student-centred teaching. Maseko (2020) similarly reports that lecturers in Mpumalanga-based colleges frequently feel overwhelmed by expectations to incorporate technology into teaching, particularly in the absence of subject-specific training or contextual support.

The application of the TPACK framework (Mishra & Koehler, 2006) to TVET contexts illustrates how readiness is multifaceted. Mbele (2021) argues that technical skill alone does not guarantee pedagogical integration. Rather, educators must be supported to align their ICT use with curriculum content and appropriate teaching strategies. This alignment is particularly complex in vocational education, where the dual imperative of theory and practical instruction demands flexible, context-sensitive pedagogical approaches (Nkula & Krauss, 2015). Research indicates that while professional development initiatives provide essential technical training, their effectiveness is often constrained by their failure to contextualise digital pedagogy within vocational learning environments (Mbatha, 2024; Abdul Razak et al., 2022). Mbele (2021) critiques generic ICT training models for overlooking discipline-specific instructional strategies, arguing that digital integration should not be a one-size-fits-all approach. In TVET colleges, where practical training is critical, lecturers must develop context-sensitive digital pedagogies that align technology use with practical demonstration, industry simulations, and competency-based assessments (Ramoroka, 2021). In a survey of high school educators in KZN, Mbatha (2024) found that many teachers felt confident using basic ICT tools but lacked confidence in applying

them to support learning outcomes. These findings suggest that professional development must be continuous, discipline-aligned, and supported by institutional incentives and peer networks.

Globally, scholars argue against assuming that exposure to technology naturally leads to integration in the classroom. Van Dijk (2020) and van Deursen and van Dijk (2010) note that the “skills gap” in digital education is often structural, not individual. Educators operate within institutional environments that either facilitate or constrain their opportunities to learn, experiment, and collaborate (Ramoroka, 2021; van der Ross & Tsibolane, 2017). When institutional support is weak, as is often the case in under-resourced TVET settings, readiness becomes a matter of resilience rather than capacity. Moreover, World Bank (2016) research into ICT use in vocational education systems highlights the importance of trust and alignment. Hugo et al. (2021) and Kana and Letaba (2024) indicate that educators are more likely to integrate digital tools when they trust that these tools are relevant to their pedagogical goals and that their use will be supported by institutional structures. In South African colleges, such trust is often undermined by inconsistent infrastructure, lack of curricular clarity regarding technology use, and minimal recognition for digital innovation (Makgato, 2019).

Norris (2001) and Srinuan and Bohlin (2011) observe that systemic inequalities play a significant role in shaping educator readiness to integrate ICTs into their classroom. They further note that digital skills are unevenly distributed across regions and sectors, reinforcing historical and structural disparities (Norris, 2001; Srinuan & Bohlin, 2011). In South Africa, this is reflected in differences between urban and rural colleges, as well as between better-resourced campuses and those that continue to operate with outdated infrastructure and limited digital capacity (Denhere & Mloi, 2021). Lupač (2018) adds that educator attitudes toward technology are shaped by broader social imaginaries, shared beliefs about what digital education should look like and what it can achieve. In contexts where digitalisation is associated with surveillance, workload intensification, or depersonalised teaching, resistance may emerge not from a lack of skill but from justified scepticism (Hassan et al., 2021; Abdul Razak et al., 2022; Jiang et al., 2024). This points to the importance of framing digital transformation not as a technical fix, but as a pedagogical conversation in which educators are meaningfully engaged.

Educator readiness is both a personal and institutional phenomenon. It involves a constellation of factors – training, support, institutional culture, policy alignment, and pedagogical imagination – that must converge if digital tools are to be used to their full potential. In TVET contexts, where teaching often involves sector-specific technical knowledge and practical demonstration, this convergence is particularly difficult to achieve. Recognising and addressing these layers of readiness is critical for sustainable and pedagogically sound ICT integration in the post-school education sector.

2.4.3 Student digital fluency and learning outcomes

Student digital fluency is increasingly recognised as a core determinant of how effectively learners participate in digitally mediated educational environments (Selwyn, 2021). It extends beyond basic digital literacy to include a blend of technical, cognitive, and social competencies that enable learners to use digital tools critically, adaptively, and creatively in support of academic and professional development (Warschauer & Matuchniak, 2010; van Deursen & van Dijk, 2010).

In the context of TVET, where the curriculum is designed to bridge theoretical knowledge and applied workplace skills, digital fluency is particularly consequential. Students must be able not only to access digital resources, but also to engage with simulations, multimedia tools, online assessments, and digital platforms that are often embedded in industry practices. However, South African research suggests that this level of fluency is far from evenly distributed (Ramoroka, 2021; van der Ross & Tsibolane, 2017). Aina and Ogegbo (2022) report that many students enrolled in South African TVET colleges come from historically disadvantaged backgrounds and lack consistent access to personal computing devices or high-speed internet. These material deficits often co-exist with low levels of prior exposure to digital technologies, especially among students from rural or peri-urban areas. Consequently, students face both first-level (access) and second-level (skills) digital divides, which compound learning challenges and restrict their ability to benefit from e-learning initiatives (Brown & Czerniewicz, 2010; van Dijk, 2020).

This disconnect between institutional digitalisation efforts and student readiness is reinforced by inadequate support systems. Holler et al. (2023) argue that institutions often fail to provide structured training in digital fluency, instead assuming that students will acquire skills informally or through incidental exposure. In many cases, students are expected to navigate complex digital platforms without prior orientation or scaffolded guidance, which undermines their confidence and limits the depth of engagement (Makgato, 2014; 2019). Compounding this problem is the

tendency to conflate device access with digital fluency (World Bank, 2016). While many students own smartphones, these devices are often used primarily for communication or entertainment and may not support more advanced academic tasks such as collaborative writing, simulation engagement, or coding (Maseko, 2020). The World Bank (2016) has warned that digital inclusion strategies focused solely on device provision risk reinforcing rather than reducing disparities, unless accompanied by systematic skill-building interventions.

Moreover, learners' ability to use technology productively is shaped by what van Dijk (2020) refers to as the "third-level digital divide" – the extent to which technology use results in beneficial outcomes. This dimension is particularly salient in vocational education, where digital proficiency must translate into improved learning performance, workplace readiness, and career opportunities. Yet, as Norris (2001) and Srinuan and Bohlin (2011) note, learners from marginalised communities are less likely to convert digital exposure into concrete educational or economic gains, due to structural inequalities in educational support, employment pathways, and digital access continuity beyond college.

Student digital fluency is also influenced by institutional culture. Where lecturers and administrators model effective digital practices, offer formative feedback, and integrate digital tools seamlessly into classroom tasks, learners are more likely to develop confidence and fluency (Selwyn, 2021). Conversely, when digital tools are used inconsistently or without a clear pedagogical purpose, students may disengage or develop superficial digital habits that do not translate into transferable skills (Abdul Razak et al., 2022; Mbatha, 2024). Papier et al. (2024) emphasise that enhancing student outcomes in digital learning environments requires more than curriculum redesign. It necessitates a comprehensive strategy that includes access support, digital skills development, psychosocial support, and integration of ICT into the core logic of vocational education delivery. Without this multi-dimensional approach, digital tools risk becoming symbolic rather than transformative. Student digital fluency is not a fixed trait but a dynamic outcome of socio-technical environments. Enhancing it requires coordinated institutional interventions that address access, skills, and outcomes simultaneously. For digital technology to support learning in TVET, it must be accompanied by inclusive pedagogies, embedded digital skills curricula, and continuous support structures that reflect the diverse realities of South African students.

2.4.4 Infrastructure and digital accessibility

Infrastructure and digital accessibility remain foundational yet contested dimensions of technology use in education. While policy narratives often treat infrastructure as a solved or purely technical issue, research from both developed and developing contexts shows that infrastructure continues to shape, constrain, and define the actual use of technology in meaningful ways (Warf, 2013; van Dijk, 2005; World Bank, 2016). Based on this insight, it may be argued that in the context of South African TVET, infrastructure cannot be reduced to the mere availability of internet or devices; it must be examined through the lens of reliability, usability, institutional fit, and equity of access.

The digital transformation of South Africa's TVET colleges has occurred against the backdrop of long-standing disparities in public sector investment, spatial inequality, and variable institutional capacity. As Hugo et al. (2021) note, although most public TVET colleges report having computer labs and internet access, these facilities are frequently inadequate in quality, outdated in specification, or limited in terms of user access time. Some campuses operate with unreliable power supply, ageing hardware, and insufficient bandwidth to support even basic online instructional delivery. In other cases, resources exist but are locked behind administrative barriers or poor scheduling, rendering them inaccessible to staff and students during peak academic periods. Such infrastructural limitations have direct pedagogical consequences. Educators are often reluctant to plan technology-rich lessons due to fears of system failure, slow internet speeds, or device unavailability, leading to conservative or alternative teaching practices (Denhere & Moloji, 2021; Maseko, 2020). Students, in turn, may be discouraged from using institutional platforms if they face long queues for access or are unable to log in from home due to data costs and weak network coverage (Chigona et al., 2014; Ramoroka, 2021). These challenges reaffirm van Dijk's (2020) argument that physical access is only the first of several thresholds in digital inclusion; what matters is the extent to which access is stable, reliable, and usable.

Digital accessibility also has a material-cultural dimension. The World Bank (2016) and Pick and Sarkar (2015) stress that the effectiveness of ICT infrastructure is shaped by its integration into institutional workflows and teaching culture. When digital tools are grafted onto analogue systems without redesigning pedagogical and administrative practices, they tend to generate inefficiencies and frustration (World Bank, 2016). In TVET colleges, this manifests in cases where educators must switch between paper-based and digital systems or where incompatible platforms impede the continuity of teaching and learning.

Another often-overlooked aspect is the differentiation of access within institutions. Even within a single college, disparities may exist between departments (engineering vs. hospitality vs business studies), between academic and support staff, or between main and satellite campuses (Makgato, 2014; 2019; Nkula & Krauss, 2015; Ramoroka, 2021). Van Deursen and van Dijk (2010) identify this as a “second-level digital divide”: not just whether people have access, but the quality and degree of access they have. In practice, this means that some lecturers may have personal devices, stable internet, and office-based support, while others may rely on shared equipment or experience frequent disruptions. Lupač (2018) takes this further by proposing that infrastructure should be conceptualised as part of the hidden curriculum of digital education. That is, the form and stability of the infrastructure available to learners sends messages about what kinds of learning are valued, what forms of participation are feasible, and whose access matters most. In South African TVET colleges, inconsistent digital infrastructure may inadvertently reproduce broader educational inequalities by limiting the scope of participation for already disadvantaged students and under-resourced campuses (van Dijk, 2020; World Bank, 2016).

From a governance perspective, institutional digital infrastructure is also vulnerable to fragmented procurement, poor maintenance systems, and insufficient interdepartmental coordination. Kana and Letaba (2024) highlight that many TVET colleges lack long-term ICT asset management plans, resulting in cycles of procurement without sustainability. This leads to mismatches between infrastructure and teaching needs – for instance, investing in general-purpose labs without discipline-specific software or failing to align ICT upgrades with academic calendars. In addressing these challenges, both national and regional frameworks call for more context-sensitive infrastructure planning. The African Union (2024) and Ezumah (2020) advocate for TVET institutions to adopt integrated infrastructure development strategies that consider the pedagogical goals of different vocational programmes and anticipate long-term maintenance needs. Similarly, Holler et al. (2023) emphasise the importance of linking infrastructure development with educator training, curriculum design, and student digital fluency, ensuring that infrastructure is not merely present but is actively supporting teaching and learning.

Digital infrastructure and accessibility in TVET cannot be assessed solely through availability and accessibility metrics. Their value lies in how well they support pedagogical and institutional objectives, how equitably they are distributed, and how reliably they function in the day-to-day life of educators and learners. For ICT adoption to be sustainable in South Africa’s TVET sector, the issue of infrastructure must be re-centred, not only as a material concern but as a key determinant of educational justice and technological agency.

2.5 Previous research on ICT use

The integration of ICTs in education has attracted extensive scholarly attention across various sectors, particularly in higher education and basic schooling. However, within the field of Technical and Vocational Education and Training (TVET), research on technology use remains relatively underdeveloped, unevenly distributed, and fragmented across disciplines. This section reviews existing literature on digital technology use in TVET, structured around four focal areas: (1) the scope and focus of current research, (2) methodological approaches, (3) theoretical and conceptual frameworks, and (4) geographic and institutional contexts.

2.5.1 Scope and focus of existing research

The global literature on technology in TVET has primarily focused on how digital tools can support skills development, industry alignment, and flexible learning models (UNESCO, 2019; World Bank, 2016). Studies in high-income countries often explore the use of digital simulations, virtual labs, and e-learning platforms to replicate workplace environments and enhance employability outcomes (Lupač, 2018; Millard, 2015). In these contexts, digital integration is typically framed as a catalyst for modernising vocational education and bridging the gap between formal instruction and industry needs.

In contrast, research in low- and middle-income countries tends to foreground issues of access, inequality, and institutional readiness. In the South African context, existing studies have explored educator perspectives on ICT integration (Maseko, 2020), infrastructural challenges (Hugo et al., 2021), student access and use (Brown & Czerniewicz, 2010), and the digital divide in teaching and learning (Aina & Ogegbo, 2022). These studies highlight systemic constraints that limit the effectiveness of technology use, including unreliable infrastructure, limited digital fluency among students and staff, and a lack of alignment between policy frameworks and practical realities.

Importantly, while the literature acknowledges the potential of digital tools, it also points to a significant implementation gap. Denhere and Moloji (2021), for example, document the disjuncture between 4IR policy ambitions and on-the-ground educator capacity. Similarly, Kana and Letaba (2024) note that while many TVET colleges have embraced the language of digitalisation, actual pedagogical transformation remains limited.

2.5.2 Methodological approaches

The existing body of research on technology in TVET employs a diverse range of methodologies, though much of it remains descriptive and exploratory in nature. Case studies dominate the literature, offering rich, context-specific insights into institutional practices, educator experiences, or student responses (Ngimwa & Wilson, 2012; Maseko, 2020). While these studies provide valuable localised data, they often lack generalisability and comparative depth.

Quantitative studies are less common, though some have sought to measure the extent of digital access, patterns of usage, or student performance outcomes (Holler et al., 2023). However, large-scale empirical studies that systematically analyse cross-institutional or regional patterns remain scarce, particularly within African contexts. Qualitative studies – particularly those rooted in interpretive paradigms – have provided important insights into the subjective experiences of technology use in constrained environments (Abdul Razak et al., 2022; Mbatha, 2024). These works offer a more nuanced understanding of how institutional culture, educator agency, and policy pressures shape technology adoption, but they often stop short of linking these insights to broader systemic patterns or global trends.

There is also a methodological gap in studies that bridge levels of analysis – for instance, connecting national policy frameworks to local institutional responses or comparing digital use across public and private providers. These limitations suggest the need for multi-level, comparative, and longitudinal research designs to generate a more comprehensive understanding of digital technology use in TVET.

2.5.3 Theoretical and conceptual frameworks

A key limitation in the literature is the relative absence of explicit theoretical frameworks, especially in studies conducted in African contexts. While some research references general theories of educational technology – such as TPACK, constructivism – few studies engage systematically with frameworks that can capture the complexity of digital adoption within vocational education systems.

Selwyn's (2012, 2021) sociotechnical approach is rarely used, despite its relevance in contexts where digital initiatives are shaped by organisational, political, and infrastructural dynamics. Affordance Theory (Gibson, 2015; Norman, 2013) and Institutional Design Theory (Gibson, 2012; Jones, 2013) remain underutilised, even though they offer useful tools for analysing the interaction between structure, agency, and technology.

Some South African studies have begun to integrate conceptual models – such as Mbele's (2021) application of the TPACK framework in vocational teaching – but these remain the exception. More often, theoretical engagement is either implied or secondary to practical description. This theoretical underdevelopment limits the ability of the field to produce cumulative knowledge, identify recurring patterns, or contribute meaningfully to global debates on educational digitalisation.

Furthermore, there is a tendency to view technology use as either a technical issue or a function of individual capacity, rather than as a process embedded in wider institutional, economic, and policy structures. As van Dijk (2020) and Pick and Sarkar (2015) argue, addressing digital inequality requires conceptual tools that can capture the systemic and recursive nature of digital exclusion – a perspective still lacking in much of the TVET research literature.

2.5.4 Geographic and institutional contexts

A final limitation of the existing research is its geographic and institutional concentration. Much of the literature on digital technology use in vocational education originates from the Global North, with countries like the UK, Germany, Australia, and Canada dominating comparative studies (UNESCO, 2019). These contexts differ significantly in terms of infrastructure, labour market alignment, and institutional autonomy, limiting the applicability of their findings to African settings.

Within South Africa, studies tend to focus on a limited number of colleges, often in urban areas or those with stronger research partnerships. This leaves gaps in understanding how rural institutions, satellite campuses, or under-resourced colleges navigate the digitalisation process. As a result, the national picture remains fragmented, and policy responses may be based on incomplete or skewed representations. Few studies have undertaken regional comparisons within South Africa or between African countries. Exceptions include Ngimwa and Wilson (2012), who examine digital library use in Kenya and South Africa, and recent work by the African Union (2024), which attempts to map digital readiness across the continent's vocational systems. However, these

studies often remain high-level and lack the granularity needed to inform pedagogical or institutional strategies.

Collectively, this review reveals a field that is growing but still maturing in both its conceptual scope and empirical depth. While considerable progress has been made in documenting the challenges associated with ICT use in TVET – particularly around issues of infrastructure, access, and educator readiness – much of the literature remains descriptive and fragmented. The absence of strong theoretical anchoring has limited the explanatory power of many studies, resulting in analyses that focus on surface-level barriers without interrogating the structural and institutional mechanisms that produce them. In particular, there is a notable lack of engagement with frameworks that can account for the complex interactions between policy environments, institutional design, and user agency in shaping technology adoption.

Methodologically, the field has yet to move decisively toward comparative, mixed-methods, or longitudinal designs that could generate generalisable insights while preserving local nuance. The dominance of single-case, urban-based studies restricts the diversity of perspectives represented and may mask significant variations in how technology is adopted across different institutional and geographic contexts. Moreover, while students are increasingly acknowledged as stakeholders in digital education, few studies meaningfully capture their experiences, perceptions, or levels of digital fluency, particularly in relation to their vocational learning goals and socio-economic realities.

Geographically, the knowledge base remains skewed toward high-income and well-resourced contexts, with African TVET systems – and subnational contexts within them – often appearing only as peripheral case studies or in grey literature. South Africa, while better represented than many other countries on the continent, still lacks cohesive, sector-wide data on how digital transformation is unfolding across its 50 public TVET colleges. Existing research disproportionately focuses on policy ambitions and infrastructural interventions, with less attention given to the granular realities of institutional cultures, pedagogical practices, and user-level experiences.

These limitations underscore the need for empirical work that connects the macro-level policy discourse with meso-level institutional dynamics and micro-level pedagogical practice. In particular, there is a need for studies that adopt a systems-thinking perspective, foregrounding the interaction between contextual factors and user agency, and linking these to observed patterns of technology adoption and use. Such an approach must be theoretically informed, empirically grounded, and sensitive to the specific institutional, geographic, and socio-technical conditions shaping vocational education in under-researched contexts like KZN.

This study responds to that need by exploring the use of ICTs in KZN TVET colleges through an integrated theoretical lens—drawing on Diffusion of Innovation (DOI), Affordance Theory, and Institutional Design Theory (IDT). By documenting ICT distribution patterns, examining institutional decision-making, and investigating pedagogical integration at the level of lecturer practice, this research seeks to contribute to both the empirical literature and the conceptual understanding of digitalisation in vocational education. Its goal is not only to describe what is happening, but to explain why these patterns emerge and how they might be reshaped to advance equity, quality, and relevance in the South African TVET sector.

2.6 Research gaps

Despite the growing body of literature on ICT use in education, the review of current scholarship – particularly in relation to TVET – reveals several critical gaps that limit our understanding of how digitalisation unfolds within TVET systems. These gaps fall into three broad categories: issue gaps, conceptual or theoretical gaps, and contextual gaps. Identifying and addressing these gaps is crucial for producing research that not only describes the status quo but also informs more effective policy, institutional strategy, and pedagogical practice. This section outlines these gaps in relation to existing research and clarifies how this study seeks to respond to them.

2.6.1 Issue gaps

One of the primary issue gaps in the literature concerns the narrow scope of focus in studies examining digital technology use in TVET. Much of the research tends to isolate specific variables such as access, device availability, or educator training, without exploring the interconnections between infrastructure, institutional governance, user agency, and pedagogical innovation. This fragmentation leads to an incomplete picture of the dynamics shaping digital engagement, often underestimating the complexity of adoption processes in vocational contexts.

Another significant issue is the under-theorisation of the adoption process itself. Many studies focus on the presence or absence of digital technologies, rather than analysing the pathways through which these tools are introduced, interpreted, institutionalised, or resisted. As a result, important questions remain unanswered: What determines whether a particular college successfully embeds digital tools into its teaching culture? What factors influence a lecturer's willingness or reluctance to experiment with digital platforms? How do institutional constraints shape pedagogical decision-making?

Moreover, few studies in the South African context examine student usage and experience with the same level of depth afforded to institutional and educator perspectives. This limits insights into how digital technologies are received, appropriated, or rejected by learners within the TVET system, particularly those facing structural barriers such as poverty, data scarcity, or limited digital literacy. As Warf (2003) and van Dijk (2020) have shown, such gaps risk reinforcing a shallow notion of access that fails to capture deeper forms of inequality and exclusion.

2.6.2 Conceptual and theoretical gaps

At a conceptual level, the literature often lacks a coherent theoretical framework for analysing ICT use in TVET. Although some studies reference frameworks such as TPACK or constructivist learning theory, few engage critically with theories that account for multi-level systemic influences, including policy, institutional design, and actor agency.

This study responds to this gap by drawing on three interrelated frameworks: DOI, which helps to explain how ICTs spread and are adopted across institutions; Affordance Theory, which focuses on the relationship between user perception and tool functionality in specific contexts; and IDT, which examines how institutional rules, norms, and decision-making structures shape technological outcomes. Together, these frameworks provide a richer analytical toolkit for examining both structural and agency-driven dimensions of ICT adoption.

Existing literature also tends to treat technology as either a neutral tool or a deterministic force, overlooking the relational and socially embedded nature of technology use. As van Dijk (2005, 2020) and Pick and Sarkar (2015) argue, digital adoption must be understood as a process mediated by institutional logics, power relations, and user capabilities. This theoretical perspective is largely missing in the TVET research landscape, particularly within the Global South, where institutional environments differ significantly from those assumed in mainstream educational technology models.

There is also a lack of research that situates technology use within broader debates on vocational pedagogy, labour market alignment, and educational equity. Digitalisation in TVET is often positioned as a technical fix to institutional weaknesses, rather than being critically examined as a process with specific social, economic, and epistemic consequences.

2.6.3 Contextual gaps

The third category of gaps concerns the limited geographic and institutional diversity in existing research. Much of the global literature on digital education in TVET is derived from high-income countries with strong infrastructure, well-established policy frameworks, and greater institutional autonomy. While useful in highlighting best practices, such studies offer limited applicability to settings like South Africa, where resource constraints, policy fluidity, and socio-economic inequality significantly shape the digitalisation process.

Within South Africa itself, research is disproportionately concentrated in a few metropolitan areas or flagship institutions with better research infrastructure and funding access. This results in a distorted understanding of the sector and an underrepresentation of under-resourced, rural, or historically disadvantaged colleges. This includes facts such as very few studies examine how TVET colleges in KZN – a province characterised by socio-economic diversity, institutional variation, and uneven access to infrastructure – navigate digital transformation. This lack of

regional specificity represents a major blind spot in both national policy design and international comparative analysis.

Furthermore, existing research tends to focus on policy-level or individual-level analysis, with limited attention to how institutional structures, such as decision-making hierarchies, budget allocations, and departmental cultures, mediate technology adoption. These contextual elements are crucial for understanding the unevenness of ICT integration across the sector and for designing interventions that are locally appropriate and sustainable.

Finally, there is a scarcity of comparative studies within the South African TVET system. Most research treats institutions in isolation rather than examining cross-institutional patterns of adoption, resistance, or innovation. This limits the sector's ability to learn from its own variation and to identify scalable models of successful digital integration.

The gaps identified in the literature – whether conceptual, contextual, or issue-based – underscore the need for a theoretically informed, empirically grounded analysis of ICT use in TVET, and a context-sensitive study of ICT adoption in South African TVET colleges. Without addressing these gaps, digital transformation efforts risk becoming surface-level initiatives that fail to engage with the institutional, pedagogical, and systemic realities shaping technology adoption. By focusing on the province of KZN, incorporating institutional, pedagogical, and policy perspectives, and grounding the analysis in an integrated theoretical framework, this study aims to contribute meaningfully to closing these knowledge gaps. It offers a layered understanding of how and why digital adoption unfolds unevenly across the sector, thereby informing more responsive, equitable, and sustainable digitalisation strategies in vocational education. The next section situates this study within these gaps, outlining how its objectives directly respond to the scholarly and policy limitations identified thus far.

2.7 Exploring the unexplored: Aligning the study's objectives with the gaps in the literature

This study is positioned as a direct response to the gaps identified in the existing literature on ICT use in TVET. By focusing on institutional, pedagogical, and systemic dimensions within a provincial context, it addresses the fragmented, theoretically thin, and geographically uneven nature of prior research. This section outlines how the study's objectives and design respond to the issue gaps, theoretical gaps, and contextual gaps identified in Section 2.6.

First, in response to the issue gaps, the study adopts a multi-phase approach to examining ICT use. Rather than focusing narrowly on access or technical proficiency, it examines the distribution, adoption, and pedagogical use of ICTs across selected TVET colleges in KwaZulu-Natal. By investigating not only what ICTs are available but also how they are used by lecturers, how institutional factors shape their uptake, and how students experience digital learning environments, the study brings together often isolated strands of inquiry. In doing so, it builds a more holistic picture of how technology is integrated (or fails to integrate) into vocational teaching and learning.

Second, to address the conceptual and theoretical gaps, the study draws on an integrated theoretical framework that combines DOI, Affordance Theory, and IDT. This composite framework allows the study to explore the layered nature of technology use – from the availability and spread of ICTs (DOI), to user engagement and perception (Affordance Theory), and finally to the organisational and policy-level constraints that shape institutional practices (IDT). This theoretical scaffolding enables the study to move beyond descriptive accounts and towards explanatory analysis, which engages directly with the mechanisms of adoption, institutional mediation, and pedagogical application. This theoretical synergy ensures a multi-layered analysis, addressing previous research limitations by linking macro-policy directives, meso-institutional structures, and micro-level educator agency in a unified explanatory model.

Third, the study addresses the contextual gaps by situating its analysis within the KZN TVET landscape, an under-researched regional context marked by diversity in institutional size, location, and resource endowment. Unlike prior studies that focus on flagship urban institutions or rely on generalised national data, this study foregrounds the localised realities of KZN colleges. It further incorporates the voices of lecturers – and, where applicable, administrative actors – to better understand the interface between institutional policy, educator agency, and classroom practice. This focus allows the research to surface both structural constraints and local innovations that are often overlooked in national-level analyses.

Additionally, by taking a comparative perspective across institutions within the same provincial system, the study is positioned to identify variations in ICT access and usage that are not visible in single-case studies. This enables it to generate insights not only about individual institutions but about systemic patterns, policy implementation gaps, and potential leverage points for more equitable digital transformation across the sector. Finally, the study contributes to the broader literature by offering a context-sensitive and theoretically grounded model of ICT adoption in vocational education. It aims to inform not only scholarly debates on educational digitalisation but also practical strategies for TVET policy, institutional development, and professional practice in South Africa and other comparable contexts in the Global South.

2.8 Conclusion

This chapter provided a comprehensive review of the literature on ICT use in TVET, with specific attention to its conceptual, empirical, and contextual dimensions. It began by clarifying how ICT use is defined and understood in the TVET context, introducing a working conceptualisation built around intentionality, contextual mediation, and pedagogical application. From there, the chapter reviewed the core components of technology use – including infrastructure, educator engagement, student digital fluency, and institutional support mechanisms – and explored the multidimensional nature of use through lenses such as institutional commitment, pedagogical integration, and accessibility.

A key finding from this review is that while the literature on educational technology is growing, research specific to TVET remains underdeveloped in both scope and analytical depth. The review highlighted that much of the existing work is descriptive, focused on infrastructure or access, and concentrated in Global North contexts. In contrast, issues such as institutional culture, pedagogical adaptation, and learner experience in low- and middle-income countries receive comparatively less attention. Furthermore, a significant proportion of research lacks a robust theoretical foundation, often treating technology as a neutral tool rather than a socially embedded phenomenon shaped by broader institutional and systemic forces.

Three major gaps were identified: (1) issue gaps, including the tendency to isolate single variables and overlook institutional and pedagogical dynamics; (2) conceptual gaps, particularly the absence of explanatory frameworks that can account for the interplay between actors, systems, and

technologies; and (3) contextual gaps, reflecting the limited empirical focus on rural, under-resourced, or otherwise marginalised TVET institutions, especially in a province such as KZN.

In response to these gaps, this study adopts a multi-level, comparative approach that is both empirically grounded and theoretically informed. Drawing on DOI, Affordance Theory, and IDT, the research is designed to investigate the distribution, adoption, and classroom integration of digital technologies in selected TVET colleges in KZN. Through this design, the study aims to contribute to both academic literature and policy discourse by offering insights into how digitalisation unfolds within vocational education systems marked by inequality, institutional diversity, and evolving pedagogical demands.

By aligning its objectives with the limitations identified in the literature, the study is well-positioned to offer a nuanced account of the challenges and possibilities surrounding digital transformation in TVET. The next chapter presents the theoretical framework that underpins the study, outlining the key concepts and analytical tools drawn from DOI, Affordance Theory, and IDT. This framework provides the basis for understanding how digital technology adoption is shaped by institutional conditions, user agency, and socio-technical environments within the TVET sector.

CHAPTER 3: THEORETICAL FRAMEWORK

“Diffusion is a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system. When new ideas are invented, diffused, and adopted or rejected, leading to certain consequences, social change occurs.” (Rogers, 2003, p. 42)

3.1 Introduction

This chapter presents the theoretical framework that underpins the study. It outlines and justifies the selection of three interrelated theories used to interpret the adoption and use of digital technologies in Technical and Vocational Education and Training (TVET) colleges in KwaZulu-Natal (KZN): Diffusion of Innovation (DOI), Affordance Theory, and Institutional Design Theory (IDT). Each theory is strategically aligned to one of the three research objectives and is selected to address a specific gap in the literature identified in Chapter 2.

The study is premised on the observation that, despite national policy support and growing recognition of the importance of digitalisation, ICT adoption across South African TVET institutions remains fragmented, uneven, and context-dependent. This inconsistency calls for a multidimensional analytical lens that captures not only the distribution of technology but also the institutional structures and individual practices that mediate its use. Accordingly, this chapter integrates perspectives from DOI to understand how ICTs are introduced and diffused across colleges, from Affordance Theory to explore how educators interpret and engage with available technologies, and from IDT to interrogate the institutional and policy frameworks that enable or constrain digital transformation.

The structure of the chapter follows the study’s three core research objectives. Section 3.2 focuses on the first research objective and applies DOI theory to examine the distribution patterns of ICTs across TVET colleges. Section 3.3 addresses the second research objective by applying IDT and Affordance Theory to analyse institutional factors that influence ICT adoption processes. Section 3.4 turns to the third objective, drawing primarily on Affordance Theory – with complementary insights from DOI – to explore how lecturers use digital technologies in their teaching practices. Each section explains the relevant theoretical concepts, discusses how each theory helps address the associated research gap, and considers how the study may contribute to extending these theoretical frameworks.

The chapter concludes with Section 3.5, which presents the overarching research framework that integrates the three theories into a cohesive analytical model. This integrative framework provides the conceptual scaffolding for data collection, analysis, and interpretation in the subsequent chapters. A summary is then provided in Section 3.6.

3.2 Distribution pattern of ICTs

The first dimension of this study examines the distribution of ICT infrastructure and resources across TVET colleges in KZN. This analysis responds to the first research question and objective, which seek to document the extent to which ICTs are spatially and institutionally available across the TVET system. According to the literature, the uneven distribution of ICTs represents a fundamental structural constraint on adoption, as disparities in access and connectivity shape the possibilities for integration at institutional and pedagogical levels (van Dijk, 2020; World Bank, 2016). These disparities often reflect broader patterns of inequality in public service delivery, where historically advantaged institutions are more likely to have stable infrastructure, qualified personnel, and access to digital resources, while under-resourced colleges face persistent backlogs in connectivity, hardware, and technical support (Aina & Ogegbo, 2022; DHET, 2020).

This section draws on Diffusion of Innovation (DOI) theory to analyse this phenomenon, which offers a conceptual framework for understanding how innovations spread through time and space within specific social systems. Initially developed by Everett Rogers (1962; 2003), DOI posits that the diffusion of innovations is a socially mediated process in which individuals or institutions move through stages of awareness, interest, evaluation, trial, and adoption. These stages are shaped by the perceived attributes of the innovation – relative advantage, compatibility, complexity – the nature of communication channels, the characteristics of the adopting unit, and the broader social system in which adoption occurs.

The theory is beneficial for capturing the mechanisms through which ICTs are introduced, evaluated, and implemented across different types of institutions, with varying capacities and historical legacies. In the case of South African TVET colleges, where institutions are characterised by diverse geographic locations, governance arrangements, and resourcing levels, DOI allows for a nuanced analysis of how innovations move unevenly through a fragmented system. Rather than treating ICT adoption as a binary or linear event, the theory foregrounds the multiple pathways through which colleges interpret, resist, delay, or selectively implement

technological innovations based on their institutional realities (Valente & Rogers, 1995; Nutley et al., 2002).

While national policy frameworks in South Africa emphasise the modernisation of the TVET sector through digital transformation (DHET, 2017; Kana & Letaba, 2024), the pace and nature of ICT diffusion vary considerably across colleges. This divergence cannot be explained solely through infrastructural availability or technical readiness. DOI theory is valuable in this context because it moves beyond static measures of access to explore the temporal and relational dynamics of adoption. It enables the study to trace how ICTs travel across institutional networks, how decisions are shaped by peer influence, policy interpretation, and perceived relevance, and how adoption is staged across time.

Studies of innovation adoption in other education sectors have similarly shown that diffusion is rarely uniform or spontaneous; rather, it is contingent upon organisational culture, leadership support, funding mechanisms, and exposure to external influences such as industry partnerships or donor initiatives (Greenhalgh et al., 2004; Dearing, 2009; Bhattacharya et al., 2020). In TVET contexts, colleges that participate in pilot programmes or international partnerships are often better positioned to acquire and institutionalise ICTs, creating what Peixoto et al. (2015) describe as “institutional islands of excellence.” These pockets of advancement may have a demonstration effect but do not automatically translate into systemic uptake without broader coordination mechanisms and policy coherence.

In this respect, DOI provides both the language and the analytical tools to explain why some TVET colleges in KwaZulu-Natal are positioned as early adopters while others remain peripheral or resistant, despite shared policy frameworks. The concept of “adopter categories” – ranging from innovators and early adopters to laggards – enables the study to classify and analyse colleges’ digital trajectories in relation to internal capacity, external connectivity, and institutional reputation. Moreover, the reinvention concept within DOI – which highlights how adopters modify innovations to fit local contexts – becomes particularly relevant in understanding how ICT infrastructure, once introduced, may be reinterpreted and redeployed based on local teaching needs and resource constraints (Sahin, 2006; Garcia-Avilés, 2020).

In summary, the distribution of ICTs across the TVET system is not simply a technical or logistical issue. It is embedded in historical inequities, policy diffusion mechanisms, and institutional agency. DOI enables a systemic analysis of these dynamics, offering diagnostic and explanatory value for understanding the spatial and institutional patterns of ICT adoption in the South African TVET sector.

3.2.1 Theoretical lens: Diffusion of innovation theory

The Diffusion of Innovation (DOI) theory – first systematised by Everett Rogers in 1962 and later refined in his influential 2003 work – offers a robust conceptual framework for understanding how innovations are introduced, adopted, and spread across populations and institutions. Rogers (2003) defines diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 5). This definition foregrounds the temporal, communicative, and social dynamics of innovation adoption and distinguishes DOI from purely technical or linear models of change. DOI’s descriptive power lies in its ability to map not just whether innovations are adopted, but how and why adoption occurs unevenly within and across institutions.

DOI’s intellectual lineage traces back to the work of early diffusion theorists such as Gabriel Tarde and Georg Simmel, who studied imitation, social contagion, and the interpersonal transmission of behaviours. This was later systematised by rural sociologists such as Ryan and Gross (1943), who examined how hybrid seed corn spread across farming communities. Since then, DOI has been applied across numerous fields – including public health, education, marketing, and communication – where it has generated wide-ranging insights into how innovations spread and what shapes their uptake (Katz et al., 1963; Rogers, 2003; Valente & Rogers, 1995; Nutley et al., 2002).

Over the past six decades, DOI studies have been classified along three major strands: patterns of diffusion, individual or organisational innovativeness, and process theory (Nutley et al., 2002; Wolfe, 1994). These strands frame different entry points into the study of innovation and provide a layered understanding of diffusion dynamics.

Studies on patterns of diffusion focus on how innovations spread across a population or social system, typically analysing how the characteristics of an innovation – such as relative advantage, compatibility, complexity, trialability, and observability – shape adoption behaviour (Das, 2020; Min et al., 2018; Nutley et al., 2002). In TVET contexts, this can include examining how specific

digital technologies – including learning management systems or interactive whiteboards – are perceived in terms of usefulness or feasibility, and how these perceptions affect uptake by institutions or individuals. These attributes influence initial awareness and the perceived “fit” of an innovation within a local educational culture.

Research on organisational and individual innovativeness shifts the focus to the characteristics of the adopters themselves. These studies investigate how organisational structure, leadership, access to information, and previous experience with innovation affect a college’s or individual’s likelihood of adopting new practices (Peixoto et al., 2015; Greenhalgh et al., 2004; Hossain et al., 2024). This line of inquiry is highly relevant in the context of South African TVET colleges, which operate under variable resourcing conditions and often experience leadership turnover or capacity constraints. Some institutions are better equipped structurally and culturally to embrace new technologies, while others may lack the autonomy, capacity, or confidence to do so.

The third DOI scholarship strand – most aligned with this study – is focused on process theory; the diffusion process as a dynamic, staged progression rather than a single event. These studies explore how innovations are introduced, negotiated, adapted, and institutionalised (Dryden-Palmer et al., 2020; Yeboah, 2023). DOI conceptualises this process through five stages: knowledge, persuasion, decision, implementation, and confirmation. In educational institutions, this involves not only formal decisions to adopt a technology but also informal practices of sense-making, pilot testing, and professional learning. Within TVET colleges, adoption processes may be shaped by external mandates – namely, DHET policy – but are also influenced by internal negotiations, staff development, and alignment with industry needs.

DOI theory is particularly suited for this study because it accommodates non-linear, context-sensitive, and iterative processes, which align closely with the realities of ICT implementation in TVET colleges. The model’s multi-layer flexibility allows systemic, institutional, and individual analysis. The model’s analytic flexibility enables this study to assess where ICTs have been adopted and how and why diffusion unfolds differently across colleges, even under shared national policy frameworks (DHET, 2017; Kana & Letaba, 2024). It accounts for variability in institutional interpretation, local leadership, and alignment between digital tools and curriculum or pedagogical practices.

Furthermore, DOI is attentive to the role of communication networks and social influence, which are especially important in the TVET sector. Adoption decisions are rarely made in isolation. They are shaped by inter-college learning, exposure to pilot programmes, donor or NGO partnerships, and relationships with industry or higher education institutions (Holler et al., 2023). Colleges with greater exposure to innovation networks are often positioned as early adopters, while more isolated institutions may struggle to build the momentum required for system-wide integration.

DOI theory provides a theoretically grounded and practically flexible lens through which to study ICT adoption in South African TVET colleges. Its relevance lies not only in its focus on what spreads and how, but in its analytical sensitivity to who gets left behind, why particular innovations succeed or fail, and how innovations are socially and contextually embedded. These features render it particularly well-suited to this study's aim of mapping the diffusion patterns of ICTs and understanding the institutional trajectories that shape digital transformation in the TVET sector.

3.2.2 Variables and relationships in the diffusion of ICTs

Diffusion of Innovation (DOI) theory identifies four interrelated variables that govern how and why innovations are adopted within a social system: the characteristics of the innovation, communication channels, time, and the social system (Rogers, 2003; Straub, 2009). In the context of ICT adoption in TVET colleges, these variables do not operate in isolation but interact in complex ways that shape the trajectories of ICT adoption. Each variable offers insights into how institutions process technological change, how educators engage with new tools, and how broader system norms either facilitate or constrain innovation. This section explores these variables in depth, emphasising their interdependence and relevance to the diffusion of ICTs in resource-constrained educational environments.

i. The innovation

The first variable of DOI is the innovation; in the context of this study, the innovation is ICTs. Within DOI, the innovation is defined not by its objective novelty, but by its perceived newness to the adopting entity (Rogers, 2003). In TVET colleges, innovations may take the form of hardware (smartboards, tablets), software (Moodle, Google Classroom), or integrated systems (learning management platforms paired with reporting tools). The decision to adopt such technologies is shaped by how their features are interpreted in relation to the college's goals, capacities, and pedagogical priorities (Dearing, 2009; Maseko, 2020).

DOI theory identifies five perceived attributes of innovations that influence their adoption rate: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). These attributes provide a conceptual lens for understanding adoption behaviour at the institutional and classroom levels.

Relative advantage refers to the degree to which an innovation is perceived as offering a superior solution compared to existing practices. In TVET, ICTs that facilitate simulations of workplace environments, improve learner engagement, or streamline assessment processes are often perceived to be advantageous (Straub, 2009). When colleges perceive ICTs as enhancing efficiency, learner outcomes, or institutional reputation, adoption becomes more likely (Dearing, 2009). However, this perception is shaped by contextual concerns, such as curriculum demands and the college's operational focus (Aina & Ogegbo, 2022).

Compatibility reflects the degree to which an innovation is aligned with existing institutional values, policies, and practices. For instance, a TVET college that emphasises practical, skills-based instruction may be more receptive to digital tools that mirror real-world industrial applications (Maseko, 2020). Innovations misaligned with current teaching methods or organisational culture may face resistance, even if their technical features are superior (Rogers, 2003). This aspect is especially significant in under-resourced colleges, where change may require broader institutional shifts beyond technological acquisition.

Complexity is another crucial variable, or the perceived difficulty in understanding and using the innovation. High-complexity technologies – such as those requiring integration across multiple platforms or extensive user training – may deter adoption (Straub, 2009). Within the TVET sector, low digital literacy among staff or students can amplify perceived complexity, even with adequate

infrastructure (Holler et al., 2023). The learning curve associated with an innovation can thus act as a structural barrier to implementation.

Trialability – the extent to which an innovation can be tested on a small scale before full adoption – helps mitigate perceived risks (Rogers, 2003). In environments where institutions are cautious about investing in unproven systems, the ability to pilot ICT tools is vital. For example, some TVET colleges have introduced new platforms through short-term projects or selective departmental rollouts, allowing feedback to guide broader implementation strategies (Greenhalgh et al., 2004).

Observability refers to the degree to which the benefits of an innovation are visible to others (Rogers, 2003). Innovations with easily seen, measured, or demonstrated outcomes are more likely to be adopted because they encourage peer learning and social validation. In TVET colleges, observability manifests when lecturers observe tangible improvements in lesson delivery, student engagement, or assessment efficiency through ICT use. These visible benefits are often shared informally through interpersonal networks, workshops, or in staff meetings, reinforcing positive perceptions of the innovation (Straub, 2009). The visibility of ICT benefits was significantly amplified during the COVID-19 pandemic, when colleges had to adopt digital teaching practices rapidly. As Aina and Ogegbo (2022) point out, many lecturers began to realise the pedagogical utility of ICTs only after being compelled to use them under emergency conditions.

In addition to these five core innovation attributes, Rogers (2003) introduces the concept of technology clusters, which refers to the tendency of particular innovations to be adopted together as part of an integrated package. A TVET college that adopts interactive whiteboards may simultaneously introduce content management platforms, high-speed connectivity, and training modules to support usage. These bundled innovations can reinforce each other's perceived value, reduce friction in implementation, and increase adoption rates (Dearing, 2009). In the TVET context, where resource constraints and fragmented planning often hinder implementation, presenting ICT solutions as integrated, purpose-aligned packages can improve perceived trialability, reduce complexity, and enhance overall institutional readiness.

Combined, these attributes shape institutional perceptions of ICTs and directly influence adoption strategies. Hypothetically, a platform like Moodle might be viewed favourably because it offers clear pedagogical advantages (relative advantage), fits into current curricular delivery methods (compatibility), is perceived as user-friendly (low complexity), allows small-scale testing

(trialability), and is already being used successfully at a neighbouring college (observability). Conversely, innovations lacking these characteristics may be resisted, even if externally promoted.

These five attributes do not operate in isolation; they are often interpreted as a cluster of perceived affordances. The perception of one attribute can shape or reinforce another. A highly observable innovation – other lecturers are seen to be using it successfully – may simultaneously appear less complex, more compatible, and easier to trial. This reinforces Rogers' (2003) emphasis on perceived characteristics, which are contextually shaped rather than objectively fixed. In the TVET context, institutional culture, peer demonstration, training exposure, and leadership communication influence how these innovation attributes are perceived and acted upon.

Moreover, Rogers (2003) proposes the idea of technology clusters – groups of related innovations that are often adopted together. In TVET colleges, this could include adopting interactive whiteboards alongside digital assessment tools, networked student management systems, or blended learning platforms. The cluster effect enhances perceived utility and encourages synergistic use, which can increase overall adoption rates (Dearing, 2009; Straub, 2009). However, it can also raise adoption barriers, as resource-constrained institutions may lack the capacity to implement multiple interdependent technologies simultaneously.

These dynamics are particularly salient in resource-diverse settings like South Africa's TVET sector. Even when innovations are introduced through national policies or donor-funded projects, their uptake depends on how institutional actors perceive their relative advantage, complexity, or compatibility within local operational realities. As Aina and Ogegbo (2022) documented, colleges with uneven staff ICT literacy or a lack of structured training often report underutilisation of new technologies, even when infrastructure is available.

Moreover, historical legacies and existing pedagogical orientations matter. In TVET colleges where teaching practices are textbook-based or face-to-face, innovations that align with traditional methods – slide presentations or digital attendance systems – may be adopted more readily than innovations that require radical pedagogical shifts – virtual simulations or AI-based feedback. This implies that compatibility is not only about the technology itself but about the institution's capacity and willingness to evolve its teaching logic.

This insight aligns with the broader observation that perception drives adoption, especially in institutions with limited monitoring and evaluation systems. If ICT tools are not seen to improve efficiency or student engagement – or if early adoption does not yield demonstrable success – then broader uptake may stagnate, even with policy incentives in place. DOI’s conceptualisation of innovation attributes thus provides a powerful lens for interpreting these institutionally contingent dynamics.

DOI theory positions the perceived characteristics of innovations as central to adoption outcomes. For this study, these insights are operationalised by analysing how ICTs are interpreted by institutional leaders, departments, and educators, each with their own value frameworks, constraints, and goals. Understanding these perceptions illuminates why adoption varies across TVET colleges and identifies levers for improving the design, packaging, and support of ICT innovations in vocational education settings.

ii. Communication channels

The second variable within the DOI framework is communication channels, which play a pivotal role in shaping how information about an innovation is transmitted and interpreted within a social system. Rogers (2003, p. 54) defines communication as “the process by which participants create and share information with one another to reach a mutual understanding.” In the context of ICT adoption in South African TVET colleges, these channels influence not only awareness but also the interpretation, legitimacy, and practical application of innovations. Diffusion is not just about exposure to new technologies – it is about how potential adopters come to understand, evaluate, and eventually accept them. The channels through which information flows mediate this process and determine whether innovation messages lead to sustained change or stall at the periphery of institutional routines (Straub, 2009; Dearing, 2009).

Rogers (2003) identifies two primary types of communication channels: mass media and interpersonal networks. Mass media channels – such as official circulars, policy briefs, national strategic frameworks, or ICT integration guidelines – can efficiently reach large numbers of stakeholders and help shape awareness. In the South African TVET context, these often include documents from the Department of Higher Education and Training (DHET), training manuals from implementing partners, and national or provincial policy pronouncements. However, while mass media effectively disseminates broad messages and sets agendas, it often lacks contextual

specificity. Research suggests that mass communication alone rarely shifts practice unless reinforced by interactive forms of engagement (Dearing, 2009; Rogers, 2003).

This is where interpersonal communication networks become instrumental. Interpersonal channels operate through professional networks, educator forums, informal peer discussions, and mentorship relationships. These settings facilitate meaning-making, dialogue, and negotiation around the innovation. Within TVET colleges, lecturers are more likely to adopt new digital tools when they can observe trusted colleagues using them effectively, receive peer advice, or participate in guided communities of practice (Valente & Rogers, 1995). Such interactions reduce uncertainty, clarify how technology aligns with existing pedagogies, and promote behavioural reinforcement through social modelling. As Frei-Landau et al. (2022) note, the credibility and proximity of peers make interpersonal networks particularly influential in shaping adoption decisions.

In many colleges, these interpersonal networks are supported by designated ICT champions, who function as internal change agents. They provide peer-level support, conduct informal training, and liaise between lecturers and ICT management units. These champions often leverage their credibility within subject departments to influence others' willingness to engage with ICT. In this way, internal champions complement external change agents – such as NGOs, provincial education officers, or DHET representatives – who bring specialised technical knowledge and resources into the institutional space (Rogers, 2003; Dearing, 2009).

Furthermore, the effectiveness of communication channels is shaped by institutional communication structures. In hierarchical systems like TVET colleges, top-down communication from management to lecturers often dominates. However, if this structure lacks reciprocal feedback flows or excludes middle-level implementers from decision-making processes, adoption may be met with resistance or disengagement (Greenhalgh et al., 2004). This is why communication strategies must be deliberately inclusive and dialogical, incorporating feedback loops, informal knowledge exchange, and embedded opportunities for professional development.

Finally, research shows that the success of diffusion efforts is contingent on the alignment between the communication strategy and the norms of the social system (Rogers, 2003; Valente & Rogers, 1995). Innovations introduced without attention to institutional culture, history, and informal networks risk being seen as externally imposed or culturally incongruent. In the South African context, where systemic inequalities and historical legacies influence staff trust and

morale, the interpersonal dimension of diffusion becomes even more significant (Aina & Ogegbo, 2022; Hugo et al., 2021). Institutions that foster a participatory dialogue and peer learning culture tend to achieve higher levels of buy-in and sustained innovation.

iii. Time

The third variable in the DOI framework is time; time is not merely a chronological marker but a conceptual variable that shapes how innovations are adopted and normalised within a social system. It features across three key dimensions: (a) the innovation-decision process, (b) adopter categories, and (c) the rate of adoption (Rogers, 2003; Dearing, 2009; Straub, 2009). These dimensions collectively help to explain the temporal variability in how different institutions and individuals engage with innovations like ICTs, and why diffusion trajectories are rarely uniform, especially in stratified systems like TVET.

a. The innovation-decision process

The innovation-decision process refers to the sequence of cognitive and behavioural stages through which an adoption unit – an individual, department, or institution – passes before embracing a new innovation. Rogers (2003) outlines five stages: knowledge, persuasion, decision, implementation, and confirmation. Each stage reflects a qualitatively distinct relationship to the innovation, and a combination of internal readiness, perceived value, and contextual support influences the movement across these stages.

In the TVET sector, institutions may possess knowledge of a digital learning management system (LMS). However, if the perceived complexity is high or its relevance to practical training is unclear, the persuasion stage may falter. Likewise, even after adoption decisions are made at the management level, successful implementation hinges on lecturer training, pedagogical alignment, and the availability of technical support – factors that influence how quickly and effectively an innovation is embedded into teaching practice (Greenhalgh et al., 2004; Hugo et al., 2021). The confirmation stage plays a crucial role in resource-constrained institutions, as it involves assessing whether the adoption decision has yielded the anticipated benefits or if adjustments are necessary to sustain use.

DOI also highlights that innovation decisions are not necessarily irreversible. If implementation challenges or disappointing outcomes emerge, adopters may abandon the innovation, revert to previous practices, or delay full-scale integration. This dynamic aligns with the reality in many South African TVET colleges, where ICT rollouts are sometimes followed by periods of stagnation or reversals due to limited follow-up support or changes in institutional leadership (DHET, 2017; Kana & Letaba, 2024).

b. Adopter categories and institutional innovativeness

A second temporal variable in DOI is the classification of adopters into five categories – innovators, early adopters, early majority, late majority, and laggards – based on when they adopt an innovation relative to others in their social system (Rogers, 2003). This typology was initially developed in agricultural studies but has since been applied across sectors, including education (Valente & Rogers, 1995; Sahin, 2006). The categories reflect differing degrees of openness to risk, access to resources, and responsiveness to peer influence.

Applied to TVET, some colleges function as early adopters, often due to stronger managerial capacity, donor relationships, or proximity to urban centres. These institutions are typically better resourced and more likely to experiment with digital innovations even before formal policy mandates. Others remain laggards – not because of a lack of interest, but due to systemic challenges such as insufficient infrastructure, staff turnover, or geographical isolation (Aina & Ogegbo, 2022; Mhlanga & Moloji, 2020). Categorising institutions in this way allows researchers and policymakers to differentiate between readiness levels and tailor interventions accordingly. However, it is important to stress that these categories are not moral judgments; they are analytical tools that reflect the interplay between institutional capacity, social capital, and contextual constraints. A college may be innovative in one area – such as student support services – but conservative in another, such as curriculum delivery. DOI encourages this kind of nuanced, disaggregated analysis.

c. The rate of adoption

Thirdly, the adoption rate refers to the speed with which members of a social system take up an innovation. DOI research consistently finds that this rate follows an S-shaped curve, with slow initial uptake, followed by rapid adoption among the early and late majorities, and finally a tapering off as saturation is reached (Rogers, 2003). However, this curve assumes a relatively homogenous system, which is not true for TVET institutions in South Africa. Factors such as provincial infrastructure disparities, funding cycles, and leadership stability disrupt the expected pattern.

As this study is less concerned with modelling the aggregate rate of adoption and more focused on institutional processes, the rate of adoption functions here as a proxy indicator. It highlights how long colleges take to move from policy to practice, and what factors enable or impede this movement. For instance, some colleges adopted online teaching tools rapidly during the COVID-19 pandemic out of necessity, but later abandoned them when face-to-face instruction resumed, suggesting a shallow adoption curve tied to crisis response rather than long-term strategy (Chaka Mbele, 2021; Holler et al., 2023). Overall, time in DOI theory allows the researcher to attend to both the micro-processes of decision-making and the macro-patterns of institutional change. In this study, it provides the conceptual space to trace not only whether ICTs were adopted but also how long it took, under what conditions, and with what degree of permanence.

iv. Social system

The fourth variable within the DOI framework is the social system, the social system is the foundational context in which innovation adoption unfolds. Rogers (2003, p. 23) defines a social system as a “set of interrelated units engaged in joint problem solving to accomplish a common goal”. These units may include individuals, groups, institutions, or entire communities, bound together by shared norms, values, and structures of interaction. The structure and culture of the social system significantly shape how an innovation is perceived, discussed, and ultimately adopted. In the context of TVET colleges, the social system encompasses formal governance structures (DHET, college management teams), informal educator networks, organisational routines, and broader institutional cultures. The key elements of the social system influencing ICT diffusion include: (a) organisational structure, (b) communication structure, (c) system norms and values, (d) opinion leaders, and (e) change agents. Each plays a specific role in facilitating or constraining adoption.

a. Organisational structure

TVET colleges in South Africa are typically characterised by hierarchical and centralised organisational structures (Jones, 2013; Gibson et al., 2012). Decision-making authority is concentrated at senior management levels, and the implementation of ICT strategies is typically cascaded through operational units such as ICT Services, Curriculum Development, and Student Support Services. While this form of governance promotes consistency and alignment with national policy directives (DHET, 2017), it may also introduce bottlenecks. Innovation decisions made at the top may lack grassroots support, particularly if lecturers and middle managers are not consulted during the decision-making process (Hugo et al., 2021).

This centralised structure, however, can also enhance predictability and coordination. As Rogers (2003) notes, formalised structures allow organisations to respond to innovations more efficiently when authority is clearly delegated. In well-functioning colleges, the vertical chain of command can facilitate rapid implementation, provided that systems of accountability, communication, and support are robust.

b. Communication Structure

Alongside formal hierarchy, the communication structure refers to the interpersonal networks through which information and meaning circulate within the institution (Rogers, 2003). These networks may be formal – such as departmental meetings – or informal – such as corridor conversations and social media groups. DOI theory distinguishes between homophilous and heterophilous communication. Homophily refers to the degree of similarity between communication partners; homophilous networks are more likely to influence attitudes and behaviours due to shared values and experiences (Rogers, 2003; Valente & Rogers, 1995).

In TVET colleges, lecturers tend to interact more frequently with peers within their subject areas or departments, leading to the formation of homophilous clusters. These clusters can act as echo chambers – either reinforcing innovation adoption or fostering resistance, depending on prevailing attitudes. The extent to which ICT champions or early adopters can disrupt these patterns and seed new practices depends on the strength and reach of their networks (Straub, 2009). In digitally lagging colleges, weak internal communication networks may result in fragmented adoption, with some departments using ICTs extensively and others remaining disengaged.

c. System norms and institutional culture

DOI theory posits that social systems are governed by norms, established behavioural expectations that influence whether innovations are seen as desirable or deviant (Rogers, 2003). In TVET institutions, these norms are embedded in institutional policies, strategic plans, performance contracts, and teaching cultures. If a college maintains a traditional, exam-focused pedagogy, for instance, ICT tools that promote interactive or blended learning may be viewed as incompatible or even disruptive (Maseko, 2020).

Conversely, when innovation is normalised – through professional development programmes, digital literacy campaigns, or leadership support – norms evolve to accommodate new practices. In such environments, adoption becomes self-reinforcing, as lecturers align their behaviours with institutional expectations and peer behaviour. As noted in the African Union’s (2024) continental TVET strategy, fostering a culture of innovation requires deliberate change management and capacity-building efforts at both systemic and institutional levels.

d. Opinion leaders

Opinion leaders are actors within the social system who possess disproportionate influence over the beliefs and behaviours of their peers (Rogers, 2003). They are not necessarily the most technically proficient individuals, but are typically seen as trustworthy, credible, and socially connected. In the South African TVET sector, many colleges have formalised the role of ICT champions – lecturers or mid-level managers tasked with promoting digital integration among their peers (Kana & Letaba, 2024). These opinion leaders serve as mediators between senior management and the teaching staff, translating ICT strategies into actionable practices. Their influence lies in their ability to align institutional objectives with peer concerns, thereby reducing resistance and facilitating uptake. However, their effectiveness depends on their access to resources, support from management, and legitimacy within the educator community (Holler et al., 2023).

e. Change agents

While opinion leaders operate within the social system, change agents are typically external actors who influence the diffusion process through advocacy, funding, or technical support. In the context of ICT adoption in TVET, these may include NGOs, development partners, SETAs, or even private-sector technology providers. Rogers (2003) emphasises that change agents are instrumental in shaping the direction, timing, and content of innovation adoption decisions. In South Africa, external actors have played a prominent role in introducing digital platforms, funding infrastructure projects, and training staff (Holler et al., 2023). While these interventions can catalyse change, they may also generate dependency or create misalignment if not coordinated with institutional strategies. The dual presence of internal opinion leaders and external change agents underscores the relational complexity of innovation diffusion in TVET settings.

The DOI concept of the social system provides a critical lens for understanding the uneven distribution of ICTs across TVET colleges in KwaZulu-Natal. Rather than viewing adoption purely as a function of technical availability or policy mandates, DOI shifts the analytical focus to how institutional arrangements, communication structures, social norms, and interpersonal influence patterns shape diffusion outcomes. By attending to the roles of formal hierarchies, informal networks, opinion leaders, and change agents, the theory makes visible the organisational and social dynamics that either enable or constrain ICT diffusion across institutions operating under the same policy umbrella.

In summary, the four core variables of DOI – innovation attributes, communication channels, time, and social systems – offer a comprehensive and interrelated framework for analysing the diffusion of ICTs across TVET colleges in KZN. These variables do not operate in isolation; rather, they interact dynamically to shape how innovations are perceived, discussed, implemented, and institutionalised. The nature of the ICTs adopted, how their benefits and challenges are communicated, the temporal progression of adoption decisions, and the institutional environment in which these processes unfold all play a role in determining how technologies are distributed and taken up. For this study, these variables help uncover the mechanisms through which disparities in ICT access and implementation emerge. They enable the research to move beyond descriptive accounts of where infrastructure exists, toward an analytical account of how systemic, communicative, temporal, and contextual factors influence patterns of ICT availability. As such, DOI theory provides the conceptual scaffolding to examine the complex, layered processes that underpin the spatial and institutional distribution of digital resources in the TVET sector.

3.2.3 Justification for the selection of DOI theory

The adoption of ICTs within the South African TVET sector presents a complex picture marked by heterogeneity, institutional fragmentation, and uneven capacity. Despite strong policy rhetoric and considerable investment by DHET, the diffusion of digital infrastructure and digital pedagogies remains inconsistent (DHET, 2017; Hugo et al., 2021). These conditions make DOI particularly well suited to analysing the systemic and temporal dynamics that characterise the spread of ICTs across TVET colleges in KZN. In contrast to models that attribute adoption outcomes solely to technical readiness or economic capacity, DOI foregrounds institutional variation, networked influence, and temporal sequencing (Dearing, 2009; Rogers, 2003; Straub, 2009). This is particularly important in the South African TVET landscape, where colleges are differentially resourced and managed, yet expected to operate under a unified national policy framework. DOI theory enables this study to trace not just whether ICTs are adopted, but how adoption unfolds across colleges, why some institutions move more quickly than others, and which contextual variables shape adoption trajectories.

Moreover, DOI's conceptual framing – including its emphasis on innovation attributes, adopter categories, communication channels, and the nature of the social system – offers a multifaceted lens that aligns with the layered nature of institutional change in the TVET sector. By interrogating how ICTs are perceived in terms of relative advantage, compatibility, and complexity, the study is able to engage with the specific forms of scepticism, resistance, or inertia that often accompany digitalisation efforts in vocational education settings (Chaka Mbele, 2021; Maseko, 2020). These perceptions are shaped not only by individual attitudes but also by institutional histories, available training, leadership practices, and the extent to which innovations are seen as pedagogically relevant or externally imposed (Rogers, 2003).

DOI's applicability is further strengthened by its compatibility with empirical methods that track adoption patterns across time and space. Given that one of the primary aims of this study is to document the distribution of ICTs – both geographically and institutionally – DOI's tools for mapping innovation flows and identifying systemic bottlenecks offer a strong methodological fit for the study. Prior research has demonstrated that DOI can be effectively used to surface structural inequalities within public education systems, including those related to rural-urban divides, governance models, and institutional autonomy (Greenhalgh et al., 2004; Valente, 1995). In this study, such inequalities manifest in differentials in ICT infrastructure, bandwidth

availability, and the presence or absence of institutional ICT strategies (Kana & Letaba, 2024; Hugo et al., 2021).

While DOI has been widely applied in higher education contexts, its application in TVET settings – particularly in resource-constrained contexts in the Global South – remains limited. Most studies in the South African context have focused either on basic education or on universities, leaving a gap in understanding how adoption unfolds within the organisational logics of vocational education (Denhere & Moloi, 2021; Holler et al., 2023). This study addresses that gap by applying DOI in a nuanced and contextually grounded manner, recognising that TVET colleges face unique pressures, including alignment with workplace demands, responsiveness to national skills priorities, and high levels of bureaucratic oversight.

Furthermore, DOI supports the study’s ambition to move beyond static models of “access” and toward a more dynamic account of how ICT adoption is shaped by institutional ecosystems. By integrating DOI into the analysis of ICT distribution, the study can critically interrogate the sequencing, clustering, and replication of ICT initiatives across colleges, identifying whether some colleges are consistently early adopters or whether diffusion is driven by external partnerships rather than internal strategic planning.

In the context of this study, DOI theory offers both the conceptual tools and the analytical depth required to examine ICT distribution in a differentiated and policy-intensive education system. Its emphasis on system-level dynamics, coupled with its sensitivity to institutional and communicative variation, makes it an appropriate and productive framework for addressing the first research question of this study. Building on this foundation, the next section explores how DOI can be extended to better capture the unique adoption dynamics within TVET institutions, particularly in structurally uneven environments.

3.2.4 Adapting DOI to uneven TVET contexts

While DOI has been widely applied across education, health, agriculture, and technology studies, its assumptions and variables have primarily been modelled on stable, well-resourced, and often Western institutional contexts (Katz, 1999; Nutley et al., 2002; Valente & Rogers, 1995). Its application to TVET institutions in the Global South – and more specifically to public, policy-intensive systems like South Africa’s – remains limited. This study extends DOI theory by operationalising it within a structurally unequal, policy-driven, and under-researched post-school education (PSET) system, where institutional capacity, autonomy, and leadership vary across colleges. In doing so, the study brings DOI into a new terrain, testing its utility in explaining non-linear, externally influenced, and context-dependent patterns of ICT adoption.

One of the key theoretical contributions of this study is its reframing of DOI’s core assumptions regarding institutional readiness and innovator agency. Traditional DOI literature, such as that of Rogers (2003) and Dearing (2009), assumes that adoption is primarily driven by internal perceptions of innovation attributes and peer influence. However, in many TVET colleges, adoption is externally initiated – often prompted by state policy, donor funding, or public-private partnerships – and occurs in environments where institutional agency is constrained by limited budgets, hierarchical governance, or policy instability (Denhere & Moloji, 2021; DHET, 2017; Holler et al., 2023). This disrupts the neat progression through Rogers’ five-stage adoption process and raises important questions about compliance-driven diffusion, where adoption occurs for audit or funding purposes rather than intrinsic motivation or pedagogical fit (Nutley et al., 2002; Straub, 2009).

This study also contributes to extending DOI by highlighting the interplay between macro-policy directives and micro-level adoption behaviours. As Bhattacharya et al. (2020) and Das (2020) argue, innovations introduced in the public sector often face multiple layers of interpretation, resistance, and reconfiguration as they move through institutional hierarchies. In the case of South African TVET colleges, national ICT strategies are filtered through provincial departments, college councils, and individual campuses, resulting in divergent implementation outcomes even under a common policy umbrella (Kana & Letaba, 2024). This fragmentation illustrates what Peixoto et al. (2015) describe as “multi-level diffusion gaps,” where innovations are adopted at the policy level but stall or transform at the point of practice. These gaps highlight the disconnect between policy-level adoption and grassroots implementation, reinforcing the need for a more adaptive diffusion model in TVET contexts.

Moreover, the study expands DOI's analytical reach by foregrounding issues of equity and asymmetrical power in innovation systems. As Wolfe (1994) and Godin (2014) point out, traditional DOI models have tended to downplay the role of structural inequality in shaping access to innovations. In South Africa's TVET sector, colleges in rural areas or with weaker infrastructure are often structurally disadvantaged in accessing innovation resources, technical support, or networked learning opportunities (Aina & Ogegbo, 2022; African Union, 2024). This study, therefore, proposes a more critical interpretation of DOI, in which diffusion is not simply a matter of speed or efficiency but also a reflection of underlying institutional disparities and governance dynamics.

Furthermore, this study contributes to ongoing efforts to hybridise DOI with institutional theories. Scholars such as Acikgoz et al. (2023) and Hossain et al. (2024) have called for integrating DOI with organisational and socio-political perspectives to better capture the systemic nature of digital transformation. By combining DOI with IDT and Affordance Theory in later sections of this chapter, this study contributes to a more holistic framework that considers not only how innovations spread, but also how institutions structure that spread and how end-users interpret and act upon the affordances that technologies present.

Finally, this study proposes extending DOI by offering contextual modifications to the adopter categories and innovation-decision processes, especially in systems with inconsistent institutional autonomy. For example, colleges may adopt innovations at the organisational level without commensurate uptake at the classroom level, or vice versa, a phenomenon also observed by Zhong and Gou (2023) in studies of centrally governed education systems. These disconnections require a more granular model of diffusion that accounts for multi-layered adoption trajectories across management, teaching, and student levels. Thus, the study builds on DOI's robust theoretical foundation but adapts and extends it to better capture the dynamics of ICT diffusion in a structurally uneven, policy-intensive, and under-theorised segment of the South African education system. In doing so, it offers not only a new empirical application but also a conceptual refinement of DOI that emphasises institutional diversity, equity of access, and systemic integration.

3.3. Institutional factors influencing ICT adoption

While patterns of diffusion highlight where and how ICTs are distributed across the TVET sector, they do not sufficiently explain the internal institutional dynamics that determine whether, how, and to what extent these technologies are adopted in practice. ICT availability does not automatically translate into meaningful integration. The adoption process within educational institutions is shaped by a range of institutional factors, such as leadership vision, organisational capacity, professional development structures, and the interpretive frameworks used by staff and management to assess the value of digital technologies. This study addresses the second research question by exploring how these institutional dynamics shape the adoption process in TVET colleges and how they contribute to the unevenness of digital transformation across the sector.

To frame this analysis, the study draws on two complementary theoretical perspectives: Affordance Theory and Institutional Design Theory (IDT). Affordance Theory is useful for exploring how institutional actors – especially educators and mid-level administrators – perceive and act on the possibilities offered by technology within their specific contexts. These perceptions are not determined solely by technological features but emerge from users' experiences, goals, and constraints. In contrast, IDT provides a structural and governance-focused lens, emphasising how institutional rules, hierarchies, decision-making procedures, and resource flows enable or inhibit technology adoption. Together, these theories provide a multi-level conceptual framework for analysing the organisational, procedural, and perceptual conditions that influence the uptake of ICTs in TVET colleges. The next sections elaborate on each theory's conceptual contribution and analytical application to the study.

3.3.1. Theoretical lens: Affordance theory and institutional design theory

Affordance Theory originated in the field of ecological psychology through the work of James Gibson (1979; 2015), who defined affordances as “action possibilities” that exist in the environment and are perceivable by an actor. Gibson's central claim was that perception is direct and action-oriented – we perceive the world not as a set of abstract properties, but in terms of what it affords us; for example, a chair affords sitting, a handle affords pulling. Later developments, particularly in design and human-computer interaction, adapted this notion to technological environments (Gaver, 1991; Norman, 1988, 2013). These scholars reframed affordances not just as physical properties but as relational features between a user and a tool,

contingent upon user skill, goals, institutional context, and interpretive framing (Chemero, 2003; Costall, 2012).

In educational research, Affordance Theory has been used to examine how ICTs offer – or fail to offer – pedagogically meaningful action to educators and students (Conole & Dyke, 2004; Liu & Choi, 2004). Consider a learning management system (LMS); it may technically afford asynchronous learning, but whether that affordance is perceived, accessed, or used effectively depends on local pedagogical cultures, professional training, and time constraints. According to Affordance Theory, affordances are not universally available; they are emergent properties of sociotechnical systems (Davis & Chouinard, 2017). What one institution sees as an enabling platform may be perceived by another as an administrative burden, depending on its internal dynamics, technological maturity, and leadership support.

In the context of TVET, where the educational environment is highly applied, industry-oriented, and often resource-constrained, the relevance of a given ICT device or platform is judged not only by its technical sophistication but by its alignment with local pedagogical demands. E-learning platforms that prioritise text-heavy content may offer limited affordance in practical training environments where demonstration and workshop-based learning dominate (Chaka Mbele, 2021). Similarly, a tool that is theoretically well-suited for blended learning may be seen as inaccessible if lecturers lack digital literacy, bandwidth is limited, or institutional support is weak (Aina & Ogegbo, 2022; Maseko, 2020). Affordance Theory, therefore, offers a valuable conceptual lens to bridge the gap between access and actual use by focusing on perception, interpretation, and contextual enactment.

Furthermore, Affordance Theory provides insights into the dynamic interactions between user agency and structural conditions. According to Davis and Chouinard (2017), affordances should be viewed not as inherent properties of technologies, but as relational and co-constructed through practice. This means that affordances are both enabled and constrained by institutional culture, organisational readiness, and historical experience with innovation – in the case of this study, ICTs. Nye and Silverman (2012) further argue that affordances operate at multiple levels – personal, organisational, and systemic – making them ideal for analysing layered adoption dynamics within complex institutions like TVET colleges.

By applying Affordance Theory to ICT adoption in South African TVET colleges, this study attends to how lecturers, administrators, and institutional leaders perceive and engage with digital tools in light of their roles, responsibilities, and environmental constraints. It recognises that perceptions of usefulness, usability, and relevance are shaped not only by the technology's design but also by local norms, workload pressures, and strategic priorities. This framing allows the research to investigate not just what ICTs are available, but how they are interpreted as pedagogically meaningful – or not – within different institutional contexts.

Where Affordance Theory helps explain individual and collective interpretations of technology within institutional settings, a deeper understanding of how those settings are structured and governed requires a complementary lens – Institutional Design Theory (IDT). IDT provides a structural lens for understanding how the rules, norms, and governance systems within organisations shape those perceptions and practices. It focuses on how institutions are configured to solve collective problems, allocate resources, exercise authority, and respond to environmental pressures (March & Olsen, 2003; Ostrom, 2005). In the case of TVET colleges, institutional design significantly affects how ICT policies are interpreted, operationalised, and sustained.

Institutional theorists view organisations not merely as formal structures but as rule-bound systems of behaviour, underpinned by shared logics, normative expectations, and regulatory frameworks (Scott, 2008; Zucker, 1987). March and Olsen (2003) argue that the design of institutions shapes not just what is done, but what is seen as appropriate to do. In their view, adoption of innovations such as ICTs is not purely rational or technical; it is shaped by the institution's design – including leadership practices, decision-making authority, incentives, accountability structures, and relationships with external stakeholders (Hodgson, 2016; Weber, 1978).

In the South African TVET context, these dynamics are particularly important. Although TVET colleges have been formally declared autonomous entities (per the Continuing Education and Training Act, 2006), their actual decision-making power is highly constrained by centralised funding mechanisms, DHET-led policy directives, and performance monitoring systems (DHET, 2017; Holler et al., 2023). IDT allows for an analysis of this tension between autonomy and control by investigating how formal rules – such as budget processes, procurement policies, performance targets – and informal norms – namely, leadership priorities, organisational culture – influence ICT strategy, adoption, and sustainability (Appelbaum, 1997; Bell, 2002).

A key concept within IDT is the notion of institutional capacity, which includes administrative competence, staff expertise, strategic clarity, and adaptability. Institutions with well-developed capacity are better positioned to integrate innovations into their operational routines, align them with institutional goals, and embed them within teaching and learning practices (Bauer & Erdogan, 2012; Bruton et al., 2010). Conversely, colleges with weak administrative systems, unclear strategic direction, or high staff turnover may adopt ICTs in name only, failing to translate policy into meaningful practice. These disparities are evident in the South African TVET system, where some colleges lead national digital pilot initiatives, while others lack even basic connectivity or digital reporting capacity (Kana & Letaba, 2024; Hugo et al., 2021).

Another critical contribution of IDT is its emphasis on institutional isomorphism – the tendency of institutions to conform to perceived norms or dominant models within a field, often in response to regulatory, mimetic, or normative pressures (DiMaggio & Powell, 1983; Scott, 2003). In the context of ICT adoption, colleges may adopt technologies or policies not because they align with internal pedagogical goals, but because doing so signals legitimacy to funders, oversight bodies, or peers. This leads to what Gibson et al. (2012) describe as symbolic adoption, where the appearance of innovation masks the absence of deep structural or cultural change.

IDT also draws attention to the importance of actor agency within structured environments. While rules and formal roles matter, so too do the capacities of individuals – such as principals, ICT champions, or curriculum managers – to interpret policies, mobilise resources, and reshape institutional direction (Clawson & Pitts, 2008; Jones, 2013). This aligns well with Affordance Theory, which foregrounds the role of user interpretation and agency. Together, these theories allow the study to trace both how institutions are configured and how actors within those institutions respond to the opportunities and constraints created by that configuration.

Finally, IDT allows this study to problematise the governance of digital transformation within TVET. Rather than assuming that ICT adoption is a linear process guided by rational planning, Institutional Design Theory frames adoption as a negotiated outcome that reflects the internal design of the institution – including the rules for allocating attention, prioritising initiatives, and evaluating success (Amenta & Ramsey, 2010; Baumol et al., 2009). This theoretical stance enables the study to ask not only how ICTs are introduced, but also why some adoption strategies succeed or fail within specific institutional contexts. Thus, IDT provides a crucial counterpoint to user-centred models by illuminating how formal structures, governance

systems, and institutional routines shape innovation trajectories.

When paired with Affordance Theory, IDT enables a layered analysis of both agency and structure, allowing this study to map the institutional terrain within which ICT adoption occurs and to understand how organisational arrangements either enable or constrain meaningful integration of digital technologies in South African TVET colleges. This dual-theoretical approach addresses a notable gap in the literature on ICT in vocational education, which often either overemphasises technological capability or neglects the institutional logics that govern adoption. By focusing on both meaning-making and institutional constraint, the framework offers a more comprehensive account of digital integration in resource-constrained educational environments.

3.3.2. Variables and relationships in the adoption of ICTs at the institutional level

Both Affordance Theory and IDT offer distinct but complementary variables and relational pathways for analysing how institutions adopt and integrate ICTs. Their combined application enables a multi-level investigation – connecting micro-level agency and interpretation (via Affordance Theory) to meso- and macro-level structures and governance processes (via IDT). This layered approach is particularly appropriate for the TVET sector, where adoption outcomes are shaped not only by individual choices and digital literacy but also by organisational structures, leadership dynamics, and institutional culture.

i. Technological properties

Affordance Theory identifies a set of variables that help explain how users interact with technological tools within specific contexts. The first variable is technological properties – the inherent functionalities and design features of a digital tool (Norman, 2013). Drawing from ecological psychology, Gibson (2015) proposed that affordances are resources for action that emerge from the environment and signal to users how objects or technologies might be used. In a TVET setting, technological properties include features such as synchronous communication, content creation, analytics dashboards, or learning management capabilities. However, as Norman (2013) and Gaver (1991) note, these features only become actionable affordances when recognised and interpreted by users. Thus, affordances are not inherent properties but relational and situational – their activation depends on the match between technological functionality and user perception, ability, and intent.

ii. Perceived affordances

The second key variable applied in this study from Affordance Theory is perceived affordances. As Davis and Chouinard (2017) emphasise, affordances exist whether or not they are perceived, but only those that are recognised become operationalised in practice. Perception is influenced by a constellation of factors – prior experience, pedagogical training, institutional support, and social norms. The design of ICT tools can either invite or obscure specific uses. In this regard, Davis and Chouinard (2017) outline six inter-referential mechanisms through which affordances function, ranging from object-driven demand mechanisms (which enforce specific behaviours) to user-driven refusal mechanisms (which inhibit action). For instance, a digital learning platform may be designed to allow flexible assessment, but if lecturers do not perceive it as such – perhaps due to limited exposure, training gaps, or negative prior experience – its affordance remains latent. Within TVET colleges, perceptions are further mediated by workload constraints, institutional pressures, and varying levels of digital maturity.

iii. Capabilities and intentions

The third variable is user capabilities and intentions. These refer to both the physical and cognitive capacities of lecturers to understand, operate, and integrate digital tools. As Chemero (2003) and Norman (2013) argue, user dexterity – including digital fluency and pedagogical agility – plays a critical role in actualising affordances. Maseko (2020) and Chaka Mbele (2021) note that in South African TVET colleges, many lecturers lack formal training in educational technologies and often rely on peer networks or self-learning to engage with ICTs. Intentionality – the degree to which users wish to innovate, experiment, or transform their pedagogy – also matters. This is shaped not only by personal motivation but by institutional culture, expectations, and reward systems. The same technology might be adopted enthusiastically in one context and ignored in another, depending on how it aligns with lecturers' perceived roles, classroom needs, and professional identity.

iv. Contextual constraints

The final variable in Affordance Theory is contextual constraints, which include both environmental and organisational conditions. Building on Gibson's (2015) notion of environmental affordances, the broader institutional setting – including infrastructure availability, professional development opportunities, time allocation, and curriculum design – significantly shapes whether technological affordances are perceived and enacted. For instance, a learning management system may theoretically support blended instruction, but in rural colleges with intermittent connectivity, limited ICT support staff, and rigid timetables, that affordance may be impossible to realise. In this sense, affordances are dynamic and conditional – emerging at the intersection of user agency, technological design, and institutional context (Costall, 2012; Nye & Silverman, 2012).

v. Governance structure

In parallel, IDT provides a complementary set of structural and procedural variables that influence ICT adoption at the institutional level. At the core of IDT is the view that institutions are not static entities but dynamic configurations of rules, practices, and shared meanings that shape collective behaviour (March & Olsen, 2003; Scott, 2008). One of the primary variables in IDT is the institution's governance structure – the way authority, decision-making, and resource control are distributed. While TVET colleges in South Africa are formally autonomous, their actual decision space is often constrained by centralised funding, procurement guidelines, and policy oversight from DHET (DHET, 2017; Holler et al., 2023). As Clawson and Pitts (2008) note, centralised governance structures often result in compliance-driven cultures, where innovation is viewed as risky or undesirable. Conversely, decentralised structures allow for local adaptation, responsiveness to context, and more agile ICT implementation strategies.

vi. Institutional rules and procedures

A second critical variable is institutional rules and procedures, which include formalised protocols for procurement, performance monitoring, curriculum delivery, and staff development. These structures create the operational routines within which ICT decisions are embedded. For instance, even when funding is available for technology procurement, bureaucratic delays or unclear responsibilities may undermine timely acquisition and deployment. Similarly, institutional incentives often prioritise administrative compliance over pedagogical innovation, resulting in symbolic or superficial forms of ICT adoption (Appelbaum, 1997; Scott, 2003). As Bruton et al. (2010) argue, institutions must be examined not only for what they do, but for how their internal rules align with broader goals of transformation and innovation.

vii. Institutional capacity

Another core variable in IDT is institutional capacity, which includes both human and infrastructural resources. This encompasses staff expertise, IT infrastructure, leadership quality, and planning systems. Bauer and Erdogan (2012) note that institutions with high administrative competence and strategic clarity are more likely to absorb and sustain innovation. In contrast, those with fragmented leadership, high turnover, or weak internal systems may adopt ICTs as a formal gesture but struggle with meaningful integration (Denhere & Moloi, 2021; Hugo et al., 2021). Institutional design thus influences whether a college can align its internal systems with national policy frameworks and external partnerships.

viii. Organisational culture

Lastly, organisational culture serves as a mediating variable in the ICT adoption process. Organisational culture refers to the informal norms, values, and shared expectations that govern daily behaviour and decision-making (Jones, 2013; Gibson et al., 2012). In hierarchical, risk-averse environments, innovation may be resisted or marginalised. In contrast, a culture that values collaboration, experimentation, and learning is more likely to encourage the uptake of digital tools. Importantly, organisational culture is not fixed – it evolves through leadership practices, staff interactions, and external pressures. As Zucker (1987) suggests, institutional culture shapes how innovations are framed and whether they are understood as opportunities or disruptions.

The interaction between the variables in Affordance Theory and IDT produces a complex ecology of ICT adoption. For example, a lecturer may perceive a digital assessment tool as useful and be willing to use it (user capability and intention), but without institutional training, access to a functioning LMS, or supportive leadership (institutional capacity and governance), adoption may not occur. Conversely, a college may invest heavily in infrastructure and staff development (institutional design), but if the tools chosen do not align with local pedagogical needs or are not perceived as usable (technological and perceived affordances), utilisation may remain low.

In this study, these interlocking variables are treated not as linear causes but as mutually constitutive conditions. Affordance Theory allows for the granular exploration of how technologies are interpreted and enacted in everyday teaching, while IDT provides the structural scaffolding that explains why certain practices are supported, sustained, or blocked. This conceptual pairing enables the research to move beyond simplistic models of “barriers and enablers” to a more nuanced account of how agency and structure intersect in the digital transformation of South Africa’s TVET colleges.

The adoption of ICTs in TVET colleges cannot be understood solely through individual intention or resource availability; it emerges from the dynamic interplay of user perceptions, institutional arrangements, and contextual constraints. Affordance Theory contributes an interpretive framework that foregrounds how educators engage with technological tools based on their skills, goals, and local pedagogical conditions. IDT complements this by elucidating the governance structures, rules, capacities, and cultural norms that either enable or inhibit such engagement. Together, these theories provide a robust conceptual basis for analysing ICT adoption as a relational and systemic process, where user agency is shaped by institutional architecture, and technological uptake is conditioned by organisational routines and institutional culture. This integrated perspective is essential for explaining the uneven integration of digital technologies in South Africa’s TVET sector and for identifying the structural and interpretive levers through which meaningful change can occur.

3.3.3. Justification for the selection of theories: Affordance theory and IDT

The selection of Affordance Theory and IDT as the conceptual anchors for this particular research objective is grounded in both theoretical fit and empirical relevance. These theories respond directly to the core problem under investigation: the uneven and fragmented integration of ICTs in TVET institutions, despite the presence of supportive policy frameworks and expanding infrastructure. Theories that merely focus on technology acceptance or linear models of diffusion are insufficient in explaining why some institutions and educators meaningfully adopt digital technologies while others, under comparable conditions, do not. Affordance Theory and IDT offer a more nuanced and context-sensitive lens by incorporating the complexity of interpretation, institutional capacity, governance, and structure.

Affordance Theory is particularly well-suited to examine individual-level responses to technology, especially in contexts where the adoption of digital tools is not mandated or standardised. In the South African TVET system, lecturers retain significant discretion over whether and how to use ICTs in their teaching. Therefore, understanding how they perceive and act upon digital affordances – whether in the form of e-learning platforms, digital content tools, or mobile communication technologies – is critical to unpacking patterns of use. Moreover, the theory acknowledges that technology is not adopted or rejected in isolation; rather, its perceived utility is shaped by pedagogical orientation, workload, training, and broader institutional support systems. This makes Affordance Theory a useful framework for capturing the variability of ICT integration at the classroom level, as well as understanding how educators adapt, improvise, or resist technological interventions.

IDT, on the other hand, is essential for explaining organisational-level enablers and constraints. As highlighted in the literature and in recent reports on the South African TVET sector (Kana & Letaba, 2024; Hugo et al., 2021), institutional contexts vary significantly in terms of leadership, strategic planning, funding structures, and ICT governance. These organisational differences are not peripheral; they shape whether digital initiatives are supported, sustained, and aligned with pedagogical priorities. IDT allows this study to probe how colleges interpret national ICT policies, what structural barriers they encounter, and how internal rules and routines influence the implementation of digital innovations. The theory is particularly relevant in a sector where governance is formally decentralised but functionally constrained, making it vital to analyse how institutional design mediates policy enactment and operational choices.

Crucially, the use of these two theories in combination provides a multi-level perspective that reflects the structure of the research questions. Research Question 2 – focused on the institutional factors that shape ICT adoption – is not adequately addressed by individual-centred theories alone. Similarly, organisational theories without a user-oriented lens risk ignoring how policies and tools are interpreted at the point of delivery. The integration of Affordance Theory and IDT, therefore, ensures that this study can analyse both how technologies are perceived and how institutions shape those perceptions through governance, norms, and incentives.

Furthermore, these theories have been successfully applied in adjacent research contexts. Affordance Theory has been used in studies of digital learning in higher education, workplace training, and blended learning environments (Davis & Chouinard, 2017; Liu & Choi, 2004). Institutional Design Theory has informed analyses of education reform, innovation management, and ICT policy implementation (Hodgson, 2016; March & Olsen, 2003). However, their combined application in the specific context of vocational education – particularly within the Global South – remains limited. This positions the study to make a novel theoretical contribution by demonstrating how these frameworks can be used together to explain the institutional and pedagogical dynamics of digital transformation in resource-constrained settings. Affordance Theory and IDT were selected because they are methodologically and conceptually aligned with the layered nature of ICT adoption in TVET. They enable the study to move beyond surface-level explanations and engage with the deeper institutional and cognitive processes that influence the uptake and integration of technology. This dual-theoretical approach supports the study's aim to generate findings that are both empirically grounded and analytically rigorous, thereby contributing to scholarship on educational technology, institutional change, and vocational pedagogy.

3.3.4. Applying affordance and institutional design theories in resource-constrained TVET environments

While Affordance Theory and Institutional Design Theory have been widely applied in educational and organisational research, their integration and application within the context of public vocational education – especially in low- and middle-income countries – remains relatively underdeveloped. This study offers an opportunity to extend both frameworks by applying them to the institutional and pedagogical realities of South African TVET colleges, where ICT adoption is mediated by systemic inequalities, policy ambiguity, and limited institutional capacity.

One key contribution this study makes to Affordance Theory lies in demonstrating how the perception of affordances is institutionally mediated. Traditional applications of the theory often treat users as relatively autonomous agents whose perception of technological utility is shaped by individual factors such as training, digital literacy, or prior experience (Norman, 2013; Liu & Choi, 2004). This study challenges the individualistic framing by showing how institutional constraints – such as curriculum rigidity, hierarchical leadership, and evaluation practices – shape what affordances are perceived as desirable, viable, or even visible. In doing so, the study supports an emerging strand of affordance research that argues for a more embedded, socially contextualised understanding of technological perception and use (Chaka Mbele, 2021; Davis & Chouinard, 2017).

Moreover, the study extends Affordance Theory by emphasising the concept of latent affordances – those technological possibilities that exist within ICT design but remain unrealised due to institutional inertia or lack of enabling conditions. This is especially salient in TVET colleges, where staff may have access to ICTs but lack the time, autonomy, or support to meaningfully incorporate them into teaching. By documenting how affordances can remain structurally suppressed, the study adds depth to the notion that affordances are not static or universal, but conditioned by local organisational dynamics.

With respect to IDT, this study extends the framework by applying it to a sector that is simultaneously governed by top-down national policies and marked by local implementation variability. While IDT has traditionally been used to study state institutions, policy innovation, and formal organisational structures (Amenta & Ramsey, 2010; March & Olsen, 2003), its application in educational institutions, particularly those that straddle the line between state bureaucracy and professional autonomy, has been limited. This study contributes to IDT by

demonstrating how institutional design in education is not merely about structural arrangements, but also about cultural norms, symbolic compliance, and institutional learning. For instance, the tendency of some TVET colleges to engage in performative ICT adoption – appearing compliant with policy while lacking substantive integration – reflects a need to update IDT’s treatment of isomorphism, legitimacy, and strategic adaptation in highly regulated environments (Gibson et al., 2012; Scott, 2008).

In addition, this study contributes to the temporal dimension of IDT by examining how digital innovation unfolds over time in institutions with fluctuating funding cycles, shifting leadership, and changing external policy pressures. It argues that institutional design must be understood not as a fixed architecture but as an evolving configuration that both enables and constrains agency across time. This builds on work by Hodgson (2016) and Bruton et al. (2010), who have called for more dynamic and processual understandings of institutional design.

By synthesising these contributions, the study positions itself to bridge gaps between agency- and structure-oriented theories, suggesting that successful ICT integration in TVET is most likely where institutional design and digital affordances are mutually reinforcing. In doing so, it not only adapts established theoretical models to a novel context but also generates insights that may inform future research in other education systems facing similar governance and resource constraints.

3.4. Adoption of ICTs for teaching and learning

The adoption of ICTs in education is frequently examined at the institutional or policy level, with comparatively less emphasis placed on how these technologies are actually used by educators in their day-to-day teaching practices. In South African TVET colleges – where infrastructural disparities and institutional support are uneven – the lecturer becomes a key figure in determining the extent and nature of ICT integration. ICTs, no matter how well-designed or widely distributed, only become pedagogically effective when educators perceive them as relevant, accessible, and aligned with their teaching goals. This section focuses on the micro-level dynamics of adoption by analysing how lecturers engage with ICTs within specific pedagogical contexts and under particular institutional conditions.

To investigate these processes, the study draws primarily on Affordance Theory, which highlights the relational nature of technology use by examining how users perceive and act upon the possibilities offered by digital tools. In addition, the section incorporates insights from Diffusion of Innovation (DOI) Theory, particularly the concept of reinvention, which captures how lecturers adapt and repurpose technologies in ways that may diverge from their intended design. Together, these frameworks provide a means to explore not just whether ICTs are used, but how they are appropriated, modified, or resisted in TVET classrooms. This dual-theoretical lens is especially valuable for understanding why ICT adoption outcomes vary so widely across institutions operating under similar policy frameworks, and how pedagogical innovation emerges – or fails to emerge – at the level of individual practice.

3.4.1. *Theoretical Lens: Affordance theory and diffusion of innovation theory*

The integration of ICTs into teaching practice is not a linear or uniform process. Rather, it is shaped by a dynamic interplay of perception, intention, institutional norms, resource availability, and professional identity. In the context of TVET, where pedagogical routines are embedded within vocational frameworks and infrastructural constraints are often acute, understanding how lecturers adopt and adapt digital tools requires a nuanced theoretical lens. This study draws primarily on Affordance Theory to examine how educators perceive and engage with ICTs within their instructional contexts, and complements this perspective with the reinvention principle from Diffusion of Innovation (DOI) theory. Affordance Theory foregrounds the relational and interpretive dynamics of user-technology interaction, while DOI's notion of reinvention offers insight into how users tailor innovations to local realities. Together, these frameworks enable a robust exploration of the pedagogical appropriation of digital tools in diverse TVET environments.

Affordance Theory, originating in the ecological psychology of James Gibson (1979; 2015), conceptualises affordances as “action possibilities” offered by the environment to a perceiving actor. This relational approach was later adapted in design and human-computer interaction research to explore how technologies present perceived possibilities for action, depending not only on their design features but also on user skill, context, and goals (Chemero, 2003; Gaver, 1991; Norman, 2013). In educational settings, affordances are understood as emerging from the intersection of digital platforms, pedagogical aims, and institutional constraints (Conole & Dyke, 2004; Davis & Chouinard, 2017). A digital tool such as a virtual whiteboard may afford collaborative knowledge-building, but that affordance becomes meaningful only if the lecturer

perceives it as pedagogically relevant, technologically manageable, and contextually viable. In this sense, affordances are not inherent but situated, varying across users and institutional environments (Costall, 2012; Nye & Silverman, 2012).

The TVET context adds further complexity. Teaching and learning in these institutions is shaped by occupational standards, competency-based curricula, and an emphasis on applied skills. Consequently, the pedagogical value of a given ICT tool is assessed in relation to its alignment with hands-on, practice-oriented learning. A tool with sophisticated communication or analytics capabilities may be perceived as misaligned if it fails to support workshop demonstrations, simulations, or real-time performance feedback. Studies such as those by Maseko (2020), Aina and Ogegbo (2022), and Chaka Mbele (2021) underscore how such judgments are not simply technical decisions but are embedded in professional practice, institutional histories, and the perceived legitimacy of ICT use. Affordance Theory allows for a layered analysis of these dynamics, highlighting how lecturers' interpretations of digital tools are shaped by their experiences, training, and the socio-material conditions of their institutions.

DOI theory, particularly Rogers' (2003) concept of reinvention, deepens this analysis by drawing attention to how users adapt innovations to fit their context. Reinvention refers to the degree to which an innovation is modified by adopters during implementation, diverging from the original intent of its designers or disseminators (Valente & Rogers, 1995). This is particularly relevant in TVET colleges, where institutional support for ICT integration may be uneven or insufficient. In such contexts, lecturers often exercise creativity and discretion in adapting available tools to meet their pedagogical needs. For instance, lecturers may appropriate social media platforms like WhatsApp for learner engagement or repurpose free mobile apps for assessment, illustrating how digital tools are reinvented to fit local challenges (Denhere & Moloji, 2021; Mbatha, 2024). This kind of adaptation reflects not only resource constraints but also an active negotiation of what counts as meaningful and practicable technology use.

The combined application of Affordance Theory and the reinvention principle of DOI provides an analytically rich framework for exploring technology use in TVET classrooms. Affordance Theory attends to the micro-level dynamics of perception and enactment – how lecturers evaluate the possibilities offered by digital tools within their particular teaching contexts. DOI, meanwhile, provides a macro-temporal perspective that captures the iterative and adaptive nature of technology adoption. Importantly, both theories resist deterministic accounts of adoption, instead portraying technology use as a socially situated and interpretive practice. They

jointly reveal how the appropriation of ICTs by lecturers is shaped by an intricate matrix of perceived usefulness, pedagogical values, infrastructural conditions, and institutional expectations.

In this way, the theoretical framework recognises that the classroom adoption of ICTs is not simply a function of availability or compliance with institutional directives. Rather, it is a negotiated process in which lecturers selectively integrate, repurpose, or even reject digital tools based on how these tools interact with their pedagogical commitments and local working conditions. This dual-theoretical lens thus enables the study to account for the diversity of technology use among lecturers – from full-scale integration to cautious experimentation and strategic resistance – and to analyse how such variation reflects broader patterns of agency, adaptation, and constraint in South African TVET education.

3.4.2. Variables and relationships in the adoption of ICTs amongst lecturers

Understanding how lecturers use ICTs in their teaching requires a detailed examination of the interplay between individual dispositions, technological properties, and institutional environments. Both Affordance Theory and the reinvention principle within DOI foreground this relational view of technology use, moving beyond deterministic models to emphasise variation, adaptation, and meaning-making. Within this framework, four interrelated clusters of variables emerge as critical: (i) technological affordances, (ii) pedagogical intention, (iii) institutional context, and (iv) lecturer identity. These variables interact to determine whether, how, and to what extent digital tools are integrated into instructional practice. Importantly, they do not operate in isolation, but are embedded within a broader ecology of perception, professional culture, and institutional design.

i. Technological affordances

The first variable – technological affordances – refers to the perceived and actionable possibilities embedded within a given digital tool. In Affordance Theory, these affordances are not objective or fixed but arise from the relationship between the user and the technology, mediated by the user's cognitive, physical, and contextual attributes (Gaver, 1991; Norman, 2013; Gibson, 2015). For instance, a digital whiteboard may offer affordances for collaboration and visual explanation, but these are only actualised if the lecturer perceives and values such possibilities. According to Norman (2013) and Davis and Chouinard (2017), affordances are

filtered through user perception and shaped by the tool's design characteristics, such as visibility, feedback mechanisms, and ease of use. In the TVET context, affordances become salient when they align with hands-on, skills-based learning goals, such as virtual simulations for trade instruction or video feedback for performance assessment (Holler et al., 2023; Denhere & Moloi, 2021). Affordances may be hidden, false, or ambiguous depending on users' prior experience, skill levels, and environmental conditions (Gaver, 1991; Nye & Silverman, 2012), thus affecting their uptake in practice.

ii. Pedagogical intention

Second, pedagogical intention plays a decisive role in mediating how technologies are used. This refers to the lecturer's goals, values, and underlying beliefs about teaching and learning. Whether a lecturer adopts a constructivist, instructivist, or blended pedagogical stance influences their openness to exploring digital platforms, the types of tools they choose, and how they apply them (Liu & Choi, 2004; Maseko, 2020). A lecturer with a constructivist orientation may be drawn to digital tools that support interaction, inquiry, and student autonomy – such as forums, collaborative documents, or gamified applications – while an instructivist may limit use to delivering pre-recorded lectures or managing submissions. However, pedagogical intention is not static. It evolves through reflective practice, professional development, and peer influence, meaning that the same lecturer may shift approaches over time as they become more confident or encounter different teaching environments (Norman, 2013; Davis & Chouinard, 2017). This evolution underscores that intention is both a personal variable and an institutional outcome, shaped by exposure to innovation and internalised organisational expectations.

iii. Institutional context

Third, institutional context significantly influences how and whether perceived affordances translate into actual use. While an affordance may be perceived, it can only be enacted if the surrounding environment enables action. Institutional conditions such as infrastructure availability, workload pressures, internet reliability, scheduling flexibility, and technical support mediate lecturers' engagement with technology. These conditions reflect what Gibson (2015) termed environmental affordances – the structural features of a setting that either constrain or enable action. Additionally, institutional culture – encompassing leadership vision, peer norms, and implicit reward systems – shapes whether experimentation with technology is encouraged or discouraged (Chaka Mbele, 2021; Jones, 2013). For instance, even motivated lecturers may

be dissuaded from exploring digital tools if their institution lacks an articulated ICT policy, if risk-taking is not recognised, or if professional development opportunities are scarce. In contrast, institutions that actively promote innovation through ICT champions, collaborative peer learning, and aligned incentives tend to foster more widespread and meaningful adoption.

iv. Lecturer identity

Fourth, lecturer identity and agency form a critical interpretive filter in technology adoption. Lecturers do not encounter technologies as passive recipients but as professionals with specific self-conceptions, career experiences, and pedagogical priorities. These identity markers influence how they engage with technology, whether as tools to be mastered, risks to be managed, or opportunities for professional renewal. According to Affordance Theory, the affordances perceived by a user are partly a function of their own physical and cognitive capabilities, preferences, and confidence (Chemero, 2003; Norman, 2013). In TVET colleges, where many lecturers may not have received formal training in digital pedagogy, the perceived complexity of new tools can undermine confidence and lead to avoidance. On the other hand, lecturers who view themselves as innovative or student-centred may take the initiative to explore and adapt digital platforms, even in the absence of institutional support. This is where DOI's reinvention principle becomes salient. Rogers (2003) and Valente and Rogers (1995) note that reinvention is a natural and often necessary part of the diffusion process, especially in decentralised environments. Lecturers frequently modify, repurpose, or simplify technologies to suit their teaching styles, comfort levels, and classroom constraints – using WhatsApp for formative quizzes, Google Forms for attendance, or YouTube videos for demonstration.

These four variable clusters – technological affordances, pedagogical intention, institutional context, and lecturer identity – operate as an interdependent system. A lecturer may possess a strong pedagogical rationale for using ICTs, work in a relatively well-resourced environment, and perceive high affordances in a given tool, yet still choose not to adopt due to lack of peer support or concerns about student access. Conversely, another lecturer may compensate for infrastructural deficits through creative reinvention and persistent experimentation. As Davis and Chouinard (2017) point out, affordances are emergent and contingent; they materialise through the dynamic and often uneven interaction of user, tool, and environment. Thus, ICT adoption cannot be fully understood through any single lens – it requires an integrative approach that accounts for both micro-level agency and macro-level constraint.

In summary, the adoption of ICTs amongst TVET lecturers is shaped by a constellation of interacting variables that reflect both the relational insights of Affordance Theory and the adaptive logic of DOI's reinvention principle. Affordance Theory helps explain why certain technologies are taken up, ignored, or adapted, based on how users perceive and experience them within institutional and pedagogical contexts. DOI offers insight into how those technologies are reshaped in practice, diverging from standardised models and reflecting local needs. Together, these frameworks allow this study to trace not just patterns of use, but the processes of appropriation, resistance, and transformation that underlie pedagogical ICT adoption in South African TVET classrooms.

3.4.3. Justification for the selection of the affordance and diffusion of innovation theories

The selection of Affordance Theory and the reinvention principle of DOI – is a deliberate response to the analytical demands of the third research question: How do lecturers use the ICTs available for teaching and learning? Unlike institutional or infrastructural analyses, this question requires close attention to how individuals interpret, appropriate, and adapt technology in relation to their pedagogical goals and contextual realities. It also calls for a theoretical framework capable of accounting for variation in use, even when access and policy directives are held constant across institutions.

Affordance Theory is particularly well-suited to this task because it positions the user at the centre of analysis, while also acknowledging the role of environmental and institutional conditions. It allows the study to explore the relational nature of ICT use, where affordances are not fixed properties of tools but emergent possibilities shaped by users' perceptions, experiences, and objectives (Gaver, 1991; Norman, 2013). This orientation aligns closely with the reality of TVET teaching, where lecturers exercise a degree of autonomy in shaping their instructional practice and often engage with digital tools in adaptive, improvised, or selective ways (Chaka Mbele, 2021; Mbatha, 2024). Furthermore, Affordance Theory accommodates non-use and resistance – phenomena that are analytically rich but often overlooked in studies that assume technology adoption is inherently positive or inevitable (Davis & Chouinard, 2017; Liu & Choi, 2004).

While Affordance Theory addresses the interpretive dimension of technology use, DOI theory contributes important insight into the behavioural and processual aspects of adoption.

Specifically, Rogers' (2003) concept of reinvention helps explain why technologies are rarely used in the way their designers intended, particularly in environments where institutional support is weak or pedagogical needs are highly specific (Rogers, 2003; Valente & Rogers, 1995). Reinvention acknowledges that users do not passively adopt innovations; rather, they adapt, modify, or selectively integrate features to serve their own goals. In the South African TVET context, where teaching and learning occur under conditions of resource scarcity, bureaucratic constraint, and pedagogical diversity, such adaptive practices are not only common but often necessary for digital tools to be viable in practice (Denhere & Moloi, 2021; Maseko, 2020).

Notably, the combined use of these theories enables the study to transcend the limitations of more deterministic models such as the Technology Acceptance Model (TAM) or Unified Theory of Acceptance and Use of Technology (UTAUT). While these models offer predictive power by identifying factors like perceived usefulness and ease of use, they tend to reduce technology use to a linear, rational decision-making process, often devoid of context, interpretation, and institutional influence. Such models are also premised on formal, top-down implementations of technology, which do not reflect the often informal, uneven, and negotiated nature of ICT use in TVET settings. By contrast, Affordance Theory and DOI – particularly as a combination – allow for a nuanced exploration of how pedagogical agency and institutional constraint intersect, offering a more contextually sensitive and theoretically flexible explanation of observed practices.

Finally, this theoretical pairing aligns with the broader methodological orientation of the study. As a mixed-method case study situated within the interpretivist paradigm, the research seeks not to predict but to understand the meaning, rationale, and patterns behind lecturer behaviour. Affordance Theory and DOI are compatible with this epistemological stance because they prioritise process over outcome, meaning over measurement, and context over generalisation. In doing so, they support the development of thick, empirically grounded explanations that are well-attuned to the complexities of teaching and learning in vocational education.

3.4.4. Exploring situated digital pedagogy in TVET contexts using DOI and affordance theory

While Affordance Theory and DOI have been extensively applied in research on educational technology, their combined application within TVET pedagogical settings – particularly in resource-constrained environments – remains limited. This study contributes to the ongoing development of both frameworks by demonstrating how they can be extended to capture the pedagogical, contextual, and adaptive dynamics of ICT use among vocational educators in South Africa.

Affordance Theory has traditionally focused on user-tool relationships in relatively stable and resourced environments, where institutional support and technological infrastructure are assumed to be in place. In this study, however, the theory is applied in contexts marked by infrastructural inequality, institutional fragmentation, and pedagogical complexity. By examining how lecturers perceive and act upon technological affordances in these conditions, the study highlights the importance of situational affordances – those that are contextually constrained or enabled by factors such as curriculum structure, resource availability, and institutional culture (Mbele, 2021; Gaver, 1991). This extends the theory by foregrounding the institutionally mediated nature of perception, where affordances are not just shaped by individual cognition but also by norms, routines, and expectations embedded within the teaching environment.

Additionally, the study contributes to the emerging discourse on latent affordances – the unrealised or underutilised possibilities of technology that remain dormant due to misalignment between user needs, institutional incentives, and tool design (Davis & Chouinard, 2017; Norman, 2013). Within the TVET colleges studied, latent affordances were often the result of disconnects between the intended pedagogical functions of a technology and the rigid, outcomes-based structure of vocational curricula. For example, collaboration platforms may offer rich possibilities for formative assessment or group-based learning, but remain unused because lecturers are bound to tightly scheduled, assessment-heavy programmes with limited time or autonomy to experiment. By identifying and explaining these latent affordances, the study advances a more critically reflexive understanding of affordance theory, highlighting the role of structural conditions in shaping – or suppressing – perceived utility.

The study also extends DOI theory, particularly the concept of reinvention, by illustrating how lecturers in under-supported environments engage in highly localised and often improvised adaptations of available tools. Rather than following a sequential model of adoption, many lecturers engage in what can be described as situational bricolage – the creative reconfiguration of digital tools – such as WhatsApp, Google Forms, and voice notes – to support vocational pedagogy in the absence of dedicated platforms or institutional guidance. This application of DOI challenges conventional interpretations of reinvention as a secondary or late-stage process, and instead positions it as a primary mechanism of innovation in constrained contexts (Rogers, 2003; Valente & Rogers, 1995). The study, therefore, adds conceptual clarity to the reinvention literature by specifying the conditions under which adaptation becomes the norm, rather than the exception.

Moreover, this contribution has implications for policy and institutional planning, particularly in systems where digital transformation is assumed to be a matter of infrastructure provision or compliance with national directives. The study suggests that without attention to the pedagogical agency of lecturers, investments in technology are unlikely to yield meaningful instructional change. In this way, the findings encourage a more bottom-up approach to ICT integration, informed by the actual interpretive and adaptive practices of educators rather than top-down prescriptions.

In summary, this study extends both Affordance Theory and DOI by embedding them within the lived pedagogical realities of TVET lecturers in KZN. It demonstrates how these frameworks can be made more context-sensitive and analytically robust by accounting for structural barriers, adaptive agency, and pedagogical logic; thereby contributing to a richer understanding of how digital technologies are used, reimagined, or resisted in everyday teaching.

3.5. Research framework

This section introduces the integrated theoretical framework that underpins the study's investigation into the adoption and pedagogical use of ICTs across TVET colleges in KwaZulu-Natal (KZN). The research problem is inherently multi-layered, situated at the intersection of uneven infrastructure provision, varied institutional capacities, and differentiated pedagogical practices. As such, the phenomenon cannot be adequately explained by a single theoretical perspective. Instead, this study adopts a theory-triangulation approach, combining Diffusion of Innovation (DOI) Theory, Affordance Theory, and Institutional Design Theory (IDT) to offer a more comprehensive and analytically flexible account of ICT adoption processes.

Each theory plays a distinct but complementary role in addressing the study's research objectives. DOI theory offers a macro-level lens for understanding how innovations, such as digital technologies, are introduced and disseminated across educational systems, highlighting the structural and temporal dynamics of adoption. Affordance Theory provides a micro-level, interpretive lens, enabling an analysis of how individual actors perceive, interpret, and engage with technologies in specific pedagogical and institutional contexts. IDT operates at the meso level, offering conceptual tools for analysing how organisational rules, governance systems, and institutional cultures condition both the opportunities and constraints for ICT uptake. By integrating these three perspectives, the framework enables a relational, multi-scalar analysis that connects national policy directives with institutional practices and classroom-level decisions.

3.5.1. Rationale for an integrated framework

Individually, DOI, Affordance Theory, and IDT each offer valuable analytical insights into the adoption and use of digital technologies. However, when applied in isolation, each framework captures only a partial view of the complex, multi-level dynamics that shape ICT adoption within vocational education settings. DOI theory is beneficial for tracing how innovations spread and identifying the structural conditions that enable or constrain adoption. Yet, its focus tends to be on macro-level trends and adoption rates, offering limited explanatory power for understanding how digital tools are integrated into teaching practice or shaped by institutional routines.

Affordance Theory, by contrast, centres on user interpretation, perception, and action. It enables an in-depth understanding of how lecturers engage with ICTs based on their goals, skills, and professional contexts. However, it often lacks systematic attention to how institutional norms, policies, and governance structures mediate these interactions. Meanwhile, IDT brings organisational rules, formal authority structures, and resource flows into view. It is well-suited to explain institutional response patterns, strategic alignment, and structural constraints, but tends to underplay the interpretive agency of educators and the everyday pedagogical choices they make.

By integrating these three theoretical perspectives, the study develops a more layered and responsive analytical framework. The triangulated model enables analysis across multiple levels: DOI provides a system-wide view of innovation spread and adoption patterns; IDT explains how institutional structures and governance logics shape responses to digitalisation; and Affordance Theory offers a grounded view of how technologies are appropriated, resisted, or reimaged in practice. By combining DOI, Affordance Theory, and IDT, this framework provides a layered perspective that captures ICT adoption as both a structured process and a negotiated practice – an analytical depth unattainable through any single theoretical lens.

This integrated approach is particularly well-suited to the South African TVET context, where national digitalisation policies exist alongside significant institutional asymmetries. Variability in infrastructure, professional development, and leadership support creates divergent pathways of adoption across colleges. Understanding these disparities requires a framework that can account for the interaction between system-level policy initiatives, institutional configurations, and educator practice. The combined use of DOI, Affordance Theory, and IDT positions the study to respond to this complexity with appropriate conceptual depth and contextual sensitivity.

3.5.2. *Theoretical mapping across research questions*

Each of the study's three research questions targets a distinct layer within the broader ICT adoption process of the South African TVET sector. By aligning each question with the theoretical framework most suited to its analytical focus, the study ensures conceptual precision and interpretive depth. This mapping also allows for a layered understanding of ICT adoption – from systemic distribution patterns to institutional dynamics and individual pedagogical practice – thereby reinforcing the rationale for a triangulated theoretical approach.

The first research question – *What is the distribution pattern of ICTs across TVET colleges in KZN?* is anchored in DOI. DOI provides the tools to analyse how innovations spread within a social system, including the identification of variables that accelerate or impede the diffusion process (Rogers, 2003; Valente & Rogers, 1995). In the context of the South African TVET system, where digital resource allocation is uneven and infrastructure disparities persist, DOI theory enables a systematic investigation into patterns of ICT deployment across colleges. It also facilitates the identification of adopter categories – from early adopters to laggards – thus offering a structured vocabulary for characterising institutional responsiveness to national digitalisation efforts (Pick & Sarkar, 2015; Das, 2020). By focusing on the attributes of innovations, communication channels, and social system dynamics, DOI provides a comprehensive lens for examining macro-level inequalities in access and uptake.

The second research question – *Which institutional factors influence the ICT adoption process in TVET colleges, and why?* – addresses the meso-level organisational structures that mediate innovation processes. IDT is deployed as the primary framework here, as it offers a robust analytical apparatus for examining how formal rules, decision-making processes, and resource flows condition institutional responses to policy mandates (March & Olsen, 2003; Scott, 2008; Bruton et al., 2010). IDT directs attention to both regulatory frameworks and cultural-cognitive dimensions, illuminating how leadership practices, governance arrangements, and institutional histories shape the way ICT policies are interpreted, implemented, and sustained. In addition, Affordance Theory enriches this layer of analysis by revealing how institutional conditions – such as timetabling, workload structures, or access to training – shape the perceived usefulness or usability of digital tools (Norman, 2013; Chaka Mbele, 2021). The combined use of IDT and Affordance Theory thus facilitates an analysis of both the structural enablers and perceptual filters that influence institutional ICT adoption.

The third research question – *How do lecturers use the ICTs available for teaching and learning?* – focuses on the micro-level of educator engagement with technology. Here, Affordance Theory provides the principal framework, allowing the study to examine how lecturers perceive and act upon the action possibilities offered by digital tools in relation to their pedagogical goals and classroom realities (Gaver, 1991; Chemero, 2003). The theory foregrounds the relational nature of technology use, highlighting how ICT uptake is shaped by personal capability, pedagogical intention, and contextual fit. To deepen this analysis, the study draws on DOI's concept of reinvention – the modification or adaptation of innovations by users during implementation (Rogers, 2003; Valente & Rogers, 1995). In resource-constrained TVET environments, lecturers often repurpose tools in ways that diverge from intended use, driven by necessity, creativity, or pedagogical alignment. This interplay between perception, adaptation, and enactment is central to understanding the diversity of digital teaching practices (Mbatha, 2024; Denhere & Moloi, 2021).

By aligning each research question with the theory best suited to its focus – and selectively integrating complementary perspectives – the study constructs a conceptually coherent and contextually grounded framework for analysis. This mapping also reinforces the study's broader theoretical orientation: that ICT adoption is not a single-layered or linear process, but a negotiated practice shaped by interlocking personal, institutional, and systemic dynamics.

3.5.3. Levels of analysis and theoretical contribution

The strength of this integrated theoretical framework lies in its capacity to operate across three interrelated levels of analysis – micro, meso, and macro – each corresponding to a different scale of influence within the digital transformation of the TVET sector. By structuring the inquiry across these levels, the study is able to move beyond single-factor explanations and engage with the layered realities that shape ICT adoption and use in complex institutional environments.

At the micro level, the study focuses on the lived experiences and pedagogical decision-making of individual lecturers. Drawing on Affordance Theory and the reinvention concept from DOI, this level interrogates how educators perceive, interpret, and enact the possibilities offered by digital tools in their specific teaching contexts (Davis & Chouinard, 2017; Norman, 2013). It addresses variables such as user intention, prior digital experience, professional identity, and the alignment between technological capabilities and pedagogical goals. Importantly, it

captures the often-overlooked aspects of ICT adoption – such as workarounds, improvisations, and resistances – that are rarely visible in policy discourse but are critical to understanding actual classroom practice. Reinvention is especially salient here, as lecturers frequently modify or repurpose tools to suit the constraints of vocational teaching or institutional capacity (Rogers, 2003; Valente & Rogers, 1995).

At the meso level, the framework turns to IDT to examine the organisational structures, governance arrangements, and managerial cultures that shape the institutional response to digitalisation. This includes the analysis of strategic planning processes, leadership practices, ICT implementation strategies, and the incentives or disincentives that influence staff engagement with new technologies (Scott, 2008; Jones, 2013). IDT provides a mechanism for understanding how formal structures – such as budget allocations, reporting systems, and professional development programmes – interact with informal norms and expectations to either facilitate or constrain technology use. Affordance Theory supplements this analysis by highlighting how these institutional conditions mediate the perception of digital tools as either pedagogically meaningful or administratively burdensome (Costall, 2012; Gibson, 2015). Together, these frameworks illuminate how institutional coherence (or fragmentation) affects the likelihood that ICT strategies translate into sustainable practice.

At the macro level, DOI theory offers a systemic lens through which to examine how national-level policy directives, funding mechanisms, and networked interventions shape the broader ecosystem in which TVET colleges operate. It enables the study to analyse how digitalisation initiatives – introduced by actors such as the Department of Higher Education and Training (DHET), SETAs, and donor agencies – are diffused across a stratified and often unequal institutional landscape (World Bank, 2016; African Union, 2024). DOI's attention to adopter categories, communication channels, and system norms allows for an examination of how innovations are differentially absorbed, with early-adopting colleges often reaping more benefits from pilot programmes and infrastructure rollouts, while under-resourced institutions may lag behind due to systemic inertia or infrastructural deficits (Zhang et al., 2015; Hossain et al., 2024).

Crucially, these three levels are not viewed in isolation but as mutually constitutive. What occurs at the classroom level is shaped by institutional support systems, which are themselves conditioned by national policy architectures and funding models. At the same time, micro-level innovations and resistances can influence meso-level cultures and inform macro-level strategy

through feedback mechanisms, adaptation, and policy learning. This relational and recursive perspective enables the study to trace how agency, structure, and policy interact in complex ways to shape digital adoption in vocational education.

By linking these levels analytically, the study offers a nuanced and multi-scalar account of ICT adoption – one that avoids simplistic binaries such as success/failure or access/non-access. Instead, it presents digital transformation as an iterative, negotiated process, embedded in a broader constellation of material, institutional, and pedagogical conditions.

3.5.4. Integrated theoretical framework for the study

The integrated theoretical framework does not merely serve as a conceptual scaffold; it actively shapes the study's analytical strategy. By aligning DOI, Affordance Theory, and IDT with the study's core objectives, the framework informs the design of research instruments, the structuring of interview protocols, and the development of coding categories for data analysis. This triangulated theoretical approach ensures that findings are interpreted holistically, capturing the interrelations between user behaviour, institutional context, and systemic influence.

For instance, interview schedules are structured to elicit insight across three domains: institutional strategies and constraints (IDT), user perceptions and interactions with technology (Affordance Theory), and broader policy and diffusion dynamics (DOI). In practice, this means the data collection instruments are crafted to probe both the technical affordances educators perceive and the organisational arrangements that enable or inhibit their realisation. Questions explore not only what ICTs are used, but also how and why usage patterns vary across roles, departments, and institutions.

In the analysis phase, this multi-theory framework provides a layered interpretive structure. The coding process is guided by a set of conceptually informed codes – such as “latent affordances” (technological potential that remains unrealised), “reinvention” (user-led adaptation of tools), “institutional coherence” (alignment between strategic vision and operational practice), and “diffusion thresholds” (barriers to innovation uptake). These codes allow for the identification of both cross-cutting patterns and localised divergences, supporting intra- and inter-institutional comparison. For example, two colleges with comparable ICT infrastructure may exhibit vastly different levels of adoption, attributable to variations in leadership orientation, professional development provision, or departmental autonomy.

Moreover, the analytical logic extends beyond pattern recognition to offer causal and interpretive depth. In instances where a particular ICT tool is widely used, the framework facilitates inquiry into whether this usage results from favourable affordances, effective institutional support, or alignment with broader policy incentives. Conversely, where digital tools remain underutilised or resisted, the analysis draws on the framework to consider multi-level explanations, from individual perceptions of relevance, to institutional misalignment, to systemic resource constraints.

This approach avoids reductionist explanations that focus solely on either access or user intention. Instead, it traces the interdependencies between structure, agency, and technology, revealing how ICT use is embedded in a complex web of institutional routines, professional identities, and policy imperatives. The framework's recursive logic enables the study to surface not only what happens in practice, but why it happens the way it does – a critical distinction in the context of South African TVET, where digital transformation efforts are shaped by deeply stratified institutional conditions and uneven implementation capacities.

In summary, the analytical logic of the study is deliberately constructed to remain sensitive to context, responsive to variation, and theoretically grounded. It provides the tools to move between micro-level experience, meso-level organisational practice, and macro-level policy environments, generating an empirically robust and theoretically coherent account of ICT adoption in vocational education.

3.5.5. Visual representation of the integrated research framework

To further clarify the theoretical logic underpinning this study, the figure below provides a conceptual map of how the three selected theories operate across different levels of analysis and align with the study's research questions. Rather than being applied in isolation, these theoretical tools are used in an integrated, layered manner to reflect the multi-scalar and context-dependent nature of ICT adoption in the TVET sector.

At the macro level, the framework draws on DOI to analyse the systemic conditions under which digital technologies are introduced and promoted across the national education landscape. DOI enables the study to examine how innovations diffuse across institutions and to identify structural factors that accelerate or inhibit uptake. Key concepts – such as relative advantage, innovation-decision processes, and adopter categories (Rogers, 2003; Valente &

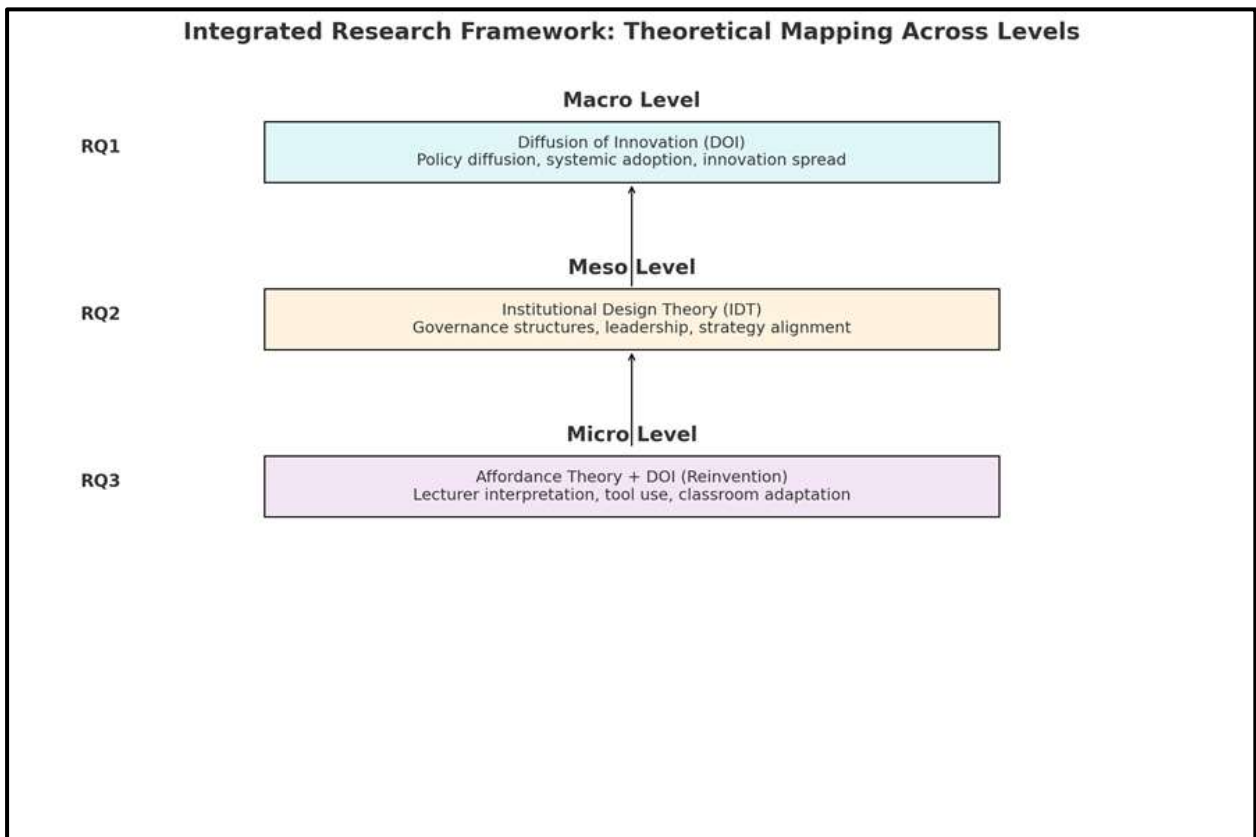
Rogers, 1995) – provide insight into why some colleges adopt digital technologies early and effectively, while others experience delays or resistance. These macro-level patterns set the enabling or constraining conditions for institutional and individual responses.

At the meso level, the framework applies IDT to explore how TVET colleges interpret, internalise, and operationalise national digitalisation directives. IDT offers a structural lens that highlights the role of governance arrangements, leadership, strategic alignment, and institutional culture in shaping the implementation and sustainability of ICT initiatives (March & Olsen, 2003; Scott, 2008). The analysis extends to both formal mechanisms – such as infrastructure planning and performance frameworks – and informal norms, including staff attitudes toward innovation and professional expectations. This level explains how and why institutional responses diverge, even within the same policy environment.

At the micro level, the study draws on Affordance Theory, enriched by DOI's concept of reinvention, to examine how individual lecturers engage with digital technologies in their teaching. Affordance Theory emphasises the relational nature of technology use – that is, how users perceive, interpret, and act upon the possibilities a tool offers, depending on their goals, capabilities, and constraints (Gaver, 1991; Norman, 2013; Davis & Chouinard, 2017). The reinvention principle (Rogers, 2003) provides further nuance by showing how educators adapt or repurpose digital tools in locally meaningful ways, especially in resource-constrained environments. This level foregrounds pedagogical agency and diversity in usage practices.

Importantly, these levels are not discrete. The framework adopts a relational and recursive logic, where each level interacts with and influences the others. Macro-level policy decisions shape meso-level institutional arrangements, which in turn shape micro-level practices. Conversely, micro-level innovations, adaptations, or resistances feed back into institutional norms and may influence future policy refinements. This interdependence is central to the study's analytical design and helps to explain the uneven, dynamic, and context-sensitive nature of ICT adoption in TVET settings.

The visual representation thus encapsulates the study's multi-theoretical, multi-level analytical stance. It highlights the value of a triangulated framework that captures not only structure and agency, but also the ways in which technological meaning and use are co-constructed across systemic, organisational, and pedagogical dimensions – all of which are essential to understanding the complexity of digital transformation in vocational education.



3.6. Conclusion

This chapter established the theoretical foundation for the study’s investigation into the adoption and pedagogical use of digital technologies in TVET colleges across KZN. In response to both empirical gaps identified in the literature and the structure of the study’s research questions, the chapter advanced an integrated analytical framework composed of three theoretically distinct but conceptually complementary lenses: DOI, Affordance Theory, and IDT.

Each theory was first introduced in alignment with a specific research question and conceptual layer of the study. DOI theory provided a macro-level lens to understand how digital technologies diffuse across the TVET sector, helping to interrogate patterns of access, infrastructure deployment, and systemic disparity. Affordance Theory contributed a micro-level perspective, illuminating how lecturers perceive, interpret, and appropriate ICTs within their pedagogical practice. IDT offered a meso-level framework for analysing institutional design, governance, leadership dynamics, and policy translation – all of which mediate how ICT initiatives are operationalised within colleges.

By mapping each theory to a distinct level of analysis – macro (systemic diffusion), meso (institutional response), and micro (classroom practice) – the chapter demonstrated how a triangulated theoretical approach enhances explanatory scope and context sensitivity. Importantly, the study does not treat these theories as discrete or parallel but rather integrates them to enable cross-scalar analysis. For example, Affordance Theory and DOI jointly illuminate how lecturers reinvent digital tools within specific pedagogical environments, while IDT explains how institutional norms, rules, and structures either support or constrain such practices.

The chapter concluded by presenting a visual and conceptual synthesis of the integrated research framework. This framework provides the analytical scaffolding that guides the study's empirical components – from instrument design to coding and interpretation – ensuring that the findings are theoretically informed and situated within the complexities of the South African vocational education context. The next chapter builds upon this theoretical base by detailing the study's research design, case selection strategy, data collection methods, and analytical procedures.

CHAPTER 4: METHODOLOGY

4.1 Introduction

The introduction of ICTs into educational institutions has created conditions where teaching and learning are no longer defined by physical spaces or confined to a specific geographic location (Facer & Selwyn, 2013; Trentin, 2016). As noted by several scholars, it has become crucial to understand how developments in the field of technology affect the teaching and learning choices made by decision-makers at the institutional level (Archer et al., 2014; Escueta et al., 2017; Selwyn, 2013). According to Ezumah (2020) and Latchem (2017a), TVET colleges must consider both internal – physical infrastructure, educational resources – and external – geography and Internet connectivity – factors when they select ICTs when selecting ICTs for teaching and learning (African Union, 2020; Ezumah, 2020; Latchem, 2017a).

This study's design is informed by the literature discussed in Chapter 2 and the synthesised theoretical framework outlined in Chapter 3, which combines the Diffusion of Innovation (DOI) theory, Affordance Theory, and Institutional Design Theory (IDT) to explore ICT adoption within TVET colleges in KwaZulu-Natal (KZN). These frameworks provide a structured lens through which the study examines how ICT attributes, institutional environments, and user interactions shape ICT adoption in teaching and learning. DOI offers insights into how ICT adoption is influenced by factors such as perceived advantages, compatibility, complexity, and visibility, while also highlighting the role of communication channels and social networks in the diffusion process. Affordance Theory directs attention to the interaction between ICT tools, institutional settings, and users, recognising how contextual factors enable or constrain adoption. IDT contributes by examining the structural, cultural, and procedural factors that mediate ICT integration within educational institutions.

This study is situated within an interpretive research paradigm, aiming to understand the institutional environment of TVET colleges from the perspective and experiences of those working within them. It employs a mixed-methods approach to explore the institutional dynamics that influence ICT selection, adoption, and implementation. By engaging with college officials, staff members, and lecturers, the study investigates the decision-making processes surrounding ICT use, the barriers to effective ICT integration into teaching and learning, and the various strategies applied by institutions to navigate the challenges related to digital transformation. The methodological approach ensures that the study not only identifies patterns

of ICT adoption but also captures the nuanced institutional and social factors that shape these patterns.

The research design is structured to align with the synthesised theoretical framework by ensuring that each phase of data collection and analysis is guided by the core principles of DOI, Affordance Theory, and IDT. The study examines how TVET colleges select and implement ICTs, the institutional structures supporting or hindering adoption, and the strategies employed to integrate technology into teaching and learning. By adopting this approach, the study generates empirical insights that contribute to a deeper understanding of ICT adoption processes within TVET institutions, reinforcing the interplay between theory and practice in shaping research outcomes.

The chapter begins with discussions on the interpretive paradigm and the comparative case study approach, which provide the rationale for the study's overall approach. The chapter then presents an overview of the study's design and describes the study's two phases, their research focus, and methods. After discussing the study's design, the chapter describes the sampling, data collection, and data analysis processes. The chapter finishes with a discussion on trustworthiness and the methods utilised by the researcher to ensure the integrity of the data collected and the validity of the findings.

The main research question that underpins this study is: What are the patterns and impacts of ICT distribution and utilisation on the adoption processes and teaching practices in TVET colleges throughout KZN?

To address this overarching question, the study posed three sub-questions:

1. What is the distribution pattern of ICTs across TVET colleges in KZN (RQ1)?
2. Which institutional factors influence the ICT adoption process in TVET colleges, and why (RQ2)?
3. How do lecturers use the ICTs available for teaching and learning (RQ3)?

The first research question, “What is the distribution pattern of ICTs across TVET colleges in KZN?” is primarily informed by DOI. This framework provides a lens to examine how innovations, such as ICTs, spread across institutions. DOI’s emphasis on the attributes of innovations – such as relative advantage, compatibility, complexity, trialability, and observability – offers tools for analysing why certain technologies are more widely adopted than others. Additionally, the theory highlights the role of social structures and communication channels in shaping the dissemination of ICTs within the TVET sector. Affordance Theory complements this by emphasising the interaction between technological characteristics and the environment, helping to uncover why certain ICTs align better with specific institutional or environmental contexts.

The second research question, “Which institutional factors influence the ICT adoption process in TVET colleges, and why?” draws on both DOI and IDT. DOI addresses how institutional decision-makers perceive the value and usability of ICTs, while IDT provides insights into how formal structures – such as institutional hierarchies – and informal cultural elements of an institution shape ICT adoption. IDT provides concepts which explain how institutional governance structures influence resource allocation and decision-making processes related to technology, while DOI offers a framework to analyse how key stakeholders act as opinion leaders or change agents in promoting ICT adoption.

The third research question, “How do lecturers use the ICTs available for teaching and learning?” is closely aligned with Affordance Theory. This framework provides a nuanced perspective on how lecturers perceive and utilise the possibilities offered by ICTs in their specific contexts. By focusing on the interaction between lecturers, their environments – such as classroom settings, and institutional support – and the technologies themselves, Affordance Theory helps to illuminate how ICTs are integrated into daily teaching practices. Furthermore, IDT adds a layer of understanding by examining how institutional culture, policies, and support mechanisms influence lecturers’ engagement with these technologies.

Aligned with these questions, the study pursued three primary objectives:

- i. To document the distribution of ICTs across TVET colleges in KZN.
- ii. To investigate the institutional factors that inform the ICT adoption process at the colleges.
- iii. To interrogate how ICTs are integrated into teaching and learning activities.

This methodological approach is justified by the complexity and multi-dimensional nature of ICT adoption in TVET colleges. The interpretive paradigm was selected to capture the subjective experiences and institutional contexts influencing ICT integration. Given that ICT adoption is shaped by institutional policies, leadership decisions, and contextual constraints, an interpretive approach allows for an in-depth exploration of these interactions from the perspectives of those directly involved.

A mixed-methods strategy was employed to ensure methodological rigor and to provide a holistic view of ICT adoption. The quantitative component, consisting of surveys across multiple colleges, ensures that broader patterns in ICT distribution can be documented, providing empirical grounding for the study. Meanwhile, the qualitative component, which includes interviews and case studies, offers deeper insights into the institutional, pedagogical, and technological factors shaping ICT adoption. The integration of these methods allows the study to triangulate data, strengthening its validity and reliability.

Furthermore, the theoretical framework underpinning this study necessitates a research design capable of capturing both systemic institutional dynamics and individual experiences with ICTs. DOI, Affordance Theory, and IDT each highlight different but interrelated aspects of ICT adoption, requiring a methodological approach that can accommodate both macro- and micro-level analyses. By aligning the research design with these theoretical perspectives, the study ensures that its findings contribute both to theoretical discourse and practical applications in ICT policy and strategy development within the TVET sector.

4.2 Research paradigm

The study was located within the interpretive paradigm as it set out to understand the institutional environment of the TVET college from the perspective and experiences of the individuals who occupy that space (Shah & Al-Bargi, 2013). The focus on subjective meanings and contextual realities aligns with the study's aim to explore the institutional processes, structures, and individual practices that inform ICT adoption and integration. This paradigm provides a fitting framework for examining the complex interplay between institutional structures, cultural norms, and personal practices while allowing for a rich, participant-centred engagement.

According to Creswell (2007) and Crotty (1998), one of the distinguishing features of research within the interpretive paradigm is that it does not have predetermined variables – dependent or independent – but focuses on interrogating the full complexity of human experience as a phenomenon unfolds. Furthermore, interpretive research attempts to understand social phenomena through the meanings that people assign to them (Deetz, 1996). In order to apply these principles, the study was designed to allow the researcher to engage openly with the participants and create opportunities for them to provide insights into the contextual dynamics of the phenomenon and, thus, shape the researcher’s interpretation of the data. Furthermore, data were gathered through open-ended instruments, allowing participants to express themselves freely.

The study was concerned with gaining insight into the institutional processes, structures and factors that informed the strategies the three TVET colleges used with regard to ICTs and how individuals within these institutions integrated ICTs into their work. At the institutional level, the study drew heavily on IDT to examine how organisational features such as structure, culture, and operational practices mediate ICT adoption. IDT underscores the role of these institutional elements in shaping decision-making processes and strategy implementation. In line with the principles of interpretivist research, the quantitative phase (Phase 1) established the distribution and usage patterns of ICT infrastructure across colleges, while the qualitative phase (Phase 2) employed a case study approach to investigate the structural arrangements of the colleges in greater depth (Creswell, 2014; Creswell & Plano Clark, 2018). The study explored how institutional structures foster ICT adoption and how institutional processes influence operational efficiency and strategic decision-making. During this phase, the study utilised semi-structured interviews with decision-makers and document analysis of institutional policies and curriculum statements to capture these dynamics comprehensively.

On an individual level, the study was informed by Affordance Theory, which emphasises the interaction between users, their environment, and the available technologies. This lens highlights how decision-makers at each TVET college perceive and act upon the affordances of ICTs within their institutional context (Gibson, 2015; Norman, 2013; Rogers, 2003). In line with this framework, the qualitative phase involved semi-structured interviews and document reviews of lesson plans to capture ICT usage in TVET classrooms. These methods facilitated an in-depth exploration of how access to resources, perceived utility, and alignment with pedagogical needs shaped the use of ICTs in teaching practices. The quantitative findings

regarding ICT availability and usage provided the foundation for selecting participants and framing the qualitative investigation into these institutional-level dynamics.

The study also integrated insights from DOI, which examines how innovations spread through social systems. DOI provided a valuable lens for understanding the role of communication channels, social networks, and opinion leaders in shaping perceptions and adoption decisions (Rogers, 2003). Within the interpretive paradigm, DOI's focus on the social and cultural dimensions of adoption complements the study's aim to explore how information about ICTs disseminates across institutional networks. This theoretical connection ensured a comprehensive understanding of how staff members influence one another's attitudes and behaviours regarding ICT adoption.

The data for this study were collected through a sequential mixed-methods design (Creswell, 2014); this is a two-phase data collection process in which quantitative data collection and analysis in the first phase informs the subsequent qualitative phase of data collection (Creswell & Plano Clark, 2018; Yin, 2009). This design is particularly suited to research aiming to explore complex social phenomena, as it combines the breadth of quantitative methods with the depth and context-sensitive insights of qualitative approaches (Creswell & Plano Clark, 2018; Yin, 2009). In this study, the quantitative phase (Phase 1) provided a macro-level understanding of ICT distribution and usage patterns across TVET colleges in KZN, which informed the purposeful selection of participants and the development of qualitative data collection instruments in the second phase. The qualitative phase (Phase 2) built on the findings from Phase 1 by delving into the institutional and individual contexts of ICT adoption, capturing the meanings, experiences, and contextual nuances emphasised by the interpretive paradigm (Crotty, 1998; Deetz, 1996).

The data analysis process was structured to align with the sequential mixed-methods approach and the interpretive paradigm. The quantitative data collected in Phase 1 were subjected to descriptive statistical analysis, which enabled the identification of patterns in ICT distribution, usage, and accessibility across TVET colleges (Babbie, 2020; Creswell, 2014; Field, 2018). These statistical insights informed the selection of institutions and individual participants for the qualitative phase and shaped the thematic focus of subsequent inquiries. The qualitative data from Phase 2 were analysed using thematic analysis (Braun & Clarke, 2006), which allowed for the identification of recurring patterns, themes, and contextual factors influencing ICT adoption. Interview transcripts, policy documents, and lesson plans were systematically coded, ensuring

that themes emerging from participant narratives were consistently linked to institutional structures and theoretical frameworks. The iterative nature of the qualitative analysis enabled the refinement of themes and ensured that participant perspectives were accurately represented within the broader institutional and technological contexts.

The study's design was carefully structured to address the multifaceted objectives and research questions that underpin the study. Phase 1 of the study addresses the first research objective: to document the distribution of ICTs across TVET colleges in KZN, while Phase 2 addresses the second and third research objectives: to investigate the institutional factors that inform the ICT adoption process at the colleges and to interrogate how ICTs are integrated into teaching and learning activities. This research design drew on both quantitative and qualitative methods and the study is framed within a synthesised theoretical framework consisting of DOI, Affordance theory, and IDT. Furthermore, the integration of statistical findings with thematic insights ensured a comprehensive analysis that captured both macro-level adoption trends and micro-level contextual dynamics. This dual-layered analysis provided a nuanced understanding of the institutional and individual factors shaping ICT adoption in TVET colleges, reinforcing the study's alignment with its theoretical and methodological foundations.

Locating this study within the interpretivist paradigm was the most appropriate choice as the study aimed to understand the institutional environment of TVET colleges through the perspectives and lived experiences of individuals within these institutions. Interpretivism is grounded in the premise that reality is socially constructed and context-dependent, making it particularly suitable for research that examines complex social phenomena such as ICT adoption and integration (Creswell, 2014; Yin, 2009). Given that the study aimed to explore institutional processes, structures, and individual practices, an interpretive approach provided a means to capture the subjective meanings and contextual realities that shape decision-making and usage patterns. By incorporating qualitative methods such as semi-structured interviews and document analysis, the study was able to uncover the deeper institutional and individual factors influencing ICT adoption, which would have been a challenge to capture through purely quantitative methods. Furthermore, the study's emphasis on IDT, DOI, and Affordance Theory aligned with the interpretivist paradigm's focus on understanding how social structures, cultural norms, and individual agency interact to shape technological adoption. This paradigm was particularly well-suited to addressing the second and third research objectives: investigating the institutional factors that inform ICT adoption and interrogating how ICTs are integrated into teaching and learning activities.

The interpretivist paradigm was also instrumental in allowing the study to integrate multiple sources of data, facilitating a comprehensive examination of ICT adoption within TVET colleges. The sequential mixed-methods approach enabled the study to establish broad patterns through quantitative analysis while ensuring that qualitative inquiry provided depth and contextual nuance. In Phase 1, the study addressed the first research objective – to document the distribution of ICTs across TVET colleges in KZN – by using quantitative methods to establish macro-level trends in ICT availability and usage. However, it was through Phase 2’s qualitative inquiry that the study was able to explore the institutional dynamics and individual decision-making processes in greater depth, directly addressing the second and third objectives. This alignment between methodology and paradigm underscores why interpretivism was the most appropriate choice for the study. Rather than imposing predefined variables, the study’s interpretive approach allowed participants to articulate their own understandings of ICT adoption, ensuring that institutional complexities and social influences were adequately captured. By prioritising participants’ perspectives, the study was able to offer a rich, context-sensitive analysis of ICT integration in TVET colleges, reinforcing the interpretivist paradigm as the ideal framework for addressing the research objectives.

4.3 Research approach: Comparative case study approach

“The case study approach is particularly useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context.” (Crowe et al., 2011, p. 1)

According to Shah and Al-Bargi (2013), interpretivist research investigates and highlights how the subjective interpretations of individuals and groups shape the objective features of a society. In this regard, the study aimed to capture how the unique characteristics of each TVET college’s institutional and social context inform their ICT approach and how individuals within those colleges experience ICTs. In order to explore all these aspects of the TVET college environment, the study applied a case study approach. Yin (2009) states that case studies can be used to explain, describe, or explore events or phenomena in the everyday contexts in which they occur. According to Bennett (2004), a case study approach allows for an in-depth investigation of an event or phenomenon using various in its natural context using various methods and data sources. In contrast to more quantitative approaches, which seek to test a specific hypothesis through deliberately manipulating the environment, the case study approach is well suited to generating data on more explanatory how, what, and why questions (Crowe et al., 2011). The case study approach was ideal for this study as it focused on how TVET colleges

and the individual lecturers decide which ICTs to adopt and the impact of their choices, if any, on their approaches to teaching and learning. The individual participants in the study included the Deputy Principals for Academic Services from the three TVET colleges, the Assistant Directors for IT Services, and the ICT technical support staff. Their positionality allowed the researcher to interrogate the institutional structures and processes that inform the TVET colleges' ICT strategy from the perspective of the individuals tasked with implementing the strategy. Through the researcher's interactions with the participants, they captured how the various units that constitute the organisational structure of the TVET colleges – such as executive management, the operational departments, and the campuses – operate in relation to each other and their roles in executing the ICT strategy. Overall, this approach allowed the researcher to understand how the institutional design of the TVET colleges works and how individual staff members behave within the institutional design.

This study followed a comparative case study approach; comparative case studies – similar to other types of case studies – cover two or more cases in a way that produces broader knowledge about causal questions, such as how and why particular programmes, interventions or policies work or fail to work (Bartlett & Vavrus, 2017; Goodrick, 2014). According to Bennett (2004), comparative case studies are a powerful means of making inferences between and across cases and could help develop “typological theories”. As a research design option, comparative case studies are suitable in the following circumstances: when exploring the processes or outcomes of an intervention, when one or more interventions are being implemented across multiple contexts, in cases where there is little or no opportunity to control implementation, when there are multiple opportunities to collect and analyse data when emphasising the significance of context in the implementation of an intervention, and when it is not possible to conduct controlled experiments or enquiries for practical or ethical reasons (Goodrick, 2014). The comparative case study approach was ideal for this particular study as the study was aimed at developing insights into how the institutional environments of the three TVET colleges shape the ICT approaches at each college, the processes that each institution utilises to make decisions regarding which ICTs to adopt, and how individual lecturers responded to the college's ICT strategy. This approach allowed the researcher to explore the phenomenon as it transpired at each TVET college and the impact of contextual factors on the individual experiences of the phenomenon at each college. The comparative case study design was relevant for this study as the three TVET colleges that participated operate in unique contexts, the individuals within those colleges have varied expertise and experiences with

ICTs, and the technical capacities at each college differ. The approach allowed this study to bring the institutional and contextual factors that influence ICT adoption and the participants' ICT experiences to the fore. It provided a framework to organise and analyse divergent sets of data.

The selection of the comparative case study approach was further justified by its strong alignment with the study's synthesised theoretical framework, which integrates IDT, Affordance Theory, and DOI. IDT provided a structural and procedural lens to examine how the formal organisational design of each institution influenced ICT adoption strategies. Affordance Theory reinforced this approach by enabling an analysis of how institutional contexts and available technologies create specific affordances and constraints that shape ICT integration. DOI Theory further justified the selection of a comparative approach by highlighting the role of communication channels, opinion leaders, and institutional networks in shaping ICT diffusion patterns across the three colleges. By adopting a comparative case study design, the study was able to systematically apply these theoretical perspectives across multiple institutional contexts, ensuring a more robust and contextually nuanced analysis of how ICT adoption unfolds at both the institutional and individual levels.

4.4 Research design

Operationally, the study was designed to be conducted over two phases. In Phase 1, a technical survey of the ICT systems at the TVET colleges was carried out to compile an inventory of the ICT infrastructure and hardware at the TVET colleges and map the distribution of ICTs across the TVET sector in KZN. The nine TVET colleges in the province were surveyed to compile an inventory of the ICT infrastructure and hardware at the colleges' disposal, semi-structured interviews with the officials were conducted to investigate how ICTs were utilised in teaching and learning settings, and to document how each college configured its ICT network. In addition, the researcher documented the types of technical challenges encountered by the TVET colleges and how they were addressed. The objective of the technical survey was to meet with the ICT support staff and curriculum services officials at each TVET college to discuss and compile an inventory list of the ICTs used by the TVET college for teaching and learning activities.

In Phase 2, an institutional case study of three TVET colleges was carried out to investigate and document the institutional factors that inform ICT adoption processes at these colleges and highlight the strategies the TVET colleges applied to integrate ICTs into teaching and learning. The study shifted into an in-depth institutional case study mode where the researcher explored the institutional environment of the three selected colleges and how those environments shaped the ICT approach adopted at each institution. These colleges were selected based on geography, campus distribution, and socioeconomic profile. The aim was to document the distribution of ICTs across these regions, explore the institutional factors that influence the adoption of ICTs in each college, and interrogate how ICTs were integrated into teaching and learning. The objective of the institutional case study would be for follow-up engagements with the academic officials and the lecturers to discuss their approaches to integrating ICTs into their classrooms.

The study utilised a mixed-methods approach across these two phases, this approach was integral to capturing the complexity of ICT adoption in the TVET sector and aligning with the theoretical framework's multifaceted perspective. The technical survey in Phase 1 provided macro-level quantitative data – underpinned by DOI – on the distribution and diffusion of ICTs. The qualitative case studies in Phase 2 delved into the micro-level dynamics of institutional decision-making and classroom practices, drawing on IDT to interrogate organisational and cultural influences and using Affordance theory to explore the practical opportunities ICTs created within specific contexts. This two-phase design aligns seamlessly with the principles of mixed methods research, which emphasises integration and complementarity between quantitative and qualitative approaches. The explanatory sequential design allows the study to leverage the strengths of both methods: the quantitative phase provides systematic, generalisable data about ICT infrastructure and patterns of usage, while the qualitative phase offers a rich, detailed exploration of the institutional and individual factors shaping these patterns (Creswell, 2007; Creswell & Plano Clark, 2018). The iterative relationship between the phases reflects a core tenet of interpretivist research, which prioritises contextual understanding and participant-centred inquiry (Crotty, 1998; Deetz, 1996; McChesney & Aldridge, 2019).

The data analysis process was structured to align with the explanatory sequential mixed-methods approach and the interpretive paradigm guiding the study. The quantitative data collected in Phase 1 were subjected to descriptive statistical analysis, which enabled the identification of patterns in ICT distribution, usage, and accessibility across TVET colleges. These statistical insights informed the selection of institutions and participants for the qualitative phase and shaped the thematic focus of subsequent inquiries.

In Phase 2, qualitative data were analysed using thematic analysis (Braun & Clarke, 2006), which allowed for the identification of recurring patterns, themes, and contextual factors influencing ICT adoption. Interview transcripts, policy documents, and lesson plans were systematically coded, ensuring that themes emerging from participant narratives were consistently linked to institutional structures and theoretical frameworks. The iterative nature of the qualitative analysis enabled the refinement of themes and ensured that participant perspectives were accurately represented within the broader institutional and technological contexts.

Due to the COVID-19 pandemic and the resulting national lockdown regulations, physical site visits to the TVET colleges were not feasible during the initial stages of the study. In response, the research design was structured to accommodate these restrictions while ensuring effective data collection. As a result, the researcher had to adapt the research design to comply with lockdown regulations. One of the solutions applied by the researcher was to incorporate video conferencing platforms – Zoom and Microsoft Teams – into the data collection process. Additionally, the study was designed to leverage a collaboration with the South African Broadband Networks (SABEN), which provided an opportunity for the researcher to be embedded within a research project with overlapping aims. This collaboration enabled strategic access to SABEN's TVET college database, facilitating the successful execution of Phase 1 of data collection.

4.4.1. Phase 1: Technical survey of ICT systems

Phase 1 involved a technical survey of the ICT systems at all nine TVET colleges in KZN, aiming to compile a detailed inventory of ICT infrastructure and hardware across the sector. Guided by DOI, this phase examined how technological characteristics – such as relative advantage, compatibility, and complexity – shaped the adoption of ICTs at an institutional level. By mapping the distribution and technical landscape of ICTs, this phase of the study also considered the role of environmental factors such as geography in shaping the dissemination of ICTs, aligning with the literature’s emphasis on geography playing a significant role in ICT diffusion patterns. Additionally, the technical survey provided insights into the affordances of each college’s inventory of ICT infrastructure, shedding light on the opportunities and constraints that emerged as a consequence of the interaction of ICTs, institutional resources, and user practices.

Data for Phase 1 of the study was collected through a semi-structured questionnaire that consisted of both open-ended and close-ended questions. The semi-structured questionnaire instrument was developed based on a comprehensive review of existing literature on ICT adoption trends and the state of ICT infrastructure in educational institutions in South Africa, ensuring that the questions addressed the key factors relevant to the study’s research objectives (Jita & Munje, 2020; Moyo, 2019; Mwapwele et al., 2019; Ramoroka, 2021). The research instrument was divided into thematic sections, covering topics such as the types of ICT hardware available at each TVET college, the network configuration of the college’s ICT system, the technical challenges faced by each college, and the technical support systems in place at each college. The semi-structured questionnaire was administered via video conferencing platforms – namely, Zoom and Microsoft Teams [MS Teams] – to ensure wide accessibility to TVET colleges and individual participants during the COVID-19 lockdown and to facilitate data collection from geographically remote colleges. Furthermore, the semi-structured questionnaire consisted of closed and open-ended questions, enabling the collection of quantitative data that was substantiated by qualitative insights from the participants. Prior to the Zoom and MS Teams sessions, participants were provided with background information on the study, an explanation of the study’s purpose, and detailed instructions on the research process, which ensured that they gave informed consent for their participation.

The semi-structured questionnaire was chosen as an appropriate instrument for the study as it aligns with interpretive research principles, and allowed for the gathering of macro-level data on the distribution of ICTs across TVET colleges in KZN. The data gathered through the semi-structured questionnaire informed the selection of TVET colleges and the design of the data collection instruments for the subsequent qualitative phases of the study. According to Walsham (2006), quantitative data – including those generated through survey-related instruments – can provide valid inputs for interpretive studies, and complement qualitative methods to enhance understanding. The decision to utilise a semi-structured questionnaire is supported by interpretivist scholarship that highlights the prevalence and value of a “multi-method” research approach in interpretive studies (Creswell and Plano Clark, 2018; Mingers, 2003; Walsham, 2006).

Examples of interpretivist studies that have incorporated surveys as a data collection tool include studies conducted by Gonzales and Ayers (2018), Koyama (2017), McChesney and Aldridge (2019), Olivier (2017), and San Antonio (2016). These studies illustrate how the effective integration of quantitative and qualitative data collection methods can enhance the depth and validity of interpretivist research (Walsham, 2006). The first study investigated how community college leaders in the USA navigate multiple expectations to achieve institutional goals. The study utilised semi-structured interviews, document analysis, and survey data to examine the tensions between bureaucratic, market-driven, and student-centred approaches to community college leadership. The findings from this study illustrated how community college leaders negotiate conflicting expectations and adapt institutional policies to align with diverse stakeholder needs. The study’s design highlighted how qualitative and quantitative methods can be applied in a complementary manner to provide a contextual perspective of broader social trends (Gonzales & Ayers, 2018).

Similarly, the second examined how school principals interpret and implement policy mandates within an accountability-driven educational environment using an ethnographic narrative approach. The study combined policy analysis, interviews, and survey data to investigate the strategies principals employ to navigate policy constraints while maintaining instructional leadership. The findings from this study highlight the creative and adaptive nature of school leadership, illustrating how qualitative narratives provide a deeper understanding of policy enactment beyond what is captured in quantitative measures (Koyama, 2017).

The third study explored the leadership practices of school principals in high-poverty schools. The study integrated a narrative ethnography approach into a mixed-methods research design. This study combined survey data with in-depth qualitative narratives to examine how principals navigate various challenges and foster school improvement. The findings highlight the complex interplay between leadership practices, socioeconomic constraints, and school culture. Furthermore, the findings demonstrate how qualitative narratives can enrich quantitative findings by capturing the lived experiences of educational leaders in disadvantaged contexts (McChesney & Aldridge, 2019).

The fourth study applied a mixed-methods approach to diagnose the organisational performance of the local government of a town in South Africa. The study integrated quantitative surveys with qualitative interviews to assess the local government's operational efficiency, service delivery, and institutional challenges. The findings indicated that bureaucratic inefficiencies, resource constraints, and leadership dynamics significantly influence the administration's performance. By combining both methodological approaches, the study provided a comprehensive evaluation of governance effectiveness, offering insights into potential strategies for organisational improvement (Oliver, 2017).

The fifth study utilised a mixed-methods approach to explore school administrators' lived experiences. The study combined surveys with ethnographic interviews to capture the nuanced challenges faced by school leaders. The findings from this study underscored the importance of personal narratives in revealing the complexities of leadership and demonstrated how qualitative insights enrich quantitative data on administrative decision-making and school culture (San Antonio, 2016). These five studies illustrate how survey methods can be utilised to highlight overarching trends of a phenomenon – such as the distribution of ICTs within a particular sector – while qualitative methods provide insights into the contextual dynamics of those trends.

The decision to integrate qualitative and quantitative data collection methods into a single study aligns with the broader goals of interpretive research, where surveys can help contextualise and validate qualitative findings (Creswell & Plano Clark, 2018). Dawadi et al. (2021) argue that this type of research design enables researchers to utilise quantitative findings to guide the qualitative phase, ensuring a comprehensive exploration of the research problem. Thus, based on these precedents, the use of a semi-structured questionnaire as a data collection instrument not only aligns with the principles of interpretive research but also leverages the strengths of both quantitative and qualitative methods to provide a robust foundation for investigating ICT

adoption trends in TVET colleges.

Phase 1 of the study was planned to be conducted in early 2020. This period coincided with the start of the COVID-19 pandemic in South Africa and the resulting national lockdown, which forced all institutions to close their doors. As a result, data collection was postponed until the lockdown regulations allowed face-to-face interaction. At this point, all the logistical aspects of the study had to be paused, and the researcher could not proceed with any form of fieldwork. In order to mitigate the impact of the COVID-19 lockdown regulations on the study's progress, the researcher adjusted the study's approach to include virtual and telephone interviews.

Towards the end of the lockdown, the researcher was invited to be part of a research team on a national study conducted by SABEN. The SABEN study aimed to explore the perspectives and experiences of selected staff members at the 50 TVET colleges regarding their use of the Internet in teaching and learning, the challenges, initiatives and innovations that have arisen, and their vision for e-learning. The researcher was invited to be part of the SABEN study due to the similarities between the two studies and the researcher's familiarity with the TVET colleges in KZN. The researcher's role in the SABEN study was as part of a team of researchers assigned to interview several TVET colleges. The researcher's responsibilities included conducting interviews with the designated participants from the TVET colleges, transcribing the audio recordings from the interviews and compiling a preliminary analysis of the data from the TVET colleges. Due to the similarities between the SABEN study and the doctoral study, the researcher's involvement in the SABEN study allowed the researcher access to the participants and the data needed for the doctoral study. The SABEN study utilised structured interviews with officials from the TVET colleges' ICT and curriculum departments. The interviews surveyed the participants on the technical aspects of the TVET college's ICT setup and the pedagogic considerations associated with integrating ICTs into the classroom. Once the SABEN study was complete and the findings reported, the researcher was granted permission to utilise the raw data generated by the SABEN study as part of the doctoral study.

Upon the conclusion of the SABEN study and the dissemination of its findings, the researcher conducted a systematic review of the raw data to establish a foundational understanding of ICT distribution within the TVET sector. This review was guided by four key criteria: mapping sector-wide ICT trends, identifying gaps in the SABEN study that warranted further exploration, assessing the relevance of specific data sets for integration into the doctoral study, and refining the methodological approach for the institutional case study phase. This structured evaluation enabled the researcher to position the doctoral study within the broader context of

ICT adoption in TVET colleges while ensuring a focused and analytically rigorous approach. Upon review, it was apparent that certain sections of the SABEN data responded directly to Research Questions 1 and 3 of this study. Specifically, these sections included those that provided insight into the distribution patterns of ICTs across the TVET sector, the extent to which ICTs were being utilised for teaching and learning at each TVET college, and the technical and pedagogical challenges encountered by TVET colleges in ICT integration. At this point, the researcher faced the choice of either replicating the SABEN study independently, which would have required him to go back to the TVET colleges and regather the same data through the same participants, or formulating an approach where the study could incorporate the SABEN data into his study's data set and generate fresh data to substantiate the SABEN findings. Due to resource and time limitations, the researcher sought permission to incorporate the SABEN data into his study and conduct institutional case studies at selected TVET colleges that would provide an institutional point of view of ICT adoption. Thus, the researcher did not have to collect any new data related to the technical aspects of the ICT infrastructure and hardware that the TVET colleges in KZN had at their disposal, how they were utilising these technologies for teaching and learning, and the types of challenges the TVET colleges were encountering. Instead, the researcher used the technical data to craft an approach to the institutional case studies and research instruments, including semi-structured interviews and focus group discussions. By integrating these findings, the study ensured a more comprehensive examination of ICT implementation within the TVET sector.

4.4.2. Phase 2: Institutional case studies profiling ICT adoption

In Phase 2, the study shifted the focus to an institutional case study of three TVET colleges that were purposefully selected to represent diverse geographic, socioeconomic, and institutional contexts across KZN's TVET sector. These colleges included one located in an industrial zone with campuses in urban and township areas, another in an agricultural region with predominantly rural campuses, and a third in a mixed industrial and commercial zone with campuses distributed across urban, township, and rural areas. This selection strategy ensured that the study could explore the nuanced interplay of institutional environments and ICT adoption strategies, and acknowledge the diversity in operational contexts and structural challenges.

The approach to the institutional case studies was underpinned by DOI, which argues that to understand the process of adoption and how decisions to adopt an innovation are made, one must examine the dynamics of the social system within which those decisions occur (Rogers, 2003). Accordingly, the second phase of the study focused on exploring the institutional processes, factors, and dynamics that inform how TVET colleges approach ICT and formulate strategies for integrating ICTs into their classrooms. Drawing on IDT, this phase also examined how organisational structures, cultural norms, and decision-making processes influenced ICT integration at each TVET college. IDT's emphasis on the mediating role of institutional mechanisms provided a framework for analysing how formal structures – such as policies, leadership practices, and resource allocations – interacted with informal cultural elements to shape ICT adoption and utilisation. Furthermore, Affordance Theory complemented this perspective by highlighting how the environmental characteristics unique to each college interacted with technological features to either enable or constrain ICT adoption and pedagogical innovation. Together, these theoretical perspectives provided a comprehensive into the mechanisms TVET colleges apply to filter and process the various factors – such as external and internal environments, stakeholder interests and relationships, pedagogic objectives, policy directives, and institutional culture – when making decisions regarding ICT adoption and integration into teaching and learning.

To capture rich, institutional data, Phase 2 employed qualitative methods, specifically semi-structured interviews and document analysis, which were designed to complement and extend the findings from Phase 1. The technical survey from the initial phase provided a quantitative overview of ICT distribution and integration across institutions, while the qualitative methods utilised in the second phase allowed for an in-depth exploration of participants' experiences, perceptions, and contextual challenges. These methods align closely with the principles of the interpretive paradigm, which emphasises understanding phenomena through the meanings and interpretations that individuals and groups assign to them (Creswell, 2007; Shah & Al-Bargi, 2013).

For the study's second phase, data were generated through semi-structured interviews, and document analysis of institutional policy documents and lesson plans. The semi-structured interviews were designed to uncover individual perspectives, fostering a conversational yet guided approach to the data collection process. Participants during this phase included the Deputy Principals for Academic Services, Assistant Directors for IT Services, IT technical

support staff, Assistant Directors for Curriculum Services, and Assistant Directors for Student Support Services, all of whom were selected based on their roles in shaping or implementing the college's ICT adoption strategy. The semi-structured interviews explored thematic areas such as participants' experiences with ICT tools, their perceptions of institutional support and limitations, the institutional factors that shape decision-making processes, and the role of interpersonal and institutional networks in shaping ICT usage amongst staff. These thematic guides were informed by the data from the technical survey findings and the synthesised theoretical framework, ensuring coherence between the study's two phases. Interactions with the participants took place through a combination of virtual and face-to-face meetings.

Document analysis served as an additional method for triangulating data, providing insights into the formal and documented strategies, policies, and practices related to ICT adoption. The documents reviewed included institutional ICT policies, curriculum guidelines, strategic plans, and operational reports. This approach not only validated participant narratives but also offered a lens into how institutions articulated and implemented their ICT strategies within broader structural and operational contexts. The iterative nature of the institutional case study phase, which integrated findings from Phase 1 with deeper qualitative exploration, ensured that the study could address the complex, multi-layered dynamics of ICT integration across various institutional contexts.

For the study's second phase, the researcher began by mapping the distribution of ICTs across the TVET colleges by applying the SABEN data. This map showed the different types of, ICT infrastructure, and hardware each TVET college in KZN had at its disposal. The next step was to add the usage data to the ICT distribution map. The usage data showed whether or not the colleges were utilising ICTs in their classrooms and – for those that were – how they were using them and the frequency of usage. From these two datasets, the researcher determined which TVET colleges had access to ICT resources, the types of ICT resources and how those resources were being utilised. However, combined, these two datasets also seemed to indicate that TVET colleges were underutilising their ICT resources. The raw data showed that notable number of TVET lecturers chose not to utilise ICTs in their lessons, even though they were available. The researcher's interpretation of the data was that something at the institutional level was causing the lecturers to either choose not to integrate ICTs into their teaching or prevent them from doing so. This observation raised the question: What mechanisms do TVET colleges have to incentivise or assist lecturers in adopting ICTs? These preliminary observations led the researcher to shift the focus of the institutional case studies away from the hardware and

technical provision of ICTs towards the strategic positioning of ICTs in teaching and learning operations.

The overall design of the institutional case studies was determined through a series of face-to-face and telephonic engagements with the research participants. In the deliberations concerning the methodology, the researcher considered the theoretical framing of the phenomenon, the logistics of the study, and the data sources required to answer the research questions. Due to the researcher's involvement in the SABEN study, one of the other factors the researcher had to contemplate in the design of the doctoral study was how it would be distinguished from the SABEN study to ensure it was not redundant. During the researcher's review of the SABEN study, the researcher identified two aspects where the focus and scope of the two studies could be differentiated in a way that would result in complementary research in this area. While the SABEN study focused on the technical aspects of ICT usage, the types of ICTs that TVET colleges have access to, how they are utilising them, and the technical challenges they encounter, the institutional case studies conceptualised for the doctoral thesis focused on the institutional and environmental aspects of ICT adoption, the factors institutions consider when deciding which ICTs to procure, the institutional structures responsible for executing the ICT strategy, and the staff members' responses to ICTs.

In terms of scope, the SABEN study was broad and included all the TVET colleges across the national TVET sector; the institutional case studies to be conducted for the doctoral study narrowed the target population to three TVET colleges in KZN. The SABEN data focused on the technical aspects of ICT usage at TVET colleges, such as Internet connectivity, provision of laptops for staff and students, and digital content creation. The institutional case studies aimed to investigate the contextual – non-technical – factors that impact ICT usage. By narrowing down the sample to three TVET colleges allowed the researcher was able to explore the governance structures, curriculum approaches and institutional culture at each TVET college and how they shaped each TVET college's approach to integrating ICTs into their teaching and learning operations. In order to narrow down the number of TVET colleges from nine to three, the researcher compiled geographic and socioeconomic profiles for each TVET college. The researcher then selected the three TVET colleges that provided insights into how TVET colleges from a range of geographic and socioeconomic contexts – urban, rural, and township – make decisions regarding ICT selection and ICT usage. This approach allowed the researcher to develop insights into the impact of institutional environments on ICT adoption and usage. The above considerations were ensured that the study's research design and data collection

instruments were aligned with established research and instrument design practices.

The study's two-phase mixed-methods design was structured to align with the interpretive paradigm, ensuring a comprehensive exploration of ICT adoption in the TVET sector. The sequential explanatory design integrated both quantitative and qualitative approaches, allowing for a systematic and contextually rich analysis. The technical survey in Phase 1 provided macro-level quantitative insights into the distribution and diffusion of ICTs, guided by DOI, while the qualitative case studies in Phase 2 examined the institutional and individual-level influences on ICT adoption through IDT and Affordance Theory. This methodological approach ensured that the study captured not only general trends but also the nuanced contextual factors shaping ICT adoption within the selected institutions. Furthermore, the iterative relationship between the two phases facilitated a deeper engagement with participants' experiences, institutional structures, and technological affordances, reinforcing the interpretivist emphasis on meaning-making and contextual understanding.

4.5 Sample selection

As discussed above, the study was conducted over two phases, for the first phase of the study – the technical survey – the sample was purposively drawn from the nine TVET colleges in KZN, and the three TVET colleges that were targeted for the second phase – institutional case study – were also sampled purposively. The TVET colleges that participated in the study – across both phases – span diverse geographic and socioeconomic regions, offering a rich and varied dataset for examining ICT infrastructure and adoption. By targeting all nine TVET colleges in the province for Phase 1 and the three for Phase 2, the study ensured a comprehensive representation of a wide range of institutional contexts within KZN, reflecting a spectrum of environmental and operational conditions.

Purposive sampling is a form of non-random sampling, described as the deliberate selection of participants based on their characteristics, roles, knowledge, experiences or expertise (Etikan et al., 2016; Gentles et al., 2015). According to Etikan et al. (2016), purposive sampling is typically used in qualitative research to identify and select those participants who will offer the most 'information-rich' datasets without being costly in terms of resources.

4.5.1. *Sample selection rationale*

For Phase 1, the decision to target the TVET colleges in KZN for the technical survey was informed by a combination of practical, logistical, and methodological considerations. Practically, the researcher's proximity to the location of the TVET colleges facilitated logistical efficiencies, including on-site visits to all nine TVET colleges, which allowed for direct engagement with individual participants and ensured thorough and contextually informed data collection. Methodologically, selecting all TVET colleges in KZN ensured that the survey encompassed the full spectrum of geographic and socioeconomic diversity present within the province. This comprehensive approach enhanced the robustness of the study by capturing a wide range of institutional variations in ICT infrastructure and adoption strategies. By incorporating this variability, the study improved the reliability of the data and ensured that the findings could reflect broader patterns within the context of South African TVET colleges.

Furthermore, the selection of these nine colleges was strategically aligned with a study conducted by SABEN, in which all the TVET colleges in KZN participated. The SABEN study was a national study that was conducted across all 50 TVET colleges in South Africa. The SABEN study provided critical technical data on the state of ICT infrastructure and adoption within these colleges. The researcher was embedded within the SABEN study, conducted the technical surveys and was granted permission to access and utilise the SABEN data as part of his doctoral study. This pre-existing dataset not only streamlined the research process but also enhanced the robustness of the institutional case study phase by ensuring access to validated and institutionally sanctioned data sources. The integration of SABEN data with the institutional case study findings facilitated a deeper exploration of ICT adoption trends and patterns across the province.

The decision to target all nine colleges for the technical survey sample aligns with the interpretive paradigm's emphasis on contextual diversity and richness (Creswell et al, 2006; Creswell & Plano Clark, 2018). By capturing data from institutions situated in varied geographic settings – ranging from urban centres to remote rural areas – the study was positioned to uncover both convergent and divergent trends in ICT infrastructure and adoption strategies. This approach aligns with the overarching goal of the research: to develop an in-depth understanding of how contextual factors shape ICT adoption and integration within the TVET sector. For the purposes of this study, the names of the nine TVET colleges that participated in Phase 1 of the study were anonymised alphabetically by allocating each college a letter (KZN TVET A – KZN TVET I). Once Phase 1 of the study was complete, the

researcher began the process of narrowing down the number of TVET colleges from nine to three.

For Phase 2, the aim was to interrogate how environmental – natural, social, political, and economic – factors intersect with and shape TVET colleges' response to ICTs. In order to determine the sample for this phase of the study, the researcher reviewed the data from the technical survey, which indicated discrepancies in the distribution of ICTs based on where TVET colleges were located. The review also raised questions related to the impact of how the location of a TVET college shapes its approach to ICT adoption. In order to answer this and other related questions, the researcher was required to conduct in-depth investigations at each of the nine TVET colleges. However, due to logistical and practical considerations, it was not possible to conduct in-depth case studies at all of the colleges in KZN; the researcher had to narrow down the number of TVET colleges to participate in the institutional case studies. After considering the logistical implications, the researcher decided that three TVET colleges would be sufficient to provide the necessary institutional data while maintaining logistical viability.

In order to narrow down the sample from nine TVET colleges to three, the researcher used geography and socioeconomic profile as the selection criteria. Geography was used as one of the selection criteria based on insights from the literature review. According to digital divide scholars, geography plays a significant role in the distribution of ICTs, which results in disparities in access between rural and urban settings (Pick & Sarkar, 2015; van Dijk, 2020; Warf, 2013). Additionally, the literature indicates that an individual's or an organisation's socioeconomic status plays a significant role in determining the rate at which they adopt innovations. Thus, the TVET colleges selected to be part of the institutional case study, were selected utilising geography and socioeconomic profile as the criteria. The sample included one TVET college located in an industrial zone with campuses in urban and township areas, another in an agricultural region with predominantly rural campuses, and a third in a mixed industrial and commercial zone with campuses distributed across urban, township, and rural areas. The process of narrowing down the number of TVET colleges from nine to three was implemented after completing the technical survey.

4.5.2. Selection of TVET colleges

As discussed above, the sample of TVET colleges was purposively drawn from the 50 TVET colleges that participated in the SABEN study. The selection of TVET colleges for Phase 1 of this study was informed by a combination of practical, logistical, and methodological considerations to ensure methodological rigour and practical feasibility. The selected colleges needed to be accessible for on-site visits, enabling observation of ICT infrastructure, classroom settings, and institutional environments. Furthermore, TVET colleges that were selected for this phase of the study would also be eligible for selection for Phase 2 of the study. TVET colleges that were further than one day's travel by car were excluded from the sample. Based on these criteria, only TVET colleges within KZN were considered for participation in Phase 1, as the researcher's proximity to these colleges allowed for cost-effective accessibility to data collection sites.

For Phase 2 of the study, the sample was narrowed from nine TVET colleges to three. In order to narrow the sample, the researcher applied two key criteria: geographic diversity and socioeconomic profile. These criteria were derived from the literature review and the theoretical frameworks underpinning the study. The first criterion – geographic diversity – was informed by digital divide scholars' emphasis on the impact of geography on shaping the disparities in ICT access and infrastructure between urban and rural settings (Pick & Sarkar, 2015; van Dijk, 2020; Warf, 2013). In order to account for geography as a variable, the researcher purposefully included one college from an urban area, one from a rural area, and one with campuses spanning both urban and rural settings. This selection ensured the representation of the diverse geographic contexts within KZN, allowing for a comprehensive examination of how location impacts ICT adoption.

The second criterion – socioeconomic profile – drew on DOI (Rogers, 2003), which emphasises the influence of a social system's socioeconomic context on its rate of ICT adoption. The socioeconomic assessment of each college's location considered factors such as the dominant economic activities in the area, income distribution, household size and related demographic indicators. These profiles were meticulously compiled using data from district municipality reports, offering a detailed understanding of the economic environments in which the colleges operate.

The process of selecting the three colleges involved three steps:

The first step entailed mapping and creating geographic profiles for all nine TVET colleges. During this step, the researcher charted the locations and campus distributions of all nine colleges. Geographic profiles were developed for each college by listing the geographic features of each college; these included the location of the central office, the location of the campuses, the type of geographic zone the college is located in, and the college's proximity to the surrounding residential areas.

The second step was the compilation of socioeconomic profiles of the TVET colleges. For the socioeconomic profile, the researcher was primarily interested in the main economic activities, income distribution, and household size in the areas surrounding the college. The socioeconomic profiles were compiled using the annual reports from the district municipalities where the TVET colleges were located. This was informed by digital divide literature which listed socioeconomic profile as one of the key indicators for access to ICTs (van Dijk, 2020).

The third step of the selection process involved the evaluation and selection of the TVET colleges to participate in Phase 2 of the study. Using the geographic and socioeconomic profiles of the colleges, the researcher identified three colleges that represented the broadest spectrum of environmental and contextual factors identified in the digital divide literature. This selection ensured that the sample captured the diversity of challenges and opportunities faced by TVET institutions in KZN.

The outcome of this process was the selection of three TVET colleges – referred to as KZN TVET B, KZN TVET D, and KZN TVET F (See Table 1 below) – which encompass a wide range of geographic settings, including urban, rural, and mixed zones. Their campuses are situated in regions with distinct settlement patterns and population densities, reflecting the social and geographic variety inherent in the province. This diverse representation aligns with the study's objective to explore the interplay of environmental and institutional factors in shaping ICT adoption. The criteria applied in the selection of these TVET colleges is consistent with the emphasis given to environmental factors as crucial in determining ICT adoption for individuals and institutions by DOI (Rogers, 2003). This targeted and methodical approach to sampling ensured that the findings from Phase 2 would provide nuanced insights into the contextual dynamics influencing ICT integration across the TVET sector in KZN.

Table 1: Institutional profiles of the three TVET colleges participating in the institutional case studies

College	KZN TVET B	KZN TVET D	KZN TVET F
No. of campuses	Eight	Five	Six
District	eThekwnini Metro iLembe District	Amajuba District uMzinyathi District	Zululand District uMzinyathi District uMkhanyakude District
Geography	Rural Urban Township	Urban Township	Rural
Economic Activity	Agriculture, Forestry, Retail, and Manufacturing	Community Services, Manufacturing, and Finance	Community Services, Finance, Informal Trade, Transport, Tourism, and Agriculture

The three colleges are in distinct geographic zones, and their campuses are dispersed across areas with diverse socioeconomic profiles. KZN TVET B is located in an industrial zone with campuses spread across urban and township areas; KZN TVET F is located in an agricultural region with campuses spread across rural areas; and KZN TVET D is located in a mixed (industrial and commercial) zone with campuses across urban, township and rural areas. This combination of factors presents several challenges and opportunities for ICT adoption at the three colleges. The selection of these colleges was informed by the theoretical frameworks, which highlight the significance of environmental – social, institutional, and natural – factors in shaping the decisions made by institutions and individuals to either adopt or reject ICTs. The diversity of the cases selected as the sample for this study allowed the study to explore how the different factors shape the decision-making processes at each college and influence the ICT adoption strategies applied by each institution.

In addition, the socioeconomic profiles of the areas serviced by these TVET colleges are characterised by wide-ranging economic activities. According to Rogers (2003), these institutional dynamics play a crucial role in shaping how these colleges approach ICTs and the factors they consider when making their ICT choices. For this reason, it was anticipated that the case studies conducted at these colleges would provide crucial insights into how institutions operating across diverse teaching and learning contexts navigate the selection, installation and integration of ICTs into teaching and learning activities.

The selection of TVET colleges for both phases of the study was guided by a rigorous methodological framework designed to ensure the validity, reliability, and contextual richness of the research. The decision to survey all nine TVET colleges in KZN during Phase 1 was driven by the need to capture the full range of geographic and socioeconomic diversity within the province, thereby grounding the study's findings within a broader TVET context. The wide representation of institutional contexts provided a comprehensive overview of ICT distribution and adoption trends, aligning with the study's objective of documenting ICT access and infrastructure across the TVET sector. The integration of data from the SABEN study further strengthened the methodological rigour, ensuring that the findings were grounded in institutionally validated data. For Phase 2, the selection of three TVET colleges was methodically determined based on geography and socioeconomic profile, criteria derived from digital divide literature and DOI. This strategic sampling approach ensured the representation of diverse institutional environments, enabling an in-depth examination of the factors shaping ICT adoption. By incorporating both macro- and micro-level analyses, the study maintained a balance between breadth and depth, reinforcing the interpretive paradigm's emphasis on contextual understanding.

4.5.3. Selection of individual participants

The selection of individual participants for Phases 1 and 2 of the study was guided by purposive sampling methods, with the aim of including individuals who held key roles in decision-making and implementation processes related to ICT adoption at each TVET college. The roles identified for inclusion were Deputy Principals for Academic Services, ICT managers, ICT support staff, and lecturers. While purposive sampling was the primary method, a snowball sampling approach was utilised in some cases where the initially targeted participants could not provide sufficient data on specific aspects of the ICT adoption strategy. In these instances, participants recommended colleagues directly involved in the relevant

aspects of ICT adoption, ensuring comprehensive data collection. The researcher targeted four key roles at each institution: The Deputy Principal for Academic Services, the Assistant Director for IT Services, and ICT technical support staff (See Tables 2 and 3 below). These roles were identified based on their relevance to the study's focus on ICT adoption and integration in educational settings. While the primary criterion for selection was participants' roles, logistical considerations, particularly availability, also influenced the final participant pool. Invitations were sent to multiple staff members within the targeted roles and participants were selected based on their willingness and ability to respond. Where the snowballing method was applied, the roles of additional participants included an Assistant Director for Curriculum Services, and an Assistant Director for Student Support Services Manager, and ICT Network Administrators. To facilitate the selection process, the researcher collaborated closely with the Deputy Principal for Academic Services (DP) at each institution, who served as the primary point of contact. The researcher provided an overview of the study and outlined the specific roles being targeted. The DPs then shared contact details of potential participants, ensuring alignment with the study's objectives.

To maintain ethical standards and voluntary participation, the DPs explicitly stated that they could not coerce staff members to participate. They extended invitations to the identified staff members, emphasising that involvement in the study was entirely voluntary. This multi-layered approach ensured a representative and diverse participant pool while adhering to ethical guidelines and respecting individual autonomy.

Table 2: Individual participants from the nine TVET colleges that participated in Phase 1 – Technical Survey

TVET College	Number of Participants	Role
KZN TVET A	2	Assistant Director: Curriculum Development and Support (CS0001) Assistant Director: IT (IT0001)
KZN TVET B	2	Acting Deputy Principal: Academic Services (DP0002) Assistant Director: ICT (IT0002)
KZN TVET C	3	e-learning Administrator (ADMIN0002) Network Administrator (ADMIN0030) Senior IT Technician (IT0003)
KZN TVET D	3	Curriculum Specialist (CS0004) Curriculum Specialist (CS0040) Acting Assistant Director: IT (IT0004)
KZN TVET E	3	Deputy Principal: Academic Services (DP0005) Assistant Director: Curriculum Services (CS0005) Acting Assistant Director: IT (IT0005)
KZN TVET F	2	Assistant Director: Student Support Services (SS0006) IT technician (IT0060)
KZN TVET G	3	Assistant Director: Curriculum (CS0007) IT Head (IT0007) Assistant Director: ICT (IT0070)
KZN TVET H	2	Acting Deputy Principal: Academic Services (DP0008) Assistant Director: IT (IT0008)
KZN TVET I	2	Deputy Principal: Academic Services (DP0009) Senior IT Technician (IT0009)

Table 3: Individual participants from the three TVET colleges that participated in Phase 2 – Institutional Case Study

TVET College	Number of Participants	Role
KZN TVET B	2	Acting Deputy Principal: Academic Services (DP0006) Assistant Director ICT (IT0060)
KZN TVET D	3	Deputy Principal: Academic Services (DP0004) Assistant Director: Curriculum Services (CS0400) Acting Assistant Director: IT (IT0004)
KZN TVET F	3	Deputy Principal: Academic Services (DP0006) Assistant Director: Student Support Services (SS0006) Assistant Director: IT (IT0060)

4.5.4. Deputy principal: Academic services

The Deputy Principal (DP) for Academic Services oversees the planning and implementation of the TVET college’s teaching and learning strategy. Their portfolio includes a curriculum unit responsible for developing teaching and learning policies, overseeing the implementation of the college’s teaching and learning objectives, and working with the lecturers to assist them in incorporating new teaching methods into their practice. Overseeing these functions places the DP for Academic Services in an ideal position to provide insight into the institutional processes, dynamics, and factors which inform the TVET college’s approach to teaching and learning and the strategies formulated by the college to integrate ICTs into that approach. Furthermore, they could elaborate on the college’s experiences with challenges or limitations associated with transitioning from an analogue to a digital approach to teaching and learning. The criterion for sampling the Deputy Principals for Academic Services was the office they occupy, and the sample consisted of one DP for Academic Services per TVET college.

4.5.5. Assistant director: ICT services, and ICT support staff

The Assistant Director for IT Services and the ICT support staff were sampled based on availability. All three TVET colleges allowed access to and provided contact details for their Assistant Director for IT services and ICT support staff. In such cases, the researcher proceeded with the first one who responded to the invitation. The ICT managers at all three colleges and one ICT support staff from KZN TVET F responded favourably to the invitation and thus were included in the sample. They provided crucial insights into their operations. The researcher interviewed the ICT managers and the ICT support staff online in one-hour sessions and recorded the audio.

4.5.6. Assistant director: Curriculum services

The Curriculum Services office is responsible for overseeing curriculum development and ensuring the effective implementation of ministerial programmes at the TVET college. Their role includes providing support for curriculum improvement, coordinating occupational programmes, and facilitating accreditation for newly identified programmes. Furthermore, curriculum services officials are tasked with lecturer development, offering guidance and support to enhance teaching methodologies and ensure alignment with national curriculum standards. The Assistant Director for Curriculum Services is well-positioned within the TVET college to provide insight into the institutional processes and strategies that shape the adoption of ICTs in teaching and learning. Their perspective is particularly valuable in understanding how curriculum policies influence ICT integration and the challenges encountered in aligning ICTs with pedagogical objectives. The curriculum services office coordinates implementation of the colleges' ICT adoption strategies with the IT office. The snowball approach was applied in the sampling of the Assistant Director for Curriculum Services. They were recommended for participation by their colleagues from the IT office.

4.5.7. Assistant director: Student support services

The Student Support Services (SSS) office is responsible for overseeing a range of services aimed at enhancing students' academic, personal, and social well-being within the TVET college. Their portfolio includes providing academic support services, student counselling, and career guidance, ensuring that students receive the necessary assistance to navigate their educational and professional journeys. The snowball approach was applied in the selection of the Assistant Director for SSS, their selection was based on the fact that the SSS office at KZN TVET F is responsible for coordinating ICT integration in teaching and learning. Thus, they are well-positioned to provide valuable insights into the institutional mechanisms that support student success, the challenges encountered in delivering these services through ICT platforms, and the role of ICT in enhancing student support initiatives.

The decision to employ purposive sampling for the selection of participants was grounded in the study's objective to obtain insights from individuals directly involved in ICT decision-making and implementation at the institutional level. This approach ensured that the data collected reflected the perspectives of those with the requisite technical expertise and institutional knowledge. The inclusion of Deputy Principals for Academic Services, Assistant Directors for IT, and the ICT support staff was justified by their roles in overseeing and operationalising ICT adoption processes within the TVET colleges.

The incorporation of snowball sampling allowed for a more flexible and adaptive approach to participant selection, particularly when initial participants identified additional key stakeholders with relevant expertise. This methodological choice enhanced the study's ability to capture a comprehensive understanding of ICT adoption by including perspectives from KZN TVET D's Assistant Director for Curriculum Services and KZN TVET F's Assistant Director for Student Support Services, whose roles intersect with ICT implementation in teaching and learning at those particular TVET colleges. Aligning with the interpretive paradigm's emphasis on contextual depth, this multi-layered selection strategy ensured that the study accounted for the institutional, technical, and pedagogical dimensions of ICT adoption within the TVET sector. Furthermore, by integrating ethical considerations – such as voluntary participation and the avoidance of coercion – this approach adhered to best practices in qualitative research while ensuring the credibility and integrity of the data collected.

4.6. Data Collection

The data collection process for this study was conducted in two distinct phases, each designed to address specific research objectives. Phase 1 was aligned with research objective one; to document the distribution of ICTs across TVET colleges in KZN and focused on conducting a technical survey across all nine TVET colleges in KZN. During this phase, baseline data on ICT infrastructure, adoption, and integration were collected through a technical survey. Phase 2 was aligned with research objectives two and three and consisted of in-depth, semi-structured interviews and document analysis at three purposively sampled TVET colleges to investigate the institutional factors that inform the ICT adoption process at the colleges, and to interrogate how ICTs are integrated into teaching and learning activities.

At each TVET college, the researcher conducted semi-structured interviews with the officials responsible for ICTs, curriculum, and student support services. In these discussions, the researcher engaged the participants about the processes, factors, deliberations, and experiences that determined how they implemented and integrated ICTs into their teaching and learning activities at the college. The aim was to develop insight into the types of ICTs that TVET colleges adopted for teaching and learning, the challenges they encountered when implementing the college's ICT strategy, and how these technologies were utilised daily in the classroom.

In the first phase of the study, data collection focused on conducting a technical survey across the nine TVET colleges in KZN. The survey was designed to capture the distribution of the ICT infrastructure, adoption patterns, and related ICT integration strategies at these institutions. A semi-structured questionnaire was used as the primary data collection instrument for this phase; the instrument was developed to align with the study's theoretical framework and research objectives. The semi-structured questionnaire consisted of closed and open-ended questions, enabling the collection of quantitative data substantiated by qualitative insights.

Participants completed the semi-structured questionnaire online during scheduled video conferencing sessions with the researcher. The semi-structured questionnaire targeted ICT managers and curriculum specialists at each of the nine colleges and – where necessary – additional input was sought from other TVET staff members involved in implementing the college's ICT adoption strategy to ensure the accuracy and completeness of responses. To encourage participation, the researcher wrote follow-up emails and made phone calls to the officials who had indicated interest in participating in the study.

The primary aim of the semi-structured questionnaire was to develop a detailed understanding of:

- i. The existing ICT infrastructure available at the nine TVET colleges.
- ii. The adoption patterns of ICT tools and platforms across diverse geographic and socioeconomic contexts.
- iii. The policies and strategies underpinning the integration of ICTs into teaching and learning activities.

The semi-structured questionnaire was designed to explore several key themes related to the technical aspects of the ICT infrastructure at the nine TVET colleges in KZN. These themes included the availability and quality of the Internet at each college, which focused on assessing internet speed, stability, and bandwidth adequacy to support e-learning activities; the technical specifications of ICT infrastructure, involving documentation of the hardware and software systems available, including servers, network configurations, and security measures; the level of access that staff and students have to computers, smart devices, and online learning platforms, examining both the quantity and usability of devices provided, as well as the extent of integration with learning management systems; the distribution of technical support, addressing the availability of personnel and resources to assist with troubleshooting, training, and the effective use of ICT tools; the volume of user traffic across the colleges' online learning platforms, aiming to capture engagement metrics such as the frequency and intensity of platform usage by staff and students; and the areas of innovation undertaken by colleges to facilitate ICT integration, highlighting unique strategies or pilot projects initiated to enhance the adoption and utility of ICTs. The data generated during this phase provided crucial insights that informed the selection of the three TVET colleges that participated in the institutional case studies in Phase 2.

In the second phase, the data collection process involved conducting semi-structured interviews with the Deputy Principals for academic services, ICT Managers and ICT technical support staff, and curriculum services officials at the three purposively sampled TVET colleges. The semi-structured interview format allowed for a balanced approach that maintained a consistent structure across interactions with participants while enabling participants to elaborate on their unique experiences and perspectives. Utilising concepts from the theoretical framework, the researcher developed an interview guide that was organised into thematic sections that addressed key aspects of ICT adoption and integration at TVET institutions. These themes included:

- a) ICT Selection and Adoption: Questions within this theme focused on the criteria used to select ICT tools, the decision-making processes involved in selecting ICTs, and the influence of external policies or factors on the institution's ICT adoption strategy;
- b) ICT Implementation Challenges: This theme explored the logistical, technical, and institutional challenges faced during the implementation of the college's ICT adoption strategy, and the strategies employed to overcome these obstacles;
- c) Utilisation of ICTs in Teaching and Learning: Questions within this theme required the participants to provide insights into how ICTs were used in daily classroom activities, including examples of innovative practices and limitations encountered in teaching and learning situations.

The data collection process was designed as follows:

First, the researcher contacted the TVET colleges, using contact details obtained from SABEN, to introduce their research interest and request permission from the principal to conduct the study at the college and engage with the participants. The TVET college principals responded that the researcher should submit a gatekeeper permission form for them to review the request to conduct research. The researcher completed the form they obtained from the DHET website and emailed it to the college principals.

Once the college principals had obtained permission, the researcher contacted the participants individually. The first participants the researcher contacted from each college were the DPs for Academic Services, who then provided the researcher with the contact details of the ICT Managers and the Campus Managers. The Campus Managers organised the lecturers who participated in the focus groups and arranged venues for the focus group discussions. Once the Campus Managers contacted the researcher and the lecturers, who indicated an interest in participating in the focus group discussions, the researcher sent the gatekeeper permission letter to all the participants. The gatekeeper permission letter provided an overview of the study – the background, research objectives, and research questions – and indicated to the participants that their participation was voluntary. The researcher also sent the topics of discussion for the semi-structured interviews and focus group discussions to the participants – for their perusal – once the participants had confirmed their participation and the researcher had confirmed the dates for the appointments with the participants. The semi-structured interviews with the deputy principals, ICT managers, and ICT support staff took place virtually; focus groups were held in

person.

The section below will discuss the design process for the data collection instruments; the section will cover semi-structured interviews with the Deputy Principals for Academic Services, Assistant Directors for IT Services and ICT support staff, Assistant Director for Curriculum Services, Assistant Director for Student Support Services and the document analysis of policies and strategies at the institutional and national levels, lesson plans, and teaching materials.

4.7. Semi-structured interviews: Institutional perspectives on ICT adoption

As indicated briefly above, the researcher conducted semi-structured interviews with the DPs for Academic Services, the ICT Managers, and the ICT support staff to discuss their experiences and practices with regard to ICTs. The semi-structured interviews focused on the institutional processes, factors, or challenges shaping how they worked with ICTs within the teaching and learning environment and their individual experiences integrating ICTs into their work. DOI was used to conceptualise the interview guides. DOI provided concepts that described the attributes that make an innovation attractive for adoption, the environmental factors that shape how individuals interact with an innovation, and the decision-making process. These concepts provided the framework to formulate the structure and prompts for the discussions with the participants. The researcher then used the descriptions provided by the concepts to formulate questions for the semi-structured interviews. The researcher also consulted research guides to ensure that the structure of the discussion prompts was consistent with the research paradigm and the type of data the researcher intended to gather.

The semi-structured interviews were conducted on-site at the colleges and virtually on video conferencing platforms to allow for convenient access to participants. Each semi-structured interview lasted between 45 minutes and one hour and was audio-recorded with the participants' consent to ensure accurate data capture. To complement the verbal data, the researcher took detailed field notes, documenting non-verbal cues, contextual observations, and additional insights not captured in the recordings. The audio recordings from the semi-structured interviews with the participants were recorded, transcribed, and stored in UKZN's OneDrive cloud.

4.7.1. Deputy principal: Academic services

The semi-structured interviews with the DPs for Academic Services covered the various aspects of the ICT adoption process from an institutional and governance point of view. The interviews comprised an open-ended discussion that focused on the following areas:

- i. The ICTs the TVET college was using and what they offered strategically and pedagogically;
- ii. The processes followed by the TVET college when selecting ICTs;
- iii. The contextual factors that were considered when selecting ICTs;
- iv. The TVET college's policy or strategy for integrating ICTs into the TVET college's teaching and learning approach;
- v. the quality assurance issues encountered with using ICTs in teaching and learning;
- vi. The issues or challenges experienced when implementing their ICT adoption strategy;
- vii. the issues or challenges posed by the introduction of ICTs into teaching and learning; and
- viii. The limitations of ICTs as teaching and learning tools.

The interviews with the DPs for Academic Services provided crucial insights into the types of ICT interventions the TVET college was exploring, how they deliberated between the various options the market offered them, the trade-offs they had to make between options, and the consequences of their choices. The interviews with the DPs provided an understanding of the institutional perspective regarding ICTs. The DPs for Academic Services were the first individuals the researcher contacted from the TVET college to secure permission to conduct the study at the college and to organise appointments with the other participants. The researcher interviewed the DPs for Academic Services online for one-hour sessions and recorded the audio.

4.7.2. Assistant director: IT services and ICT support staff

In these semi-structured interviews, the researcher probed the Assistant Directors for IT Services and ICT support staff on the technical specifications and the requirements of the TVET college's ICT system. The aim was to understand the capabilities of the physical assets – hardware, network infrastructure, digital platforms, and any other resources that formed part of the TVET college's ICT strategy. The researcher also engaged the ICT Managers and ICT support staff regarding their role in supporting teaching and learning activities. The researcher used interviews with the Assistant Directors for IT Services, ICT support staff, and the

inventory list compiled by SABEN to develop a technical overview of the TVET college's ICT system. This data set was used for reference during the discussions with the DPs and the lecturers.

4.7.3. Assistant directors for curriculum services and student support services

The semi-structured interviews with the Assistant Directors for Student Support Services and Curriculum Services provided critical insights into the role of ICTs in teaching and learning. Their perspectives helped clarify how TVET colleges leverage ICTs and associated digital platforms to enhance student engagement, provide academic and personal support, and facilitate access to learning resources. The semi-structured interviews explored:

- i. The ICTs used to support curriculum development;
- ii. How ICTs are integrated into the college's academic programmes;
- iii. The strategies for using ICTs in lecturer development and training;
- iv. The challenges associated with integrating ICTs in curriculum delivery; and
- v. The limitations of ICTs in facilitating curriculum innovation and instructional improvement.

These semi-structured interviews provided insights into the impact of ICT integration on curriculum and lecturer development at the college. Furthermore, they provided an institutional perspective on how ICTs shape curriculum delivery and innovation.

4.8. Document analysis: Triangulating institutional perspectives

In addition to the semi-structured interviews and the focus groups, document analysis was utilised to provide secondary data sources to complement primary data collection methods. The researcher reviewed three key categories of documents to gather contextual and operational insights into ICT integration at the three TVET colleges. The documents collected for analysis included institutional and departmental policy documents, implementation plans, evaluation reports and lesson plans. The researcher sourced these documents from the participants and requested copies of any documents the participants mentioned during the semi-structured interviews. The researcher compiled these documents into a dossier for each TVET college. It

should be noted that access to these documents was granted under the terms and conditions stipulated by the TVET college in the gatekeeper's permission letter. The researcher analysed these documents to:

- i. Identify the strategic drivers for ICT adoption at each TVET college;
- ii. Identify the gaps between policy objectives and realities of implementation;
- iii. establish a historical account of the technology adoption process at each TVET college, and
- iv. Track shifts in lecturers' approach during implementation.

4.8.1. *Institutional policies and strategies*

Institutional documents that included strategic plans and ICT policies were reviewed to understand how individual colleges conceptualised and operationalised their ICT adoption strategies. These documents provided insight into the institutional frameworks guiding ICT implementation, the allocation of resources, and the institutional priorities related to the integration of ICTs into teaching and learning. The researcher analysed these texts to identify commonalities and discrepancies in policy approaches across the three TVET colleges, with a particular focus on alignment with national ICT strategies and responsiveness to local needs.

4.8.2. *National policies and strategies*

National-level policies, white papers, and strategic documents on ICT in TVET were reviewed to contextualise the colleges' approaches within broader governmental objectives. These documents outlined the overarching goals, funding mechanisms, and performance benchmarks for ICT integration across the education sector. By examining these texts, the researcher identified how national objectives shaped institutional strategies and the extent to which colleges adhered to or diverged from prescribed guidelines.

4.8.3. *Lesson plans and teaching materials*

To gain insight into the practical application of ICTs in the classroom, the researcher reviewed lesson plans and teaching materials provided by lecturers. These documents were analysed to determine how ICT tools and platforms were integrated into curriculum delivery. The review focused on the types of ICT resources used, the instructional strategies utilised, and the alignment between teaching practices and institutional ICT objectives. This analysis highlighted the on-the-ground realities of ICT usage, including challenges and innovations encountered by TVET educators.

The document analysis process followed a structured protocol. First, criteria – based on the theoretical framework and the research objectives – were established to ensure that the selected documents were relevant and reliable, focusing specifically on policies that addressed ICT adoption, integration, and operational challenges within TVET colleges. Each policy document was then examined for both explicit content and implicit insights which outline institutional priorities related to ICT adoption and integration. The extracted data were subsequently organised into themes that aligned with the study's research objectives, including ICT infrastructure, institutional structure, and pedagogy and curriculum. Finally, findings from the document analysis were cross-referenced with data collected through technical surveys, and semi-structured interviews to validate insights and identify any discrepancies. The data from the document analysis was used to cross-check data from the semi-structured interviews and focus group discussions. Furthermore, the researcher used the data from the document analysis to frame the case studies of the three TVET colleges.

The selected approach to data collection was guided by the study's interpretivist paradigm, research objectives, and the need for methodological alignment to ensure a comprehensive understanding of ICT adoption in TVET colleges. The two-phase design, beginning with a technical survey followed by institutional case studies, was the most appropriate strategy for capturing both the breadth and depth of ICT integration. The approach followed in Phase 1 was justified by the need to establish a baseline understanding of ICT conditions before selecting cases for in-depth institutional analysis. The engagements with the participants ensured that data collection was informed by institutional expertise, while supplementary input from additional institutional stakeholders added depth to the findings. The findings from Phase 1 directly informed the purposive sampling of the three TVET colleges selected for the institutional case studies, ensuring methodological coherence by allowing subsequent qualitative inquiry to build upon the

survey's empirical foundation.

The semi-structured interviews and document analysis utilised in Phase 2 were selected as the data collection methods as they aligned with the study's interpretivist design. The semi-structured interview format provided a balance between consistency in thematic coverage and flexibility to accommodate the lived experiences of key stakeholders. This approach aligned with the study's research objectives by allowing participants to articulate their perceptions of ICT adoption processes, challenges, and institutional strategies within their specific contexts. Furthermore, the inclusion of document analysis served a crucial triangulation function, strengthening the credibility of findings by comparing interview narratives with institutional policies, strategic plans, and lesson plans.

This multi-method approach reinforced the interpretivist emphasis on understanding meaning-making within institutional contexts while ensuring coherence between research objectives, theoretical framing, and data collection techniques. Ultimately, the integration of multiple data sources provided a robust foundation for analysing ICT adoption in TVET colleges, ensuring that the study captured both systemic trends and localised perspectives in a manner consistent with its philosophical and methodological underpinnings.

4.9 Data analysis: Developing institutional insights into ICT adoption at TVET colleges

The data analysis process was designed to systematically interpret the findings from both phases of data collection, ensuring that the insights were grounded in the data and aligned with the study's theoretical framework and research objectives. The study utilised both quantitative and qualitative data analysis methods. The quantitative data generated during Phase 1 was analysed using descriptive statistics and the qualitative data from both Phase 1 and Phase 2 was analysed using the framework analysis approach.

According to Ward et al. (2013), framework analysis falls under thematic or qualitative content analysis methods. Several scholars have noted that thematic analysis approaches can provide a rich and insightful understanding of complex phenomena, be applied across a range of theoretical and epistemological approaches, and expand on or test existing theories (Lewis & Ritchie, 2003; Ritchie et al., 2003; Smith & Firth, 2011). The framework analysis approach was developed in the 1980s by social policy researchers at the United Kingdom's (UK) National Centre for Social Research to analyse qualitative data applied to policy research (Gale et al.,

2013; Lacey & Luff, 2009; Ritchie et al., 2003). The framework analysis approach is described as an interpretive process where data is systematically dissected to identify patterns within the data to provide an instructive description of the phenomenon under study (Lewis & Ritchie, 2003). According to Lacey and Luff (2009), one of the benefits of framework analysis is that it provides clear and systematic stages to the analysis process; this provides support to inexperienced researchers throughout the various stages of extracting findings from the data. Framework analysis prescribes that data are sifted, charted, and sorted according to key issues and themes. This entails a five-step process: familiarisation, identifying a thematic framework, indexing, charting, and mapping and interpretation (Lewis & Ritchie, 2003; Ritchie & Spencer, 1994)

For Phase 1, the technical survey data collected from the nine TVET colleges were subjected to both quantitative and qualitative analysis. The quantitative data were analysed using descriptive statistics. Descriptive statistics provide initial insights into the data and provide a platform for more complex analysis processes (Field, 2018). According to Creswell (2014) and Babbie (2020), descriptive statistics are particularly valuable in educational research for summarising large datasets and uncovering trends that inform policy and practice. Tufte (2001) argued that the descriptive statistics approach enhances the clarity and interpretability of comparative analyses as the data can be visualised through graphs and charts.

For each thematic category, descriptive statistics, and frequency distributions were calculated. This process allowed for the identification of patterns, variability, and trends in ICT adoption and usage across colleges. Results from the statistical analysis were visualised using maps and tables. These visualisations were tailored to reflect the key themes, facilitating clear comparisons across metrics like internet speeds, equipment availability, and e-learning platform usage. Principles outlined by Tufte (2001) guided the design of these visuals to ensure clarity and interpretability.

The data were systematically compared across the surveyed colleges, with a focus on each thematic category. This comparison highlighted significant disparities or commonalities in areas such as access to technical infrastructure, ICT usage patterns, and levels of innovation. To provide a holistic analysis, quantitative results were cross-referenced with qualitative themes emerging from open-ended questionnaire responses and semi-structured interviews. This triangulation enriched the understanding of how numerical trends aligned with or differed from participant narratives. By incorporating thematic analysis with descriptive statistics, the study

ensured a comprehensive exploration of ICT adoption and integration within TVET colleges, aligning with research objective number 1 – to document the distribution of ICTs across TVET colleges in KZN.

The qualitative data from open-ended questionnaire responses were analysed thematically, employing an inductive coding approach as described by Braun and Clarke (2006). This approach involved:

Familiarisation with the Data: This is the first step in the process, the researcher immerses themselves in the data by reading and re-reading the survey responses to develop a holistic understanding of the content. This step ensured that the researcher grasped the context and nuances of participants' responses before proceeding with the coding process (Braun & Clarke, 2006). According to Nowell et al. (2017), familiarisation is a critical foundation in qualitative analysis, as it allows the researcher to identify preliminary patterns and note emerging ideas for further exploration. The most notable trends that emerged during this process included the impact of geography on the distribution of ICT infrastructure across TVET colleges in KZN and the limitations to teaching and learning caused by unequal access to ICTs, and the Internet.

Initial Coding: In this step, the researcher systematically reviewed the data line by line, assigning codes to specific excerpts of text that represented meaningful information. The codes were designed to capture the essence of each data segment, ranging from specific phrases to broader concepts. This open coding process was iterative, with codes refined as the analysis progressed to maintain accuracy and coherence (Strauss & Corbin, 1998). In this study, initial codes included: "Technical limitations", "Resource Allocation", "Pedagogical Innovation", "Curriculum Alignment"

Theme Development: Following the coding process, the researcher grouped the codes into broader themes and sub-themes to create a structured framework for understanding the data. The themes that were developed were informed by with the study's research questions – namely, research questions 1 and 3 – and theoretical framework, ensuring relevance and coherence. This process also allowed for the identification of patterns, relationships, and unique insights within the data. By combining descriptive statistics with thematic analysis, the researcher ensured that the data analysis for Phase 1 was comprehensive and addressed both the numerical and contextual aspects of ICT adoption within TVET colleges.

For Phase 2, the data from the semi-structured interviews conducted at the selected TVET colleges were analysed using a thematic analysis approach, guided by the reflexive thematic analysis framework of (Braun & Clarke, 2006; Lewis & Ritchie, 2003; Ritchie et al., 2003; Smith & Firth, 2011). This process allowed the researcher to systematically explore participants' perspectives and experiences with ICT adoption and integration.

The first step involved transcription and data preparation. All audio recordings of the semi-structured interviews were transcribed verbatim to ensure accuracy. Field notes were digitised and included in the dataset to provide contextual insights. This comprehensive dataset formed the basis for subsequent analysis. The researcher engaged in an iterative process of familiarisation with the data, reading and re-reading the transcripts and field notes to identify key patterns and nuances. Coding was performed using a combination of pre-determined codes, derived from the semi-structured interviews, and emergent codes that arose during the analysis. This dual approach ensured that the analysis captured both expected and unexpected findings, reflecting the complexity of ICT adoption within TVET colleges. This study sorted and processed the data from the inventory lists, document analysis, and transcripts from the semi-structured interviews using a Microsoft Excel spreadsheet. The data analysis process followed the five steps of framework analysis, as described below.

4.9.1. *Familiarisation*

During this step, the researcher worked with the transcripts from the interviews and focus groups and cross-checked them against the audio recordings. The researcher utilised a digital transcription platform – Colibri – to transcribe the audio recordings from the semi-structured interviews and the focus group discussions. However, due to technical reasons, there were instances where the transcript did not match the audio. In cases where the digital transcript did not match the audio, the researcher reconciled the text and the audio. Manual editing entailed reading through the transcript while listening to the audio recording. The researcher would pause the recording and correct the text when there was a gap. This exercise allowed the researcher to listen repeatedly to certain portions of the discussions. Listening to the recordings several times enabled the researcher to pay closer attention to the information conveyed by the tone of the participants. One example of this was that, in the focus group discussions with the lecturers, across most groups, most lecturers responded openly and freely when discussing policy but seemed hesitant to voice opinions that they felt might be contrary to the college's position. This process also allowed the researcher to cross-reference the responses in the

transcripts with documents, such as lesson plans, that the researcher had obtained from the participants. By the end of this process, the researcher had become familiar with the transcripts and had already begun identifying the early patterns and themes within the data. As the researcher listened to the recordings, he noted three themes: governance, curriculum, and ICT capacity. The researcher noted these emerging patterns in writing at the end of each transcript.

4.9.2. *Identifying a thematic framework.*

This stage occurs after the researcher has become familiar with the data and begins to recognise emerging themes or issues in the data set. These emerging themes or issues may be linked to predetermined themes and issues; themes and issues may also emerge directly from the data through the familiarisation process (Gale et al., 2013; Lewis & Ritchie, 2003). This study identified themes through cross-referencing concepts from the theoretical framework and repeated listening to the audio recordings. Once the researcher had finished correcting the transcripts, he listened to the recordings again to understand more deeply what the participants were saying. As the researcher listened to the recordings, he began to notice that the discussions with all the participants focused on four areas of concern for the participants: institutional support for lecturers and students, availability of ICTs for teaching, and challenges blocking ICT implementation in the classroom.

Once the researcher had listened to the recordings several times and noted areas and topics that the participants were referring to frequently, he colour-coded key phrases or sentences on the transcripts. After colour-coding the transcripts, the researcher referred to the theoretical framework to identify concepts or principles that could be used to organise the emergent themes into a format that could be analysed. After consulting the adoption and diffusion model (Rogers, 2003) provided by DOI, the researcher identified two concepts that corresponded with all the data sets: innovation (in this study, the innovation was ICTs) and social system (in this study, the TVET college).

The adoption model ascribes five traits through which an innovation influences the adoption process: advantage, compatibility, complexity, trialability, and observability (Rogers, 2003; Rouse & Serban, 2011; Straub, 2009). The researcher used these traits as categories to organise all the responses where the participants mentioned or discussed the role or function of ICTs in teaching and learning. The researcher captured the instances where participants mentioned ICTs on an Excel spreadsheet. The researcher then colour-coded the data in the spreadsheet using the innovation traits provided by the adoption model. At the end of that process, the researcher reviewed the table for patterns emerging from the data. The researcher noted that the most prominent pattern was the high frequency of instances where participants mentioned two of the five traits – advantage and compatibility – when discussing using ICTs in their teaching. In the adoption model, these two traits are linked directly to the technical capability of the innovation. The data suggested that a significant proportion of the participants' concerns about ICTs were directly linked to the technical function of ICTs, whether they could derive an advantage from the ICTs in their teaching, and whether the ICTs were compatible with the curriculum for the subject they were teaching. Regarding the technical aspect of ICTs, data for the distribution of ICTs, the uses of ICTs, and the ICT traits perceived by the users had been captured. This exercise identified two themes linked to ICTs that could be analysed using the DOI adoption model: the availability of ICTs in the classroom and their compatibility with the curriculum.

DOI describes a social system as the context, culture, and environment in which an individual is located (Rogers, 2003). Social systems are underpinned by norms, values and practices that frame and influence how members behave and react to innovation (Rogers, 2003). During this step, the researcher repeated the same process he had followed for the ICT data. For the social systems data, the researcher used institutional norms, institutional processes, institutional culture and classroom practices as categories for the responses related to the TVET college's approach to ICTs. Here, the responses were concentrated around institutional processes and institutional culture, and the responses seemed to indicate that these two categories shaped classroom practices. In this data set, participants expressed divergent sentiments. The deputy principals perceived their institution as doing all it could to facilitate the adoption of ICTs. However, they perceived the lecturers as not doing enough to implement the institution's ICT strategy. The ICT managers expressed that the colleges had sufficient technical capacity to implement ICTs in the classroom, but the lecturers' limited ICT skills resulted in ICTs being underutilised. The lecturers expressed the sentiment that not enough was being done by the institution to empower them to integrate ICTs effectively into their teaching; this included their

skills (ICT and pedagogy) development, equipping the classroom with the necessary technologies, and equipping the students with ICT devices.

As the researcher was coding all the data, a new theme that emerged strongly from the data was the impact of the COVID-19 pandemic. In their responses, participants referred to COVID-19 and the lockdown as the point at which they were forced to turn to ICTs to continue lessons and communicate with students. The lecturers noted the difficulties they experienced during this period because the college had not previously implemented measures to teach remotely, and they were forced to improvise their teaching approach. On the technical side, the lockdown period affected the global ICT supply chain; this meant that those colleges that had ordered laptops and other devices for staff did not receive them before the lockdown was imposed. Overall, the experience of the colleges during the COVID-19 pandemic highlighted the strengths and weaknesses of their ICT strategies. Those TVET colleges that had already begun integrating ICTs into teaching and learning were able to continue this process and support existing practices. Meanwhile, those who had not begun this process before the lockdown had to find ways to initiate remote teaching and learning. In this regard, the COVID-19 theme provided a mini case study of how institutions respond when faced with conditions that disrupt standard practice.

By the end of these processes, five themes had emerged from all the data sets (the technical survey and institutional case studies):

- i. COVID-19
- ii. ICT infrastructure and hardware
- iii. Institutional governance
- iv. Curriculum and pedagogy
- v. Institutional culture

4.9.3. Indexing

In this stage, the researcher identifies portions or sections of the data corresponding to a particular theme (Gale et al., 2013). This process is applied to all the textual data that has been gathered. This step was done simultaneously with the previous step; the researcher compiled the data into a colour-coded spreadsheet. The data in the spreadsheet was organised thematically according to the themes identified in the previous step. The researcher then applied the DOI's adoption model to evaluate how the sentiments expressed in the responses were likely to either facilitate or hinder ICT adoption. To do this, the researcher grouped the responses into four quadrants: institutional actions that increase ICT adoption, institutional actions that block ICT adoption, individual actions that increase adoption, and individual actions that block adoption. These four quadrants were then used as a framing device to construct ICT adoption case studies for each TVET college. In this regard, the data were indexed to highlight how the various actors at the three TVET colleges responded to ICTs, their roles within the institution, and their interactions with other staff members (across all levels). The code table and the emergent themes were reviewed over several rounds of peer reviews to ensure that the themes and the codes cohered with the theoretical framework.

4.9.4. Charting

In this stage, the specific pieces of data indexed in the previous stage were arranged in charts organised by theme (Gale et al., 2013; Lewis & Ritchie, 2003). Indexing requires the data to be lifted from its original textual context and placed in charts consisting of the headings and subheadings drawn up during the thematic framework. For this step, the researcher utilised the colour-coded spreadsheet to arrange the data from each TVET college into separate institutional case study reports; here, the researcher used the categories and themes identified in the previous step to structure the case study reports. The researcher used the themes and subthemes as headings and subheadings for the institutional case study reports. Once the researcher had established the structure, he populated the reports with the corresponding inputs from the participants. Structuring the institutional case studies according to the themes allowed for a clear and coherent discussion of the findings and made drawing insights about the data easier.

4.9.5. Mapping and interpretation

This final stage involves analysis of the critical characteristics displayed in the charts. This analysis should generate a schematic diagram of the event or phenomenon, thus guiding the researcher in interpreting the data set (Lewis & Ritchie, 2003).

Data from the inventory lists was analysed and utilised to construct a technology profile for each TVET college and a graphic account of the distribution of ICT resources across the TVET colleges' campuses. Furthermore, each technology item was catalogued according to its function within the system of technologies, its relationship to other technologies, the frequency with which TVET lecturers interacted with the technology, and its role in teaching and learning activities. The researcher also described why specific TVET colleges preferred a particular combination of technologies over other alternatives.

Data from the interviews and focus groups was analysed to provide contextual and individual accounts of ICT usage within each TVET college. This account described the rationale behind each TVET college's technology choice, the impact of ICTs on the TVET college's teaching and learning strategy, and the lecturers' experiences of integrating ICTs into their teaching practice.

Data from the document analysis were analysed to construct an overview of the TVET college's institutional framework (strategy, policy, and governance). These data provided insights into the institutional design of the TVET college, how this shapes the institutional culture, shape perceptions about ICTs, and how the TVET colleges have responded to ICTs. Moreover, these data were used to cross-check the data collected during the interviews.

Once the researcher had completed the five steps discussed above, he compiled the themes into case studies and presented them to his colleagues through peer dissemination. The researcher prepared a slideshow presentation covering the background of the study, research questions, methodology, and emerging themes and findings. The researcher presented the slideshow to their colleagues during their monthly in-house seminars. During the researcher's presentation, his colleagues engaged with the various aspects of the study and interrogated the researcher about the data collection process, the emerging themes, and the research findings. This engagement with peers tested the rigour of the research processes applied by the researchers. At the end of the presentation, the colleagues indicated that the researcher had followed the appropriate steps when collecting, handling and analysing the data. The colleagues indicated

that the researcher had sufficient data to answer the research questions, and the emergent themes were coherent with the theoretical framework. They recommended that the researcher compile the research findings and discussions into the writing of the thesis. Subsequently, the researcher began compiling the research findings and writing the thesis.

The selection of a combined quantitative and qualitative data analysis approach was essential for ensuring a comprehensive and methodologically rigorous examination of ICT adoption within TVET colleges. The use of descriptive statistics to analyse the quantitative data provided a systematic means of summarising large datasets, identifying trends, and facilitating meaningful comparisons between institutions. This was particularly appropriate given the study's objective of documenting the distribution of ICTs across TVET colleges, as it allowed for a structured representation of numerical data, highlighting variations in ICT infrastructure, internet connectivity, and digital teaching resources. Complementing this, the application of framework analysis to the qualitative data ensured a structured and systematic process of coding, categorisation, and interpretation, which enabled the researcher to uncover deeper insights into the contextual and institutional factors shaping ICT adoption. By employing both methods in a complementary manner, the study aligned with principles of methodological triangulation, thereby enhancing the credibility and depth of the findings.

This data analysis approach aligned with the interpretivist paradigm by prioritising the understanding of subjective experiences, institutional contexts, and the complexities of ICT adoption as perceived by various stakeholders. The framework analysis approach reflected interpretivist principles by enabling the researcher to engage in an iterative process of data familiarisation, coding, and thematic development, ensuring that findings remain closely connected to participants' perspectives. This approach also reinforced methodological alignment with the study's overarching research framework, particularly its engagement with DOI, as the categorisation of themes allowed for a structured examination of the institutional and individual factors influencing ICT adoption. Furthermore, the combination of thematic and descriptive statistical analyses ensured coherence with the study's research objectives by capturing both quantifiable patterns and in-depth qualitative insights. This methodological integration strengthened the study's capacity to provide a nuanced, evidence-based account of ICT adoption within the TVET sector.

4.10 Trustworthiness: Processes to validate and safeguard the integrity of the data

Trustworthiness is generally understood to be concerned with the soundness and adequacy of the methods used to gather and verify data. The principle of trustworthiness is centred around applying research methods that establish credibility, transferability, dependability, and confirmability of a research study's findings (Baxter & Jack, 2008; Creswell, 2007; Creswell & Miller, 2000). Trustworthiness is defined as the extent to which research findings could be replicated if another researcher conducted the same study using the same or similar methods while targeting a different sample group (Lacey & Luff, 2009; Lewis & Ritchie, 2003). The trustworthiness of qualitative research is established through the processes used to gather and verify research data (Alhojailan, 2012; Lacey & Luff, 2009). Lacey and Luff (2009) argue that the researcher must ensure that the methods they use for gathering data can generate findings consistent with the phenomenon being researched and reproducible if applied to a different sample group.

Lewis and Ritchie (2003) suggest two practical measures that researchers can apply to ensure the trustworthiness of their research: 1) establish internal checks to ensure quality in the process of gathering data as well as the interpretation of the findings, and 2) communicate clearly when giving an account of the research design and data gathering processes. Creswell and Miller (2000) suggest that member checking is a third practical measure to establish the trustworthiness of research findings. Member checking entails taking data and interpretations back to the study participants so they can confirm the credibility of the information and narrative account (Creswell, 2007; Creswell & Miller, 2000). The researcher used the following measures to ensure the trustworthiness of the data and the data collection analysis methods.

4.10.1. Credibility

Credibility in qualitative research is concerned with the extent to which the data collected and analysed for the study reasonably and accurately reflects the reality of the participants (Creswell, 2007; Creswell & Miller, 2000; Lacey & Luff, 2009; Lewis & Ritchie, 2003). Credibility is concerned with the data accurately reflecting the phenomena under study from the perspective of the study's participants. The data are considered credible if they accurately represent the aspects of the phenomena that they are intended to describe, explain or theorise (Lewis & Ritchie, 2003). According to Korstjens and Moser (2018), credibility is established when the researcher shows through their research design, they have familiarised themselves

with the setting and context of the phenomenon, identified the most significant aspects of the phenomenon under observation, included multiple data collection methods to allow for triangulation, and incorporated member checking to verify the data they collected.

Regarding the study's design, the researcher used his participation in the SABEN project to familiarise himself with the TVET sector and the state of the colleges' ICT infrastructure. This approach allowed the researcher to become familiar with all the TVET colleges targeted for study and the officials from those colleges, which made it possible for the researcher to design instruments that are relevant to the TVET sector, instruments that captured the TVET lecturer's experience with ICTs. The study utilised semi-structured interviews, and document analysis to generate data. Once the data collection instruments were finalised, they were attached to the gatekeeper permission application form for the TVET principals to review and approve. When the TVET principals granted permission for the researcher to conduct his study at their colleges, they also approved the research instruments.

After permission to conduct the study at the TVET colleges was granted, the researcher emailed copies of the interview guides and topics of discussion to the Deputy Principals for Academic Services, the Assistant Directors for IT Services, Curriculum Services, Student Support Services, and the ICT support staff for them to preview before each appointment. In response, these participants indicated the sections or concepts that were confusing to them. Subsequently, the researcher would clarify the concept or rephrase the question for the participants. Once the instruments were clear enough for the participants to understand without explanation, the researcher conducted the semi-structured interviews and focus group discussions. During the data collection process, the researcher recorded the audio from the sessions with the participants; this was done to ensure that none of the data were lost. The recordings were labelled to indicate the participant's name, TVET college, and the session date. The recordings were stored digitally on UKZN's OneDrive and backed up onto UKZN's central server. Additionally, the researcher shared the link to the recordings on UKZN's OneDrive to ensure that the data were always accessible.

Once the researcher had completed data collection, they transcribed the interview recordings, sorted the research notes, and conducted member checking with the participants via email. The researcher distributed the transcripts of the semi-structured interviews and the document analysis notes via email to the participants for them to review. The participants were given time to review these documents and confirm that they reflected what was shared during the data collection process. This process was done to verify that the researcher had captured participants' views accurately and had not misrepresented them. These processes ensured that the data collection instruments accurately captured the participants' experiences with ICTs adoption at their institutions, and the findings reflected their views on ICT usage at their college.

4.10.2. *Transferability*

Transferability in qualitative research is concerned with the extent to which the study's findings and recommendations can be applied to other contexts (Korstjens & Moser, 2018). The challenge of qualitative research – particularly case studies – is that the research findings are limited to specific contexts, environments, or individuals; therefore, it is difficult to show how the research findings and recommendations can be applied to other contexts, environments, or individuals (Ritchie et al., 2003; Shenton, 2004). According to Shenton (2004), “It is also important that sufficient thick description of the phenomenon under investigation is provided to allow readers to have a proper understanding of it [the phenomenon and its context]” (Shenton, 2004, p. 70). The thick description allows the reader to compare the insights into the phenomenon described in the research report with those they might encounter in other contexts. Korstjens and Moser (2018) and Shenton (2004) state that it is the researcher's responsibility to ensure that they provide adequate descriptions of the research site's context to allow the reader to identify the possibilities and limitations for transfer. The researcher must provide information on the research sites and their location, clear descriptions of the selection process of the participants – individuals and institutions, the data collection methods, data collection sessions, and the overall research period (Korstjens & Moser, 2018; Ritchie et al., 2003; Shenton, 2004).

In order to enhance the study's transferability, the researcher has provided detailed descriptions of the study's rationale, research design, sampling criteria for the TVET colleges and the individual participants, and data collection and analysis processes in Chapter 4. The researcher has also provided descriptions of the participating TVET colleges' institutional environments in Chapters 5 and 6 of this thesis; these provide an account of the contexts and settings of the study. Providing details of the research sites was crucial as the contexts surrounding the TVET colleges played a significant role in how the colleges approached ICT adoption. This information allows readers to understand the parameters of this study's design and the sites where it was conducted, allowing them to make accurate inferences regarding its findings and their transferability to other contexts. The research findings were also presented at a peer debriefing, where the study's design was reviewed.

4.10.3. *Dependability*

Dependability in qualitative research is concerned with the extent to which the study's findings could be repeated if another study, utilising the same or similar methods, was conducted (Ritchie et al., 2003). According to Creswell (2007), a study's dependability is established by auditing the study's research processes. In order to ensure dependability, the researcher must provide a detailed report of the research design and its implementation, operational details of data collection, and reflection on these processes (Creswell, 2007; Shenton, 2004). This type of report makes it possible for future researchers to replicate the study, even though they might not necessarily gain the same results (Shenton, 2004). A study's dependability can be enhanced by applying data collection and analysis processes that align with the accepted standards for a particular research design (Korstjens & Moser, 2018).

In order to ensure the dependability of this study, the researcher utilised an established case study design, as outlined by Creswell and Miller (2000), Crowe et al. (2011), Lacey and Luff (2009), and Yin (2009). This design and its underpinning rationale are clearly outlined in Chapter 4. Regarding the data collection process, all the semi-structured interviews and focus group discussions were recorded and transcribed to ensure no data was lost and accurate when reporting the findings. In addition to the semi-structured interviews and focus group discussions, the researcher utilised document analysis to ensure the accuracy of the data. The recordings and their transcripts allow potential researchers to review the data generated by the study against the study's design.

To ensure dependability, the data analysis process followed the structured guidelines prescribed by the framework analysis approach (Lewis & Ritchie, 2003). The framework analysis approach is based on a systematic approach to the data analysis process, which provides clear and strict guidelines for processing and interpreting data (Gale et al., 2013; Lacey & Luff, 2009; Smith & Firth, 2011). The researcher combined the framework analysis processes with concepts from the DOI, Affordance Theory, and IDT to dissect and identify patterns within the data. Applying the framework analysis processes ensured that the researcher complied with recognised practices and interpreted the data according to accepted standards. The researcher used colour-coded spreadsheets to identify themes emerging from the data, assign descriptive values to the themes, and indicate links between themes. Once the data analysis process was complete, the researcher conducted a peer debriefing where he presented the research design, data collection methods, data analysis, and findings to his peers. The peers probed the researcher on the various aspects of his study, commented on his findings, and recommended how these aspects could be presented in his thesis.

4.10.4. *Confirmability*

Confirmability in qualitative research is concerned with the extent to which the study's findings are the outcome of the participants' experiences and ideas rather than the researcher's biases (Shenton, 2004). Confirmability can be established by indicating the rigour of a study's design. This rigour can be demonstrated through an audit trail of the research processes, member checking, and peer debriefing (Morse et al., 2002). Shenton (2004) reiterates that it is the researcher's responsibility to ensure that they provide detailed descriptions of the research design process and data processing methods to assist the reader in evaluating the rigours of the study. For the PhD study, the researcher utilised multiple data collection methods to ensure that the findings can be verified across multiple data sources. There are also email communication records between the researcher and the participants during the member-checking process. The confirmability of the findings can be verified through the text and audio records of the data. The text records include notes compiled by the researcher throughout the research process. The transcripts, audio recordings, and documents collected throughout the research process are stored on UKZN's OneDrive and available for review upon request.

4.11 Ethical considerations

Due to the unstructured and probing nature of qualitative research, there is significant potential for a researcher to encounter unanticipated ethical issues during the course of their study (Ritchie et al., 2003). Conducting an ethical qualitative study entails more than the researcher complying with the requirements stipulated by institutional review committees or boards (Creswell, 2007). Creswell (2007) argues that a qualitative study can be considered ethical when the researcher considers all the potential ethical issues of their study and incorporates measures to mitigate those issues into their study's design. In addition to addressing ethical issues in the research design, researchers must consider their positionality and recognise the significant role played by their subjective point of view in shaping how they conduct research, interact with participants, and process and interpret data (Creswell, 2007). In this regard, Creswell (2014) argues that "Researchers need to protect their research participants; develop a trust with them; promote the integrity of research; guard against misconduct and impropriety that might reflect on their organisations or institutions" (Creswell, 2014, p. 132). Thus, the research design should incorporate ethical processes throughout all study's phases, not only during data collection and reporting (Creswell, 2007; Creswell, 2014; Ritchie et al., 2003). These processes include – but are not limited to – obtaining informed consent from research participants, maintaining anonymity and confidentiality throughout the study, and protecting the participants from harm (Ritchie et al., 2003).

4.11.1. *Permission to conduct study*

Before conducting the study, the researcher applied for and obtained ethical clearance from the University of KwaZulu-Natal's (UKZN) Humanities and Social Sciences Research Ethics Committee (HSSREC). As part of the HSSREC ethical clearance process, the researcher obtained gatekeeper permission to conduct his study from the TVET colleges. The gatekeeper permission process required the researcher to provide his study's background, intention, research questions, and objectives to the principals of the TVET colleges he was targeting. The principals reviewed the researcher's application and granted permission to the researcher to conduct his study. KZN TVET B granted permission on the condition that the researcher use pseudonyms for the college's name when he reports the study's findings. Once all the necessary institutional authorities granted permission to conduct research, the researcher contacted the Deputy Principals for Academic Services, ICT Managers, ICT support staff, and the lecturers. The researcher outlined the background, intention, research questions, and research objectives

of his study to the participants. The researcher outlined to the participants that their participation is voluntary, they would not accrue any material benefits, their identities would be kept anonymous, and their contributions would be treated with confidentiality. The participants indicated their consent verbally and in text.

4.11.2. Data collection and presentation of findings

During the data collection process, the researcher began each session by outlining the objectives of the study, highlighting that the study had been approved by UKZN's HSSREC, explaining that the information sought by the study was not harmful or sensitive to them, indicating that each session would be recorded and that they could request copies of the recordings, inviting the participants to take part in the study, and sharing his contact details should the participants wish to withdraw from the study. The researcher would then extend an opportunity for the participants to ask questions about the study. Once the participants were satisfied that the researcher had responded to their questions, they signed informed consent forms. Signing the informed consent forms indicated that the participants understood that their participation in the study was voluntary, that they agreed to participate in the study, that they could withdraw at any point, and that they were satisfied that the researcher had provided them with sufficient background information of the study and its objectives. At the end of each session, the researcher reiterated to the participants that their participation was voluntary. The lecturers could request to be removed from the study at any point, that their contributions would be handled with confidentiality, and that their contributions would not be used to cause them harm.

Once the data were collected, the researcher used codes to label the recordings, the transcripts, and direct quotes from individual participants. The researcher confirmed his research findings through the process of member checks with the participants. The researcher emailed copies of the transcripts to the respective participants for them to review, fact-check, and make additional contributions to the data. Once the participants had reviewed the transcripts and indicated that they reflected the information they had shared with the researcher during data collection, the researcher began compiling the data for presentation. The participants' anonymity was maintained throughout the presentation and review of findings – such as member checks and peer debriefing – by utilising codes to identify individual participants and pseudonyms for the TVET colleges when data were disseminated. These codes allowed the researcher to use the participants' contributions without identifying them directly. All the digital files containing the raw data from the semi-structured interviews, focus group discussions, and data analysis were

stored on UKZN's OneDrive server under a password-protected account.

4.12 Conclusion

The study utilised a comparative case study design in terms of research design. Through this approach, the study explored the ICT distribution trends across TVET colleges in the province, ICT usage and associated challenges, and institutional processes and structures implemented by TVET colleges to facilitate ICT adoption. The study was located within the interpretive paradigm and explored the phenomenon of ICT adoption from the perspective of the officials and staff members at the selected TVET colleges. Conceptually, DOI shaped the study design, which considers ICT adoption to have both technical and social aspects.

The study was conducted in two phases; the first focused on the distribution of ICT resources across the nine TVET colleges in KZN, and the second on the institutional factors that shape ICT adoption. After completing the technical survey, the participants for the institutional case studies were selected purposively; the three TVET colleges were targeted due to their geographic and socioeconomic profiles, while the individual staff members were targeted based on their role within the TVET college. Logistically, this approach allowed the researcher to narrow the research focus to three of the nine TVET colleges in the province and conduct an institutional investigation into the contextual factors that inform ICT adoption at those three TVET colleges. By following this approach, the researcher observed how specific factors affected individual TVET colleges and how their impact varied across colleges operating in different teaching and learning contexts.

The data collection process was predominantly incident-free, with COVID-19 being the most significant disruption the researcher encountered. The data were collected through a combination of methods: semi-structured interviews, focus group discussions, and document analysis. These methods enabled the researcher to capture the individual participants' experiences working with ICTs, institutional policies for ICT adoption, curriculum strategies used to integrate ICTs into the classroom, and the various factors limiting ICT adoption at the individual, institutional and environmental levels. The data were analysed using a framework approach, which yielded five themes. These five themes included COVID-19, ICT infrastructure and hardware, institutional governance, curriculum and pedagogy, and institutional culture. Data analysis further showed a correlation between institutional structure and institutional culture. The researcher shared their findings with the participants, and peers to

verify the data and ensure the study's trustworthiness. Chapter 5 presents the findings from the study's technical survey. The findings presented in Chapter 5 include an inventory of the ICTs available at the TVET colleges and a discussion of how the various ICTs were utilised.

CHAPTER 5: FINDINGS OF THE ICT SURVEY (PHASE 1)

5.1 Introduction

This chapter presents the findings generated during Phase 1 of the study, which examined the distribution of information and communication technology (ICT) infrastructure and use across the nine public Technical and Vocational Education and Training (TVET) colleges in KwaZulu-Natal (KZN). The study's first phase involved a technical survey that aimed to map the distribution of ICT resources, identify the institutional and environmental factors shaping adoption, and assess the ways in which digital technologies are being integrated into teaching and learning. These findings speak directly to the study's first research question and its related objective, which focuses on the spatial and institutional availability of ICTs, the organisational conditions affecting their adoption, and the usage patterns that define their pedagogical application.

The presentation of findings in this chapter is structured around three interrelated dimensions. The first examines the distribution of ICT infrastructure and services across TVET colleges, including their network configurations, hardware inventories, and internet access arrangements. The second dimension focuses on the institutional responses to ICT constraints, highlighting how colleges navigate infrastructure limitations through internal strategies and external partnerships. The third explores the use of digital technologies for teaching and learning, engaging with lecturer skills, pedagogical compatibility, and perceptions of digital integration within TVET classrooms. Each of these dimensions aligns with a corresponding research objective, offering a layered view of how digital equity and innovation are unfolding in the provincial TVET sector.

The chapter is analytically grounded in Affordance Theory, which conceptualises ICT adoption as the outcome of dynamic interactions between users, technologies, and the environments in which they operate. In this framework, affordances are not just technical possibilities but the perceived and real capacities that emerge at the intersection of institutional structures, user competencies, and socio-material conditions. The study employs this lens to evaluate how environmental conditions, such as geography and physical infrastructure, shape technological access; how technological affordances guide strategic decisions on ICT deployment; and how user-level factors influence the translation of access into meaningful pedagogical practice.

In addition to the affordance lens, the chapter introduces elements of Diffusion of Innovation (DOI) theory to deepen the analysis of how ICTs spread unevenly through differentiated institutional contexts. DOI theory draws attention to the socially mediated processes through which innovations are introduced, evaluated, trialled, and either adopted or resisted within a given system. By bringing this perspective into dialogue with Affordance Theory, the study is able to address both the technical and social dimensions of ICT adoption in TVET colleges. Rather than treating adoption as a uniform or binary event, this chapter reveals the interdependent ways in which structural constraints, environmental contexts, and human agency influence how colleges implement and engage with digital technologies. Together, these theoretical frames allow for a nuanced account of the challenges and opportunities associated with digital transformation in the TVET sector. The subsequent sections offer a thematically organised analysis of the findings: the first section addresses the distribution pattern of ICTs across colleges; the second explores institutional factors influencing ICT adoption; and the third examines lecturers' use of digital technologies in teaching and learning.

The chapter focuses on findings that provide insights into the state of ICT infrastructure, usage patterns, and institutional support systems across the nine TVET colleges in KZN. The chapter opens with a technical overview of the ICT network configurations currently deployed at these institutions, including the nature of their hardware inventories, internet access mechanisms, and local connectivity strategies. It then examines the role of geographical context – specifically, how campus location, topography, and infrastructure availability influence the deployment and functionality of ICTs. The discussion also outlines the specific technical and strategic interventions colleges have adopted to overcome limitations in connectivity and network capacity. Finally, the chapter explores lecturers' perceptions and experiences of ICT integration within classroom settings, including barriers related to skills, digital pedagogy, and institutional support. Collectively, these findings address Research Objective 1, which sought to document the distribution pattern of ICT infrastructure and use across TVET colleges in KZN, and respond to Research Question 1: What is the distribution pattern of ICTs across TVET colleges in KwaZulu-Natal?

5.2 Distribution pattern of ICTs

The first dimension of the study focused on documenting the availability and configuration of ICT infrastructure across TVET colleges in KwaZulu-Natal (KZN). This analysis responds directly to Research Objective 1, which sought to document the distribution pattern of ICT infrastructure and use, and addresses Research Question 1: *What is the distribution pattern of ICTs across TVET colleges in KZN?* The findings presented in this section were generated in the technical survey phase (Phase 1) of the study, which generated a detailed institutional inventory of ICT hardware, internet infrastructure, digital access mechanisms, and platform usage. Rather than treating access to ICTs as a binary category – presence or absence of ICTs – this section explores the quality, functionality, and strategic deployment of digital infrastructure across different institutional and geographic contexts.

Drawing on insights from the digital divide literature, the analysis in this section foregrounds the uneven spatial and institutional distribution of ICTs, which reflects underlying structural disparities in infrastructure investment, service provision, and institutional capacity. These disparities mirror broader social inequities that shape the differential availability of ICT resources across South African education systems. In support of this analysis, the section draws conceptually on DOI, which frames ICT adoption not as a linear or uniform process, but as a socially embedded dynamic shaped by institutional characteristics, historical legacies, and environmental conditions (Rogers, 1962; 2003). When applied to the South African TVET landscape, this theory allows for a nuanced understanding of how technological innovations are adopted, resisted, or repurposed based on institutional location, governance arrangements, and infrastructure readiness.

The findings presented in this section illustrate that access to ICTs is not simply a question of hardware availability, but one of technological equity – of how colleges' geographic location, service infrastructure, and internal resources condition their capacity to leverage ICTs. In this context, the concept of access must be expanded to include not only physical presence but also issues of bandwidth, usability, reliability, and contextual relevance. The following subsections examine these dynamics in greater detail, beginning with a conceptual framing of digital distribution and equity, followed by an analysis of institutional inventories and spatial variability.

5.2.1. Conceptual framing: Digital access and ICT diffusion

Understanding the distribution of ICTs across TVET colleges in KZN requires moving beyond a simple inventory of devices or internet access points. The disparities in ICT infrastructure availability, bandwidth reliability, and platform integration reflect deeper structural inequalities rooted in the rural-urban spatial divide, uneven resource allocation, and institutional capacity. These disparities emerged clearly in the findings: for instance, rural campuses consistently reported slower connectivity, less access to qualified IT support, and fewer devices – ICT or otherwise – deployed for teaching and learning, despite comparable policy mandates. In contrast, colleges in or near urban centres exhibited more advanced infrastructure, better integration of learning management systems (LMSs), and greater consistency in device availability.

These observations underscore a critical analytical insight that ICT adoption does not operate as a binary condition but as a gradient of opportunity, shaped by intersecting spatial, infrastructural, and administrative factors. Hardware and internet presence alone do not guarantee meaningful ICT engagement; instead, access is mediated by local interpretations of need, capacity for maintenance, and the adaptability of available systems to institutional realities. These patterns – highlighted through variations in Wi-Fi coverage, LMS uptake, and the deployment of wireless technologies like VSAT or radio link – suggest that infrastructure choices are often as much about local constraints as technological or technical preference.

To make sense of these findings, the study draws conceptually on DOI (Rogers, 1962; 2003), which emphasises that institutional adoption of new technologies proceeds not in a linear or uniform manner, but in staged, context-sensitive ways. TVET colleges, differentiated by geographic location, legacy infrastructure, and governance arrangements, demonstrate varying rates of awareness, trial, and adoption. As the data reveal, some colleges were (at the time of data generation) in a state of experimentation – trialling pilot LMSs or slowly phasing in lecturer laptop distribution – while others had already outsourced core infrastructure to cloud-based services or achieved near-universal lecturer connectivity.

These staggered adoption pathways illustrate the usefulness of DOI theory in explaining ICT integration across a fragmented system. Moreover, by placing DOI theory in conversation with Affordance Theory, which is used throughout this chapter, the analysis can capture both the trajectory of innovation diffusion and the conditions of use that mediate uptake. Adoption, in this light, is not solely about ICT availability, but about how geography, infrastructure, and user dynamics converge to render ICTs either functional or inert. This conceptual framing provides the backdrop for the detailed empirical patterns that follow.

5.2.2. Mapping ICT availability: Hardware, connectivity, and access

The technical survey conducted during Phase 1 generated a detailed inventory of the ICT infrastructure available at the nine public TVET colleges in KZN. This included information on hardware distribution, internet connectivity, Wi-Fi availability, learning management system (LMS) adoption, and strategies to extend internet access beyond campus hours. These data points provide insight into the material conditions shaping digital engagement across institutions and highlight significant variations in ICT availability and configuration. While this inventory offers a useful snapshot of ICT availability, it also raises a critical question about the nature of ‘access’ in the context of digital equity. The presence of hardware alone, even when specified by type, does not necessarily reflect the quality of access (Fuchs & Horak, 2008; Graham & Dutton, 2019; Napoli & Obar, 2020). While all colleges reported some level of ICT provisioning, the extent, functionality, and institutional integration of these technologies differed markedly between sites.

Table 4 below presents a comparative inventory of the core ICT components across the surveyed colleges:

Table 4: Inventory of ICTs at the nine TVET colleges in KwaZulu-Natal, South Africa

College	Hardware	Internet	Wi-Fi	LMS	Off- campus
KZN TVET A	Classroom projectors PCs (student and staff labs) Laptops (senior lecturers)	Fibre SD-WAN MPLS VSAT	No	No	zero-rated sites data bundles for staff
KZN TVET B	Roving projectors PCs (student and staff labs) Laptops (senior lecturers)	MPLS WAN	Yes	No	zero-rated sites data bundles for staff
KZN TVET C	Classroom projectors PCs (student and staff labs) Laptops (all lecturers)	MPLS VSAT	Yes	Moodle	Offline student app
KZN TVET D	Classroom projectors Classroom smartboards PCs (student and staff labs) Laptops (all lecturers)	Fibre ADSL	Yes	Moodle (pilot) Majuba LMS (custom- built)	zero-rated sites data bundles for staff

KZN TVET E	Computer Lab projectors PCs (student and staff labs) Laptops (all lecturers)	Fibre	No	Moodle	zero-rated sites
KZN TVET F	Roving classroom projectors PCs (student and staff labs) Laptops (senior lecturers)	Fibre VSAT Microwave Network	Yes (admin block only)	Moodle	zero-rated sites data bundles for staff
KZN TVET G	Classroom projectors Classroom smartboards PCs (student and staff labs) Laptops (all lecturers)	Fibre	Yes	Moodle	zero-rated sites data bundles for staff
KZN TVET H	Classroom projectors PCs (student and staff labs) Laptops (all lecturers)	Fibre Radio-link Diginet	No	StudentHub 'Planet Learning' (pilot)	zero-rated sites data bundles for staff
KZN TVET I	Roving projectors PCs (student and staff labs) Laptops (senior lecturers)	Fibre Microwave Network	Yes	under procurement	zero-rated sites data bundles for staff

As Table 4 illustrates, all surveyed colleges had invested in basic ICT infrastructure, such as PC labs and classroom projectors. However, there were notable disparities in the depth and reach of ICT access. For instance, only five colleges had issued laptops to all lecturers, while the others had restricted laptop access to senior staff. Similarly, although every institution reported some form of internet connection, Wi-Fi availability was uneven, with three colleges reporting no campus-wide wireless access, and one restricting it to administrative blocks only.

The adoption of learning management systems (LMSs) was also inconsistent. Four colleges reported full or pilot use of Moodle, while two were experimenting with custom-built systems or niche platforms such as StudentHub or Planet Learning. One college indicated its LMS was still under procurement, and two had no LMS integration at all, reflecting divergent approaches to digital pedagogy and institutional readiness.

Furthermore, while the majority of colleges implemented zero-rated access and subsidised data as off-campus solutions, only one institution offered an offline student app to extend learning continuity in low-connectivity areas. These trends illustrate that while ICT infrastructure is present across the system, its functionality and alignment with teaching and learning remain fragmented.

The findings affirm that access cannot be measured solely by the presence of devices or platforms. Instead, meaningful ICT availability must account for factors such as the quality of internet service, integration of platforms into teaching practice, and equitable device access among staff and students. The next section further unpacks these differences by examining how geographic location interacts with infrastructure availability, shaping the digital capabilities of each college within its local context.

5.2.3. *Geographic inequities: Spatial distribution and affordances*

The findings revealed that geographic location plays a defining role in shaping the accessibility, reliability, and functionality of ICT infrastructure across TVET colleges in KZN. Colleges situated in urban centres – such as KZN TVET B, KZN TVET D, and KZN TVET H – reported more consistent internet connectivity, closer proximity to fibre networks, and greater access to external service providers. In contrast, colleges located in rural or peri-urban regions contended with a range of access challenges, including limited bandwidth, shared internet infrastructure, and unreliable service provision. These geographic disparities reflect the uneven distribution of ICT infrastructure in South Africa and underscore the enduring impact of spatial inequality on institutional development.

Across multiple institutions, rural campuses were found to suffer from slow or intermittent internet speeds due to their distance from core ICT service infrastructure. In two instances – KZN TVET A and KZN TVET C – colleges reported that their rural campuses were required to share bandwidth with nearby institutions, leading to regular disruptions and insufficient capacity for e-learning. One IT official (IT0001, KZN TVET A) stated:

“[For the college’s rural campuses, their] Bandwidth is shared with other colleges [located nearby]. Shared bandwidth leads to very slow internet connection and at times there is no internet connection at all.”

While another IT official (IT0008, KZN TVET H) reflected on the stark contrast between urban and rural campus experiences:

“The biggest challenge is the infrastructure backbone available to each campus; for instance, urban campuses like Richards Bay experience less connectivity issues when compared to rural campuses like Nkandla. This [challenge] is primarily due to the fact that the urban campuses are catered for when it comes to infrastructure while the rural ones are forgotten or neglected.”

These accounts reveal not only the technical limitations experienced by rural campuses but also the perception of being excluded from mainstream infrastructure investment.

The findings also indicated that geography shapes service delivery and decision-making at both technical and strategic levels of the college. Colleges with campuses in remote locations had more limited access to ICT vendors, faced longer wait times for technical maintenance, and were more likely to adopt workaround strategies to offset service gaps, such as relying on Very Small Aperture Terminals (VSATs) or radio link technologies, or collaborating with local radio stations to broadcast lessons. While these strategies demonstrated adaptability, they were often reactive, reflecting institutional attempts to compensate for infrastructural deficits rather than expand affordances.

In affordance terms, geography acts as an environmental filter that conditions what is technically possible for TVET colleges. Urban campuses are afforded a wider range of technology choices, more responsive maintenance, and smoother integration of cloud services. Conversely, rural campuses face constrained affordances – not because the technology is unavailable in the abstract, but because the environment restricts its functionality. This reflects Gibson's (2015) conception of environmental affordances, wherein the physical characteristics of a setting determine the scope of interactions between users and objects. In this case, the ICTs may be technically capable, but their affordances are muted by distance, uneven investment, and infrastructural neglect.

Beyond access and usability, these patterns also raise critical equity considerations. The unequal distribution of ICT functionality means that students and lecturers in rural settings are not afforded the same opportunities for digital engagement, skill acquisition, or innovation as their urban counterparts. As such, the spatial configuration of infrastructure reproduces educational inequality, embedding structural disadvantage into the digital transformation process. While some institutions adopted creative responses – such as zero-rated mobile data initiatives or targeted e-learning for remote campuses – their effectiveness was limited by the very spatial constraints they sought to overcome.

These findings highlight the need for policy interventions that move beyond universal ICT provisioning toward targeted investment strategies that address regional disparities. A one-size-fits-all approach fails to account for the spatial politics of infrastructure development and risks deepening the digital divide between TVET colleges and across campuses of the same college. Instead, a differentiated strategy that recognises geography as a structuring force is required; one that treats rural colleges not as outliers, but as institutions in need of deliberate infrastructural and pedagogical support.

5.2.4. Beyond the device: Physical infrastructure as an affordance of access

Beyond geographic location and network configuration, the physical infrastructure within TVET colleges emerged as a significant factor shaping the availability and use of ICTs. While all nine colleges had some form of computer laboratory infrastructure—usually shared by students and lecturers—there were clear disparities in the quality, distribution, and adequacy of physical teaching and learning spaces, particularly between urban and rural campuses.

Most institutions had equipped their staff and student labs with PCs and data projectors, with several colleges piloting classroom-based smartboards or mounted projection units. However, findings revealed that infrastructure disparities followed spatial and historical patterns: urban campuses reported better-maintained labs and more reliable access to utilities, while rural campuses were more likely to contend with overcrowded labs, intermittent electricity, limited maintenance capacity, and insecure facilities for ICT hardware.

Respondents from multiple colleges stressed the foundational nature of physical infrastructure in enabling digital engagement. One IT official (IT0008, KZN TVET H) noted,

“We need to ensure that we provide proper infrastructure for all campuses, especially in rural areas, as they have never been adequately catered for in the past.”

The same IT official (IT0008, KZN TVET H) further elaborated that:

“The rural campuses are falling behind their urban counterparts because their internet infrastructure is not able to fully support the internet demands of teaching and learning.”

These reflections underscore the fact that ICT integration is contingent on basic infrastructural readiness, not only in terms of device provisioning but also the physical environments that support stable power supply, classroom layout, and secure storage.

Drawing on Ezumah's (2020) work, which emphasises the hierarchy of infrastructural needs in rural TVET institutions, the findings suggest that ICT adoption efforts cannot succeed unless they are supported by investments in core amenities. In several cases, colleges were required to prioritise the maintenance of buildings and utilities before implementing upgrades to ICT infrastructure. This reality constrained the scale and scope of ICT adoption initiatives and diverted attention from long-term digital strategy to short-term operational viability.

In affordance terms, physical infrastructure represents a foundational layer of the institutional environment that either enables or restricts the functionality of ICTs. A well-equipped lab affords opportunities for shared learning, experimentation, and multimedia instruction. A crumbling or overcrowded facility, by contrast, transforms ICT access into a constrained and frustrating experience. Here, affordances are not about the device itself but about the conditions of use; a projector in a climate-controlled classroom with stable electricity functions very differently from the same device in a space with frequent outages and limited security.

Ultimately, the state of physical infrastructure intersected with geographic affordances to create distinct institutional profiles of ICT functionality. TVET colleges located in rural areas with weak utility infrastructure faced a double burden: limited access to broadband and inadequate physical environments to host digital tools and digital learning platforms. These findings confirm that sustainable ICT integration cannot proceed without strategic attention to the enabling material conditions – including buildings, electricity, and campus layout – that make digital teaching and learning viable in practice.

5.2.5. Reflections on access and equity

The findings presented in this section underscore the complex and layered nature of ICT access across KZN's public TVET colleges. While all institutions surveyed reported having core ICT infrastructure in place – such as computer labs, networked devices, and internet connectivity – the quality, consistency, and institutional integration of these technologies varied markedly. This variation was most visible along spatial and infrastructural lines, where colleges with campuses situated in or near urban centres demonstrated stronger connectivity, more robust infrastructure, and greater technical capacity than those operating in rural or peri-urban contexts.

These disparities suggest that ICT access must be conceptualised not merely in terms of technological presence, but in terms of the institutional and environmental conditions that enable or constrain its educational use. Affordance Theory proved instrumental in illustrating how ICTs do not function identically across settings, but are instead shaped by user capabilities, institutional context, and environmental variables. A well-resourced campus with reliable internet and upskilled staff may actualise a device's full pedagogical potential, while a rural campus with limited bandwidth, strained infrastructure, and under-supported staff may experience the same technology as fragmented or ineffectual. In this way, access is not a fixed or neutral condition – it is mediated by institutional realities and expressed through degrees of functionality.

Similarly, the use of DOI helped highlight how institutions progress through different adoption pathways based on local configurations of readiness, leadership, and external support. Colleges that had previously invested in digital platforms, staff development, and external partnerships appeared more likely to experiment with new technologies or adopt cloud-based solutions. Others remained at earlier stages of trial or awareness, constrained by infrastructural deficits or cautious internal cultures. These diverse trajectories reflect not resistance per se, but the differentiated capacities that shape what is possible at each site.

Taken together, the findings invite reflection on the equity implications of ICT distribution. While there was no single absence of access, there were clear gradients in the quality of digital engagement across the system. In some cases, colleges were able to leverage ICTs to support e-learning, extend internet access to students off-campus, or embed LMSs into their curriculum. In others, access remained contingent on lab scheduling, data constraints, or informal workarounds. These dynamics suggest that efforts to promote digital inclusion in TVET cannot

rely solely on technical provisioning. They must also consider the spatial, infrastructural, and organisational landscapes into which technologies are introduced.

The patterns discussed here reinforce the idea that addressing digital inequality in TVET contexts requires a multi-layered strategy—one that moves beyond device counts and technical inputs to engage with the contextual factors that determine how ICTs are used, maintained, and embedded into everyday institutional life. While individual colleges are making important strides, sustained and equitable digital transformation across the sector will likely require targeted investments, context-responsive support, and policy strategies that recognise the differentiated conditions under which ICTs are deployed.

5.3 Institutional factors influencing ICT adoption

While the previous section examined how geography and infrastructure shape the distribution of ICTs across KwaZulu-Natal's (KZN) TVET colleges, this section shifts focus to the institutional logics, governance structures, and strategic responses that influence how digital technologies are adopted – or constrained – in practice. This analysis responds directly to Research Objective 2, which sought to identify institutional factors influencing the adoption and implementation of ICTs, and addresses Research Question 2: *What institutional factors influence the adoption of ICTs across TVET colleges in KZN?*

The section is analytically grounded in two complementary theoretical lenses: Affordance Theory and Institutional Design Theory (IDT). Affordance Theory, as outlined in Chapter 3, conceptualises ICT adoption as a relational process shaped by the interaction between users, technologies, and institutional environments (Gibson, 2015; Norman, 2013; Davis & Chouinard, 2017). It highlights how technologies do not carry fixed meanings or uses, but instead offer action possibilities that are interpreted and enacted differently depending on institutional culture, leadership, and pedagogical priorities. As one IT official (IT0005, KZN TVET E) noted:

“The Internet is used mainly for computer-related courses, e.g. computer literacy. Internet is used for e-learning. They [the lecturers] do their own thing. E-learning doesn't cover all the campuses; the focus is on the smaller campuses [Community Development Centres (CDCs)]. CDCs are very remote, and e-learning departments are trying to support CDC students, [limiting] the need to travel to lessons. E-learning is mainly at remote CDCs.”

This underscores the idea that affordances are not simply technical; they are perceived, negotiated, and enacted within specific organisational and pedagogic contexts.

To deepen this analysis, the section also draws on Institutional Design Theory, which focuses on how formal rules, governance systems, and organisational routines shape institutional behaviour (March & Olsen, 2003; Ostrom, 2005). In the South African TVET context, where colleges are formally autonomous but practically constrained by centralised funding and policy directives (DHET, 2017; Holler et al., 2023), IDT provides a lens for understanding how institutional capacity, decision-making authority, and external dependencies influence ICT strategy. As one Deputy Principal (DP0007, KZN TVET G) explained:

“We are working with CISCO, which uses a ‘champions’ approach and then a ‘train the trainer’ approach. It doesn’t quite work for the smaller colleges. They’ve given us some content and free courses to capacitate the lecturers, but we have found that most of the lecturers haven’t bothered to take them.”

This reflects how institutional design – particularly around incentives, communication, and accountability – can shape the uptake of even well-intentioned initiatives.

Together, these frameworks allow for a layered analysis of ICT adoption: Affordance Theory helps explain how institutions interpret and act upon digital opportunities, while IDT reveals how those interpretations are structured by governance arrangements, resource flows, and organisational norms. The subsections that follow examine these dynamics through five interrelated themes: how institutions perceive affordances, how they respond to technical constraints, how governance and autonomy shape decision-making, how institutional culture and capacity influence readiness, and how these factors converge to produce differentiated ICT adoption strategies across the TVET sector.

5.3.1. *Interpreting institutional affordances*

Building on the spatial-inequity patterns identified in Section 5.2, this subsection turns to how colleges interpret the ICT affordances within their organisational environments. The adoption and integration of ICTs within TVET colleges are not solely determined by infrastructure availability or policy mandates. Rather, they are shaped by how institutions perceive, interpret, and act upon the possibilities that technologies afford within their specific contexts. Drawing on Affordance Theory, this section explores how colleges interpret their environments and technologies, and how these interpretations influence strategic decisions around ICT use. Affordances, in this sense, are not fixed properties of technologies but relational features that emerge through the interaction between institutional actors, their environments, and the tools at their disposal (Gibson, 2015; Norman, 2013; Davis & Chouinard, 2017).

As the findings indicate, TVET colleges varied significantly in how they responded to similar infrastructural constraints. For example, while KZN TVET A and KZN TVET C reported shared bandwidth arrangements that led to frequent disruptions, KZN TVET G and KZN TVET D had invested in fibre and custom-built LMS platforms, enabling more stable and integrated digital environments. These divergent responses suggest that affordances are not simply “there to be used,” but must be perceived as actionable and meaningful within a given institutional contexts (Gaver, 1991; Chemero, 2003). This aligns with Davis and Chouinard’s (2017) argument that affordances are co-constructed through practice, shaped by both the material properties of technologies and the interpretive frameworks of users.

Participant accounts reinforced this interpretive dimension. As one curriculum development official (CD0001, KZN TVET A) explained:

“[The] college engaged with KZNTV1, [a DSTV channel] and televised lessons were created and shared. [The college] also engaged with radio stations, and lesson recordings were created and shared via radio.”

This response illustrates how affordances are co-constructed through institutional creativity and contextual responsiveness. The college did not passively accept infrastructural limitations; instead, it interpreted its environment as affording alternative modes of delivery and mobilised partnerships to actualise them. In this way, affordances are not only shaped by technology design but by institutional logics, leadership orientation, and pedagogical alignment (Majchrzak

et al., 2013; March & Olsen, 2003). This is echoed in the findings from KZN TVET H, where leadership explicitly prioritised infrastructure development in rural campuses to redress historical neglect.

Moreover, affordances are historically and spatially situated. TVET colleges located in rural areas often faced compounded constraints – not only in terms of infrastructure, but also in terms of institutional memory, staff turnover, and limited access to service providers. For instance, KZN TVET F and KZN TVET I reported that Wi-Fi was either restricted to administrative blocks or still under procurement, while KZN TVET D and KZN TVET G had already piloted or implemented LMSs and zero-rated access. These environmental affordances – or constraints – shaped how technologies were perceived and enacted. Colleges with prior exposure to donor-funded ICT adoption initiatives or stronger ties to industry partners were more likely to perceive ICTs as enabling tools, while others viewed them as burdensome or misaligned with their operational realities (Peixoto et al., 2015; Denhere & Moloji, 2021).

The indication from the findings is that affordances shift over time. Some colleges that had initially resisted cloud-based services or decentralised access platforms began revisiting those positions in response to shifting policy expectations, student demand, or peer benchmarking. For example, KZN TVET A transitioned from MPLS to SD-WAN and later to SABEN, reflecting a dynamic recalibration of perceived affordances in response to evolving institutional needs. This temporal dynamism reflects the non-linear nature of adoption described in DOI (Rogers, 2003) and reinforces the idea that affordances are emergent, contingent on context, and not static.

Notably, the perception of affordances is mediated by institutional design. Colleges with more decentralised decision-making structures, stronger ICT governance, and clearer strategic alignment – such as KZN TVET D and KZN TVET G – were better positioned to recognise and act upon affordances. Conversely, institutions with fragmented leadership or compliance-driven cultures often struggled to move beyond symbolic adoption. This was evident in KZN TVET E, where Moodle was technically available but underutilised due to limited staff engagement and weak institutional support. This suggests that affordances are not only relational but also institutionally filtered – what is perceived as possible is shaped by what is institutionally permissible or prioritised (Scott, 2008; Gibson et al., 2012).

In summary, this section underscores that ICT adoption in TVET colleges is not merely a function of technical availability. It is a relational, interpretive, and institutionally mediated process, shaped by how colleges perceive their environments, assess their capacities, and align technologies with their strategic and pedagogical goals. Institutional affordance interpretation is the lens through which identical infrastructures gain distinct purposes. In the next section, we explore how those interpretive frames translate into concrete responses to technical constraints.

5.3.2. Strategic responses to technical constraints

Having seen how colleges perceive and make sense of ICT affordances, we now examine the specific strategies they deploy to tackle bandwidth, connectivity, and support shortfalls. While infrastructural limitations were a common feature across the TVET sector, colleges did not respond to these constraints uniformly. Instead, the findings revealed a spectrum of strategic responses, shaped by institutional interpretation, leadership orientation, and perceived affordances. This section examines how colleges navigated bandwidth bottlenecks, connectivity gaps, and administrative limitations – not simply as passive recipients of constraint, but as active agents making context-sensitive decisions.

Three dominant response patterns emerged from the data:

a. Infrastructure augmentation

Several colleges pursued direct investment in physical infrastructure, including fibre upgrades, VSAT installations, and the expansion of Wi-Fi coverage. For instance, KZN TVET A reported a transition from MPLS to SD-WAN and later to SABEN Fibre, citing improved bandwidth and cost efficiency. As one IT official (IT0001, KZN TVET A) explained:

“[The college] had service provider that was providing network. Internet connection has varied. [We] had some challenges due to bandwidth. [The] service provider was using SD-WAN technology, which was a bit faster than previous MPLS. [We] have changed service providers now and again in [the] process of switching over to SABEN with MPLS and higher bandwidth.”

These decisions reflected a strategic reading of the environment: that long-term ICT integration required stable, scalable infrastructure. In some cases, colleges leveraged donor partnerships or DHET grants to support these upgrades, suggesting that institutional capacity to mobilise external resources was a key enabler. This aligns with IDT, which posits that governance structures and resource mobilisation capacity shape institutional responsiveness (March & Olsen, 2003; Ostrom, 2005).

b. Access expansion through local innovation

Other colleges adopted contextually adaptive strategies to extend access without overhauling infrastructure. For example, some institutions piloted offline LMS platforms or experimented with decentralised access models to support asynchronous learning in bandwidth-constrained areas. However, these efforts were often constrained by shared infrastructure and limited internal capacity. As one IT official (IT0003, KZN TVET C) explained:

“Neotel [was] previous internet [provider]. [Currently on] MPLS design that interlinks with six other TVETs sharing bandwidth. [This] causes strain in terms of connectivity... Not working well.”

This quote highlights how infrastructural arrangements – such as shared bandwidth across multiple institutions – can severely limit the perceived and actual affordances of digital platforms. Even when LMSs or cloud-based tools are technically available, their functionality is undermined by unstable connectivity, leading to fragmented or inconsistent user experiences. In such institutional contexts, affordances are not only constrained by the environment but also by institutional dependencies and legacy infrastructure (Gibson, 2015; Norman, 2013).

In response to these limitations, some colleges recognised the need to build internal capacity for digital content creation and support. As one IT official (IT0001, KZN TVET A) noted:

“Need [for] specialists for creating digital content. [We] need [a] multimedia specialist to train the staff on how to create content...”

This reflects a growing awareness that technical infrastructure alone is insufficient; TVET colleges must also invest in human capital and pedagogical support systems to translate access into meaningful use. The absence of such expertise can lead to underutilisation of platforms or reliance on low-tech workarounds, reinforcing the gap between provision and practice. As Davis and Chouinard (2017) argue, affordances are not just about what technologies can do, but about what institutions are able and willing to do with them, given their internal capacities and strategic priorities.

c. Outsourcing and externalisation of ICT services

A third strategic response to ICT adoption observed across several colleges involved the outsourcing of ICT services and the externalisation of key digital functions. This approach was often adopted as a pragmatic response to internal capacity constraints, particularly in institutions with limited technical staff or fragmented ICT governance structures, such as KZN TVET B, KZN TVET F, and KZN TVET I. These TVET colleges outsourced a range of services, including network administration, cybersecurity, learning management system (LMS) hosting, and digital content delivery. While this strategy enabled institutions to access specialised expertise and reduce the burden on internal teams, it also introduced new dependencies and governance challenges.

In some cases, colleges relied on external service providers to manage their core network infrastructure, including transitions between different connectivity technologies such as MPLS, SD-WAN, and SABEN Fibre – KZN TVET A. These transitions were often iterative and marked by variability in service quality, reflecting the complexities of managing outsourced infrastructure in environments with uneven broadband access. Similarly, several colleges partnered with third-party organisations to deliver digital content or facilitate lecturer training through externally hosted platforms – KZN TVET H. While these partnerships expanded access to resources, they were not always aligned with institutional needs or lecturer capacity, leading to uneven uptake and limited pedagogical integration.

The externalisation of ICT services, while offering short-term efficiencies, raised important questions about institutional autonomy, digital sovereignty, and long-term sustainability. Colleges that lacked robust internal ICT strategies or monitoring mechanisms were particularly vulnerable to fragmented implementation and reduced control over critical digital infrastructure. These findings align with Rohyans et al. (2019), who caution that while outsourcing can

streamline operations, it may also dilute institutional ownership and hinder the development of internal digital capacity.

Overall, the reliance on external actors to manage core ICT functions reflects a broader tension in the sector: the need to rapidly expand digital capabilities in the face of constrained resources, without compromising institutional coherence or pedagogical relevance. This underscores the importance of developing context-sensitive outsourcing strategies that are embedded within clear governance frameworks and aligned with long-term digital transformation goals.

Across all three approaches, the findings suggest that strategic responses to ICT adoption were shaped by both perceived affordances and institutional design. Colleges with stronger ICT governance structures and clearer strategic alignment were more likely to pursue proactive, integrated solutions. In contrast, institutions with fragmented leadership or compliance-driven cultures tended to adopt reactive or symbolic measures. This reinforces the idea that technical constraints do not determine outcomes; rather, they are mediated by how institutions interpret, prioritise, and act upon them (Scott, 2008; Davis & Chouinard, 2017). Institutional sense-making leads to three distinct response patterns – augmentation, local innovation, and externalisation – which scaffold or stifle ICT uptake. Section 5.3.3 will show how these strategies play out at the user level.

5.3.3. *User affordances: Constraints and sentiments*

Following institutional strategies, this section investigates how those responses are enacted – or resisted – by individual lecturers. While earlier sections examined how institutions interpreted affordances structurally and strategically, this subsection shifts focus to the individual-level dynamics shaping ICT adoption – particularly among lecturers. Drawing on Affordance Theory and the concept of “reinvention” from [DOI] (Rogers, 2003), the analysis explores how user experiences, perceptions, and pedagogical orientations influenced the degree to which digital technologies were embraced, resisted, or transformed in practice.

a. Lecturer agency and digital competence vary widely across colleges.

Even when infrastructure and platforms were in place, uptake was uneven – shaped by individual skill, confidence, and perceived pedagogical fit. This aligns with Davis and Chouinard’s (2017) emphasis that affordances are not determined by technology alone, but by users’ ability and willingness to see particular tools as relevant and usable within their local contexts.

A recurring theme across multiple colleges was the heterogeneity of digital competence among staff. While some lecturers were proactive adopters – experimenting with blended learning or using messaging apps to distribute assignments – others expressed discomfort or disinterest. As one Deputy Principal (DP0007, KZN TVET G) explained:

“One of the barriers is that lecturers, especially in the rural areas, are not computer savvy or Internet savvy. They are literate – they can do the basics – but when you introduce Moodle, it becomes a huge obstacle, and the first thing lecturers say is they want training on it. So, we are not ready yet to move to online learning.”

This response echoes research by Aina and Ogegbo (2022), who found that digital literacy gaps among South African TVET lecturers significantly hindered the pedagogical integration of ICTs, even when infrastructure was available. Similarly, Mhlanga and Moloji (2020) argue that digital competence is not merely a technical skill but a pedagogical disposition – requiring confidence, contextual understanding, and alignment with teaching goals.

Moreover, the unevenness in digital competence often mirrored broader spatial inequalities. Lecturers in rural campuses were more likely to report limited exposure to ICTs, fewer opportunities for professional development, and lower confidence in using digital tools. This reinforces the argument that user affordances are not evenly distributed, but are shaped by geography, institutional support, and prior experience.

b. ICT integration workload: Content creation, demands and constraints.

Several colleges reported that lecturers struggled with the time and expertise required to create digital content. This was especially pronounced in institutions where LMSs had been implemented but support structures were limited. As one IT official (IT0004, KZN TVET D) noted:

“[There is a] Need [for] specialists for creating digital content. [We] need [a] multimedia specialist to train the staff on how to create content...”

This reflects a broader tension between technical provision and pedagogical support. As Denhere and Moloji (2021) observe, the success of digital platforms in TVET settings depends not only on access but on the availability of instructional design support and time for content development. Without these, lecturers often default to low-tech tools or avoid digital integration altogether.

This finding also aligns with the concept of latent affordances (Davis & Chouinard, 2017) – where the potential of a technology remains unrealised due to contextual constraints. In this case, the LMS may afford asynchronous learning, but that affordance is inaccessible without time, training, and content development support. The result is a gap between technical capability and pedagogical enactment, which undermines the transformative potential of ICTs.

Furthermore, this challenge is compounded by the absence of workload recognition for digital content creation. As Mbatha (2024) notes, lecturers often perceive digital integration as an “add-on” rather than an embedded part of their teaching responsibilities, particularly when institutional incentives and performance metrics remain tied to traditional delivery modes.

c. ICT hesitance and fear of redundancy shape lecturer attitudes.

Beyond skills and workload, the findings revealed that some lecturers viewed ICTs with suspicion or anxiety. In particular, the shift toward digital platforms was perceived by some as a threat to job security. As one Deputy Principal (DP0007, KZN TVET G) shared:

“Lecturers are experiencing fear of the unknown. Some think that with the move to the 4IR, they might become redundant.”

This sentiment underscores the affective dimension of affordances – where technologies are not only tools but symbols of institutional change. Resistance, in this context, is not merely technical but cultural and emotional. As Rogers (2003) notes, innovations that are perceived as disruptive to professional identity or job security are more likely to be resisted, regardless of their technical merits.

This finding resonates with Frei-Landau et al. (2022), who argue that digital transformation in education often triggers identity dissonance among educators – particularly when change is rapid, top-down, or poorly communicated. In the TVET context, where many lecturers have built their careers around hands-on, workshop-based instruction, the shift to digital platforms can feel alienating or even threatening.

Moreover, this fear is not unfounded. As Kana and Letaba (2024) point out, the introduction of digital platforms in South African TVET colleges has often been accompanied by ambiguous messaging about the future of teaching roles, fuelling anxiety and resistance. Addressing these concerns requires more than technical training; it demands transparent communication, participatory planning, and reassurance about the evolving role of educators in digitally mediated environments.

These findings collectively reinforce the argument that a meaningful ICT adoption strategy must foreground the user experience. Infrastructure and policy may set the stage, but lecturer confidence, capacity, and pedagogical alignment ultimately determine how technologies are taken up – or left behind – at the level of the classroom. Affordance Theory serves as a reminder that technologies afford possibilities, but do not guarantee outcomes. Whether those possibilities are recognised, valued, and enacted depends on how individuals perceive and inhabit their roles within educational systems. Lecturer agency, competence, and emotion play a significant role in

shaping institutional plans. The meta-analysis in Section 5.3.4 will reveal the cross-cutting patterns that emerge when we step back from these details.

5.3.4. *Synthesising empirical trends*

The findings show that ICT affordances across TVET colleges are fundamentally relational rather than uniform. Identical technologies – whether it’s LMS platforms, broadcast partnerships, or messaging apps – did not yield consistent outcomes, but instead took on meaning according to how institutional actors and lecturers interpreted their potential. For instance, one college embraced local radio broadcasts as an innovative pedagogical channel, while another regarded the same approach as a marginal workaround. This finding echoes Gibson’s (2015) assertion that affordances emerge only in relation to user goals and environmental context, Gaver’s (1991) distinction between perceived and real affordances, and Norman’s (2013) warning that design attributes alone cannot guarantee uptake. In our data, these perceptions were shaped by leadership vision, prior experience with digital pilots (Peixoto et al., 2015), and prevailing institutional norms around innovation.

Strategic responses to technical constraints were likewise informed as much by interpretive schemas as by material limitations. Although shared bandwidth and infrastructure bottlenecks set the stage, colleges framed those constraints in different ways: some pursued fibre roll-outs and SD-WAN solutions to circumvent connectivity gaps, while others viewed the same constraints as justification for postponing digital ambitions. This pattern aligns with IDT’s insight that formal rules are mediated through leadership interpretations (March & Olsen, 2003). It also extends Davis and Chouinard’s (2017) view that affordances are co-constructed through practice, showing how governance structures – such as ICT steering committees – filtered which strategic options were seen as viable or cost-effective.

Even in institutions with robust infrastructure and clear strategies, the ultimate reach of those affordances depended on user-level dynamics. Lecturers’ confidence, time pressures, and pedagogical orientations determined whether available tools were activated or left dormant. Feelings of overload, fear of redundancy, and low digital literacy meant that many technical possibilities remained latent, consistent with Rogers’ (2003) “reinvention” principle. Studies by Aina and Ogegbo (2022) and Mhlanga and Moloji (2020) similarly document how skill gaps and affective barriers block meaningful technology use in South African TVET contexts. Without targeted support – such as workload recognition, scaffolded training, and participatory planning

– lecturers’ informal innovations (for example, WhatsApp-based quizzes) stayed isolated rather than becoming embedded practices.

Combined, these trends underline that ICT adoption in TVET is never just about devices or platforms. It is enacted through nested relationalities between institutional structures and interpretive frameworks, between strategic agency and environmental constraint, and between technological promise and user-level activation. Recognising this complexity is essential for moving beyond device counts or compliance checklists toward integrated interventions that align policy, governance, and pedagogy in service of transformative educational practice.

Table 5 below provides a structured overview of the key analytical insights derived from the findings in this chapter. The table summarises the interplay between institutional decision-making, technological affordances, and systemic constraints shaping ICT adoption in TVET colleges. The findings are framed by a synthesis of DOI, Affordance Theory, and IDT as analytical lenses. This framework highlights the core factors influencing digital integration, offering a nuanced understanding of the challenges and opportunities within the TVET sector.

Table 5: Analytical overview of ICT adoption in KZN TVET colleges

Thematic Area	Key Insights	DOI Perspective	Affordance Theory Perspective	IDT Perspective
Environmental Affordances and ICT Accessibility	ICT adoption varies significantly across urban and rural campuses due to disparities in internet connectivity, power supply, and access to ICT service providers. Colleges in rural areas face systemic barriers, necessitating alternative strategies like bandwidth sharing and radio-based teaching.	Rural colleges experience slower ICT diffusion due to infrastructural constraints, limiting their ability to reach the implementation stage of the innovation process.	Environmental affordances dictate whether ICTs can be effectively utilised; the presence of technology does not automatically translate to meaningful access.	Institutional ICT strategies must consider external constraints, adapting technologies to local conditions rather than assuming universal applicability.
Technological Affordances and Institutional Strategies	Colleges employ different ICT strategies: augmenting physical infrastructure, expanding wireless networks, or outsourcing network administration. Each approach presents trade-offs between sustainability, cost, and institutional control.	The decision to adopt ICT solutions is influenced by perceived advantages, compatibility with existing systems, and financial feasibility.	The perceived affordances of ICTs shape decision-making; colleges prioritise investments that align with operational constraints.	Institutions must balance long-term sustainability with short-term needs, requiring adaptive strategies to navigate technological and financial limitations.
User Affordances and ICT Integration Challenges	Lecturer resistance, limited digital literacy, and workload concerns impede ICT adoption, even where infrastructure is available. Training and support are critical for meaningful integration.	Adoption depends on user buy-in; without positive perceptions and adequate training, ICTs remain underutilised.	The effectiveness of ICTs depends on how users perceive and engage with them; ICTs must be designed with user needs in mind.	Institutional change requires targeted interventions to build digital confidence and address resistance to new technologies.
Synthesis	Successful ICT adoption requires an integrated approach that accounts for infrastructural realities, institutional strategy, and user engagement. Sustainable ICT implementation must go beyond infrastructure investment to include capacity-building and policy frameworks that promote digital equity.	ICT adoption follows a phased process, influenced by institutional readiness and external conditions.	ICT affordances are shaped by the broader socio-technical environment, requiring holistic strategies for meaningful engagement.	Effective ICT integration depends on institutional adaptability, stakeholder collaboration, and alignment with broader educational and economic goals.

5.4 Conclusion

Chapter 5 has mapped the multi-layered terrain of digital adoption across KZN's TVET colleges, moving from the uneven geography of ICT distribution to the interpretive work of institutions and the lived experiences of lecturers. We have shown that technology uptake is never merely a function of access or policy, but unfolds through a dynamic negotiation of relational affordances – where possibilities emerge at the intersection of infrastructure, strategy, and human agency.

At the institutional level, colleges actively interpreted their environments, crafting responses to constraints that ranged from fibre roll-outs and offline LMS piloting to creative broadcast partnerships and outsourcing arrangements. These studies illuminate how governance structures, leadership vision, and resource-mobilisation capacity shape which digital affordances are recognised and realised. Without coherent steering committees or integrated planning, even well-provisioned platforms can languish; conversely, agile, cross-functional teams can transform modest tools into pedagogical breakthroughs.

Equally crucial is the user dimension: lecturers' confidence, digital competence, and professional identity determine whether institutional affordances become enacted in classrooms or remain latent. We've seen how skill gaps, workload pressures, and fear of redundancy can block meaningful uptake—and how, in the absence of formal support, educators nevertheless innovate through informal channels like messaging apps, revealing the power of bottom-up “reinvention.” A truly transformative ICT strategy must therefore embed targeted training, recognise digital labour in workload models, and foster open dialogue about the evolving role of educators.

Taken together, these findings call for multi-level interventions that align technology provision, governance design, and pedagogical support. Policymakers and college leaders must move beyond compliance checklists to cultivate cultures of experimentation, build internal capacities, and nurture the interpretive frameworks through which affordances are perceived. This chapter's empirical insights set the stage for Chapter 6's institutional case studies, where we will delve deeper into how individual colleges harness – or struggle with – these intersecting forces to realise their digital visions.

CHAPTER 6: FINDINGS OF THE INSTITUTIONAL CASE STUDIES (PHASE 2)

6.1. Introduction

The study set out to explore the distribution of ICTs across TVET colleges across KZN and to gain insight into the institutional factors that affect the adoption of ICTs at these TVET colleges. The findings presented in this chapter were generated during the study's second data collection phase. The objective of this phase was to interrogate the processes and structures utilised by the TVET colleges to filter the various factors – such as external and external environments, stakeholder interests and relationships, pedagogic objectives, policy directives, and institutional culture – that may inform their ICTs adoption decisions and how these factors shaped the strategies the colleges used to integrate ICTs into teaching and learning. This phase of the study specifically investigates the social system of the TVET college, a key concept within the Diffusion of Innovation (DOI) theory. The internal dynamics of this social system, including its communication channels and organisational structure, are crucial for understanding how ICT adoption decisions are made and implemented.

The data collection methods utilised during this phase were based on concepts from the DOI and Institutional Design Theory [IDT] (Gibson et al., 2012; Rogers, 2003). Based on the concepts from these theories, this phase of the study focused on the dynamics of the institutional environment of three TVET colleges. This phase explored how those dynamics informed these colleges' approach to ICT adoption decisions. The study's second phase utilised semi-structured interviews and focus group discussions to gather data from participants on the roles and responsibilities of the colleges' institutional units in the colleges' ICT adoption strategies, the strategies utilised by the TVET colleges to integrate ICTs into teaching and learning practices, and the perceptions amongst individual staff members about utilising ICTs in their lessons. The chapter provides an overview of each TVET college, its history, ICT adoption at the college, e-learning at the college, and curriculum challenges. Additionally, the chapter will highlight how the colleges utilised their ICT inventory in response to COVID-19 and the teaching and learning restrictions that resulted from the lockdown regulations.

6.2. KZN TVET B

6.2.1. Geographic, demographic and economic profile of KZN TVET B

KZN TVET B is located in a commercial zone near the coast of KZN; its eight campuses cover urban, rural, and township settings. KZN TVET B's campuses are distributed across the eThekweni Metropolitan (eThekweni Metro) area and Ndwedwe Local Municipality (COGTA, 2020b; Elangeni TVET College, 2022; Ndwedwe Local Municipality, 2022). EThekweni Metro is located on KZN's east coast and has a population of 3.9 million people – 34.7% of the total population of KZN (COGTA, 2020b). Ndwedwe Local Municipality is one of four municipalities that constitute the iLembe District Municipality, which lies north of the eThekweni Metro and has a population of 143,117 (COGTA, 2020c; Ndwedwe Local Municipality, 2022). The economic activities in these areas include agriculture, forestry, retail, and manufacturing. EThekweni Metro has a diversified economy; the metro's four leading sectors – in terms of GDP proportions – are finance, community services, manufacturing, and trade (COGTA, 2020b). In contrast, approximately 8% of Ndwedwe's residents are employed in the formal sector, and the municipality's main economic activities are commercial and subsistence agriculture (Ndwedwe Local Municipality, 2022).

KZN TVET B was selected for the study because of the diverse communities the college's campuses service. The college has campuses in deep rural areas, townships, and one in the CBD. Additionally, the communities serviced by the college are on the periphery of the eThekweni Metro, and most of the population commutes to the metro for economic opportunities. The socioeconomic and geographic profiles of the college's surrounding areas present challenges that require the college to have a differentiated approach to ICT adoption. The researcher was interested in exploring how that spread of campuses affects their technical setup and how they approach ICTs, considering the variety of geographical and socioeconomic settings they must consider when formulating their ICT approach. These diverse settings represent varying environmental affordances, which, as Affordance Theory suggests, will significantly impact the potential for ICT use and the perceived versus actual benefits of different technologies.

eThekweni Metro is the third largest metropolitan municipality in the country, and the metro is divided into five municipal planning regions (MPRs); seven of KZN TVET B's campuses are scattered across three of these MPRs, the North, Central, and Outer West (COGTA, 2020b). According to the metro's IDP (2021), 57% of the population is below 35, and 62% is within the economically active age range (15 – 59). The metro has an average household size of 3.3, with 8,802 households in the metro headed individuals between the ages of 15 and 19, and female-headed households making up 42.14% of households (COGTA, 2020b; eThekweni Municipality, 2021). According to COGTA (2020b), 2.1 million of eThekweni's residents live below the poverty line, and according to Stats SA Community Survey (2016), 17.1% of the population reported having no income in 2016. A diversified economy characterises the metro; the top four sectors are finance (21%), community services (21%), manufacturing (19%), and trade (COGTA, 2020b).

Ndwedwe Local Municipality is one of four municipalities forming iLembe District Municipality, which lies north of the eThekweni Metro (Ndwedwe Local Municipality, 2022). The iLembe district has a total population of 657,612 people, with Ndwedwe's population making up 22% (143,117) of this figure (COGTA, 2020c). Ndwedwe municipality is a largely rural, traditional area, with 68% of the land under the authority of traditional leaders and administered by the Ingonyama Trust (Ndwedwe Local Municipality, 2022). The average size of households in the municipality is 4.2, with 55% headed by females and approximately 8% headed by individuals below the age of 15 (COGTA, 2020c). According to COGTA (2020c), 55% of the iLembe district's population lives below the poverty line, and 70,3% of those live in Ndwedwe. In addition, approximately 28% of those employed in Ndwedwe are in the formal sector, and 8% are in the informal sector. The area's main economic activity is commercial and subsistence agriculture (Ndwedwe Local Municipality, 2022).

6.2.2. Formation and growth of KZN TVET B

KZN TVET B was established through the merger of three public technical colleges in 2002 (Elangeni TVET College, 2022):

- a. Pinetown Technical College (Pinetown campus)
- b. Sivananda Technical College (KwaMashu campus)
- c. Ntuzuma Technical College (Ntuzuma campus)

By 2010, the college had grown and added five new campuses to the existing three (Elangeni TVET College, 2022):

- a. Qadi Campus
- b. Mpumalanga campus
- c. Ndwedwe campus
- d. KwaDabeka campus
- e. Inanda campus

Most of the college's campuses are located in peri-urban areas characterised by high levels of unemployment, illiteracy, and single-parent households (COGTA, 2020b, 2020c; Elangeni TVET College, 2022; Ndwedwe Local Municipality, 2022). The one exception is the Pinetown campus, which is located in an urban area (Elangeni TVET College, 2022). The college's northern campuses are in eThekweni Metro's Inanda, Ntuzuma, KwaMashu (INK) Area-Based Management and Development Zone (ABMD). This area is home to half a million residents in an area of 9,423 hectares; this constitutes one of the largest concentrations of low-income residential housing in South Africa (Elangeni TVET College, 2022). The college has tailored its programme offerings according to the economic zones surrounding the campuses to ensure their programmes are relevant and responsive to local contexts (Elangeni TVET College, 2022).

6.3. ICT infrastructure overview at KZN TVET B

This section presents the findings related to the technical infrastructure; the section lists the TVET college's ICT hardware, discusses the state of Internet access at the college, and presents an overview of the ICT challenges faced by the college. Additionally, this section provides critical information about the technological affordances present at KZN TVET B, as well as the environmental affordances related to existing infrastructure. These affordances will shape the possibilities for action within the college's teaching and learning environment.

6.3.1. *ICT infrastructure and hardware*

At the time of the study, KZN TVET B had had an ICT system for over ten years. They were initially connected to the Internet via the State Information Technology Agency (SITA) network (Assistant Director for IT [IT0002], unstructured interview, 19 August 2022; 31 March 2021). The college's network used a combination of Wide-Area Network (WAN) and Multiprotocol Label Switching (MPLS) infrastructure to distribute the Internet across its campuses (IT0002, unstructured interview, 19 August 2022; 31 March 2021). Each campus had computer labs set up separately for staff and students (IT0002, unstructured interview, 19 August 2022; 31 March 2021).

The number of computer labs on each campus differed according to the campus size; some had six labs, and others had two or three labs (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The computer labs were used primarily for lessons for ICT-related subjects, and students mainly accessed them during lesson time (IT0002, unstructured interview, 19 August 2022; 31 March 2021). After hours or between lessons, students could use the computer labs for various academic tasks such as typing assignments or conducting research (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The lecturers had been provided with a pool of roving data projectors to use for their lessons. Lecturers could access the roving data projectors from the administrators (IT0002, unstructured interview, 19 August 2022). According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), the college had plans to construct resource centres on each campus. However, that process had not moved beyond discussions at the management level. Each campus had been allocated a technician who provided technical support to the lecturers, students, and administrators (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The planned construction of resource centres represents an attempt to enhance the environmental affordances of the college, creating spaces

specifically designed to support ICT use. The presence of campus-based technicians directly addresses user affordances by providing readily available support to improve lecturers' and students' skills and confidence in using ICTs.

Regarding hardware, not all computer labs had mounted data projectors; most computer labs shared data projectors with the rest of the campus staff (IT0002, unstructured interview, 19 August 2022). According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), there were no significant differences in the technical specifications of the computers at each campus, and the computers themselves were similar. The most notable difference between the computers was their age; however, regardless of their age, the performance of the computers was similar (IT0002, unstructured interview, 19 August 2022). In this regard, the college was phasing in newer computers, adding more computers to the computer labs, and adding more computer labs (where space was available) (IT0002, unstructured interview, 19 August 2022). The college used data centres to host its web-based services and core servers. The data centres freed up more space on site for the college to add more computers and any other relevant hardware (IT0002, unstructured interview, 19 August 2022).

Similarly, the college planned to migrate its data from server storage to cloud-based platforms. For the classrooms, the college was in the process of procuring and installing smart screens (IT0002, unstructured interview, 19 August 2022; 31 March 2021). In addition, the college was phasing out and replacing old network infrastructure such as network switches, cables, and computers (IT0002, unstructured interview, 19 August 2022; 31 March 2021).

6.3.2. *Network connectivity and internet access*

The college's network used a combination of WAN and MPLS infrastructure to provide access to the Internet (IT0002, unstructured interview, 19 August 2022; 31 March 2021). According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), all the campuses were connected to the Internet. The college had also installed several Wi-Fi hotspots across its campuses, providing internet access for staff and students through designated SSIDs (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The internet speed varied from campus to campus; the cause of the variation was the high volume of users on the network and limited bandwidth (IT0002, unstructured interview, 19 August 2022; 31 March 2021).

As indicated above, lecturers received data packages worth 50 GB per month to facilitate remote teaching (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The data packages allowed lecturers to work from anywhere, conduct research, compile materials, and prepare lessons (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The data packages supplemented the laptops previously issued to the lecturers (IT0002, unstructured interview, 19 August 2022; 31 March 2021). Students primarily accessed the Internet through computer labs and cell phones (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The variation in internet speed highlights the uneven distribution of environmental affordances across the college's campuses. The provision of data packages to lecturers is a direct response to address limitations in user affordances – access to reliable internet outside of campus – and to enhance the perceived affordances of working remotely.

6.3.3. ICT system management and technical challenges

KZN TVET B had a reasonably extensive ICT network, catering to eight campuses and the central office (IT0002, unstructured interview, 19 August 2022). Beyond maintaining the technical infrastructure, the ICT department provided administrative support for teaching and learning activities (IT0002, unstructured interview, 19 August 2022). According to the Deputy Principal for Academic Services [DP0002] (unstructured interview, 28 September 2022; 14 September 2021) and the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), the college's system was relatively dependable and did not encounter many issues.

The main technical issues affecting the college's ICT system can be classified into two categories (IT0002, unstructured interview, 19 August 2022). The first category is related to the age and performance of the hardware. The college's infrastructure environment was aged, and the hardware was at an age where it was no longer compatible with current operating systems and software (IT0002, unstructured interview, 19 August 2022). This issue of software compatibility highlights a potential mismatch between the technological affordances of older hardware and the requirements of newer software. This can create a situation of hidden affordances, where the full potential of the software cannot be realised due to limitations in the hardware. The second category is related to the availability of bandwidth. With the increased traffic on the network, the available bandwidth was insufficient to support all the college's internet traffic (IT0002, unstructured interview, 19 August 2022; 31 March 2021).

The challenges of outdated hardware and bandwidth limitations point to a larger issue of resource allocation and prioritisation. The “perpetual cycle” of replacing ageing hardware highlights the need for a long-term, strategic approach to ICT planning and budgeting. This raises questions about how ICT investments are prioritised within the TVET sector, and whether sufficient resources are being allocated to ensure that colleges can keep pace with technological change. The issue is not only about finding the money; it’s also about making a conscious decision to invest in technology as a core component of educational quality. This also involves considering the total cost of ownership of technology, including not just the initial purchase price but also the ongoing costs of maintenance, support, and upgrades.

The college faced increasing technical issues related to its ICT hardware and infrastructure; a significant portion of the ICT inventory needed to be replaced (IT0002, unstructured interview, 19 August 2022). According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), some computers in the computer labs were over ten years old. Over the years, the hardware had not been upgraded or had been upgraded slowly (IT0002, unstructured interview, 19 August 2022). The slow turnover in hardware had resulted in a situation where the oldest computers had become obsolete, and the slightly newer ones were getting old (IT0002, unstructured interview, 19 August 2022). The old hardware presented several challenges; however, the issue of software compatibility was the most relevant to teaching and learning (IT0002, unstructured interview, 19 August 2022).

According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), the operating systems on the old computers sometimes could not run current versions of teaching and learning applications and software (IT0002, unstructured interview, 19 August 2022). The college had begun to address this issue by replacing outdated hardware; the process was unfolding in phases, prioritising the replacement of the oldest hardware (IT0002, unstructured interview, 19 August 2022). The Assistant Director for IT (IT0002, unstructured interview, 19 August 2022) noted that despite the college’s intention to refresh the hardware as soon as possible, the high cost of the computers would inadvertently slow the process. The slow process creates a perpetual cycle where the college replaces ageing hardware while the hardware on-site becomes outdated yearly (IT0002, unstructured interview, 19 August 2022).

Regarding bandwidth-related issues, historically, the college had established a reliable backend infrastructure system for its Internet (IT0002, unstructured interview, 19 August 2022; 31 March 2021). However, with the various teaching and learning activities such as assessments, student administration, and lessons migrating online, the system had experienced a surge in the volume of users (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The user surge has resulted in a shortfall in bandwidth availability across the college's network (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The Assistant Director for IT (IT0002, unstructured interview, 19 August 2022) noted that the system's bandwidth decreased when the students and lecturers were active online during classes. The limited bandwidth affected other parts of the college that relied on the same bandwidth to do their work; the consequence was that the internet speed slowed significantly during peak periods (IT0002, unstructured interview, 19 August 2022; 31 March 2021). The system was affected even more severely during examinations; there was concern that the situation could become untenable when the college's LMS came online (IT0002, unstructured interview, 19 August 2022; 31 March 2021).

According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), one of the solutions to this issue was to procure additional bandwidth for the network. However, with bandwidth, procuring additional bandwidth is not the primary challenge; the more significant factor is the time it would take for additional bandwidth to come online (IT0002, unstructured interview, 19 August 2022). When there was a bandwidth shortage on the college's network, the users felt the effects immediately (IT0002, unstructured interview, 19 August 2022). However, the impact of providing additional bandwidth would come into effect only once the procurement process had been completed (IT0002, unstructured interview, 19 August 2022). In 2022, the college approved a proposal to increase bandwidth; it was hoped that when the additional bandwidth came online, it should allow for more stable internet speed across the network (IT0002, unstructured interview, 19 August 2022).

Other notable technical issues the college faced include intermittent power outages (load shedding), the limited number of computers available for the academic staff, unstable internet connectivity at some campuses, and technical support (IT0002, unstructured interview, 19 August 2022; 31 March 2021; DP0002, unstructured interview, 28 September 2022; 14 September 2021). In response to load shedding, the college installed a backup power supply consisting of UPSs in the server rooms and generators (IT0002, unstructured interview, 19

August 2022).

Regarding computer access for the academic staff, the college's short-term plan was for the lecturers to share the computers in the staff computer lab (DP0002, unstructured interview, 28 September 2022) while in the process of procuring 300 laptops for the lecturers to address the need long-term (IT0002, unstructured interview, 19 August 2022; 31 March 2021; DP0002, unstructured interview, 28 September 2022; 14 September 2021). At the time of the study, the college was in the process of finalising the distribution of those laptops to the lecturers (DP0002, unstructured interview, 28 September 2022). Once the lecturers had received their laptops, the pressure on the college's old computers was expected to lessen (IT0002, unstructured interview, 19 August 2022).

A few KZN TVET B campuses indicated that they periodically experienced internet connection issues attributable to location (IT0002, unstructured interview, 19 August 2022). In such cases, the ICT department dealt with each issue on a case-by-case basis (IT0002, unstructured interview, 19 August 2022). In terms of technical support, the primary role of the ICT department was to support and maintain the infrastructure. However, with the additional activities that came with the introduction of e-learning, the department had been tasked with providing administrative support for the LMS (IT0002, unstructured interview, 19 August 2022). According to the Assistant Director for IT (IT003, unstructured interview, 19 August 2022), ICT staff were increasingly spending their time solving administrative issues. The Assistant Director for IT (IT0002, unstructured interview, 19 August 2022) noted that it would be helpful for the technicians to receive training to develop their administrative skills.

6.4. Blended learning: Integration of ICT into teaching and learning approach

KZN TVET B's leadership favoured migrating teaching and learning activities onto online platforms (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022; 14 September 2021). The college had already convened meetings with internal and external stakeholders to promote the adoption of ICTs (DP0002, unstructured interview, 28 September 2022). Throughout 2020, the college continued to engage with and update stakeholders on progress toward e-learning (DP0002, unstructured interview, 28 September 2022; 14 September 2021). The college had yet to implement e-learning formally; the combination of the COVID-19 pandemic, budgeting processes, and the lack of laptops for students had delayed implementation (DP0002, unstructured interview, 28 September 2022).

However, the college had proceeded with research and preparations for an LMS platform and developing content for the LMS (DP0002, unstructured interview, 28 September 2022).

In the long term, the college intended to utilise blended learning rather than relying exclusively on e-learning (DP0002, unstructured interview, 28 September 2022). According to the Deputy Principal for Academic Services (DP0002, unstructured interview, 28 September 2022), this would allow flexibility for teaching and learning. A blended approach would allow lecturers to access students and materials remotely whilst maintaining the campus culture that comes with direct contact with students (DP0002, unstructured interview, 28 September 2022). Under the organisational structure at the time, e-learning was coordinated by the Curriculum Unit (DP0002, unstructured interview, 28 September 2022). Within this structure, the curriculum manager worked with campus managers and existing academic structures to coordinate e-learning activities at the campus level (IT0002, unstructured interview, 19 August 2022; 31 March 2021; DP0002, unstructured interview, 28 September 2022; 14 September 2021).

The college's intention to use blended learning raises a fundamental question about the purpose and pedagogy of technology integration. How can the college ensure that ICTs are used to enhance, rather than simply replicate, traditional teaching methods? This points to a need for a clear pedagogical vision for blended learning, one that goes beyond simply providing access to materials online. It's about creating engaging, interactive learning experiences that leverage the unique affordances of both online and offline environments. This also involves addressing issues of digital equity within the blended learning context: how can the college ensure that all students have equal opportunities to participate and succeed, regardless of their access to technology or their digital literacy skills?

Despite not having an active e-learning programme, the college planned to begin to prepare the lecturers and develop their ICT skills in this direction (DP0002, unstructured interview, 28 September 2022). According to the Deputy Principal for Academic Services (DP0002, unstructured interview, 28 September 2022), lecturers could use the period during which the college procured an LMS and developed a blended learning policy to familiarise themselves with ICTs. Regarding teaching and learning, the lecturers were responsible for producing or curating digital learning materials (DHET, 2021). The Deputy Principal for Academic Services (DP0002, unstructured interview, 28 September 2022) suggested that lecturers could start with their lesson plans; instead of writing them out by hand as they used to, they could use a word processing programme and begin to use the existing hardware (projectors, smart screens,

computers) to deliver those lessons (DP0002, unstructured interview, 28 September 2022). This strategy aimed to prepare lecturers for transitioning to blended learning, assist lecturers with acclimatising to teaching with ICTs, and identify the skills gaps (DP0002, unstructured interview, 28 September 2022). The Curriculum Unit had also begun to work with the campuses to design developmental activities that would provide lecturers with the necessary ICT skills to utilise the LMS effectively once it came online (DP0002, unstructured interview, 28 September 2022).

This plan to utilise a blended learning approach demonstrates an awareness of the need to integrate technological affordances – online platforms – with user affordances – lecturers' existing teaching practices and comfort levels. The emphasis on developing ICT skills is a direct attempt to enhance user affordances. This emphasis on training directly addresses the issue of user affordances. The goal of training is to increase the lecturers' skills and knowledge, thereby expanding the range of actions they can perform with the technology. This, in turn, should lead to a closer alignment between perceived affordances and actual affordances.

The college planned to utilise the existing academic structures to implement the blended learning strategy (DP0002, unstructured interview, 28 September 2022). The Curriculum Unit would coordinate the teaching and learning approach (DP0002, unstructured interview, 28 September 2022). The required roles are outlined in the *Guidelines for the planning, establishment and implementation of an effective blended and remote learning system in a TVET College* [National Guidelines] (DHET, 2021; DP0002, unstructured interview, 28 September 2022). The reliance on the National Guidelines highlights the influence of the regulatory pillar within Institutional Design Theory. These guidelines provide an external framework that shapes the college's internal policies and procedures related to ICT adoption.

6.4.1. *Blended learning: Policy framework and implementation strategy*

At the time of the data collection, the college had not yet developed an institutional policy framework for ICT adoption or integrating ICTs into teaching and learning. The TVET college's approach to procuring ICTs and developing an ICT-based learning approach was informed by DHET's National Guidelines document (DP0002, unstructured interview, 28 September 2022; DHET, 2021). However, the college had developed a policy to guide and regulate how the lecturers utilised college-issued laptops and hardware (DP0002, unstructured interview, 28 September 2022). The National Guidelines document outlines the principles that underpin DHET's approach to remote and blended learning. The guidelines prescribe the technical specifications required for the colleges' ICT and LMS systems, the curriculum and

content development procedures, monitoring and evaluation procedures; and lecturer ICT skills required by TVET colleges that are necessary for colleges to apply when developing their blended and remote learning approaches (DHET, 2021):

Regarding policy implementation at the classroom level, the Curriculum Unit coordinated the strategy and utilised the existing academic structures to implement blended learning (DHET, 2021). The subject Heads of Department were responsible for quality-assuring the content produced for the LMS and assisting lecturers with developing content for online platforms (DHET, 2021). Lecturers were responsible for face-to-face contact sessions, developing and posting learning materials – class notes, summaries, and hand-outs – and communicating with students (DHET, 2021). In addition, lecturers were expected to teach their students the necessary ICT skills to access and utilise the LMS and any other digital platform the college used (DHET, 2021).

Since the college had not begun implementing blended learning, most focus had been on lecturer development and curating materials for the college's digital platforms (DP0002, unstructured interview, 28 September 2022). The Curriculum Unit had been assigned to facilitate the transition from full-contact learning to blended learning (DP0002, unstructured interview, 28 September 2022). Part of their responsibilities entailed ensuring the continuation of teaching and learning activities in situations where the lecturers and students do not have complete access to the Internet or devices (DP0002, unstructured interview, 28 September 2022). Their responsibilities included formulating contingencies and developing low-tech alternatives for blended learning (DP0002, unstructured interview, 28 September 2022). In addition to lecturer development, the responsibilities of the Curriculum Unit included enacting policy and ensuring that all the technical components to support blended learning were in place (DP0002, unstructured interview, 28 September 2022). The Curriculum Unit coordinated lecturer development, managed the LMS, quality-assured content production, and provided teaching and learning support (DP0002, unstructured interview, 28 September 2022). The college aimed for the Curriculum Unit to drive the strategic aspects of blended learning while collaborating with campuses and academic structures on the operational aspects (DP0002, unstructured interview, 28 September 2022).

6.4.2. Adapting to the COVID-19 pandemic: Resilience in teaching and learning

When the COVID-19 pandemic arrived, it caught the TVET sector by surprise, and most colleges did not have responses ready (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022; 14 September 2021). Like other colleges, KZN TVET B had to suspend contact sessions and formulate other means to resume teaching and learning activities (DP0002, unstructured interview, 28 September 2022; 14 September 2021). According to the Deputy Principal for Academic Services (DP0002, unstructured interview, 28 September 2022), the college had to introduce a different teaching mode with minimal resources available rapidly. During the Alert Level 5¹ period of the COVID-19 lockdown, the college's internal stakeholders met to discuss possible strategies they could implement when teaching and learning resumed (DP0002, unstructured interview, 28 September 2022).

In addition to the shortage of hardware for the lecturers, the college faced the challenge of not having an LMS or any other digital platform to facilitate online teaching and learning (IT0002, unstructured interview, 19 August 2022; 31 March 2021; DP0002, unstructured interview, 28 September 2022; 14 September 2021). In response, the college advised lecturers to use WhatsApp and the college website to connect with their students and disseminate learning materials (DP0002, unstructured interview, 28 September 2022; 14 September 2021). This rapid adoption of WhatsApp and the college website demonstrates the importance of communication channels within the social system, as described by DOI theory. In the absence of a formal LMS, these readily available tools became crucial for maintaining communication and disseminating information.

Most teaching and learning activities occurred on WhatsApp and the college's student portal during the Level 5 lockdown (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022). At this point, the college had not begun issuing laptops to the lecturers. The lecturers had to use their cell phones, laptops, and data for teaching and learning (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022). In one case, an accounting lecturer created a chart and hung it

¹ Alert level 5 of COVID-19 lockdown was declared by the Minister of Cooperative Governance and Traditional Affairs (COGTA) on 26 March 2020, and was meant to be in place for 14 days. Under Alert level 5, "(i) every person was confined to his or her place of residence, unless strictly for the purpose of performing an essential service, obtaining an essential good or service, collecting a social grant, pension or seeking emergency, life- saving, or chronic medical attention; every gathering, as defined in regulation 1 is hereby prohibited, except for a funeral as provided for in subregulation (8); and (iii) movement between provinces and between metropolitan and district areas is prohibited except—(aa) for essential workers who have to travel to and from work" (RSA, 2020, p. 6)

in her dining room at home, then recorded a lesson where she talked to the chart and posted the lesson on the class WhatsApp group (DP0002, unstructured interview, 28 September 2022). In addition to WhatsApp, the ICT department created content folders for the various subjects on the college's student portal (IT0002, unstructured interview, 19 August 2022). The lecturers used the student portal to upload materials and activities for students to access remotely (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022).

Around July 2020, the lockdown regulations were eased, and the college could resume contact sessions at reduced capacity (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022). During this period, students attended classes on a weekly rotational cycle; half attended, while the other half studied from home (DP0002, unstructured interview, 28 September 2022). The lecturers had to ensure that the group not attending had enough work to last them for a week (DP0002, unstructured interview, 28 September 2022). In this regard, the college developed a 'paper-based distance learning' approach, where the lecturers issued hard copies of learning materials, activities, and instructions to students studying from home for the next cycle (DP0002, unstructured interview, 28 September 2022). The students would then submit their work during their next contact cycle (DP0002, unstructured interview, 28 September 2022). During this period, WhatsApp was used mainly to assist students with any issues with their work (DP0002, unstructured interview, 28 September 2022). Work and materials began to be posted on the student portal once it was functional and the students' online profiles were activated (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022).

6.4.3. Implementation of a digital learning management system: Challenges and expectations

The college completed the process of procuring a Moodle-based LMS in 2020, and at the time of the site visit, the service provider had completed its installation (IT0002, unstructured interview, 19 August 2022). During installation, the college trained 60 lecturers on using Moodle (IT0002, unstructured interview, 19 August 2022). One noted benefit of Moodle for the college was that it was compatible with the Coltech MIS that the college used to manage student data (IT0002, unstructured interview, 19 August 2022). Both the Deputy Principal for Academic Services (DP0002, unstructured interview, 28 September 2022) and the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022) noted that there had been

delays in installing the college's LMS. One of the significant factors that contributed to the delays was the lack of devices, laptops, or smartphones from which students could access the LMS (DP0002, unstructured interview, 28 September 2022). Providing student laptops was the responsibility of NSFAS and thus beyond the college's control (DP0002, unstructured interview, 28 September 2022). This delay due to a lack of student devices highlights a critical limitation in environmental affordances – access to technology – and user affordances – students' ability to participate in online learning. This underscores the interconnectedness of these factors in determining the success of ICT integration.

Regarding the LMS, the Curriculum Unit collaborated with the ICT department to customise the features of the LMS (IT0002, unstructured interview, 19 August 2022). The Curriculum Unit formulated a list of academic features required for the LMS, while the ICT department determined the technical specifications (IT0002, unstructured interview, 19 August 2022). According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), the college wanted the LMS to have embedded online conferencing platforms such as Microsoft Teams, Zoom, or Google Classroom; cloud-based applications and storage and compatibility with the various software used by the different subjects.

In terms of teaching and learning, the main feature the college emphasised for the LMS was the ability to conduct lessons remotely (DP0002, unstructured interview, 28 September 2022). In addition, the LMS needed to provide lecturers with a means to distribute learning materials, conduct online assessments, automate marking, and track student activities (DP0002, unstructured interview, 28 September 2022). For the students, the college needed an LMS that would allow them to view and download materials, watch lesson videos, conduct discussions amongst their peers, and communicate with their lecturers (DP0002, unstructured interview, 28 September 2022). At the time of writing, the college's LMS had not come online; thus, the college could not provide feedback on adoption, user experience, and challenges related to the LMS (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022).

6.5. Professional development initiatives for academic staff

Despite not having launched online learning activities at the time of data collection, the college had been actively organising training for the academic staff (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022). The college's ICT department provided training workshops for the lecturers that focused on basic computer skills (IT0002, unstructured interview, 19 August 2022). For online teaching and digital content production, the college enrolled two groups of 150 lecturers in a UNISA ICT training programme in 2020 (DP0002, unstructured interview, 28 September 2022). The training programme ran for six months, and lecturers could attend sessions remotely (DP0002, unstructured interview, 28 September 2022). The UNISA training programme was expected to provide the necessary foundation for lecturers to utilise the LMS once it came online entirely (DP0002, unstructured interview, 28 September 2022).

In addition, the college intended to continue seeking training opportunities for their lecturers; DP0002(unstructured interview, 28 September 2022) identified blended learning skills as the next target for training. These training initiatives represent a direct effort to enhance user affordances by increasing lecturers' ICT skills and confidence. This is crucial for bridging the gap between perceived affordances and actual affordances of the technology.

6.6. Addressing lecturers' hesitance towards ICT use

The findings reported in this section are based on the views and opinions expressed by KZN TVET B's Deputy Principal for Academic Services and the ICT Manager regarding the use of ICT in the classroom. According to the Deputy Principal for Academic Services and the Assistant Director for IT, the reluctance displayed by some lecturers was found to stem primarily from their general discomfort with technology (IT0002, unstructured interview, 19 August 2022; DP0002, unstructured interview, 28 September 2022). According to the Assistant Director for IT (IT0002, unstructured interview, 19 August 2022), interacting with technology requires technical skills and expertise, and he thought that college lecturers might have felt overwhelmed by new technologies rapidly appearing in their space. The Assistant Director for IT stated that lecturers may also have been reluctant to embrace ICTs as they disrupt practices and habits that lecturers might be familiar with (IT0002, unstructured interview, 19 August 2022).

This discomfort with technology directly relates to user affordances. A lack of skills and experience limits the range of actions lecturers feel comfortable performing with ICTs, leading to a lower perceived affordance of the technology. According to the Deputy Principal for Academic Services (DP0002, unstructured interview, 28 September 2022), a significant number of lecturers at the college were not computer literate, and their lack of ICT skills resulted in them preferring to continue utilising traditional teaching methods. Teaching with ICTs requires different teaching methods, which require expertise that the lecturers might not have yet had (DP0002, unstructured interview, 28 September 2022).

The acknowledgement of lecturers' lack of computer literacy and the need for different teaching methods highlights a critical need for transformative professional development. It's not enough to simply provide technical training; lecturers need support in rethinking their pedagogy and developing new approaches to teaching and learning that leverage the potential of ICTs. This points to a larger challenge: how can we create a culture of continuous learning within the TVET sector, where lecturers are encouraged and supported to experiment with new technologies and develop their digital fluency? This also involves addressing issues of workload and incentives: are lecturers given sufficient time and recognition for the effort involved in adapting their teaching practices? The data implicitly suggests a need to move beyond a deficit model of lecturers' skills and towards a more empowering approach that values their expertise and supports their professional growth.

6.7. Geographic and socioeconomic influences on ICT adoption at KZN TVET B

Based on the findings, KZN TVET B's approach to ICT adoption is shaped by a complex interplay of geographic, economic, and institutional factors. This interplay demonstrates how external conditions influence both the pace and structure of digital integration within TVET institutions. The college's campuses are spread across urban, peri-urban, and rural settings, each of which presents distinct affordances that impact access to ICT infrastructure, technical support, and service providers. The first of these affordances is geography; the college's geography plays a crucial role in determining the stability and reliability of ICT services, with urban campuses benefiting from high-speed broadband and a well-developed ICT ecosystem, while rural campuses face persistent connectivity challenges, shared bandwidth constraints, and limited access to technical expertise. This spatial variation underscores a fundamental principle of Affordance Theory, which suggests that technologies do not function independently but are shaped by the environments in which they are embedded. The data indicate that geography not only dictates the

availability of ICTs but also influences institutional decisions regarding which technologies to implement, how they should be deployed, and what adaptations are necessary to ensure their functionality in different contexts.

The socioeconomic landscape further reinforces these disparities, creating an additional layer of complexity in ICT adoption. EThekweni Metro's diversified economy allows for greater private-sector engagement and access to ICT service providers, while Ndwedwe Municipality, with its largely subsistence-based economy, lacks the same level of economic activity to support widespread digital infrastructure investment. Socioeconomic constraints mean that many students and staff in peri-urban and rural areas rely entirely on institutional ICT provisions, as personal access to digital resources remains financially out of reach for a significant proportion of the population. From a DOI perspective, these conditions slow the rate of ICT adoption, not because of a lack of interest, but due to financial and infrastructural barriers that restrict engagement. IDT suggests that TVET colleges must account for these external economic constraints when formulating digital strategies, ensuring that policies prioritise accessibility and affordability for students in lower-income regions.

In response to these challenges, KZN TVET B has structured its ICT and academic offerings to align with the economic conditions of its surrounding communities. The college's decision to tailor its programmes according to the economic activities of each region demonstrates an adaptive institutional design strategy that seeks to integrate digital learning with labour market needs. Urban campuses, which benefit from greater connectivity and access to ICT resources, offer business and IT programmes, while rural campuses focus on vocational training that aligns with local industries such as agriculture and manufacturing. This differentiation highlights the ways in which institutional decision-making is shaped by external structural conditions, reflecting IDT's emphasis on how organisational strategies must respond to environmental constraints and opportunities. Furthermore, the reliance on ICT-based learning initiatives in peri-urban areas suggests that ICTs are being used not only as tools for education but also as mechanisms for economic inclusion.

The findings illustrate that the affordances of ICTs in the TVET sector are neither uniform nor neutral. Rather, they are shaped by a dynamic interaction between physical infrastructure, economic conditions, and institutional strategy. The diffusion of ICTs is not simply a matter of making ICTs available; it is also about ensuring that they are accessible, usable, and meaningful within specific local contexts. While urban campuses may be able to adopt high-end technologies with fewer constraints, rural and peri-urban campuses require more nuanced, context-sensitive interventions that acknowledge the limitations imposed by economic and infrastructural conditions. As a result, KZN TVET B's ICT adoption strategy must navigate a balance between equity and efficiency, ensuring that all students – regardless of geographic location – are afforded meaningful access to digital resources while maintaining a model that is financially and logistically sustainable. This underscores the broader challenge facing ICT integration in the TVET sector: how to design digital inclusion strategies that are responsive to socioeconomic realities while also fostering long-term sustainability and institutional autonomy.

6.8. KZN TVET D

6.8.1. Geographic and demographic profile of KZN TVET D

KZN TVET D is located in Newcastle, with seven campuses across the Amajuba and uMzinyathi districts. According to (COGTA, 2020a), the municipality has a population of 409,000 with an annual growth rate of 1.27%. The municipality is predominantly urban, with most of the urban population living in Newcastle and the townships of Madadeni and Osizweni (Newcastle Local Municipality, 2022). The local economy comprises the following sectors: trade and retail, community services, manufacturing, mining, agriculture, and finance (Newcastle Local Municipality, 2022). The area is well known for manufacturing, with prominent corporations such as Arcelor Mittal and Karbochem operating in the area (Newcastle Local Municipality, 2022). In addition, the area has notable agriculture and textile sectors (COGTA, 2020a). According to 2019 figures, the Amajuba District contributed 2.76% to KZN's GDP, to which Newcastle contributed 80% (COGTA, 2020a; Newcastle Local Municipality, 2022). The community services sector accounts for the most considerable contribution (24.3%) to the area's economy, followed by the manufacturing (17.7%) and finance (15.0%) sectors (COGTA, 2020a). In terms of socioeconomic indicators, the average household income is below R40 000 per annum – below the national average; in the years between 2009 and 2019, unemployment increased on average by 4.18% per annum, and a Gini

Coefficient of 0.62 (COGTA, 2020a; Newcastle Local Municipality, 2022).

KZN TVET D was selected to be part of the case study because of its longstanding links to the industries in the region; through these links, the college had kept up to date with industry practice and technological trends. The college's links to local industries placed it in an ideal position to identify trends in ICT usage across different sectors early and adjust its teaching and learning approach accordingly. Additionally, the college was identified as the leading TVET college in ICT integration by officials from the other TVET colleges in KZN during the first phase of the study. The college's previous experiences integrating ICTs into teaching and learning activities made it an ideal participant to provide the study with insights into the ICT approach considered best practice across the TVET sector.

6.8.2. *History and development of KZN TVET D*

In 2002, KZN TVET D was established through the merger of Madadeni Technical College – located in Madadeni, Section 5, St Oswalds Technical College – located in Newcastle, Barry Herzog Park, and the Newcastle Technical College – located in Newcastle, Barry Herzog Park (Majuba TVET College, 2020).

The college consists of five campuses, namely (Majuba TVET College, 2020):

- a. Majuba Technology Centre
- b. Centre for People Development
- c. IT and Business Campus
- d. Newcastle Technology Centre
- e. Dundee Technology Centre

In addition to the five campuses, the college has three specialisation units (Majuba TVET College, 2020):

- a. Open Learning Unit
- b. Occupational Programmes Unit
- c. Newcastle Training Centre

The Majuba and Newcastle Technology Centres are fully integrated engineering studies campuses. These campuses boast new high-tech workshops fully equipped with relevant, modern equipment and machinery. They offer a diverse range of exciting and innovative courses in the field of engineering (Majuba TVET College, 2020).

The Centre for People Development and the IT and Business Campus are fully integrated business studies campuses. These campuses offer a diverse range of exciting and innovative courses in the field of business (Majuba TVET College, 2020).

The Dundee Technology Centre is a fully integrated campus that combines engineering and business studies. This campus offers a diverse range of exciting and innovative courses in business and engineering (Majuba TVET College, 2020).

6.9. ICT infrastructure overview at KZN TVET D

This section presents the findings related to the technical infrastructure; the section discusses the evolution of TVET college's ICT system, the methods the college uses to enhance Internet access, and the strategies the college uses to mitigate ICT and Internet-related challenges.

6.9.1. *Evolution of KZN TVET D's ICT system*

KZN TVET D has had an ICT system for over a decade; in the earlier years, the system was used primarily to support the administrative tasks of the college (Assistant Director for ICT [IT0004], unstructured interview, 3 June 2022; 14 September 2021; Deputy Principal for Academic Services [DP0004], unstructured interview, 17 May 2022). The college took the first steps towards adopting ICTs for teaching and learning in 2017 when its IT technicians submitted a request to college management to upgrade the outdated ICT infrastructure (IT0004, unstructured interview, 3 June 2022). At this point, a significant portion of the infrastructure could no longer support the college's administrative, teaching, and learning functions (IT0004, unstructured interview, 3 June 2022).

In addition to the outdated infrastructure, the college did not have a stand-alone ICT department until 2018 (IT0004, unstructured interview, 3 June 2022). Before that, the college had IT technicians deployed to campuses who reported to different departments; no specific ICT department was servicing the college's ICT needs (IT0004, unstructured interview, 3 June 2022). When the ICT department was established, its primary task was to provide technical support and maintain the hardware (IT0004, unstructured interview, 3 June 2022). However, with the introduction of blended learning, the scope of the department's work had widened to include administrative support, software licensing, and developing lecturers' ICT skills (IT0004, unstructured interview, 3 June 2022). The establishment of a stand-alone ICT department represents a change in the organizational structure, creating a specialized unit to address the growing demands of ICT integration. This reflects the concept of horizontal differentiation within IDT.

The college's ICT system was upgraded in phases, with the current system being installed in 2019 and going live in November 2019 (IT0004, unstructured interview, 3 June 2022). Liquid Telecom provided the college's external technical support throughout the installations (IT0004, unstructured interview, 3 June 2022). One of the main drivers of the upgrades to the college's ICT system was the need to extend the capacity of the ICT infrastructure to support teaching and learning (IT0004, unstructured interview, 3 June 2022; 14 September 2021).

The upgrades allowed the college to transition from contact-based teaching and learning to e-learning (IT0004, unstructured interview, 3 June 2022). The upgrades included the procurement of computer equipment for student computer labs, procurement of laptops and routers for lecturers, upgrades to internet infrastructure, installation of smartboards and projectors for classrooms, migration of college data to cloud storage, and installation of an LMS that was custom built for the college (IT0004, unstructured interview, 3 June 2022; 14 September 2021).

6.9.2. *Enhancing internet access at KZN TVET D*

In addition to the upgrades to the physical infrastructure, the college addressed issues related to internet access (IT0004, unstructured interview, 3 June 2022). Before the infrastructure upgrade, the internet speed varied from campus to campus (from 2mbps to 8mbps); this created an environment where the internet connection was slow and unstable (IT0004, unstructured interview, 14 September 2021). Due to the deficiencies in the network infrastructure, the college experienced disruptions to teaching and learning activities during periods of high internet traffic (IT0004, unstructured interview, 14 September 2021). During disruptions in connectivity, the ICT department was forced to ration bandwidth between the classroom and the office (IT0004, unstructured interview, 14 September 2021).

During this period, the central office was the only site connected to a fibre network, while the campuses connected through a microwave system (IT0004, unstructured interview, 14 September 2021). This setup changed in 2019 when the college installed ADSL at all the campuses, increasing the speed – to a steady 10mbps – and internet bandwidth (IT0004, unstructured interview, 14 September 2021). With the ADSL, Wi-Fi hotspots were installed across all the college’s campuses, and separate SSIDs were created for staff and students to control access and traffic (IT0004, unstructured interview, 14 September 2021). In 2021, the college’s network infrastructure underwent further upgrades with the installation of fibre internet from SABEN, and the speed of the Internet increased to 30mbps (IT0004, unstructured interview, 14 September 2021).

6.9.3. *Addressing technical challenges and ensuring equitable access*

Overall, KZN TVET D had developed a relatively functional ICT infrastructure system and equipped lecturers and classrooms with the necessary tools to implement online learning (IT0004, unstructured interview, 3 June 2022). However, they still faced several technical challenges, occasionally leading to system downtime (IT0004, unstructured interview, 3 June 2022). The most significant challenge affecting daily teaching and learning activities was intermittent power outages [load shedding] (IT0004, unstructured interview, 3 June 2022). Load shedding affected the labs, computers and servers, internet access, and teaching and learning (IT0004, unstructured interview, 3 June 2022). To mitigate the effects of load shedding, the college had installed backup power sources – uninterrupted power supplies (UPSs) and generators – at all its campuses (IT0004, unstructured interview, 3 June 2022).

Another ICT-related challenge the college had been grappling with was the discrepancy in internet access across its campuses (IT0004, unstructured interview, 3 June 2022). In this regard, internet access issues could be grouped into three types (IT0004, unstructured interview, 3 June 2022). The first and most noted type was unstable internet connectivity due to infrastructure or hardware (IT0004, unstructured interview, 3 June 2022). Issues of this type were attributed to faults with the infrastructure or the hardware; this ranged from temporary disconnections that required a system reboot to long-term shutdowns that required infrastructure and hardware to be replaced (IT0004, unstructured interview, 3 June 2022). The second type was slow browsing speed due to limited bandwidth across the system (IT0004, unstructured interview, 3 June 2022). Issues of this type were caused by the increased number of users on the network; the adoption of ICTs in teaching and learning further strained the network's speed (IT0004, unstructured interview, 3 June 2022).

The impact of the surge in internet traffic was further exacerbated by the bandwidth requirements of the various online learning platforms used by lecturers (IT0004, unstructured interview, 14 September 2021). In this regard, the college is hopeful that the fibre soon to be installed by SABEN would provide a stable connection to the Internet for all the campuses and sufficient bandwidth to accommodate all the users in the network (IT0004, unstructured interview, 14 September 2021). The third type was remote access to the college's online platforms (IT0004, unstructured interview, 3 June 2022). According to the Deputy Principal for Academic Services (DP0004, unstructured interview, 17 May 2022), lecturers and students struggled to access the LMS and other learning resources remotely. For students, the college provided zero-rated access to the LMS and student portal (IT0004, unstructured interview, 14 September 2021; DP0004, unstructured interview, 17 May 2022). The provision of laptops for students was the responsibility of NSFAS, and there had been delays in their distribution (DP0004, unstructured interview, 17 May 2022). For lecturers, the college had provided routers with monthly data bundles and had initiated procurement processes for laptops (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022).

However, the college had experienced delays in procuring laptops for lecturers due to disruptions to external supply chain processes during COVID-19 (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). The Deputy Principal for Academic Services (DP0004, unstructured interview, 17 May 2022) cited all the technical challenges above as potential barriers to ICT adoption amongst lecturers. The various technical challenges associated with ICT adoption might have made the lecturers reluctant to integrate

ICTs into their teaching (DP0004, unstructured interview, 17 May 2022). The students' lack of access to ICTs was a concern for both the lecturers and the college (DP0004, unstructured interview, 17 May 2022). The lack of student access to ICTs put the college in a predicament where they risked excluding students from teaching and learning because they could not access a laptop or the Internet (DP0004, unstructured interview, 17 May 2022).

6.10. ICT integration into the teaching and learning approach

KZN TVET D has taken significant strides toward integrating ICTs into teaching and learning (DP0004, unstructured interview, 17 May 2022). Despite having a well-established ICT infrastructure, KZN TVET D only began adopting ICT for teaching and learning in 2020 (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). It took this step at that point partially due to COVID-19 restrictions and the lack of available devices for lecturers before this (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). Before pursuing blended learning, the college researched its teaching and learning needs, infrastructure requirements, and curriculum approaches (DP0004, unstructured interview, 17 May 2022). The college's research included engaging with various institutions (TVET colleges and universities) for insights they could use to successfully implement e-learning at KZN TVET D (DP0004, unstructured interview, 17 May 2022). After conducting research, internal discussions were held to determine a budget and finalise a strategy for an online offering at the college (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022).

Through their research and development, the college decided that the appropriate strategy for their current context would be to pursue blended learning rather than a fully-fledged online offering (DP0004, unstructured interview, 17 May 2022). A blended learning approach allowed the college to continue offering contact teaching, the preferred mode for the courses they offered, considering their practical component while drawing on the flexibility of an online curriculum delivery system (DP0004, unstructured interview, 17 May 2022). In this regard, the college worked with Idol Consulting (IT service provider) to develop an LMS that was custom-designed for KZN TVET D's teaching and learning needs (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). The final step in the development phase was formulating a blended learning policy for the college (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). In addition to the remote and blended learning guidelines prescribed by DHET in the National Guidelines document, the college developed its own blended

learning policy (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022; DHET, 2021).

6.10.1. *Blended learning: Policy framework and implementation strategy*

The Curriculum Services Department oversaw the development of the college's blended learning policy (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). The college's policy framework was based on DHET's Guidelines for the planning, establishment and implementation of an effective blended and remote learning system in a TVET College [National Guidelines]; the policy had been adapted for KZN TVET D's teaching and learning context (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022; DHET, 2021). The policy framework was underpinned by the remote and blended learning guidelines outlined in the National Guidelines document (DHET, 2021; Majuba TVET College, 2021). This use of both the DHET guidelines and an institutionally-developed policy shows an understanding of the interplay of the regulatory, normative, and cultural-cognitive pillars of IDT.

Regarding policy implementation at the classroom level, Curriculum Services utilised the existing academic structures to implement blended learning (Majuba TVET College, 2021). The subject HoDs were responsible for quality assurance of the content produced for the LMS and assisted lecturers with developing content for online platforms (Majuba TVET College, 2021). Lecturers worked with the LMS to augment face-to-face contact sessions, circulate learning materials – class notes, summaries, and hand-outs – for students, and communicate with students (Majuba TVET College, 2021). In addition, lecturers were expected to teach their students the necessary ICT skills to access and utilise the LMS and any other digital platform the college used (Majuba TVET College, 2021). The college's policy framework also called for the college to appoint an LMS coordinator (Majuba TVET College, 2021).

Alongside the academic staff, KZN TVET D had appointed an LMS coordinator to oversee the online component of teaching and learning. The LMS coordinator's role included the following (Majuba TVET College, 2021):

- a. Advising academic staff (lecturers, senior lecturers, and HoDs) on strategies for developing lessons and content for the LMS – and other digital platforms if applicable;
- b. Providing administrative support for the LMS;
- c. Arranging and coordinating the training of academic staff regarding the use of the LMS;
- d. Liaising between the college and its various external stakeholders;
- e. Conducting market research to aid the development of the LMS and the college's blended learning strategy;
- f. Assessing the performance of the LMS, particularly concerning the college's teaching and learning objectives.

In addition, the LMS coordinator was responsible for reporting to internal stakeholders on issues related to the LMS to ensure that the college's blended learning strategy remained current and relevant (Majuba TVET College, 2021).

6.10.2. Adapting to the COVID-19 pandemic: Shifting lecturer perceptions

Historically, lecturers at KZN TVET D were hesitant to integrate ICTs into their teaching. The general practice at the college was to avoid apps such as Facebook and WhatsApp in the classroom, as the general perception was that these apps increased the risk of drawing students' attention away from learning (DP0004, unstructured interview, 17 May 2022).

However, with disruptions to contact-based teaching and learning due to COVID-19, lecturers were forced to adopt the same apps and other digital platforms to ensure that teaching and learning continued (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). When the COVID-19 pandemic arrived, and the national lockdown was announced, the college had little time to set up remote teaching and learning structures or strategies (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). The lectures did not have attendance registers; they did not have student email addresses or cell phone numbers (IT0004, unstructured interview, 3 June 2022).

During Alert Levels 4 and 5 of the COVID-19 lockdown, as the college worked out its teaching and learning strategy, WhatsApp groups were widely adopted by lecturers as a means of transmitting their lessons and notifications to students (DP0004, unstructured interview, 17 May 2022). This forced adoption of digital platforms during the pandemic highlights the power of necessity to overcome resistance. It also demonstrates the importance of interpersonal networks – lecturers sharing strategies and experiences – in shaping attitudes towards innovation, a key aspect of DOI’s communication channels. The WhatsApp platform allowed teaching and learning to continue without contact and allowed students to access learning materials while studying remotely (DP0004, unstructured interview, 17 May 2022).

The main attraction of WhatsApp was that its built-in functions allowed lecturers to create and transmit digital content to students at relatively low data costs (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). The types of digital content included video or voice recordings of lessons, documents with homework or assignment tasks, and voice or text feedback to students (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). In that regard, the platform was relatively successful, and lecturers considered it the most dependable means of connecting with their students (DP0004, unstructured interview, 17 May 2022).

In the middle of the 2020 academic year, the national lockdown restrictions were reduced, and contact-based teaching and learning resumed with classroom capacity reduced to 50% (DP0004, unstructured interview, 17 May 2022). During this period, students were platooned into two groups per class, and these groups alternated attending contact lessons weekly (DP0004, unstructured interview, 17 May 2022). This situation meant that even though the physical restrictions to contact-based teaching and learning were removed, lecturers had to manage two groups of students simultaneously (DP0004, unstructured interview, 17 May 2022). Around the same time as the resumption of contact-based teaching, the college’s LMS came online (IT0004, unstructured interview, 3 June 2022). The LMS provided an additional digital platform that lecturers could utilise as part of their teaching toolkit (IT0004, unstructured interview, 3 June 2022). In addition to what they could do using WhatsApp, lecturers could create automated tasks and assessments for the students, and the LMS allowed for more data-heavy content (IT0004, unstructured interview, 3 June 2022).

Additionally, the LMS had features that allowed lecturers to generate reports, schedule classes, and track student progress, which assisted lecturers with managing their classes and performing administrative tasks (IT0004, unstructured interview, 3 June 2022). According to IT0004 (unstructured interview, 3 June 2022), there was a noticeable spike in internet traffic over the college's network during the Levels 3 and 4 lockdown periods. This observation was supported by the Assistant Director for Curriculum Services [CS0004] (unstructured interview, 7 July 2022), who stated that, over the same period, approximately 60% of the college's teaching and learning activities took place online, either through the LMS or online meeting platforms such as Microsoft Teams and Zoom. However, the surge in traffic was brief, as lecturers reverted to full-contact teaching when COVID-19 restrictions were lifted entirely (CS0004, unstructured interview, 7 July 2022). As a result, reliance on the LMS was reduced to serving as a repository for course notes (CS0004, unstructured interview, 7 July 2022).

According to CS0004 (unstructured interview, 7 July 2022), at the height of the COVID-19 pandemic, lecturers made a concerted effort to develop online lessons and content for students. However, they became more reluctant to continue with those lessons throughout the Alert Level 5 lockdown period as many students could not access them (CS0004, unstructured interview, 7 July 2022). The Deputy Principal for Academic Services (DP0004, unstructured interview, 17 May 2022) estimated that the number of students who could access the college's online platforms – LMS, Microsoft Teams, Student Portal – may have been as low as 5 out of a class of 30. These access issues impacted lecturers' willingness to continue producing online content (DP0004, unstructured interview, 17 May 2022). The lack of access for students was attributed mainly to delays in the distribution of laptops to students, which was the responsibility of NSFAS (DP0004, unstructured interview, 17 May 2022). The issue of access to student laptops was further exacerbated by discrepancies in internet access across campuses and off-site [as discussed above] (CS0004, unstructured interview, 7 July 2022). The lack of remote access for students was a significant challenge for teaching and learning as platforms such as the LMS were the only link to the college for students.

6.10.3. Learning management system: Development and integration

Regarding the LMS, the Curriculum Services Department oversaw the system's operations (IT0004, unstructured interview, 3 June 2022; CS0004, unstructured interview, 7 July 2022). According to the organisational structure, the Curriculum Services Department oversaw the daily functions of the LMS while the ICT Department maintained and serviced the system's hardware and infrastructure (IT0004, unstructured interview, 3 June 2022; CS0004, unstructured interview, 7 July 2022). Regarding the development of the LMS, the college piloted a Moodle-based LMS where they experimented with essential features and engaged with lecturers to discover their needs (IT0004, unstructured interview, 3 June 2022; CS0004, unstructured interview, 7 July 2022; DP0004, unstructured interview, 17 May 2022). During this process, Curriculum Services researched the LMS's academic scope (DP0004, unstructured interview, 17 May 2022). This scope was handed to the ICT department, which determined the technical specifications and the project's cost (DP0004, unstructured interview, 17 May 2022). Following the pilot, the college developed a comprehensive technical specification document for their LMS; this document was used as a reference document during the tendering process (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022).

The college wanted an LMS that could be integrated with the Caltech Management Information System (MIS) – the national MIS for TVET colleges (IT0004, unstructured interview, 3 June 2022). An LMS provides lecturers and managers with a means to create and deliver content, track and monitor student participation in their courses, provide student support where required, and assess student performance (IT0004, unstructured interview, 3 June 2022; CS0004, unstructured interview, 7 July 2022). The college wanted a platform that would blend the benefits of a physical classroom with the convenience of an online platform for students and lecturers, a platform that could provide a means of collaborative learning for the students (CS0004, unstructured interview, 7 July 2022). From an administrative perspective, the sought-after LMS assisted with streamlining and managing user data, managing course catalogues, recording student and lecturer activities, and providing reports for various stakeholders (IT0004, unstructured interview, 3 June 2022).

The detailed description of the desired LMS features highlights the ambition to use technology for a wide range of tasks. However, this implicitly raises a question about the risk of over-reliance on a single platform. Is there a danger of the LMS becoming a ‘one-stop shop’ that dictates the entire teaching and learning experience, potentially neglecting other forms of pedagogical interaction and support? This points to a need for a balanced approach to technology integration, one that recognises the limitations of any single tool and encourages the use of a variety of resources and approaches. It’s also crucial to consider the pedagogical implications of using an LMS: how can it be used to foster collaboration, critical thinking, and creativity, rather than simply delivering content and assessing knowledge? The data implicitly asks: how can we ensure that technology serves the pedagogical goals of education, rather than the other way around?

6.10.4. Developing a culture and practice of using ICTs in the classroom

As noted, KZN TVET D had planned to integrate ICTs into teaching and learning activities before COVID-19 (DP0004, unstructured interview, 17 May 2022). The disruptions caused by COVID-19 presented the college with an opportunity to accelerate its plans to implement its blended learning strategy (IT0004, unstructured interview, 3 June 2022; DP0004, unstructured interview, 17 May 2022). Following the lockdown period, DP0004 (unstructured interview, 17 May 2022) instituted several changes to the college’s teaching approach in line with the blended learning policy. One of the crucial changes was the addition of ICT skills as a requirement for lecturers (DP0004, unstructured interview, 17 May 2022). The college expected its lecturers to have basic ICT skills to operate a computer and to apply those skills to conduct online lessons and produce materials for its online platforms (DP0004, unstructured interview, 17 May 2022). In cases where the necessary ICT skills were lacking, the college organised training for lecturers (DP0004, unstructured interview, 17 May 2022).

The ICT department facilitated ICT skills workshops, and UNISA offered a course on online teaching (DP0004, unstructured interview, 17 May 2022). A requirement was introduced that new lecturers must have ICT skills as part of the hiring process (DP0004, unstructured interview, 17 May 2022).

6.10.5. Addressing ICT-curriculum alignment and lecturer hesitancy

Despite the benefits of adopting ICTs demonstrated during the COVID-19 pandemic, lecturers reacted tentatively towards using them in their teaching (CS0004, unstructured interview, 7 July 2022; DP0004, unstructured interview, 17 May 2022). According to the Deputy Principal for Academic Services (DP0004, unstructured interview, 17 May 2022) and CS0004 (unstructured interview, 7 July 2022), a few lecturers embraced the use of ICTs during COVID-19, which resulted in them developing high-quality lessons and online content. These lecturers continued using ICT in their teaching after resuming contact-based lessons (CS0004, unstructured interview, 7 July 2022). However, according to the Assistant Director for Curriculum Services, most of the older lecturers expressed reluctance about using ICTs, fearing that new technologies might make them obsolete and thus threaten their job security (CS0004, unstructured interview, 7 July 2022). The Assistant Director for Curriculum Services reported that these lecturers immediately reverted to ‘chalk and talk’ pedagogies once face-to-face classes resumed (CS0004, unstructured interview, 7 July 2022). This reluctance, even after the pandemic experience, suggests that the perceived affordances of ICTs still did not fully align with the user affordances (skills, comfort levels) and pedagogical needs of many lecturers. This highlights the ongoing need for support, training, and addressing anxieties.

Beyond the technical challenges, the reluctance to adopt ICTs was linked to the curriculum (or aspects of the curriculum) and the lack of subject-specific implementation guidelines (CS0004, unstructured interview, 7 July 2022). According to CS0004 (unstructured interview, 7 July 2022), it is difficult to prescribe a singular approach to lecturers as the approach for each subject depends on the subject and its intended outcomes. CS0004 (unstructured interview, 7 July 2022) indicated that lecturers teaching theory-heavy courses had found integrating ICTs into their lessons easier than their counterparts teaching practical courses.

The recognition of the curriculum as a source of reluctance to adopt ICTs highlights a fundamental need for curriculum reform. It’s not enough to simply add technology to existing curricula; the curriculum itself needs to be rethought and redesigned to leverage the potential of ICTs. This points to a larger challenge: how can we create flexible, adaptable curricula that are responsive to the changing needs of students and the evolving landscape of technology? This also involves addressing issues of assessment: how can we assess student learning in ways that are authentic, meaningful, and aligned with the goals of a digitally enhanced curriculum? The appointment of an LMS coordinator is a positive step, but it's crucial to ensure that this

individual has the pedagogical expertise to guide the integration of technology into the curriculum, not just the technical skills to manage the platform.

To address this gap, the Curriculum Services Department had appointed an LMS coordinator to work with lecturers individually and in their subject groupings to develop strategies to align the curriculum requirements of each subject with the ICTs at their disposal (CS0004, unstructured interview, 7 July 2022). In addition, the Deputy Principal's office had spent significant time consulting with the various academic structures to ensure they secured lecturers' buy-in for the college's blended learning strategy (DP0004, unstructured interview, 17 May 2022). The engagements between college leadership and lecturers were intended to ensure that no lecturers were left behind or became disgruntled as the college transitioned from contact-based teaching and learning to e-learning (DP0004, unstructured interview, 17 May 2022). These consultations highlight how IDT addresses organisational culture, and specifically, the communication patterns sub-concept.

6.11. Industry-driven ICT adoption at KZN TVET D

KZN TVET D's approach to ICT adoption reflects a dynamic interaction between institutional strategy, economic context, and technological affordances. As a recognised leader in ICT integration within the KZN TVET sector, the college's digital transformation efforts are shaped by a combination of external industry influences, internal governance structures, and user engagement. The presence of strong industry links has positioned the college as an early adopter of ICTs, enabling it to align its digital strategies with sectoral demands. DOI suggests that institutions at the forefront of ICT adoption set the precedent for others, and KZN TVET D's role as an opinion leader within the TVET system exemplifies this process (Rogers, 2003). However, while the college's status as an ICT leader allows it to model best practices, the scalability of its approach across other TVET institutions remains uncertain due to variations in resource availability and infrastructure capacity.

The findings indicate that KZN TVET D's ICT leadership is underpinned by a structured governance framework that prioritises technological integration. The college's ability to sustain its digital initiatives suggests the presence of internal policies, industry collaborations, and institutional investments that facilitate ICT adoption. However, despite these institutional strengths, broader socioeconomic disparities in the surrounding region pose significant challenges. The Amajuba and uMzinyathi districts, where the college operates, exhibit high unemployment

and below-average household incomes, which limit students' financial capacity to engage with digital learning outside of formal classroom environments. This reinforces IDT's argument that institutional strategies must be responsive to external conditions (Thelen, 2009). While KZN TVET D may be a model for ICT implementation, its ability to foster digital inclusion among students from disadvantaged backgrounds remains a critical consideration. The persistence of economic inequalities raises questions about how institutional ICT policies can be designed to address digital access beyond the campus setting.

Affordance Theory provides a useful lens for understanding how environmental, technological, and user factors shape ICT adoption at KZN TVET D. Environmental affordances play a dual role in the institution's digital strategy. On one hand, the college benefits from its proximity to Newcastle's manufacturing and services industries, which afford it access to industry-relevant technological advancements. On the other hand, the economic disparities between urban and township communities introduce structural barriers to ICT adoption, as financial limitations may prevent students from fully engaging with digital learning opportunities. Technological affordances highlight how the institution's diverse ICT infrastructure supports digital teaching and learning. However, the effectiveness of these technologies depends on their usability across different campus settings. The extent to which ICT tools can be standardised across the college's urban, peri-urban, and township campuses remains a key concern. Lastly, user affordances determine how students and lecturers interact with ICT tools. While KZN TVET D's leadership in digital adoption suggests a strong institutional commitment to technology, the success of its ICT initiatives ultimately depends on the digital literacy and engagement of staff and students. Differences in ICT proficiency levels may impact the effectiveness of digital teaching strategies, requiring ongoing professional development and student support programmes.

KZN TVET D's status as a leader in ICT adoption highlights both the opportunities and challenges of digital transformation in the TVET sector. The college's industry partnerships, institutional policies, and digital infrastructure position it as a model for best practice. However, persistent socioeconomic disparities and variations in digital literacy among users present significant challenges to ensuring equitable access to ICTs. The findings underscore the importance of aligning institutional ICT strategies with broader economic and social conditions, ensuring that digital transformation efforts extend beyond technological implementation to foster meaningful and inclusive engagement with ICTs in TVET education.

6.12. KZN TVET F

6.12.1. Geographic, economic and demographic profile of KZN TVET F

KZN TVET F is situated in northern KZN. Its eight campuses cover a vast area that straddles three district municipalities: Zululand District Municipality, uMkhanyakude District Municipality, and uMzinyathi District Municipality. The population across the three districts is approximately 1.4 million (Mthashana TVET College, 2022). KZN TVET F's catchment area is characterised by high levels of unemployment, where the poverty rate is estimated to be as high as 79% in some local municipalities (Mthashana TVET College, 2022). The economy of Zululand district is driven by the tertiary sector, with community services having the highest contribution, followed by finance and trade (COGTA, 2020f). In uMkhanyakude District Municipality, the main economic activities are community services, finance, trade, and transport (COGTA, 2020d). The two main economic sectors in uMzinyathi District Municipality are agriculture and tourism (COGTA, 2020e). KZN TVET F was selected for the study primarily for its geographic profile. The distribution of the college's campuses covers the largest geographical area of all the colleges in the province, with the distance between the campuses and the central office varying from 70 km to 300 km. This geographic profile presented unique operational challenges in determining the college's ICT strategy.

The areas where the campuses are situated are predominantly rural, with agriculture as the primary economic activity. KZN TVET F was selected for the study because it covers an extensive geographic region, with most campuses located more than 100 km from each other and the central office. Furthermore, KZN TVET F is the only college with all its campuses in rural areas. The researcher was interested in exploring how the college navigated the issues of geography, such as the distances between campuses and the central office, the remote locations of two of its campuses, and the terrain surrounding the college's campuses when implementing its ICT adoption strategy. The researcher was particularly interested in how the institution's leadership coordinated the implementation of the college's ICT adoption strategy and provided technical support for staff and students across all its campuses, given the distances and terrain between campuses and the central office.

The Zululand district municipality, where the Nongoma, Ulundi, and Vryheid campuses are located, has a population of 868,031, 7.8% of the total KZN population (COGTA, 2020f). Zululand is the biggest of the three districts in terms of population; the district has a total of 178,516 households with an average of five persons per household (COGTA, 2020f). Most of the households are located within the rural areas of the municipality; women head 53.8% of these households (COGTA, 2020f). The economy of Zululand district is driven by the tertiary sector, with community services having the highest contribution at 31%, followed by finance at 18%, and trade at 12% (COGTA, 2020f).

UMkhanyakude District Municipality, where the Maputa campus is located, has a population of 689,090 (COGTA, 2020d). The District is the second-largest district in KZN in size (COGTA, 2020d). The district is predominantly rural, with most of the population residing in areas under traditional leadership (COGTA, 2020d). Despite 55.7% of the land within this district being natural, only approximately 17.9% of the land is used for agriculture, and approximately 33.2% of the land is formally protected, falling into three nature reserves: Hluhluwe, iSimangaliso Wetland, and Sodwana Bay (COGTA, 2020d). Most of the population lives below the poverty line (COGTA, 2020d). The two main sectors of economic activity are agriculture and tourism, with employment opportunities in the agricultural sector remaining relatively stable for over a decade (COGTA, 2020d). However, economic activities in other sectors, such as retail, catering and hospitality, manufacturing, and community services, have increased since 2011 (COGTA, 2020d).

UMzinyathi District Municipality, where the Nquthu campus is located, has a population of 568,284, totalling 126,790 households; 59% of these are women-headed households (COGTA, 2020e). UMzinyathi is among the top five poverty-stricken districts nationally, with 66% of the population living in poverty (COGTA, 2020e). The most poverty-stricken areas in the district are found in the areas of Nquthu (75%) and Msinga [72%] (COGTA, 2020e). The main economic activities in the district are community services (32%), finance (17%), trade (14%), and transport (9%) (COGTA, 2020e). In addition, approximately 40% (344 479 hectares) of land in the uMzinyathi district municipality is owned by the Ingonyama Trust Board (ITB) (COGTA, 2020e). The implication is that potential land developments or investments on this land require approval from the ITB and relevant traditional authorities (COGTA, 2020e). The district municipality and Endumeni Local Municipality are under the administration of the provincial government – Section 139 intervention (COGTA, 2020e). A Section 139 intervention is a legal mechanism that authorises the provincial government to intervene in the

administration of a local municipality when it does not fulfil its executive obligation in terms of *'The Municipal Finance Management Act 56 of 2003'* (COGTA, 2020e).

6.12.2. History and development of KZN TVET F

In 2001, KZN TVET F was established through the merger of Nongoma Technical School, Nongoma (KwaGqikazi) Teacher Training College, and Vryheid College. The College's central office is in Vryheid (Personal Assistant to the Principal [PA0006], email, 7 February 2023).

The college consists of six campuses, namely (Mthashana TVET College, 2023):

- a. Emandleni (Ulundi)
- b. Maputa (Manguzi)
- c. Nquthu
- d. KwaGqikazi
- e. Nongoma
- f. Vryheid.

KZN TVET F planned to realign its campus offerings to create specialisation hubs. The specialisation hubs would hone in on the dominant economic activities of the local areas surrounding the campuses (PA0006, email, 7 February 2023). By specialising in line with local economies, the campuses would empower students to take advantage of opportunities in their immediate vicinity (PA0006, email, 7 February 2023). Emandleni was designated to become an agricultural hub, KwaGqikazi a hospitality hub, Nongoma a civil engineering hub, Nquthu a tourism hub, and Vryheid a mechanical engineering hub (PA0006, email, 7 February 2023), and Maputa a skills hub (PA0006, email, 7 February 2023).

The shift to specialisation hubs would require lecturers to upskill and reskill (PA0006, email, 7 February 2023). KZN TVET F is characterised by the long distances between the central office and its campuses (PA0006, email, 7 February 2023). The distances from the central office to the different campuses are as follows: Emandleni Campus is 115km, Nquthu Campus is 75km, Nongoma Campus is 180km, KwaGqikazi Campus is 180km, and Maputa Campus is 315km (PA0006, email, 7 February 2023). The Emandleni, Nongoma, and KwaGqikazi campuses provide on-site student accommodation (PA0006, email, 7 February 2023).

6.13. ICT infrastructure overview at KZN TVET F

This section presents the findings related to the technical infrastructure; the section discusses the various challenges encountered by the college in developing the college's ICT system, the state of Internet access at the college and its limitations, and the disparities in the distribution of technical infrastructure across the college's campuses.

6.13.1. ICT system: *Development and challenges*

Despite KZN TVET F's rural location, the college has had an ICT system since 2007 (IT Manager [IT0060], unstructured interview, 6 June 2022). However, that system had been used primarily for administrative purposes until 2020 (IT Technician [IT0060], unstructured interview, 14 September 2021). In 2021, the college began allocating resources toward developing its ICT infrastructure to accommodate teaching and learning activities (Student Support Services [SS0006], unstructured interview, 14 September 2021). The strategy included procuring an LMS, adding to their existing infrastructure and hardware, and beginning to procure laptops for academic staff (IT0060, unstructured interview, 6 June 2022; SS0006, unstructured interview, 14 September 2021).

In terms of infrastructure and hardware, the college began with installing the necessary infrastructure and hardware in classrooms and workshops (IT0060, unstructured interview, 6 June 2022). At the time of writing, not all the college's classrooms and workshops had the necessary infrastructure or hardware to allow lecturers to utilise ICTs to deliver their lessons (IT0060, unstructured interview, 6 June 2022; Deputy Principal for Academic Services [DP0006], unstructured interview, 20 May 2022).

In the meantime, the college focused on leveraging the physical space available to add to its existing computer rooms or increase the size of its existing ones (DP0006, unstructured interview, 20 May 2022). These facilities were initially used for ICT-related courses; however, the scope of their function was widened to enable access for students and lecturers in non-ICT courses (DP0006, unstructured interview, 20 May 2022). The benefit of these facilities was that they were already available on each campus; they were equipped with the necessary hardware (computers, smart boards, and projectors), could accommodate large numbers of lecturers and students at one time, and were already connected to the Internet (IT0060, unstructured interview, 6 June 2022; IT0006, unstructured interview, 14 September 2021).

Regarding providing laptops for the lecturers, the college began procuring laptops for individual lecturers around the same time as the arrival of the COVID-19 pandemic (IT0060, unstructured interview, 6 June 2022). However, at the time of writing, the college had only managed to provide laptops to managers, departmental heads, and senior lecturers (DP0006, unstructured interview, 20 May 2022). The delays in providing laptops to lecturers were attributed partly to disruptions to the global supply chain for laptops caused by the COVID-19 pandemic (IT0060, unstructured interview, 6 June 2022). The Deputy Principal for Academic Services indicated that it was planned that lecturers would receive laptops in phases and a monthly supply of data bundles once procurement processes resumed (DP0006 unstructured interview, 20 May 2022). The college expected that once lecturers received the laptops, they would use them to plan and deliver lessons – on-site and remotely – and create learning content to be used on the LMS (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022).

6.13.2. Internet access and connectivity

In terms of providing access to the Internet, all the college's sites (campuses and central office) were connected via a combination of Very Small Aperture Terminals (VSAT), fibre, and microwave networks (IT0006, unstructured interview, 14 September 2021). According to the IT Technician (IT0006, unstructured interview, 14 September 2022), before 2021, four campuses were connected via VSAT and two via fibre optic cables (IT0006, unstructured interview, 14 September 2021). However, in 2021, the college received upgrades to its fibre installations through SABEN (IT0006, unstructured interview, 14 September 2021). These upgrades extended access to fibre internet to all the campuses (IT0006, unstructured interview, 14 September 2021). The overall speed of the Internet across the college's network was estimated to range between 6 Mbps and 10 Mbps (IT0006, unstructured interview, 14 September 2021).

Although all the college campuses had internet infrastructure, internet access for staff and students was limited to the computer rooms and the administration buildings (IT0006, unstructured interview, 14 September 2021). According to IT0006 (unstructured interview, 14 September 2021), the college had begun to install Wi-Fi hotspots across its campuses to provide more areas for students to access the Internet and LAN connections to the classrooms and workshops to extend the Internet into teaching spaces. To facilitate remote access to the network, the college had applied for zero-rating for various educational websites – such as the college's student portal and LMS, provided lecturers with 3G routers, and the ICT department

had set up VPN access to the college's network (IT0060, unstructured interview, 6 June 2022). The VPN allowed lecturers to securely access all the college's network facilities while completing their work remotely (IT0060, unstructured interview, 6 June 2022).

6.13.3. *Technical challenges and infrastructure disparities*

The college faced several technical challenges, constraining how ICTs could be utilised in the classroom (IT0060, unstructured interview, 6 June 2022). Most of the challenges did not stem directly from the ICTs but rather from the disparities in the quality of physical infrastructure and the distribution of ICT resources across the college's campuses (DP0006, unstructured interview, 20 May 2022). At the time of data collection, two issues hampered the uptake of ICTs. (DP0006, unstructured interview, 20 May 2022). First, most physical teaching and learning spaces (classrooms and workshops) had not yet been fitted or supplied with the necessary infrastructure and hardware – such as projectors, smart boards, and the Internet – to support e-learning (IT0060, unstructured interview, 6 June 2022). Second, the number of physical spaces (computer rooms) that provided access to computers on campus was insufficient to accommodate the number of students who required computer access (DP0006, unstructured interview, 20 May 2022).

The impact of these two issues was compounded by the fact that none of the campuses offered Wi-Fi access to students; where Wi-Fi was available, access was limited to the administration block and staff members (IT0060, unstructured interview, 6 June 2022). Thus, on most campuses, students' access to computers and the Internet was limited to the computer rooms (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). This also relates to Affordance Theory, and specifically to hidden and false affordances. It may be that certain software or platforms do offer accessibility offline, but the staff and students do not know this, or perceive it not to be true.

Regarding the distribution of hardware and infrastructure, visible differences existed in the quantity and quality of ICT resources available at each campus (DP0006, unstructured interview, 20 May 2022). The disparities in the distribution of resources across the campuses ranged from campuses where the college had begun installing LAN connections, projectors, and smartboards to the classrooms on the one end to campuses where there had been minimal infrastructure development on the other end (DP0006, unstructured interview, 20 May 2022). The equipping of classrooms was still in the early stages, and classrooms still needed the

infrastructure and hardware to allow lecturers to utilise ICTs during their lessons (DP0006, unstructured interview, 20 May 2022). For campuses where the process had not begun, the college had allocated hardware for the lecturers to share (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). To access the required hardware, lecturers at these campuses had to book the equipment with the HoD or the campus manager to sign it out (DP0006, unstructured interview, 20 May 2022). According to the Deputy Principal for Academic Services, the lecturers perceived having to sign out hardware from the HoD or campus manager as inconvenient (DP0006, unstructured interview, 20 May 2022).

The Deputy Principal for Academic Services further stated that it would have been ideal if hardware had been allocated for each classroom, regardless of whether it was mounted or not (DP0006, unstructured interview, 20 May 2022). This arrangement would allow lecturers who intended to utilise their personal computers for presentations or show videos during lessons easier access to the hardware (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services also noted that the unequal distribution of infrastructure and hardware across the campuses significantly restricted the pedagogic possibilities for what lecturers could do with the ICTs (DP0006, unstructured interview, 20 May 2022). From a curriculum perspective, it impeded the development of a coherent, collegewide teaching and learning strategy for ICTs (DP0006, unstructured interview, 20 May 2022). This statement connects to IDT and the organisational structure, and the horizontal and vertical differentiation sub-concepts.

With the installation of ICT infrastructure in classrooms at the college still in its early stages at the time of data collection, lecturers and students depended on the computer rooms for access to computers and the Internet (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). These facilities had desktop computers, mounted projectors, and printers in each room (IT0060, unstructured interview, 6 June 2022; IT0006, unstructured interview, 14 September 2021). According to the Deputy Principal for Academic Services, despite the college's computer rooms having the necessary resources to support teaching and learning, the computer rooms did not have sufficient capacity – space and computers – to provide access to a workstation to all the staff and students all the time (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services (DP0006, unstructured interview, 20 May 2022) stated that previously, access to the computer rooms was reserved for students taking ICT-related courses; however, access to computer rooms had become necessary for students taking non-ICT-related courses as well due to the

increased curriculum requirements for computers and the Internet from general courses (DP0006, unstructured interview, 20 May 2022).

Beyond the curriculum requirements, accessing the computer rooms was crucial for teaching and learning as most students did not own or have access to ICT devices once they left campus. Therefore, it was important for the college to ensure there was sufficient space and computers in their computer rooms to support all their teaching and learning requirements (DP0006, unstructured interview, 20 May 2022). To extend access beyond ICT courses, the college had established a booking system that allowed lecturers to secure computer access for their students during class time (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). As a result, the computer rooms were usually fully booked during lesson time due to the high user demand (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022).

The combination of having to share hardware and the limited number of spaces in the computer rooms was a barrier to lecturers' use of ICTs for teaching and learning (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services (DP0006, unstructured interview, 20 May 2022) noted lecturers' frustration with scheduling computer room sessions and how the availability of the computer rooms had become a crucial factor for lecturers when they formulated their lesson plans. For most lecturers, frustrations with the computer room booking process had contributed to the perception that working with ICTs was an unnecessary burden placed on them by the college (DP0006, unstructured interview, 20 May 2022). Some lecturers argued that limited computer access impeded their ability to complete their teaching of the syllabi (DP0006, unstructured interview, 20 May 2022).

Pedagogically, these challenges resulted in lecturers eschewing ICTs in their teaching in favour of traditional modes of content delivery — commonly referred to at the college as 'chalk and talk' (DP0006, unstructured interview, 20 May 2022). Over the short term, the college planned to resume the procurement of laptops for lecturers, which had been suspended due to the COVID-19 pandemic and the resulting shortage of laptop stocks locally (IT0060, unstructured interview, 6 June 2022). For the long term, the college was formulating plans to develop skills centres that would cater for all the college's ICT needs (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services did not provide details on how these skills centres would work or how they would differ from the already available facilities. However, the college intended to ensure that each campus had a space where the college's e-

learning resources would be accessible to students and lecturers as and when they were required (DP0006, unstructured interview, 20 May 2022).

Beyond the issues listed above, other technical challenges faced by the college included daily intermittent power outages (load shedding), slow and unstable internet connectivity on campus, lack of internet access off campus, and delays in the delivery of student laptops (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). In order to mitigate the impact of load shedding, the college had installed UPSs and generators to provide the network and hardware with backup power (IT0060, unstructured interview, 6 June 2022; IT0006, unstructured interview, 14 September 2021). These devices minimised the impact of load shedding on teaching and learning activities that required ICTs (IT0060, unstructured interview, 6 June 2022).

Regarding internet speed, IT0060 (unstructured interview, 6 June 2022) noted that the Internet at the college was not fast enough and was sometimes unstable, particularly during periods of high user traffic. The limitations of the college's Internet were due partly to the increased bandwidth demand caused by the high number of users (IT0060, unstructured interview, 6 June 2022). In response, the ICT department rationed the network's bandwidth during high-traffic periods, prioritising administrative tasks over teaching and learning (IT0060, unstructured interview, 6 June 2022). In addition to the limited access to computers on campus, the lecturers' reluctance towards adopting ICTs was influenced by the students' lack of access to the Internet when they were off campus (DP0006, unstructured interview, 20 May 2022).

According to the IT0060 (unstructured interview, 6 June 2022), some campuses were surrounded by areas with no network coverage; the coverage was so poor that students could not access the Internet, even on cell phones (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The college had attempted to extend off-campus internet access through the zero-rating of sites such as the student portal and the LMS (IT0060, unstructured interview, 6 June 2022; IT0006, unstructured interview, 14 September 2021). However, these interventions depended on sufficient network coverage in the surrounding areas to be effective (IT0060, unstructured interview, 6 June 2022).

6.14. E-learning: Strategy and implementation

Despite the college's technical challenges, it favoured pursuing e-learning and had previously planned to do this for several years. According to DP0006 (unstructured interview, 20 May 2022) and IT0060 (unstructured interview, 6 June 2022), the college had formulated a five-year implementation plan for e-learning before the Level 5 lockdown regulations took effect. However, due to the disruptions to teaching and learning caused by the COVID-19 pandemic, the college had had to expedite implementation despite not having had all the necessary infrastructure and hardware in place (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The college's intention to pursue e-learning was driven by the technological transformation they had observed globally (DP0006, unstructured interview, 20 May 2022).

Due to the technical challenges discussed above and the lack of e-learning expertise, the college had not yet begun implementing e-learning (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services indicated that there was an urgent need for the college to establish an e-learning unit (DP0006, unstructured interview, 20 May 2022).

Similarly, the Student Support Services Director noted that there had been delays in establishing an e-learning unit due to the unavailability of staff to oversee the coordination of e-learning (SS0006, unstructured interview, 14 September 2021). In this regard, officials at the college recommended that the necessary roles be identified and staff be appointed to fill those roles (SS0006, unstructured interview, 14 September 2021). However, appointing officials required the creation of new posts, which required authorisation from DHET, and filling these types of posts at the college level could take up to three years (SS0006, unstructured interview, 14 September 2021).

The procedures involved with creating e-learning posts had thus contributed to the delays in the college establishing a stand-alone e-learning unit (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Service (DP0006, unstructured interview, 20 May 2022) and the Student Support Services Director (SS0006, unstructured interview, 14 September 2021) expressed the view that DHET should consider means to expedite the process to enable the appointment of e-learning personnel at the college level. Beyond personnel issues, the Deputy Principal for Academic Services at the college noted that it would not be to the college's benefit to force implementation of e-learning at this stage as the necessary hardware and infrastructure were not yet in place at every campus (DP0006, unstructured interview, 20

May 2022).

Under the existing institutional structure, the college had no designated official, structure, or department exclusively responsible for e-learning (DP0006, unstructured interview, 20 May 2022). The responsibility for overseeing e-learning had been delegated to Student Support Services; in addition to their other responsibilities, Student Support Services provided administrative support for e-learning at the college (IT0006, unstructured interview, 14 September 2021; SS0006, unstructured interview, 14 September 2021). Their responsibilities included working with the ICT department to ensure that the college's online platforms were operational, assisting the academic staff with uploading learning content onto the college's LMS and assisting students with e-learning issues (DP0006, unstructured interview, 20 May 2022). The college had also appointed an 'LMS champion' at the central office who liaised with campus management on e-learning issues on behalf of college management (DP0006, unstructured interview, 20 May 2022). The LMS champion was responsible for attending academic meetings, providing campus feedback and updates on ICT-related issues, and promoting ICT adoption across the college.

From a technical point of view, the ICT department was responsible for managing the computer rooms and hardware, overseeing the college's network, and maintaining the college's LMS (DP0006, unstructured interview, 20 May 2022). The ICT department was also responsible for ensuring connectivity for the academic staff and students while they were on campus. To establish a coordinated e-learning approach, the college had appointed a manager whose primary role was implementing e-learning operations (DP0006, unstructured interview, 20 May 2022). At the time of the interview with the Deputy Principal for Academic Services, the e-learning manager had yet not assumed their duties, which would include overseeing the installation of infrastructure and hardware in the classrooms, coordinating e-learning operations at the campus level, and managing the college's proposed skills centres (DP0006, unstructured interview, 20 May 2022).

At the campus level, campus managers worked with the existing academic structures to coordinate e-learning; each campus had subject committees consisting of heads of department (HODs), senior lecturers, and lecturers (DP0006, unstructured interview, 20 May 2022). The HODs and senior lecturers supervised content development and provided quality assurance for e-learning materials and digital content (DP0006, unstructured interview, 20 May 2022). Additionally, the HODs and senior lecturers were responsible for capacitating lecturers within

their subjects to create content, download online resources, and upload content (DP0006, unstructured interview, 20 May 2022). Lecturers used the hardware available to produce learning materials and design lesson plans (DP0006, unstructured interview, 20 May 2022).

6.14.1. E-learning strategy: Policy framework and roles

In terms of strategy, the college did not have an active institutional e-learning policy; instead, the college's approach to e-learning was informed by the *Standard Operating Procedure for Blended/Open Learning at TVET Colleges in KZN* [SOP] (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The Standard Operating Procedure was developed through the college's collaboration with the other eight TVET colleges in KZN and was published by DHET in 2022 (DHET, 2022). It provides an implementation framework for e-learning and open-learning strategies designed for the TVET context (DHET, 2022). The SOP outlines the mechanisms, processes, and roles TVET colleges require to execute an effective and efficient e-learning operation (DHET, 2022). It provides implementation guidelines that assist the colleges in organising their online learning procedures and standardising lecturer practice across subjects (DHET, 2022).

Regarding roles and responsibilities, the SOP identifies three additional role-players required beyond the academic staff to implement an e-learning strategy. Those roles are outlined as follows (DHET, 2022):

- a. **Subject matter expert (SME)** – A non-teaching subject expert who forms part of the e-learning department (DHET, 2022). The SME works with the different syllabi and develops lesson plans and online content templates (DHET, 2022). They liaise with lecturers and HoDs to ensure that the lessons and online materials they develop for individual subjects align with the college's teaching and learning approach (DHET, 2022).
- b. **Instructional designer (ID)** – A senior academic staff member, such as an HoD or senior lecturer, who oversees online content creation; they work with lecturers to gather source materials, digitise materials, upload content onto the LMS platform, and organise student activities on the LMS (DHET, 2022).
- c. **Quality manager (QM)** – An official from the Curriculum Services unit responsible for moderating online content and coordinating the college's online teaching and learning strategy (DHET, 2022).

The SOP also provides a model for creating a workflow for creating digital materials (DHET, 2022). The model outlines each stage of the content creation process and how quality is assured at each stage (DHET, 2022).

The delineation of specific e-learning roles (SME, ID, QM) highlights a move towards specialisation and professionalisation. However, the questions around whether colleges will have the capacity to fill these roles are critical. This speaks to the broader issue of human resource development within the TVET sector. Beyond just creating positions, there's a need for ongoing training, mentorship, and career pathways for individuals working in these emerging roles. It also raises a question about resource allocation: are colleges prioritising these roles, or are they seen as secondary to traditional teaching positions? The success of e-learning initiatives depends not just on technology, but on having the right people with the right skills in the right positions.

6.14.2. KZN TVET F's response to COVID-19: Adapting to limitations and challenges

The college did not have an e-learning system at the beginning of the Alert Level 5 of the lockdown period. The college used the lockdown period to formulate plans for resuming teaching and learning (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). Before the lockdown, the college had been piloting a Moodle-based LMS that one of their service providers had recommended (IT0060, unstructured interview, 6 June 2022). Unfortunately, the LMS had various operational issues, such as staff and students experiencing difficulties accessing their profiles (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). During this period, the service provider failed to provide any solutions and, according to the Deputy Principal for Academic Services (DP0006, unstructured interview, 20 May 2022), they exacerbated issues in some instances. These challenges resulted in the college terminating the provider's services (DP0006, unstructured interview, 20 May 2022). Due to this, the college had to formulate a new plan when the COVID-19 pandemic caught them without a functional online platform or means to continue teaching and learning remotely (DP0006, unstructured interview, 20 May 2022).

In addition to lacking an LMS platform, the college had limited remote teaching and learning options (DP0006, unstructured interview, 20 May 2022). Without an LMS, the ICT department created a Google Drive profile where lecturers could upload required learning materials for students (IT0060, unstructured interview, 6 June 2022). Subsequently, all the files on Google Drive were transferred to the college website (IT0060, unstructured interview, 6 June 2022). Next, the lecturers created class groups on WhatsApp for general communication and student engagement (DP0006, unstructured interview, 20 May 2022). The lecturers regarded WhatsApp as the most viable option as it was the most accessible platform for students and carried low data costs (DP0006, unstructured interview, 20 May 2022).

As the lockdown continued, the ICT department configured email accounts for staff and students (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). Once these accounts were operational, lecturers used them to disseminate class notes and learning content (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The college used VPNs to allow lecturers to access the network remotely and applied for zero-rating of the college website to allow students to access the content without incurring data costs (IT0060, unstructured interview, 6 June 2022). When the lockdown restrictions were eased to allow limited contact, face-to-face lessons resumed at 50% of classroom capacity. Each class was divided into two groups of students; the two groups alternated their attendance weekly (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022).

During this period, lecturers posted their lessons (video or audio recordings) on the website and sent instructions to students for tasks via WhatsApp (DP0006, unstructured interview, 20 May 2022). According to IT0060 (unstructured interview, 6 June 2022), before the COVID-19 pandemic, most lecturers had visited the college's website once a week. During the lockdown, they used the website more frequently to allocate tasks, upload content, and respond to students' queries (IT0060, unstructured interview, 6 June 2022). Similarly, students had previously visited the website once every two months, on average. However, during the lockdown period, they typically visited it daily and spent up to three hours online daily (IT0060, unstructured interview, 6 June 2022).

6.14.3. Implementation of a digital learning management system: Overcoming setbacks

Following the failure of the initial LMS pilot, the college procured a new LMS in 2021 through a different service provider (DP0006, unstructured interview, 20 May 2022). Academic Services was responsible for selecting the LMS and determining its specifications (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The main factor that the college emphasised when selecting the LMS was the ability of the system to provide remote learning capability for the college (DP0006, unstructured interview, 20 May 2022). According to IT0060 (unstructured interview, 6 June 2022), the role of the ICT department during this process involved ensuring that the selected system would be compatible with the college's existing ICT infrastructure. The ICT department was also responsible for ensuring that the LMS would be accessible to staff and students from both on and off-campus sites (IT0060, unstructured interview, 6 June 2022).

The development of the new Moodle-based LMS began during Alert Level 5 of the COVID- 19 lockdown, and Gagasi IT Solutions provided technical support (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The college successfully launched the LMS after lockdown regulations were lifted (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). The college continued to use the Cisco system for some ICT-based courses (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). Regarding technical specifications, DHET's *Guidelines for the planning, establishment and implementation of an effective blended and remote learning system in a TVET College* [National Guidelines] recommended lecturer laptops with the following specifications: a solid-state hard drive with a minimum of 200 GB (SSD), 8 GB RAM, and an I5 processor (IT0060, unstructured interview, 6 June 2022; DHET, 2021).

For students, the laptop specifications recommended by the National Guidelines are a solid-state hard drive with a minimum of 200 GB (SSD), 4 GB RAM, and an I5 processor (DHET, 2021). The LMS allowed the lecturers to upload various types of content, such as video recordings of their lessons, study guides, assignments, and readings (IT0060, unstructured interview, 6 June 2022). The LMS also allowed lecturers to automate tasks such as marking assessments, providing feedback, and disseminating student notifications (IT0060, unstructured interview, 6 June 2022). Not all lecturers could utilise the LMS due to the shortage of laptops and the other technical issues discussed above (IT0060, unstructured interview, 6 June 2022). The biggest challenge experienced with the LMS was registering students on the LMS and assigning roles to

lecturers on the LMS (DP0006, unstructured interview, 20 May 2022). Hosting the LMS and providing user support remained the service provider's responsibility (IT0060, unstructured interview, 6 June 2022).

6.14.4. Addressing the skills gap: Empowering lecturers for e-learning.

At the time of data collection, the development of e-learning at the college had reached the point where the biggest skills-related issue that the college was contending with was the lack of basic computer skills among lecturers (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). According to the IT Manager, most lecturers were not computer literate, leading to inefficiencies in implementing the e-learning strategy. In this regard, IT0060 (unstructured interview, 6 June 2022) recommended that the college equip the lecturers with skills to operate the hardware and the knowledge to understand the software. In addition, lecturers needed to be aware of the security threats that come with internet browsing and using online materials (IT0060, unstructured interview, 6 June 2022). In the long term, the college planned to train lecturers to be able to teach using ICTs (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). This again emphasises the issue of user affordances. Addressing the skills gap is a critical step in increasing the perceived and actual utility of ICTs for lecturers.

6.15. Harnessing ICTs to overcome curriculum challenges

The college's geographic location was one of its most significant challenges in introducing ICTs; however, its geography also made the introduction of ICTs particularly beneficial for the college (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services noted that students at the college had limited exposure to industries because of their location (DP0006, unstructured interview, 20 May 2022). Most had few opportunities to leave their hometown and experience other settings (DP0006, unstructured interview, 20 May 2022). Rural students' lack of exposure to concepts and objects beyond their environment can add additional challenges to teaching (DP0006, unstructured interview, 20 May 2022; IT0060, unstructured interview, 6 June 2022). In this regard, the Deputy Principal for Academic Services noted that ICTs could be used to provide audio-visual content to enrich lessons (DP0006, unstructured interview, 20 May 2022). Thus, Teaching with ICTs could help the college compensate for its remoteness from industries and make experiences more readily accessible to rural students (DP0006, unstructured interview, 20 May 2022).

The college intended for students to be exposed to workshops or industries, at least through video content, if they could not visit these in person (DP0006, unstructured interview, 20 May 2022). The Deputy Principal for Academic Services also raised the issue of the many students registered for distance learning at the college (DP0006, unstructured interview, 20 May 2022). At the time of the interview, the college's distance learning was still entirely paper-based; integrating ICTs into teaching and learning would give these students greater access to learning opportunities (DP0006, unstructured interview, 20 May 2022). The college planned to develop an e-learning system and an ICT network to address these issues.

6.16. Navigating ICT adoption across a dispersed rural landscape

KZN TVET F presents a unique case study in ICT adoption due to its extensive geographic spread, rural setting, and the socio-economic conditions of its surrounding communities. The vast distances between the central office and its campuses introduce significant logistical challenges in maintaining ICT infrastructure, providing technical support, and ensuring equitable digital access. The rural landscape exacerbates these difficulties, with many campuses operating in areas with limited ICT service provider coverage, weak broadband infrastructure, and unreliable road networks. According to Affordance Theory, these environmental constraints shape how the college engages with ICTs, as its campuses must navigate a complex balance between technological possibilities and infrastructural limitations. The availability of ICTs does not automatically translate into effective digital integration; rather, the quality of access is determined by the local infrastructure and the institutional capacity to sustain ICT initiatives.

Beyond infrastructure, IDT highlights the governance and policy constraints that influence ICT adoption at KZN TVET F. Several municipalities where the campuses are located are subject to Section 139 interventions, which affect local governance and service delivery, adding layers of complexity to ICT implementation. Furthermore, the Ingonyama Trust's land administration system regulates development projects in many rural areas, requiring additional bureaucratic approvals that may delay ICT infrastructure investments. These policy and governance factors create a fragmented environment in which the college must operate, requiring institutional leadership to develop ICT strategies that account for both external administrative constraints and internal logistical realities. The planned transition towards specialisation hubs further complicates this landscape, as it necessitates a recalibration of digital resources to align with the

needs of industry-focused curricula.

From a DOI perspective, KZN TVET F's specialisation hubs represent a proactive approach to aligning ICT strategies with economic demands. The decision to tailor campuses to specific industries – such as agriculture, hospitality, and mechanical engineering – indicates an awareness of how ICTs must be adapted to different vocational training contexts. However, this shift also presents challenges related to faculty preparedness and the upskilling of lecturers to integrate ICTs into evolving curricula. Moreover, on-site student accommodation at some campuses presents an opportunity to embed ICT adoption into daily learning environments, potentially enhancing digital literacy and engagement. Despite these promising developments, the college must address the persistent issue of unequal access to ICTs, ensuring that its most remote campuses do not lag behind in ICT accessibility and quality of service. KZN TVET F's case underscores the broader reality that ICT adoption in TVET institutions is not solely a technological issue but one deeply intertwined with geography, policy, and institutional decision-making.

6.17. Institutional ICT adoption trends

The ICT adoption strategies of KZN TVET B, KZN TVET D, and KZN TVET F reflect distinct institutional responses shaped by geographic, economic, and infrastructural factors. While all three institutions face challenges related to digital infrastructure, network management, and policy implementation, their approaches vary significantly based on their respective environments. KZN TVET B demonstrates a gradual shift towards blended learning, constrained by financial and infrastructural limitations. KZN TVET D emerges as a leader in ICT adoption, benefiting from industry links and a structured policy framework. KZN TVET F, operating in a predominantly rural setting, has adopted innovative yet low-tech solutions to navigate its connectivity and resource constraints. These differences highlight the diverse realities of ICT integration within the TVET sector, underscoring the need for adaptive and context-specific digital strategies.

6.17.1. KZN TVET B: Incremental expansion and emerging blended learning strategies

KZN TVET B exhibited an incremental approach to ICT adoption, shaped by its urban and peri-urban setting. The college benefits from proximity to the eThekweni Metro, which provides relatively stable access to ICT service providers and infrastructure. Over the past decade, KZN TVET B has steadily expanded its digital capacity, investing in a combination of Wide-Area Network (WAN) and Multiprotocol Label Switching (MPLS) infrastructure to support connectivity across its campuses. Despite these investments, the institution continues to experience challenges related to outdated hardware, bandwidth limitations, and network congestion, particularly as more teaching and learning activities transition to online platforms.

In response to national policy directives and the disruptions caused by the COVID-19 pandemic, KZN TVET B has initiated a transition towards e-learning. The college has prioritised lecturer training and digital upskilling to prepare for integrating Learning Management Systems (LMS) and online content delivery. However, this transition has been hindered by delays in implementing e-learning platforms due to budgetary constraints and a lack of student access to devices. Although the institution has engaged in strategic planning for e-learning, it has yet to develop a comprehensive internal policy framework for ICT integration, instead relying on the National Guidelines to inform its decisions.

The gradual adoption of ICTs at KZN TVET B suggests an institution that is open to ICT adoption and integration but remains constrained by infrastructural and financial limitations. While the college has taken steps towards modernising its ICT environment, particularly through cloud-based storage and data centre enhancements, systemic challenges such as hardware obsolescence and inconsistent network performance highlight the need for sustained investment and strategic planning.

6.17.2. KZN TVET D: Industry-aligned digital leadership and policy-driven ICT integration

KZN TVET D demonstrates a more structured and proactive approach to ICT adoption, leveraging its location in Newcastle, a region with a strong industrial presence. The college's close ties to the manufacturing, finance, and community service sectors have positioned it as a leader in digital integration within the TVET sector. Unlike KZN TVET B, which is still in transition, KZN TVET D has already implemented an e-learning model and successfully incorporated ICTs into its teaching and learning framework.

A key factor distinguishing KZN TVET D from other TVET colleges across the province, is its strong institutional policy on ICT adoption. The college has not only adhered to the National Guidelines document but has also developed its internal policy framework to guide the integration of ICTs into teaching and administration. This structured approach has enabled the institution to align its digital strategy with industry needs, ensuring that students receive training in technologies that are directly relevant to the job market. The institution's proactive stance is further reflected in its investments in high-quality ICT infrastructure, robust internet connectivity, and a well-maintained digital learning environment.

Despite these advancements, KZN TVET D faces ongoing challenges related to maintaining its ICT infrastructure. The financial burden of keeping up with technological advancements remains a concern, as does the need for ongoing staff training to ensure that lecturers are fully equipped to integrate ICTs into their pedagogy. However, the institution's ability to secure external partnerships and leverage industry collaborations provides it with a strategic advantage in sustaining its ICT development.

6.17.3. KZN TVET F: Rural digital innovation and adaptive ICT strategies

KZN TVET F operates within a significantly different context compared to the other two institutions. Its campuses are spread across three district municipalities, covering vast rural areas with limited ICT infrastructure. The college faces considerable geographic and logistical challenges, including unreliable internet connectivity, a lack of access to ICT service providers, and the high costs associated with maintaining infrastructure over long distances. These factors necessitate a more adaptive approach to ICT adoption.

Given its rural setting, KZN TVET F has developed alternative strategies to facilitate digital learning. The institution has adopted a specialisation hub model, aligning its campuses with local economic activities such as agriculture, hospitality, and civil engineering. By integrating ICTs in ways that directly respond to regional workforce demands, KZN TVET F has sought to maximise the utility of its digital investments despite financial and infrastructural constraints. In terms of e-learning, the institution has relied on low-tech solutions, such as radio broadcasts and printed study materials, to bridge the digital divide for students with limited internet access.

Financial constraints pose a significant challenge to KZN TVET F's ICT adoption efforts. Unlike KZN TVET D, which benefits from strong industry partnerships, KZN TVET F operates within a more resource-limited environment, making long-term sustainability a pressing concern. The institution follows national ICT guidelines but lacks an internally developed policy tailored to its unique needs. Consequently, while KZN TVET F has demonstrated resilience and innovation in navigating its challenges, its digital strategy remains reactive rather than systematically planned.

The analysis of ICT adoption across KZN TVET B, KZN TVET D, and KZN TVET F highlights distinct institutional responses shaped by geographic, economic, and infrastructural conditions. While each college has implemented strategies to integrate ICTs, the effectiveness of these efforts is influenced by their respective contexts. Despite the differences in their institutional settings, common themes emerge across the three colleges, including disparities in ICT access, constraints in infrastructure investment, and the significant role of policy frameworks in shaping ICT strategies. The following comparative analysis examines these shared themes while highlighting the nuanced ways in which each institution navigates the digital landscape within the TVET sector.

6.18. Comparative analysis of ICT adoption across KZN TVET B, KZN TVET D, and KZN TVET F

The exploration of ICT adoption strategies across KZN TVET B, KZN TVET D, and KZN TVET F reveals distinct institutional responses shaped by geographic, economic, and institutional contexts. Each institution represents a distinct ICT adoption trajectory, shaped by its location, available resources, and institutional priorities. This comparative analysis applies concepts from DOI, Affordance Theory, and IDT to critically explore the patterns of ICT adoption, the barriers encountered, and the strategic responses developed by each institution. Overall, the analysis reveals that while common challenges such as limited bandwidth, financial constraints, and disparities in digital literacy exist across the three institutions, each institution's approach is mediated by its unique operational environment.

6.18.1. Geographical and infrastructural constraints

The role of geography in ICT adoption aligns with Affordance Theory's notion of environmental affordances, wherein the physical setting determines the possibilities for action. KZN TVET B, located in a metropolitan area, benefits from stable ICT service provision and proximity to service providers, which facilitates faster maintenance and upgrades. In contrast, KZN TVET F's dispersed rural campuses create logistical barriers, limiting internet reliability and technical support availability. KZN TVET D, positioned between these two extremes, leverages its industrial partnerships to mitigate infrastructural shortcomings. These differences underscore the impact of geographical affordances on ICT deployment, demonstrating that rural colleges require alternative strategies, such as decentralised ICT hubs or mobile connectivity solutions, to bridge the infrastructural divide.

From an IDT perspective, the regulatory and cultural-cognitive pillars play a role in shaping how institutions address these challenges. KZN TVET B and KZN TVET D benefit from structured support networks and established ICT policies, while KZN TVET F faces additional barriers due to its reliance on external agencies for infrastructure development. This uneven institutional landscape suggests that regulatory interventions at the national level should prioritise resource distribution to address systemic infrastructural inequities across TVET colleges.

6.18.2. ICT infrastructure and network management

The variations in ICT infrastructure investment across the three colleges illustrate the principles of DOI, particularly the role of relative advantage and compatibility in driving adoption decisions. KZN TVET B has focused on upgrading its ICT infrastructure over the past decade, implementing WAN and MPLS networks to ensure connectivity. However, bandwidth limitations remain a persistent challenge, particularly during peak usage periods. KZN TVET D, recognised as a leader in ICT integration, has strategically aligned its infrastructure investments with industry demands, ensuring compatibility with contemporary digital practices. KZN TVET F, constrained by its geographic dispersion, has had to adopt an adaptive approach, establishing campus-specific hubs to maximise resource efficiency.

Affordance Theory further explains the role of technological affordances in shaping adoption patterns. While all three institutions possess ICT infrastructure, their ability to fully leverage these resources depends on institutional preparedness and network capacity. The persistent challenge of limited bandwidth across colleges underscores the need for sustainable investment in digital infrastructure, particularly for rural institutions where connectivity remains unreliable. This reinforces the importance of IDT's organisational structure dimension, which suggests that decentralised ICT management models may enhance network efficiency and responsiveness in large, multi-campus institutions.

6.18.3. Blended learning and e-learning implementation

The transition to blended learning and e-learning reflects the different institutional strategies, that have emerged from their innovation-decision processes. KZN TVET B has adopted a phased approach, prioritising lecturer training and incremental LMS integration. KZN TVET D, having already incorporated digital learning frameworks, has moved towards a more structured implementation, leveraging its industry connections to enhance content delivery. KZN TVET F, facing significant digital equity barriers, has relied on alternative learning modes, such as radio broadcasts and community-based digital content distribution.

User affordances – as outlined in Affordance Theory – also play a critical role in this context. While technological affordances exist, their effective utilisation depends on lecturers’ digital literacy and students’ access to devices. The lack of personal ICT devices among students at KZN TVET B and KZN TVET F has slowed the adoption of e-learning, demonstrating the interplay between perceived and actual affordances. KZN TVET D’s ability to implement e-learning more effectively suggests that institutional culture – part of IDT’s normative pillar – plays a key role in fostering digital adoption. Colleges that embed ICT training and support within their academic frameworks are more likely to achieve sustainable digital transformation.

6.18.4. *Institutional responses to digital equity and policy frameworks*

In terms of the regulatory and normative pillars of institutional processes, KZN TVET B follows the national ICT guidelines but lacks a comprehensive internal policy, leading to fragmented implementation. KZN TVET D, in contrast, has developed institution-specific ICT policies, aligning digital adoption with its academic and industrial objectives. KZN TVET F, operating in a more resource-constrained setting, has tailored its ICT strategy to regional needs, focusing on skills hubs aligned with local economic activities.

DOI’s concept of compatibility is evident in these responses. Colleges that align ICT strategies with institutional missions – such as KZN TVET D’s integration with industry standards – demonstrate higher adoption efficacy. Conversely, the lack of a cohesive ICT policy at KZN TVET B suggests that institutions require clearer implementation frameworks to facilitate structured digital transformation. The need for a coordinated national strategy becomes evident, as localised ICT adoption efforts remain inconsistent and, in some cases, reactive rather than proactive.

In summary, the comparative analysis underscores that ICT adoption within TVET colleges is not a uniform process but is shaped by institutional, geographic, and policy-related variables. DOI highlights the role of innovation characteristics in adoption decisions, Affordance Theory explains how environmental and technological constraints shape ICT usage, and IDT elucidates how institutional structures and policies influence implementation. While all three colleges have made progress, digital inequities persist, particularly in rural and resource-limited contexts. Addressing these challenges requires not only financial investment but also strategic planning that incorporates local needs, regulatory support, and adaptive learning models. Moving forward, a more integrated approach to ICT adoption – balancing national policy

directives with institutional autonomy – will be crucial in ensuring that digital transformation efforts within the TVET sector are both equitable and sustainable.

6.19 Conclusion

Institutionally, the three TVET colleges shared similar organisational hierarchies and institutional processes. The similarities in institutional frameworks imply that each TVET college has followed the same institutional processes when deciding to adopt ICTs. However, as indicated in the technical survey, geography and socioeconomic profile have played a crucial role in driving ICT strategies at the institutional level. Geography and socioeconomic profile played a significant role in selecting the three TVET colleges for participation in the case study. The three TVET colleges have a presence in urban, peri-urban, and rural areas; however, each college has a unique geographic and socioeconomic profile.

The findings emphasise the interplay of factors that shape ICT adoption and indicate the need for a more systemic and equitable approach to ICT adoption. The focus on geography and socioeconomic profile highlights the uneven playing field within the TVET sector. This raises a fundamental question: how can we ensure that all TVET colleges, regardless of their location or resources, have the opportunity to effectively integrate technology into teaching and learning? This points to a need for policy interventions that address the underlying structural inequalities and provide targeted support to colleges that are most in need. It's not just about providing technology; it's about creating a level playing field where all students and lecturers have the opportunity to succeed in a digital age.

Beyond the technical specifications of their hardware, the TVET colleges also had to consider the external conditions of their operational environment when deciding on their infrastructure configuration. In their considerations, the TVET colleges had to evaluate how their location and distribution of campuses would affect internet connectivity, technical support for the local infrastructure, and provision of user support across campuses. In terms of the operational environment, the TVET colleges also had to consider whether their existing physical infrastructure could support the rollout of e-learning and ensure that they had physical spaces available to cater to the e-learning needs of the college.

Finally, the TVET colleges had to address the various user-related issues that limited the scope of their implementation. It is worth noting that environmental, technical, and user factors do not exist in isolation; instead, they intersect and amplify each other. This intersection of factors reinforces the importance of considering the interplay between environmental, technological, and user affordances, as described by Affordance Theory. It also highlights the complexity of the social system within which ICT adoption takes place, a core concept within DOI theory. In this regard, concerns about the environmental conditions or the state of hardware could lead to lecturers not embracing ICTs as they might be unable to utilise them effectively in their classrooms. These factors and other findings from the institutional case studies and the technical surveys are discussed and analysed in Chapter 7. The Chapter will analyse the study's findings and discuss the impact of the various aspects of the institutional design on the ICT adoption process.

CHAPTER 7: DISCUSSION AND ANALYSIS OF FINDINGS

7.1. Introduction

The findings generated during the study's two phases provide crucial insights into the distribution of ICTs across the TVET colleges located across KZN, the institutional factors that affect the adoption of ICTs at these TVET colleges, and the institutional mechanisms utilised by TVET colleges to integrate ICTs into teaching and learning operations. The findings were generated through processes that interrogated the environmental and institutional factors that informed TVET colleges' ICT choices; the findings emphasise the correlation between the institutional environment – both physical and organisational – and ICT adoption. The findings highlight the significant role played by the institutional design of the TVET colleges in shaping how the institutions approach ICTs and the rate at which they adopt ICTs. The findings outline the factors that inform the decision-making processes of TVET colleges when adopting ICTs and the structures responsible for implementing the decisions.

This chapter will analyse the study's findings and discuss the impact of the various aspects of the institutional design on the ICT adoption process. The analysis will draw on concepts from Institutional Design Theory (IDT) and Diffusion of Innovation (DOI) theory. These concepts include; social systems, organisational structure, differentiation, chain of command, span of control, and communication networks. To a lesser extent, the analysis will also draw on concepts from Affordance Theory. Affordance Theory, while primarily used in Chapter 5 to analyse the technical survey data, provides a valuable lens for understanding how the interaction between the environment, ICTs, and users shapes the potential for ICT use, and how that potential is perceived and realised within the TVET college context.

The discussions will highlight the institutional design features that underpin each TVET college's social system, the delegation of roles and responsibilities at the various levels of the TVET college's organisational structure, the role of organisational leadership in driving the ICT adoption process, and the communication channels utilised to disseminate ICT strategy and information. Additionally, the discussions will cite cases of best practices and instances where institutional design was a barrier to the adoption process.

7.2. The TVET college as a social system: The interplay between institutional design and ICT adoption

“A social system is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, organizations, and subsystems” (Rogers, 2003, p. 60).

According to DOI, the process by which ICTs are adopted involves four elements: innovation (the idea or technology), communication channels, time, and social systems (Rogers, 2003). This analysis will focus on the organisational structure and the institutional design that underpins the TVET college as a social system. The decision to focus the analysis on the social system was based on the assertion that the social system constitutes the boundary within which the adoption process takes place and affects how the adoption process unfolds in several ways (Rogers, 2003).

In addition, all the units within a social system collaborate to solve shared challenges or reach mutual objectives. The presence of shared objectives or challenges binds the units of a system to each other (Rogers, 2003). This shared objective, in the context of this study, is the effective integration of ICTs into teaching and learning. However, as the findings from Chapters 5 and 6 demonstrate, the perception of this objective, and the perceived affordances of ICTs in achieving it, can vary significantly among different units and individuals within the social system. Thus, the social system provides the setting and the social structure for the adoption process and defines the relationships between the individual units within the system. Understanding the structural arrangements of social systems and their impact on the adoption process provides insights into how and why adoption occurs within specific social contexts.

In the context of this study, the social system under observation was the TVET college, and the units in question were the structures and officials that constitute the institutional environment of the TVET college. The discussion aims to identify the various units that constituted the selected TVET colleges' institutional designs and describe how each unit contributed to the adoption process. The data referred to in this discussion are drawn from an analysis of TVET-related legal and policy documents and unstructured interviews with participants from the TVET colleges.

As outlined above, social systems are interrelated social units that work together to solve problems and accomplish shared objectives. The members or units of a social system may be individuals, informal groups, organisations, and subsystems (Rogers, 2003). Therefore, any group of social units or individuals connected through a common objective and shared norms can be considered a social system (Jones, 2013; Rogers, 2003).

In the case of this study, the social system in question was the public TVET college, and the phenomenon under review was the adoption of ICTs at the three TVET colleges. In order to provide insight into how the process of ICT adoption occurred at each of the TVET colleges, it was crucial to explore the composite units that constituted the institutional design of TVET colleges, how these units were organised in relation to each other, and the rules that underpinned their interactions (Rogers, 2003). These rules and arrangements influence not only the formal processes of decision-making – as described by IDT – but also the informal communication channels and the flow of information about innovations – as described by DOI. An institutional design provides a blueprint that outlines the arrangement of organisational units, the allocation of roles and responsibilities, the mechanics of institutional procedures, and the delegation of authority (Clawson & Pitts, 2008; Gibson et al., 2012; Jones, 2013).

The discussions below focus on the characteristics of the TVET colleges' institutional design and how these characteristics shaped the adoption process at the institutional level. The discussion outlines how aspects of the institutional design, such as organisational structure, authority structure, governance procedures, and role allocation, affected the adoption process at the three TVET colleges.

7.3. Institutional design framework and its impact on ICT adoption: The TVET perspective

According to institutional theory, institutions are established through a formal set of rules, agreements, shared interactions, and socially accepted assumptions that organisations and individuals are expected to follow (Bruton et al., 2010; Scott, 2003). These external sources of legitimisation – which form the regulatory pillar of the institution – interact with the internal normative pillar – the institution's internal systems of norms – and the cultural-cognitive pillar – the shared frameworks of understanding amongst the staff – to shape the overall institutional design and its influence on ICT adoption. These rules are derived from sources such as regulatory structures, governmental agencies, laws, courts, professions, scripts, and other

societal and cultural practices that provide external legitimisation for the institution (Bruton et al., 2010). Thus, an institution is established by tailoring institutional rules, values, and practices into organisational forms that serve a specific purpose (Kavanagh et al., 2017).

South Africa has a long history of institutions that provide technical and vocational training in the TVET sector (Kuehn, 2019; McGrath, 2006; Terblanche & Bitzer, 2018). However, the current institutional configuration was established through the Further Education and Training Colleges Act of 2006 (the Act), sections of which were amended through the Further Education and Training Colleges Amendment Act of 2012 (the Amendment). In terms of institutional theory, the Act (2006) serves three functions in the establishment of an institutional framework for TVET colleges: it provides a statutory boundary that differentiates TVET colleges from other education institutions; it articulates the underlying mechanisms that regulate the work of the various structures and units within the TVET college; and it frames the organisational arrangements of the TVET college (Bruton et al., 2010; Kavanagh et al., 2017; Scott, 2003). In this regard, the Act (2006) provides an external source for the legitimacy of TVET colleges as institutions, and it articulates the underlying rules and structures that guide how each institution operates as a self-contained social system.

According to DOI, two aspects of an institution's design affect the adoption process. These are the institution's social and communication structures (Rogers, 2003). The social structure refers to the formal arrangement of the members or units of a system within a social system – the organisational hierarchy. The communication structure refers to the network of interpersonal interactions between members of a social system – the social network (Rogers, 2003).

According to Rogers (2003), understanding the mechanics of these two structures provides insight into how the adoption process unfolds systematically within an institution. An organisation's social structure provides a template that specifies how an organisation operates, how its composite parts are arranged in relation to each other, how authority is delegated throughout the organisation, and how work is allocated (Gibson et al., 2012; Jones, 2013; Kavanagh et al., 2017). Concerning the ICT adoption process at the TVET colleges, the colleges' organisational arrangements – social structure – determine how adoption decisions are made, who gets to make those decisions, and how those decisions are executed.

7.4. Organisational structure: Characteristics of TVET college's functional design

Theoretically, the social structure of a social system is the pattern or arrangement of the units that form the social system (Rogers, 2003). The social structure regulates the activities of the members of the system, provides stability to collective practices within the system, and allows one to anticipate individual behaviour within the system with some degree of accuracy (Gibson et al., 2012; Jones, 2013; Kavanagh et al., 2017; Rogers, 2003). The social structure provides the framework for constructing organisational hierarchies; it indicates how authority is delegated and how work is distributed across organisational units (Gibson et al., 2012). For example, the horizontal differentiation observed in the TVET colleges, with specialised departments like IT and Curriculum Units, directly impacts how ICT-related tasks are allocated and executed.

The classification of organisational structures into types is derived from four institutional design concepts: differentiation, alignment, the span of control, and chain of command (Clawson & Pitts, 2008; Gibson et al., 2012). Briefly, differentiation refers to the process by which an organisation allocates people and resources to organisational tasks. Differentiation is concerned with breaking down work into its composite parts and assigning it according to specialisation across the various parts of the organisation (Clawson & Pitts, 2008; Gibson et al., 2012). Alignment involves arranging organisational units into operational structures, separating jobs by type or expertise and combining them into departments according to some shared characteristic or basis (Gibson et al., 2012). Span of control refers to the number of people reporting to a single supervisor (Clawson & Pitts, 2008). The chain of command is the decision-making structure of an organisation; the authority to make decisions is higher at each ascending stage of the organisational hierarchy (Clawson & Pitts, 2008; Gibson et al., 2012).

These elements can be tailored into multiple designs to achieve the desired organisational form. Depending on the combination of these concepts, an organisation can be differentiated vertically or horizontally, be centralised or decentralised in decision-making, and be specialised or generalised in their division of labour (Clawson & Pitts, 2008; Gibson et al., 2012; Jones, 2013; Kavanagh et al., 2017). The degree of centralisation in the chain of command, as seen in the TVET colleges, has significant implications for how decisions about ICT adoption are made and communicated throughout the organisation.

Regarding the adoption process, these features of the institutional design determine the administrative processes that underpin the institution’s work, influencing whether an institution is open to innovation and how rapidly an innovation might be adopted across the institution. This is an example of the effects of a management principle called unity of direction (Gibson et al., 2012; Kavanagh et al., 2017). This “unity of direction” is crucial for ensuring that all parts of the organisation are aligned in their approach to ICT adoption, minimising resistance and maximising the perceived affordances of the technology among staff members. Furthermore, these features intersect with the affordances offered by the ICTs themselves and by the environment in which those must be deployed. This addresses the concept of inter-referentiality from Affordance Theory.

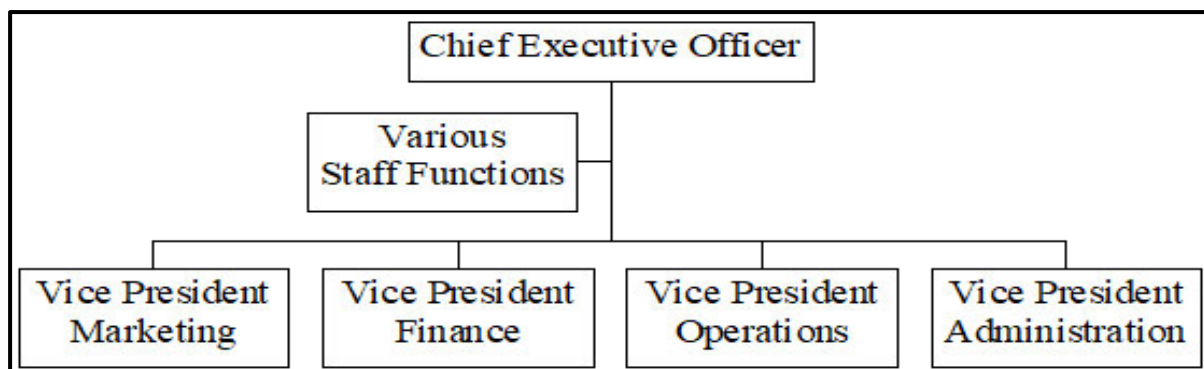


Figure 1: Example of a functional organisational structure (Clawson & Pitts, 2008)

According to Clawson and Pitts (2008), Gibson et al. (2012), and Jones (2013), eight types of organisational structures form the basis of contemporary institutional design. These eight types of organisational structures are functional, product, customer, geographic, matrix, divisional, amorphous, and hybrid (Clawson & Pitts, 2008; Gibson et al., 2012; Jones, 2013). Based on the institutional design features outlined by the Act (2006) and the Amendment (2013), TVET colleges can be classified as functional organisations – sometimes referred to as scalar organisations – that operate according to bureaucratic processes, with a centralised chain of authority, and specialist roles or occupations (Clawson & Pitts, 2008; Gibson et al., 2012; Jones, 2013). According to Clawson and Pitts (2008), functional organisations are characterised by an organisational structure that is differentiated vertically, with operational units grouped or arranged by type and a stratified chain of command where authority flows from the top of the organisation through the ranks. This top-down flow of authority, characteristic of vertical differentiation, means that the initial decision to adopt ICTs, and the overall strategic direction, rests primarily with the executive leadership.

While this centralised decision-making structure – inherent in the functional design of TVET colleges – provides a clear chain of command for ICT adoption, it also creates a potential disconnect between the strategic vision and the operational realities. The findings from Chapters 5 and 6 reveal that the success of this top-down approach is heavily contingent on the executive leadership’s understanding of – and commitment to – addressing the multifaceted challenges associated with ICT integration. These challenges include not only the procurement of hardware and software – addressing RQ1 – but also the crucial aspects of staff training, addressing anxieties about technological change, and ensuring equitable access for both staff and students – relating to RQ3. Furthermore, the leadership’s ability to navigate the external environment – such as securing reliable internet connectivity and dealing with power outages – directly impacts the institutional factors that influence the adoption process – RQ2.

Therefore, while the organisational structure provides a framework, the effectiveness of that framework in driving ICT adoption is mediated by the leadership’s responsiveness to the diverse needs and constraints at the operational level, and their ability to bridge the gap between strategic intent and practical implementation. This highlights the interplay between the formal structure – IDT – and the informal realities of user experiences and environmental constraints – Affordance Theory.

According to Rogers (2003), this type of organisational structure is ideal for ICT adoption due to three design features: a centralised chain of command, a specialised division of work, and a narrow span of control. The combination of these features has a significant bearing on the adoption process; as features of the institutional design, their impact can be positive or negative. At this level of the organisational structure, the most significant factor determining whether the adoption of ICT takes place and the pace at which it takes place is the decision-making process of the institution’s leadership (Rogers, 2003).

7.5. Executive level structures: Making decisions and formulating strategy

The organisational structures of the three TVET colleges that participated in the study can be seen in the figures below – Figure 2, Figure 3, Figure 4. These figures show how the TVET college structures conformed to the design features of functional organisations as outlined by Clawson and Pitts (2008), Godwin et al. (2017), and Jones (2013). The figures below depict how the TVET colleges were structured at the executive level. The structures below the executive level and their relationship to the ICT adoption process will be discussed later in the chapter. At the executive level, the officials who occupied these posts were responsible for the day-to-day management and administration of the college. Comparatively, the three TVET colleges had similar structures: a principal – the college’s chief executive officer – and deputy principals who were assigned operational divisions and assisted the principal in executing their administrative duties. The deputy principals were also the executive leaders of the operational divisions of the college (*Further Education and Training Act, 2006*).

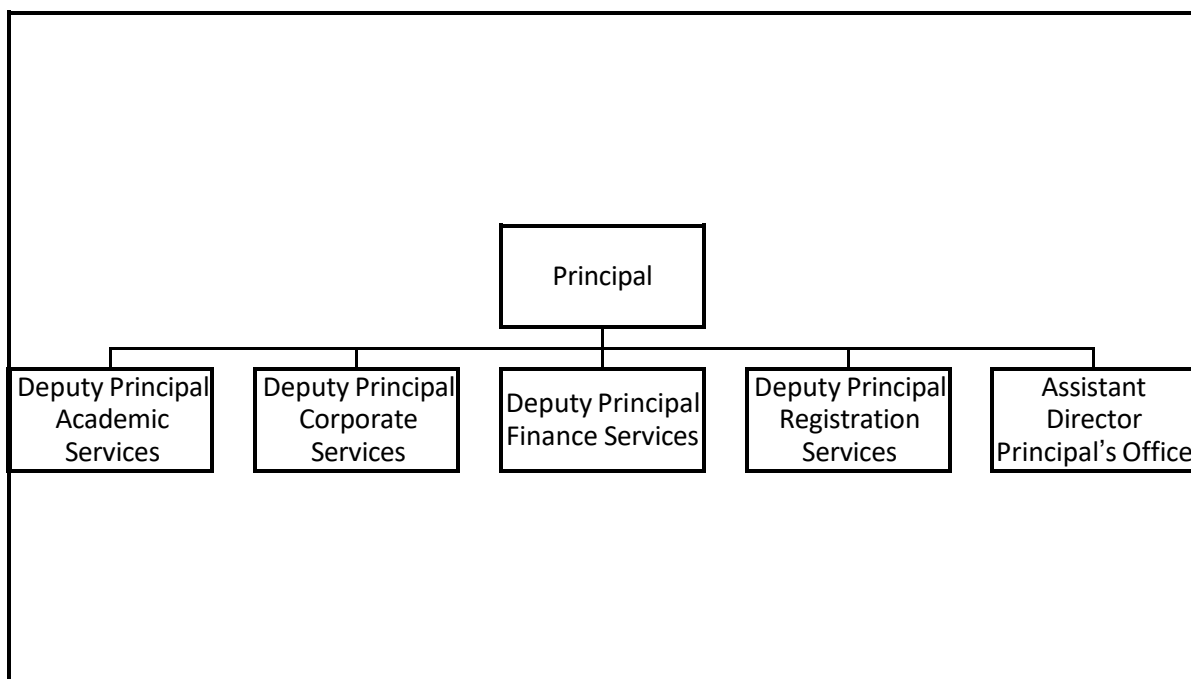


Figure 2: Organisational structure for the executive level of KZN TVET B (DP0002, email, 30 June 2023)

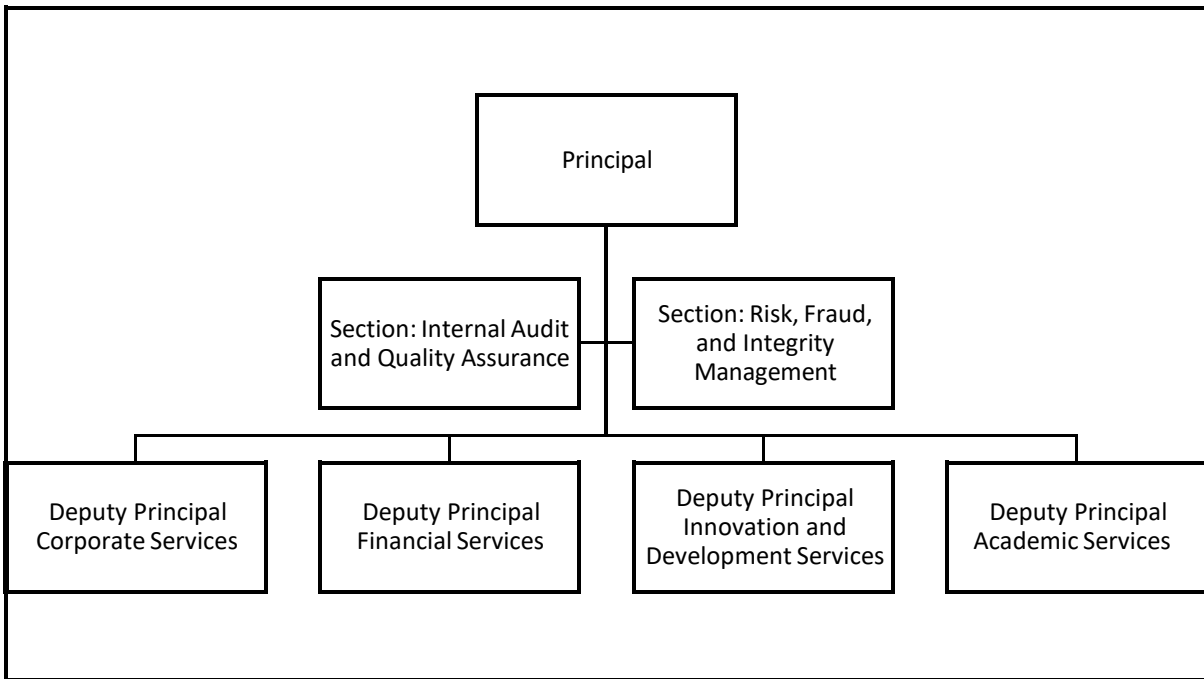


Figure 3: Organisational structure for the executive level of KZN TVET D (DP0004, email, 11 May 2023)

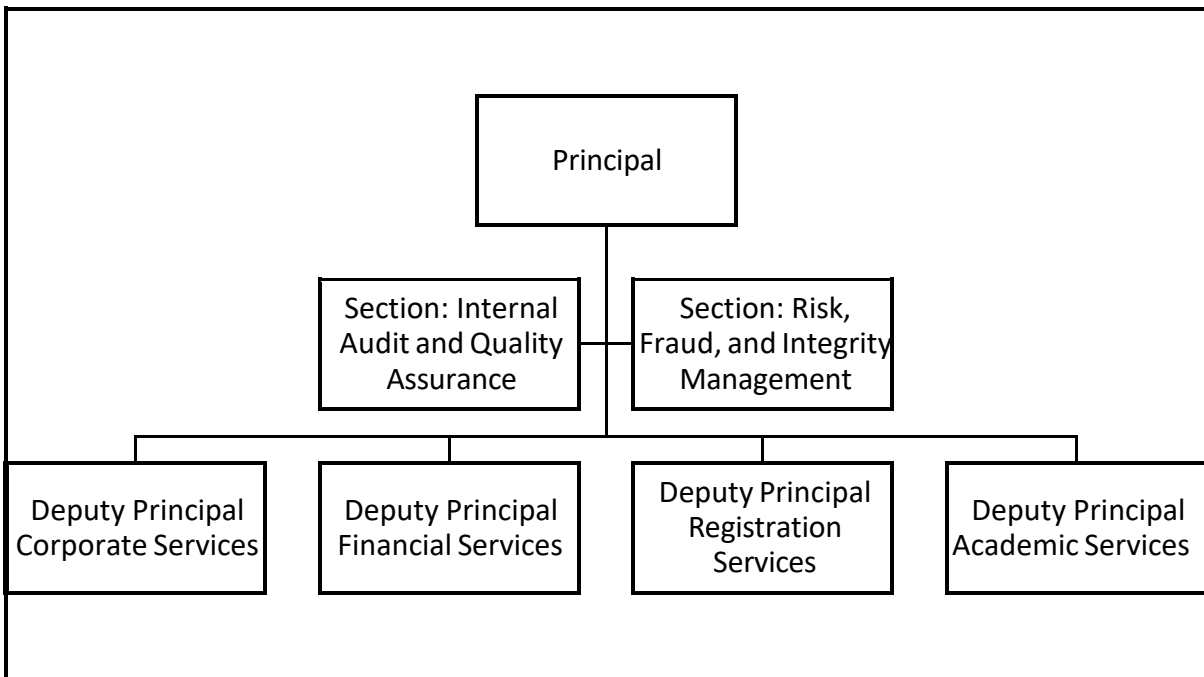


Figure 4: Organisational structure for the executive level of KZN TVET F (SS0006, email, 25 May 2023)

Regarding the organisational arrangement, the main difference between the three TVET colleges at the executive level was the number of operational divisions and the areas of specialisation. All three TVET colleges had three divisions in common: academic services, corporate services, and financial services. Beyond these three divisions, each college had additional divisions based on the strategic objectives of the college. At this level of the organisational structure, it is difficult to assess the extent of the impact that the differences in the number and specialisation of the divisions might have had on the ICT adoption process. In order to determine the nature of their impact, one has to consider how the executive structures function in relation to the rest of the TVET colleges' organisational structures. One way to assess whether these differences impacted the ICT adoption process is to consider the role of officials within the executive ranks of a functional organisation.

Conceptually, the primary role of officials at the executive level within a functional type of organisation is to plan, organise, lead, and control operational activities; the role played by executives enables organisations to operate efficiently and accomplish their strategic goals (Gibson et al., 2012). In simpler terms, the role of an executive is to oversee the work process but not to execute work tasks. In terms of institutional theory, the function of the executive in relation to the operations of an organisation is to establish and maintain a unity of direction and a productive "esprit de corps" amongst the rest of the organisation (Pryor & Taneja, 2010; Uzuegbu & Nnadozie, 2015). Based on the organisational structure and the underlying mechanisms of this type of structure – namely, a centralised chain of command, a specialised division of labour, and a narrow span of control – there are several implications for the adoption process.

7.5.1. Decision-making dynamics and operational implementation

Firstly, with a centralised chain of command, decisions regarding the adoption of ICTs are made centrally by delegated individuals or structures, who then issue orders to those in the organisation who are responsible for their implementation (Armstrong & Taylor, 2014; Gibson et al., 2012; Jones, 2013). This centralised decision-making process – while potentially efficient – can also create challenges if the executive leadership lacks a clear understanding of the technological affordances of the ICTs – the user affordances of the staff – or the environmental affordances of the college context. Within functional organisations, the authority to make innovation adoption decisions is delegated according to an individual's position within the organisational hierarchy or their technical expertise in the technology or subject (Edwards,

2018; Godwin et al., 2017; Rogers, 2003).

In the case of the three TVET colleges, this type of decision-making process was cited as the method used by the colleges when making decisions regarding the adoption of ICTs. At KZN TVET D, the Deputy Principal noted that ICT-related decisions at the college were made through a combination of executive authority and technical expertise. The Deputy Principal stated,

“[The college executives] worked out [the technical] specifications with our IT department to go out on tender after engaging.” – DP0004

Similarly, at KZN TVET F, decisions related to adopting an ICT system were made through a collaborative process between the IT department and academic services. According to the IT officer at the college,

“We [IT] were involved because of [the technical aspects]. [...] Before we can accept the system or install the system in our server, [the] IT department must be consulted and must make sure that the system that is going to be implemented it is compatible with the existing infrastructure. [In terms of] user requirements, I think that’s [a task] for Academic [Services] because the Academic must make sure that LMS or the system that is implemented for lecturers should address all lecturers’ requirements.

So, [the] Academic [Services] department are the ones that understand the user requirements.” – IT0060

In the case of KZN TVET B, decisions were made through subcommittees where the different divisions of the college were represented. The IT official cited the college’s academic senate as the structure where decisions regarding its ICT strategy were made. The IT official stated:

“From an IT management perspective, we sit in, we have the academic senate, for example. Which is like, which is like a subcommittee, [...] that deals with academia. [...] all your senior management and all senior lecturers and HODs, and IT sit there as well.” – IT0002.

Secondly, the process of implementing the TVET college's ICT strategy at the operational level was assigned to units or individuals within the college who have specialist skills to implement the strategy. According to Clawson and Pitts (2008), the division of work into specialised departments makes it more efficient for leaders within functional organisations to manage operations and track the implementation of an adoption strategy. In the case of TVET colleges adopting ICTs, multiple specialists and skills are required to execute all the tasks required to implement an ICT strategy. For all three TVET colleges, implementing an ICT strategy was divided into tasks that could be allocated to specialists. In all the cases, the responsibility for overseeing the implementation of the college's ICT strategy was split between the IT department and one of the academic services departments, either the Curriculum department or the Student Support Services department. This division of labour, reflecting horizontal differentiation, highlights how different specialised units contribute their expertise to the overall implementation process. This operational arrangement was noted in the responses below:

"We've got a curriculum manager and exams manager, facilities manager who oversees the hardware, and an IT [technician]." – DP0006.

"The technical specification, I think that that role was more IT that played. IT took the lead there because they are experts on the technical side, what curriculum just indicated this is what we want [in terms of teaching and learning], and this is how far we wanted to go." – DP0004.

"Everything is done in our curriculum is controlled or coordinated from our curriculum unit." – DP0002.

"It's our responsibility [as IT] to source the technology [specifications], the technology and drive that part of it [implementation]." – IT0002.

For all three TVET colleges, the specialised division of work was the aspect of the institutional design where there were explicit variations in ICT strategy; the impact of these variations in strategy implementation will be discussed in the operations section.

7.5.2. Institutional leadership: Shaping the ICT adoption landscape

Up to this point, the discussion has outlined the various institutional design features of the TVET colleges and how they relate to the ICT adoption process. However, these features only provide the institutional settings for innovations to be accepted or rejected; the institutional design – on its own – does not guarantee that the adoption process will take place (Rogers, 2003). Institutional leadership is the one aspect of institutional design that drives the adoption process. In this regard, scholars have noted that in addition to having the authority to manage the institution's affairs, leaders are responsible for establishing an environment that supports the institution's strategic objectives (Gibson et al., 2012; Jones, 2013). In the case of ICT adoption, Rogers (2003) argues that, although officials at the executive level of an institution might not be directly involved in the operations of the college, they play a crucial role in creating conditions within the TVET college that shape how the adoption process unfolds amongst members of staff. This cultivation of a positive institutional culture is directly related to the normative and cultural-cognitive pillars of IDT. Leaders play a key role in shaping the shared values, beliefs, and expectations surrounding ICT use within the college.

7.5.3. Navigating the demands of the institution's internal environment

Additionally, the culture that the leaders cultivate within the college can either encourage or hinder the impulse of individuals within the institution to pursue or interact with ICTs (Rogers, 2003). In this regard, several scholars also note that the level of innovation within an organisation is a product of the institutional culture that leaders cultivate (Armstrong & Taylor, 2014; Edwards, 2018; Godwin et al., 2017; Rogers, 2003). The relationship between institutional culture and the adoption process indicates leaders' crucial role in the adoption process; they ensure that institutional processes align with the adoption process. The instrumental role played by leadership in shaping the approach to ICTs adopted by TVET colleges was noted by several participants. When reflecting on the progress that the TVET college had made with its ICT strategy, the IT official from KZN TVET D indicated that the successes they had achieved as a college in adopting ICTs were related to the decision by the leadership to invest financially in ICTs. The official stated:

“You will find that we are very lucky in our college because we have a forward-thinking executive management that wants us to get to a very reasonable stage when it comes to the ICT state. Hence, I think over the past two years or three years, it’s [IT] one of the departments that the college overall they’ve heavily invested on so much to us to get that [hardware and infrastructure]; of which that has greatly assisted.” – IT0004.

The discussion of leadership’s role highlights the importance of vision and investment, but it raises a question about the nature of leadership in a rapidly changing technological landscape. What does ‘forward-thinking’ leadership actually look like in the context of ICT adoption? Is it about embracing the latest technologies, or is it about fostering a culture of experimentation and learning? This indicates a need for leaders who are not just tech-savvy, but also pedagogically informed and collaborative. They need to be able to engage with lecturers and students, understand their needs and concerns, and create a shared vision for the future of teaching and learning that is both ambitious and achievable. The most successful leaders are those who are constantly asking critical questions, and challenging the status quo. These sentiments were echoed by the IT official’s colleague from KZN TVET D’s Curriculum Services office, who stated:

“We actually, as a college, had started with the looking at the LMS and that and when it came into COVID level 5 lockdown. Um, fortunately for us, our Council had decided that they were going to buy laptops before that.” – CS0004.

In the responses cited above, the participants point to the significant role played by their college’s leadership in ensuring that the adoption of ICTs at their college was supported financially. Within this particular TVET college, the adoption process benefitted from the financial investment in hardware and infrastructure. As a result, KZN TVET D was mentioned by other TVET colleges across the province as a model of best practice with regard to integrating ICTs into teaching and learning.

Conversely, the influence of leadership can also have an adverse effect on the adoption process. There are cases where the leaders themselves or the alignment of structures create obstacles that slow down the adoption process. One such example is the case of KZN TVET F. The Deputy Principal at this college noted how misalignments in the chain of command between two leadership structures, central office and campus management, led to delays in implementing the college's ICT adoption strategy. The Deputy Principal stated:

“Now, I think what then happened, which I saw as a problem, is everything being so centralised that the campus managers have become a conveyor belt of messages, not taking ownership of their campus because all decisions were made centrally and then passed on. That's how they felt. Now, what we've done subsequently is we still got central office, but more powers are given back to campus managers.” – DP0006.

This response indicates how misalignments between the administrative and operational ranks of the college's organisational structure created a disconnect that made it difficult for the college to implement its ICT strategy at the desired rate. The solution for the college, as identified by the Deputy Principal, was to delegate more decision-making authority to campus managers (lower on the organisational hierarchy). This management approach is worth noting because the role of campus managers within the design of the TVET colleges is to provide operational leadership at the campus level. In contrast, the leadership of the central office is administrative (*Further Education and Training Act, 2006*). Furthermore, the importance of an alignment between the administrative and operational leadership is highlighted by the fact that the bureaucratic nature of functional organisations requires that operational decisions or tasks be subjected to administrative oversight by the relevant organisational structure before they can be executed or operationalised (Armstrong & Taylor, 2014; Gibson et al., 2012; Jones, 2013).

Within an institutional context, administrative oversight comes in the form of institutional policies, procedures, protocols, and codes, which must be adhered to when executing operational tasks within the institution (Gibson et al., 2012; Jones, 2013). Administrative oversight forms part of the chain of command and mediates interactions between individuals or units and innovations (Jones, 2013). For the ICT adoption process, administrative oversight affects the rate at which the adoption process unfolds and the scope of innovation an institution allows (Rogers, 2003). An example of the impact that administrative oversight can have on the rate of the ICT adoption process was noted by the IT official from KZN TVET B. The official

was responding to a question about the challenges that the college's IT department faced when it comes to implementing the ICT strategy. The official said:

“So, they [college leadership] do know that ICT is imperative to be able to do everything that we need to do in the institution, but there are challenges when it comes to being able to get to where we are or where we want to be. [...], it's a long process. [...], being a government institution, there are many processes involved to do certain things.” – IT0002.

When probed to elaborate further, the official went on to say,

“We are getting there slowly and easily, but there's a lot of, uh, red tape. There's a lot of policies from, from a procurement perspective that sort of limit operational needs [...] This is the challenges we experience where, you know, sometimes we have to be compliant in policy and audits and stuff.” – IT0002.

The responses cited above indicate how aspects of institutional design influenced the TVET colleges' approach to ICTs. In terms of leadership, even though TVET college leaders might not have been directly involved in operations that require interaction with ICTs, they were instrumental in creating an enabling environment and structures for ICTs to take root within the institution. However, it is worth noting that leaders can impact the adoption process positively or negatively. If the leadership has negative perceptions about ICTs, or they do not allocate resources towards ICTs, or even if they pursue strategic objectives that are not aligned to support ICTs, this could lead to an institutional environment that is not friendly to ICTs (Rogers, 2003). This relates to what is referred to in Affordance Theory, as inter-referentiality – and in particular – to the concept of refusal. If the overall sentiments of leadership towards ICTs are negative, it could curtail the adoption process.

7.5.4. Resolving the challenges presented by the external environment

In addition to their responsibility to cultivate an internal environment conducive to ICT adoption, institutional leaders must contend with any barriers to the adoption process posed by external conditions in the environment surrounding the institution (Rogers, 2003). These external conditions directly impact the environmental affordances available to the TVET colleges, shaping the context in which ICTs can be used and influencing the perceived and actual benefits of different technologies. For example – as discussed in Chapter 5 – the uneven distribution of reliable internet access across urban and rural areas creates significant differences in environmental affordances, impacting the feasibility and effectiveness of e-learning initiatives. The local contexts surrounding institutions shape how responsive those institutions are towards innovation (Gibson, 2015; Gibson et al., 2012; Jones, 2013; Scott, 2003). In this regard, the TVET colleges and their approach to ICTs are shaped by the local socioeconomic conditions of their communities. This connection implies that principals and deputy principals must be aware of their local contexts and the potential obstacles or opportunities that those contexts present for their ICT strategy.

Based on the responses from the participants, the external challenges that affected the ability of the TVET colleges to adopt ICTs fell into three categories: technical, logistical, and geographic. Notably, these categories do not operate in isolation; instead, they intersect and amplify each other (Gibson, 2015). When discussing the external challenges, the Deputy Principal of KZN TVET B identified power outages (load shedding) as an issue that affected college operations and noted how the college has had to develop countermeasures to mitigate its effects. The Deputy Principal stated,

“At the moment, the college is in the process of purchasing generators for all our campuses. We have eight campuses, and out of eight campuses, three already had the generators so that when there’s no load shading, when there’s load shedding, we are able to run.” – DP0002.

In addition to the challenges posed by intermittent power outages on the college's operations, the IT official from KZN TVET B noted how, despite the college having a strategy in response to the disruptions in power, incidents of theft of backup power hardware from the surrounding telecommunications infrastructure rendered the college's response moot.

According to the IT official,

“You have challenges of theft where the backup power and the UPSs and inverters for these towers are being stolen. So, the power, so those links drop or, or there's power challenges because the tower loses power, uh, due to load shedding and whatever it is.” – IT0002.

For KZN TVET F, one of their biggest operational challenges was the distance between the central office and the campuses. The Deputy Principal stated,

“The distances that we have between Central Office, you know, one of our campuses is 350 km away. [One] is about 200[km] from the Central Office. [Another campus] is about 123[km], [and one is] about 70[km]. That's not return; that's one way.” – DP0006.

In addition to the operational challenges related to the location of their campuses, the Deputy Principal also noted how the distribution of their campuses across a vast geographic area impacted their ability to procure the services of an ICT service provider. In this regard, the DP stated,

“Do you know what we experienced, where we located? We get people service providers. I mean, obviously, they're not located in [our area]; for instance, one is located in Durban. So, if we've got something that needs to be fixed, they have to come down. It takes some time.” – DP0006.

Lastly, all participating TVET colleges mentioned experiencing problems related to unstable internet connectivity due to uneven coverage. The most significant factor seemed to be the rural/urban divide, where TVET colleges indicated that their urban campuses struggled less with connectivity issues than their rural counterparts. The Deputy Principal of KZN TVET B noted how some of their campuses situated in rural areas have had to deal with connectivity issues related to limited network coverage. The Deputy Principal stated,

“When we purchased laptops, we also purchased the routers for them [lecturers], and then they have data every month. The only challenge is networks in the areas where you’ll find that in [one of the campuses], for instance, MTN will not always be up and running; then, if that is the case, it is [an issue] in the entire area.” – DP0002.

Similarly, the Deputy Principal of KZN TVET F remarked:

“Let’s say we had a functional e-learning, 100% functional, not semi-functional. Some of our students will still battle, and even if they had data, [they’ll] still battle accessing [the system]. That[is]because in our area, you’ll have to climb the hill to get a signal, and that’s out of our control.” – DP0006.

The Deputy Principal of KZN TVET D indicated:

“We learned that one of our campuses in [the township, we were] having a major challenge with connectivity at that site.” – DP0004.

These were among the challenges most often mentioned by the TVET colleges as the reasons for their inability to adopt ICTs or the slow pace of integrating ICTs into their operations. In this regard, the challenges cited by the participants were similar: limited network coverage, intermittent power outages, and lack of ICT infrastructure in rural communities. However, there were variations in the severity, impact, and responses to these challenges depending on the location of the campuses, the resources allocated to ICTs, and the state of the TVET college’s leadership. The technical issues cited by the participants and their associated challenges were discussed in more detail in the technical survey chapter. In addition to those discussions, the responses above emphasise the significant impact of environmental factors on the college leadership’s approach to ICTs. The examples of external challenges (load shedding, theft, geographical distances, connectivity) and the colleges’ responses highlight a crucial tension between short-term solutions and long-term sustainability. While generators and data bundles may address immediate needs, they don’t solve the underlying problems of unreliable infrastructure and unequal access. This points to a larger issue: the need for a more systemic and coordinated approach to addressing the digital divide. This requires collaboration between TVET colleges, government agencies, telecommunications providers, and other stakeholders to create a more robust and equitable digital infrastructure. The solution is not just about reacting

to challenges; it entails proactively building a more resilient and inclusive digital ecosystem. This also touches on the issue of environmental sustainability: how can we ensure that ICT solutions are not only effective but also environmentally responsible?

Overall, the challenges associated with the ICT infrastructure in the area surrounding the TVET college affected the college regardless of the college's organisational structure, the state of the college's infrastructure, or the quality of leadership. However, the organisational structure did mitigate against the more severe impact of the challenges associated with the TVET college's external environment. For instance, the quality of the college's leadership determined how the college responded to external challenges; the presence or absence of infrastructure informed the type of technical strategies available to the college, and the organisational structure affected how the strategy was implemented. In addition, the TVET college had to manage relationships with external stakeholders, such as local government and telecommunications corporations, who were responsible for installing or maintaining the ICT infrastructure surrounding the college.

7.6. Operational level structures: Implementing the institution's ICT adoption strategy

Regarding institutional design, Figure 5 (below) depicts the structures of the three TVET colleges at the operational level. The figure depicts how the divisions responsible for implementing the college's ICT strategy were organised and highlights the units within those divisions that work with ICTs. In the context of TVET college operations, adopting ICTs formed part of the broader strategy of implementing e-learning (DHET, 2020, 2021).

Operationally, the responsibility of implementing e-learning was shared between two divisions; one was responsible for the technical infrastructure, and another was responsible for integrating ICTs into teaching and learning activities.

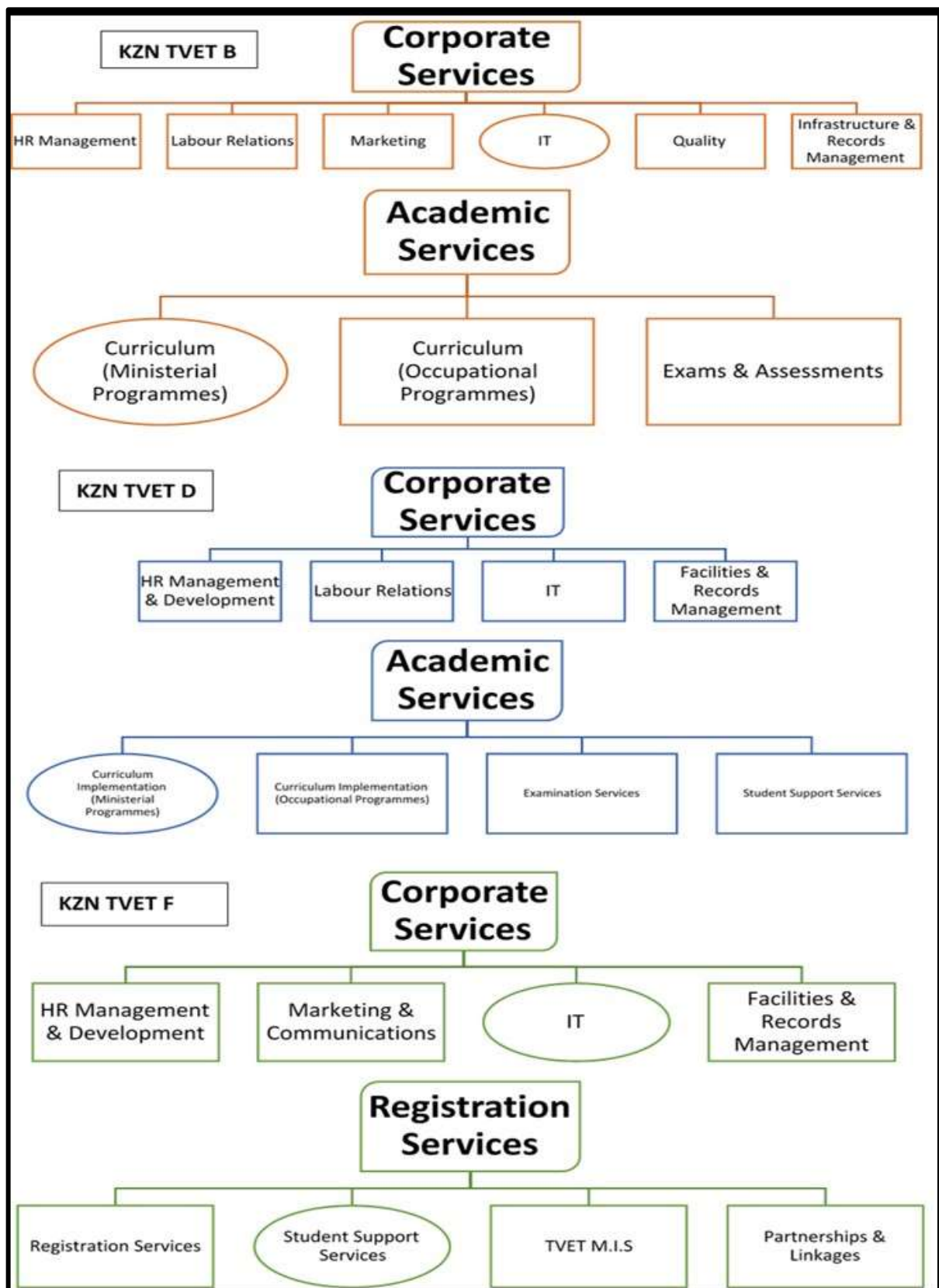


Figure 5: Combined view of operational structures responsible for the implementation of ICT strategy at 3 TVET colleges

As indicated in Figure 5, the three TVET colleges had designated the e-learning responsibilities to different combinations of units. At KZN TVET B:

“E-learning is coordinated within the curriculum unit. The curriculum manager works in conjunction with campuses/campus managers and HoDs.” – DP0002.

In the case of KZN TVET B, the Curriculum Unit was located within the Academic Services division. It worked with existing academic structures to develop a curriculum and teaching strategies compatible with ICTs. The IC department played the following role:

“IT provide[s] more, a support role in terms of technical support; there’s two parts [we are] giving support [...] we have computer labs and lecturers. So, there is that technical desktop support. We are [also] responsible for the software upgrades [and] procurement of the software that’s acquired for teaching and learning.” – IT0002.

Similarly, e-learning at KZN TVET D was overseen by units within corporate and academic services divisions. According to the Assistant Director for Curriculum Services at KZN TVET D, the roles and responsibilities for e-learning within the college’s organisational structure were organised as follows:

“[The] e-learning structure follows the same organisational structure [subject HoDs quality assure materials from lecturers] as contact-based teaching and learning. Once content and materials are vetted by HoDs, it is submitted to the curriculum department where there is a curriculum specialist who oversees the LMS.” – CS0004.

The Assistant Director for ICT at KZN TVET D also added,

“[The IT department’s] support is centred around teaching and learning. We might not be involved in a sense of [...] facilitation of [...] the curriculum, but we ensure basically the availability of all the [ICT] resources. We facilitate in terms of the platform[s] that are used for teaching and learning.” – IT0004

KZN TVET F had a slightly different structure, with Corporate Services and Registration Services sharing responsibility for e-learning. As with KZN TVET B and KZN TVET D, the IT unit at KZN TVET F was located within the Corporate Services division and played a similar role to the IT units at the other two colleges.

“On the teaching and learning side, our role as IT is to make sure that systems are up and running, license[s] are being paid, laptops are provided, uh maybe if there’s a glitch we respond very quick, you see. So yeah, so once laptop laptops and other systems are up and running.” – IT0060.

The most significant difference structurally at KZN TVET F was that,

“[E-learning is] managed by student support [services]. [The college] does not have an e-learning unit. [The] college has identified roles. Would like to have a unit for e-learning, but advertising posts and appointing officials take long. [An official from student support services] has been tasked with coordinating e-learning.” – SS0006.

Regarding the curriculum component, KZN TVET F worked on a decentralised model where curriculum activities were coordinated at the campus level. In this model, each campus’s campus managers and academic structures were responsible for developing and quality-assuring curriculum content for the college’s LMS platform. According to the Deputy Principal,

“How it works is we’ve got a system at [KZN TVET F] where each subject expert from a campus sits on their own forum led by [a] program coordinator, who’s a lecturer, where they make these [content] decisions and collate these initiatives. It hasn’t been driven by us at [the] central office.” – DP0006.

7.7 Functional variations in operational structures across the three TVET colleges

In terms of operations, all three TVET colleges had similar operational placement and role designation for their IT units. All three IT units report vertically to the DP for corporate services; their role included overseeing maintenance of the ICT infrastructure, providing technical support to users, and overseeing software installations and upgrades. Regarding e-learning, the most significant structural difference was the placement of the curriculum component. At KZN TVET B and KZN TVET D, the curriculum component was overseen by the Curriculum Unit, while at KZN TVET F, it was overseen by Student Support Services. Regarding the organisational design, the Curriculum Unit at KZN TVET B and KZN TVET D reported vertically to the Academic Services division.

In contrast, at KZN TVET F, the Student Support Services unit reported to the Registration Services division. This difference in the division placement of these units affected three aspects of their operations: the functional objectives of the division, the specialist skills embedded in the division, and the expected outputs of the division. This arrangement affected general operations and how the TVET colleges implemented e-learning. The concept of affordances can be considered when discussing this operational arrangement, particularly the aspect of inter-referentiality. Depending on which division is assigned the task of e-learning, will determine how tech is encouraged, demanded, requested, allowed, discouraged, or refused.

Unlike the Academic Services divisions at KZN TVET B and KZN TVET D, KZN TVET F's Academic Services division was not directly involved in the e-learning processes. Regarding roles and responsibilities, the Academic Services division at KZN TVET F specialises in providing curriculum implementation and development services for academic programmes and managing examination processes and the college's campuses. The division's focus is overseeing the development and implementation of the college's face-to-face teaching and learning strategy. The contrast in the approaches to e-learning at KZN TVET F and KZN TVET D is captured in these two responses from the Deputy Principal Academic Services at the two colleges:

“Our curriculum unit has to start working with campuses to design activities that we will prepare so that when we have a learning management platform, we will be able to put them there.” – DP0002 (KZN TVET F).

“We went to an extent as to develop our own LMS as a college. So, we actually develop a comprehensive one where it took us maybe a full year to engage our lecturers so that they can tell us what is it that they are looking for.” – DP0004 (KZN TVET D).

In both cases, the Curriculum Unit within the Academic Services division worked to ensure that the curriculum content and delivery were compatible with ICTs. In contrast, e-learning was overseen by a division whose responsibilities included managing student registration processes, providing student support services, managing the college’s information system, and initiating partnerships and linkages with relevant sectors. The function of this division was primarily to put measures in place to ensure that students have a positive learning experience and to develop strategic relationships with external stakeholders. In the case of KZN TVET F, ICTs and, by extension, e-learning were regarded as a means of providing academic support to students. Thus, it made strategic sense for the college to oversee e-learning under the Student Support Services unit. Oversight of the curriculum component was located at the campus level, where the campus managers were responsible for organising academic tasks. According to the college’s organisational structure, campus managers report to the Academic Services division.

According to a Student Support Services official from KZN TVET F:

“Campus Managers [are responsible for operations] at campus level where they delegate [academic] functions, content development, [and] quality assurance to HODs and Senior Lecturers.” – SS0006.

The implication of these differences in organisational design at the operational level significantly affected how the three TVET colleges utilised their ICTs and organised their teaching and learning activities. As discussed, the functional roles allocated to the divisions shaped how those divisions approach ICTs and e-learning. When e-learning was understood as an academic function, curriculum specialists embedded in the Academic Services division who oversee the development of the college’s teaching and learning approach ensured that the college’s ICT resources were compatible with the college’s curriculum approach. When e-learning was approached as a student support function, Student Support officials were responsible for the administration of the college’s LMS. Their responsibilities included collating and uploading curriculum content onto the LMS and ensuring students had access to

the LMS. However, Student Support Services did not generate the content; this responsibility belonged to the college's curriculum specialists – lecturers, senior lecturers, and HoDs – at the campus level, who created, edited, and generated the digital content. This highlights how the organisational structure, specifically the horizontal differentiation and departmentalisation, shapes the roles and responsibilities related to ICT integration. The specific skills and expertise within each unit influence how effectively they can support the adoption process.

The different organisational placements of the curriculum component – Academic Services vs. Student Support Services – highlight a fundamental tension in the conceptualisation of e-learning. Is it primarily about pedagogical innovation, or is it about providing support and access? This points to a need for a more integrated and holistic approach to e-learning, one that recognises the interconnectedness of curriculum, pedagogy, and student support. The organisational structure should facilitate, rather than hinder, this integration. This also raises questions about communication and collaboration between different departments: how can we ensure that Academic Services and Student Support Services work together effectively to create a seamless and supportive learning environment? The data implicitly suggests that the organisational silo can be a significant barrier to effective ICT integration.

These two organisational arrangements significantly impacted how the institutions integrated ICTs into their operations. The impact of these differences on operations is illustrated by the responses below;

“[The] college bought laptops for the lecturers” – DP0004.

“At the moment, all the campus managers, including HoDs and senior lecturers, each has been provided with laptops and data.” – DP0006.

The responses illustrate two approaches to ICTs: ICTs as curriculum and ICTs as administrative tools. In colleges such as KZN TVET B and KZN TVET D, where ICTs were regarded as curriculum tools, the college provided laptops to all its lecturers. In contrast, colleges that perceived ICTs as a means to provide student support, such as KZN TVET F, had only provided laptops to staff members who had administrative roles.

7.8. Communication structure and opinion leadership: Influencing ICT perceptions amongst lecturers

The communication structure is the second type of structure within the social system of an institution that affects its adoption of ICTs. The communication structure consists of the various interpersonal networks that link members of a social system to each other (Rogers, 2003). The communication structure does not form part of an institution's design; instead, it emerges from the regular, repeated interactions between members of an organisation (Gibson et al., 2012; Jones, 2013). According to Rogers (2003), the communication structure is an expression of the level of interconnectedness across members of a social system, and the degree of interconnectedness is a continuum that ranges from heterophily on the one side to homophily on the other. These informal networks, as described by DOI theory, are crucial for the diffusion of information and attitudes about innovations. The presence of opinion leaders within these networks can significantly influence whether staff members embrace or resist ICTs. Additionally, the communication structure plays a crucial role in disseminating information about innovation throughout a social system.

Briefly, homophily refers to the degree to which an individual within a social system interacts with others similar to them. On the other hand, heterophily refers to the extent to which an individual interacts with others dissimilar to them (Rogers, 2003). Thus, a high level of homophily within a social system indicates that individuals primarily interact with those with similar characteristics. By contrast, a high level of heterophily suggests that individuals are likely to interact equally with similar and dissimilar individuals. According to Rogers (2003), a high level of homophily increases the chances of adoption taking place as individuals who share similar characteristics are more likely to influence their peers when it comes to making adoption decisions.

Within an organisation's communication structure, specific individuals may emerge to assume the roles of opinion leaders within their peer group or operational unit. Opinion leaders can influence their peers' attitudes or behaviour towards specific trends. However, the role of an opinion leader is not a function of the individual's formal position or status within the organisation; it is earned through their informal interactions and relationships with others in the social system (Rogers, 2003). In functional organisations, such as TVET colleges, the underpinning institutional design creates an environment where communication networks mirror the social structure (Jones, 2013).

Due to this institutional design of the TVET colleges, these opinion leaders do not emerge organically; the institution has to formally appoint an individual into that role where they will advocate for ICT adoption amongst their peers or implement programmes that will cultivate certain behaviours and attitudes amongst their staff. This is an attempt to create change agents within the organisation, individuals who can promote the adoption of ICTs and influence the perceived affordances of the technology among their peers. These initiatives aim to address both user affordances – by increasing skills – and perceived affordances – by providing support and addressing concerns. However, as the findings suggest, the success of these initiatives depends on the existing communication structure and the presence of trusted opinion leaders within the informal networks. According to Edwards (2018); Godwin et al. (2017); Rogers (2003), within institutions that follow a centralised authority structure, it is the leadership’s responsibility to cultivate an “esprit de corps” amongst members of staff that will ensure that the staff understand the strategy and have a positive morale towards implementing the strategy.

In order to encourage a culture of ICT usage amongst their staff, TVET colleges developed blended learning or e-learning policies, initiated ‘ICT champion’ programmes, and organised ICT skills training for their lecturers. These interventions were intended to equip staff members with the necessary skills to effectively utilise ICTs in their classrooms and provide them with technical and curriculum support to feel comfortable interacting with ICTs. However, according to the deputy principals at all three TVET colleges, the general sentiment of individual staff members towards adopting ICTs was hesitant. Lecturers were resistant to the idea of adopting ICTs on personal or pedagogic grounds. When describing their lecturers’ response to ICTs, KZN TVET D’s Deputy Principal stated,

“At the moment, we really cannot lie and say it’s 100% embraced. In as much as we have that policy, you still find that lecturers are not necessarily fully into this, embracing it fully.” – DP0004.

The Curriculum Officer at KZN TVET D said,

“From a blended learning policy, we’ve got the blended learning policy available and that. But you can’t force a lecturer to make anything at the moment. [We’re] trying, but I don’t think [we’re] probably at 20% if I had to put a percentage to it. I don’t think [we’re] doing nearly enough.” – CS0004.

The Deputy Principal of KZN TVET B echoed these sentiments:

“There is a level of reluctance in the sense that it is something new. Lecturers are used to the traditional ways of teaching. Not all lecturers are computer literate. Some of our lecturers are there from the older generation, which is not very familiar with a technology. Some of them just run away...” – DP0002.

These responses indicate that despite the colleges favouring the adoption of ICTs and implementing measures to cultivate ICT usage amongst their staff, they struggled to persuade their staff members to integrate ICTs into their classrooms. The responses further indicate that, although individual staff members did not play an active role in making decisions related to the ICT adoption strategy, they played a crucial role within their operational units in influencing their peers’ sentiments towards ICTs. In their role as opinion leaders, the leadership of the TVET colleges utilised the formal structures of the college to foster an ICT- friendly culture amongst their staff members. Initiatives such as ‘ICT champions’ had been implemented at all three TVET colleges and yielded varying results. Without opinion leaders emerging organically from the operational ranks, the various training and support initiatives created platforms for staff to familiarise themselves with ICTs and develop their skills alongside their peers.

7.9. Theoretical discussion on ICT adoption in TVET colleges

The discussion in this section situates the findings within the study's synthesised theoretical framework, which draws on concepts from DOI, Affordance Theory, and IDT. The discussion will critically analyse the ICT adoption process in TVET colleges, and highlight how geographical constraints, policy frameworks, and user engagement shape ICT adoption within the sector. Furthermore, the discussion demonstrates the interconnectedness of environmental, institutional, and user-related factors in shaping institutional responses to ICTs. These insights directly address the study's three research questions, particularly in examining the distribution patterns of ICTs (RQ1), the institutional factors shaping adoption (RQ2), and lecturers' use of ICTs in teaching and learning (RQ3).

7.9.1. ICT adoption through the lens of DOI

Conceptually, DOI provided the lens for understanding how ICT adoption varies across institutional contexts. The findings illustrate that geographical location, institutional readiness, and perceived benefits of technology influence the adoption curve. Urban colleges, benefit from better infrastructure, reliable internet connectivity, and access to ICT service providers, and this correlates with them demonstrating a high level of ICT integration. In contrast, rural institutions face significant adoption barriers, including inadequate digital infrastructure, bandwidth limitations, and logistical challenges in providing technical support. These findings align with RQ1, which examines the distribution patterns of ICTs across TVET colleges, revealing a clear geographical disparity in ICT access and adoption rates.

The findings further highlight how institutional attitudes towards innovation affect adoption. Colleges with a structured ICT policy and leadership commitment to digital learning exhibited faster adoption rates and greater integration of ICTs into teaching and learning. Conversely, institutions with fragmented ICT strategies or limited technical support experienced slower diffusion and inconsistent ICT use across campuses. This variation underscores the importance of institutional support structures in facilitating or hindering the spread of digital innovations in TVET colleges, directly contributing to RQ2, which investigates the institutional factors shaping ICT adoption.

7.9.2. Affordance theory: Perceived and actual use of ICTs

Insights into how ICTs are perceived, accessed, and utilised within TVET institutions were provided by Affordance Theory. The study found that while ICTs offer potential affordances – such as improving pedagogical delivery, expanding learning access, and enhancing administrative efficiency – their actual utility is constrained by institutional, infrastructural, and user-related factors.

One of the key findings – in this regard – is that affordances are not universally experienced; they are shaped by lecturers' digital literacy, institutional ICT support, and resource availability. While some lecturers effectively integrate ICTs into their pedagogy, others struggle with ICTs due to a lack of training, time constraints, and inadequate technical assistance. Moreover, the unreliability of internet access, outdated hardware, and limited access to digital platforms hinder meaningful engagement with ICTs, particularly in rural and resource-constrained campuses. These findings provide critical insights into RQ3, which explores how lecturers use ICTs in teaching and learning.

The study also identified perceived affordances as a crucial factor influencing ICT uptake. Some lecturers view ICTs as valuable tools for enhancing student learning, while others perceive them as disruptive, time-consuming, or a threat to traditional teaching methods. This suggests that successful ICT adoption requires not only infrastructure investment but also targeted training programs, institutional incentives, and a shift in pedagogical culture. The findings demonstrate that digital affordances are only meaningful if lecturers have the capacity and confidence to integrate them into their teaching practices, further addressing RQ3.

7.9.3. Institutional design and the structuring of ICT adoption

IDT provided a framework for understanding how institutional structures, governance mechanisms, and policy decisions influence ICT adoption. The findings reveal that TVET colleges with clear ICT governance structures, dedicated e-learning units, and strategic partnerships tend to integrate technology more effectively. Institutions lacking structured ICT policies and decision-making frameworks struggle with fragmented implementation, inconsistent adoption rates, and resource misallocation.

A key insight from institutional data is that institutional design moderates the impact of external constraints, such as budget limitations, geographical barriers, and policy misalignment. Colleges with flexible governance structures and proactive leadership demonstrated greater adaptability in responding to digital challenges – such as COVID-19 disruptions, bandwidth shortages, and digital equity concerns. These findings reinforce RQ2, which examines the institutional factors influencing ICT adoption, particularly in terms of policy, governance, and institutional responsiveness to external pressures.

Furthermore, the study highlights the role of external policy frameworks in shaping institutional ICT strategies. While national guidelines provide a broad roadmap for ICT integration, colleges must develop tailored policies that align with their unique operational contexts. The findings suggest that greater alignment between national policy directives and institutional-level implementation strategies is necessary to ensure sustainable and equitable digital adoption across the TVET sector.

7.9.4. Implications for ICT adoption in TVET colleges

The application of DOI, Affordance Theory, and IDT in this study underscored the multi-layered nature of ICT adoption in TVET institutions. The findings suggest several key implications for policy and practice:

The first key implication is the need for *context-sensitive ICT strategies* within TVET colleges. A one-size-fits-all approach to ICT adoption is insufficient. In order to successfully adopt and integrate ICTs, colleges must tailor their ICT strategies to their specific geographical, infrastructural, and institutional realities (RQ1 & RQ2).

The second implication is the necessity for *targeted capacity building* amongst academic staff. Lecturer development programmes must go beyond the basic digital literacy training to include pedagogical strategies for integrating ICTs into teaching and learning. Institutions must also provide ongoing technical support to address individual barriers to adoption (RQ3).

The third implication is the importance of TVET colleges attracting *sustainable ICT investment*. Long-term funding models are necessary for not only the initial ICT procurement but also maintenance, infrastructure upgrades, and support services to ensure continuity in digital learning initiatives (RQ2).

The fourth implication is the necessity for *enhanced policy coordination* at the institutional level. While national frameworks might provide implementation guidelines, there is a need for stronger alignment between national ICT policies and the specific needs of TVET colleges to promote equitable access and usage of ICTs (RQ1 & RQ2).

These findings reinforce that ICT adoption in TVET colleges is not simply a technological issue but an institutional and socio-economic challenge. Addressing these challenges and the institutional gaps requires a holistic approach that integrates strategic investment, policy coherence, and user-focused capacity-building efforts to maximise the transformative potential of ICTs in vocational education.

7.10 Conclusion

This chapter has provided an in-depth analysis of ICT adoption in TVET colleges, framed through a synthesised framework of DOI, Affordance Theory, and IDT. The findings illustrate that factors such as geographical constraints, institutional policies, and user engagement play a crucial role in shaping ICT adoption at the institutional level. Furthermore, the findings indicate that inequalities in ICT access have the potential to reinforce broader socio-economic inequalities. Across the three institutions that participated in case study, ICT strategies were influenced by infrastructural readiness, governance structures, and perceived technological affordances, demonstrating the complexity of integrating ICTs into teaching and learning.

The application of DOI highlighted the varied diffusion rates of ICTs across institutions, with urban colleges benefiting from better infrastructure and rural colleges facing greater adoption barriers. Affordance Theory revealed that ICT integration is not solely about access but also about how users perceive and engage with ICTs, emphasising the role of lecturer training and institutional support. IDT further demonstrated that governance structures and policy alignment play a crucial role in shaping how effectively ICTs are integrated into educational practices. The findings reinforce that ICT adoption in TVET colleges is a multi-dimensional process requiring context-sensitive strategies. While national policies provide a broad framework, institutional responsiveness, financial sustainability, and user capacity are critical to successful ICT integration. Chapter 8 is the final chapter of the thesis; it discusses the study as a whole and reflects on the various aspects of the research. It synthesises key findings, highlights the study's contributions, and provides recommendations for policy, practice, and future research.

CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

This chapter provides a synthesis of the study's findings and reflections on ICT adoption in TVET colleges in KwaZulu-Natal (KZN). The study explored the distribution of ICTs across TVET colleges, the institutional factors influencing ICT adoption, and the ways in which lecturers integrate ICTs into their teaching practices. Using the Diffusion of Innovation (DOI) theory, Affordance Theory, and Institutional Design Theory (IDT) as analytical frameworks, the study examined the complex interplay between institutional design, technological affordances, and user adaptation.

The chapter begins with a synopsis of the thesis, summarising each chapter's contribution to the study. This is followed by a reflection on the theoretical implications of the findings, discussing the catalysts and barriers to ICT adoption in TVET colleges. The institutional factors shaping ICT adoption are then explored, categorised into environmental, technological, and user-related dimensions. The chapter also includes reflections on the research methodology and its implications for future studies. Finally, the chapter outlines the study's contributions to knowledge, suggests recommendations for policy and practice, and identifies areas for future research.

8.2 Thesis Synopsis

The thesis was structured into eight chapters, each addressing a key aspect of ICT adoption in TVET colleges and building upon the previous chapter to develop a comprehensive analysis of the research problem.

Chapter 1: Introduction. This chapter provided an overview of the study's background, outlining the significance of ICT adoption in TVET colleges within the broader context of digital transformation in education. It introduced the research problem, objectives, and questions guiding the study. The chapter also highlighted global and national ICT distribution trends, as well as the challenges faced by education institutions in integrating ICTs. Additionally, it introduced the theoretical framework and research design that underpin the study.

Chapter 2: Literature Review. The literature review examined existing scholarship on ICT adoption in education, with a particular focus on the TVET sector. It explored ICT distribution trends at global, regional, and national levels, discussing the factors influencing digital access and adoption in educational institutions. The chapter also reviewed theories and models of ICT adoption, including discussions on the digital divide, institutional barriers to ICT integration, and the role of policy frameworks in shaping digital transformation in TVET colleges.

Chapter 3: Theoretical Framework. This chapter outlined the theoretical framework guiding the study, drawing on Diffusion of Innovation (DOI) theory, Affordance Theory, and Institutional Design Theory (IDT). DOI theory was used to explain the processes through which ICT adoption occurs within TVET institutions, identifying key factors influencing diffusion. Affordance Theory provided insights into how technological, institutional, and user affordances shape ICT usage in educational settings. IDT was employed to analyse decision-making processes related to ICT implementation within TVET colleges, highlighting the role of institutional leadership and organisational culture in shaping ICT adoption strategies.

Chapter 4: Research Methodology. This chapter detailed the research design and methodological approach used in the study. It explained the rationale for selecting a comparative case study design and described the mixed-methods approach that combined qualitative and quantitative data collection techniques. The chapter also outlined the data collection process, including surveys, interviews, and document analysis. Additionally, it discussed sampling procedures, data analysis techniques, and ethical considerations, ensuring the study's validity and reliability.

Chapter 5: Findings of the ICT Survey (Phase 1). This chapter presented the results of the technical survey conducted across TVET colleges in KZN, providing an overview of the distribution of ICT infrastructure and digital resources. The chapter examined the institutional factors influencing ICT adoption, including financial constraints, geographic disparities, and policy frameworks. It also discussed the challenges TVET colleges faced in integrating ICTs into teaching and learning, such as bandwidth limitations, outdated hardware, and the digital skills gap among lecturers.

Chapter 6: Findings of the Institutional Case Studies (Phase 2). This chapter provided an in-depth analysis of the ICT adoption strategies of three selected TVET colleges – KZN TVET B, KZN TVET D, and KZN TVET F. It explored how institutional policies, geographic location, and socioeconomic conditions shaped ICT implementation at each college. The chapter examined the role of leadership, infrastructure investment, and faculty development in facilitating ICT adoption. It also highlighted innovative strategies used by colleges to overcome challenges, such as leveraging industry partnerships, developing specialised skills hubs, and implementing blended learning models.

Chapter 7: Discussion and Analysis of Findings. This chapter synthesised the findings from Chapters 5 and 6, linking them to the theoretical framework and addressing the research questions. It provided a critical analysis of ICT adoption patterns, institutional decision-making processes, and user engagement with ICTs. The chapter explored the interplay between environmental, technological, and user-related factors in shaping ICT adoption and identified broader systemic issues affecting digital transformation in the TVET sector.

Chapter 8: Conclusions and Recommendations. The final chapter consolidates the study's findings, discussing their theoretical and practical implications. It reflects on the study's contributions to knowledge, policy, and practice and provides recommendations for enhancing ICT adoption in TVET colleges. The chapter also acknowledges the study's limitations and suggests directions for future research.

By structuring the thesis in this manner, the study systematically examined ICT adoption in TVET colleges, offering insights into the factors influencing digital transformation within the sector. The following sections explore the study's theoretical contributions, methodological reflections, and practical implications in greater detail.

8.3 Summary of key findings

The study's findings highlight the unequal distribution of ICTs across TVET colleges in KZN. According to the theoretical framework, the unequal distribution of ICTs is shaped by geographic, economic, and infrastructural factors. Three main findings that emerged from the study included:

8.3.1. *ICT distribution patterns*

The findings from both the technical survey and the institutional case studies indicate that ICT resources are distributed unevenly across TVET colleges, with urban-based institutions having greater access to digital infrastructure than their rural counterparts. TVET colleges in urban areas benefit disproportionately from better Internet connectivity, access to service providers, and technical support, whereas rural colleges struggle with unreliable internet, outdated hardware, and limited technical expertise. These disparities reinforce the urban-rural digital divide, where institutions in well-connected areas can leverage advanced ICT resources, while those in remote regions face persistent infrastructural challenges. As a result, rural colleges often rely on alternative, low-tech solutions to bridge ICT access gaps, which can limit the scope and effectiveness of digital learning initiatives.

Beyond geographical disparities, the uneven distribution of ICTs is also influenced by institutional funding models and procurement processes. Colleges in economically stable regions often have greater autonomy in securing ICT investments, while those in financially constrained areas depend heavily on government funding cycles, which can delay upgrades and limit the ability to implement long-term ICT strategies. Furthermore, reliance on outdated procurement policies exacerbates inefficiencies in ICT distribution, leading to inconsistencies in the types and quality of ICTs available to different colleges. These systemic barriers highlight the need for coordinated policy interventions to ensure more equitable ICT access across the TVET sector.

8.3.2. *Institutional factors influencing ICT adoption*

The institutional case studies identified environmental, technological, and user-related factors affecting ICT adoption. Environmental constraints such as geography and socioeconomic status shape infrastructure investment, with colleges in low-income regions facing funding limitations that restrict their ability to upgrade ICT systems. Technological factors, including legacy systems and bandwidth limitations, hinder seamless ICT integration, affecting the efficiency and reliability of digital platforms. User-related factors, particularly lecturers' digital literacy and perceptions of technology, further influence adoption rates. While some lecturers embrace ICTs, others require sustained training and institutional support to overcome resistance and improve confidence in using ICTs for pedagogical purposes. This highlights the importance of structured ICT capacity-building programmes to ensure equitable adoption across institutions.

Additionally, organisational culture and leadership play a crucial role in ICT adoption at the institutional level. Institutions with proactive leadership and a clear digital strategy tend to implement ICT initiatives more effectively, fostering an environment where lecturers feel supported in integrating technology into their teaching practices. Conversely, in colleges where digital transformation is not embedded within institutional planning, ICT adoption is often fragmented, with lecturers left to navigate the various ICT tools independently. The study found that institutions with strong governance structures and dedicated ICT leadership demonstrated higher levels of digital engagement, reinforcing the significance of institutional commitment in shaping successful ICT integration strategies.

8.3.3. *Lecturers' use of ICTs*

The ICT usage trends at the institutional level indicate that ICT usage varies widely depending on institutional support, training, and infrastructure availability. While some lecturers effectively integrate ICTs into teaching, others face challenges related to skill gaps, workload demands, and resistance to change. The study found that the adoption of e-learning practices is more successful when institutions provide structured training, ongoing support, and policies that align with teaching and learning needs. Lecturers who received professional development opportunities reported greater confidence in incorporating ICT into their teaching, while those in under-resourced institutions often struggled due to a lack of dedicated ICT support. Additionally, institutions that embedded digital literacy as part of their curriculum framework demonstrated higher adoption rates, reinforcing the role of organisational commitment in fostering sustainable ICT integration.

The study also found that lecturers' perceptions of ICT usefulness significantly influence their willingness to engage with ICTs. In environments where ICT is seen as an administrative burden rather than a pedagogical asset, lecturers are less likely to invest time in developing digital competencies. Moreover, workload intensification due to digital content creation was frequently cited as a barrier to ICT adoption. Institutions that provided structured incentives – such as workload adjustments, dedicated ICT support staff, and recognition for digital innovation – saw higher engagement levels. These findings suggest that successful ICT adoption in teaching and learning requires not only technical infrastructure and training but also institutional policies that address workload concerns and create a supportive environment for digital transformation.

8.4 Theoretical contributions

In terms of scholarship, this study contributes to the theoretical discourse on ICT adoption in education by demonstrating how DOI, Affordance Theory, and IDT can be applied within the TVET sector. These frameworks provided analytical lenses through which the institutional, environmental, and user-related dynamics of ICT adoption were explored. The findings extend these theoretical perspectives by highlighting the contextual factors shaping ICT diffusion in TVET colleges and illustrating how institutions navigate infrastructural and organisational challenges associated with digital transformation.

8.4.1. *Diffusion of innovation theory*

The study's findings confirm that ICT adoption in TVET colleges follows distinct phases, with early adopters influencing broader institutional uptake. In line with Rogers' (2003) DOI model, the study found that a small group of technologically proficient lecturers and institutional decision-makers played a critical role in shaping ICT integration strategies. However, systemic barriers – such as infrastructural deficits, digital literacy gaps, and resource constraints – significantly slowed the adoption process. While early adopters were instrumental in championing their institutions' ICT adoption initiatives, the broader institutional uptake was hindered by unequal access to resources and inconsistencies in digital skills.

Furthermore, the findings suggest that ICT adoption in TVET colleges does not always follow a linear progression as described in DOI. Instead, adoption patterns are cyclical and iterative, influenced by external disruptions, policy shifts, and financial constraints. For instance, while some colleges had begun integrating ICTs before the pandemic, the crisis accelerated adoption in ways that deviated from conventional diffusion models, particularly through emergency technology use rather than structured implementation. This suggests that DOI, while useful in understanding adoption trajectories, must be contextualised within broader socio-economic and policy environments to fully explain ICT diffusion in localised TVET settings.

8.4.2. *Affordance theory*

The study confirms the argument that technology adoption is contingent upon the perceived and real affordances available within an institution. Some TVET colleges leveraged their existing ICT infrastructure creatively, while others struggled due to infrastructural limitations and inadequate support mechanisms. In line with Norman's (2013) stance on object affordances, the findings highlight that technological affordances alone do not determine adoption; instead, user perceptions, training, and institutional policies significantly shape how affordances are realised in practice.

A key insight emerging from the study is the role of institutional affordances – the ways in which organisational structures and policies enable or constrain ICT adoption. In colleges where digital infrastructure was supported by clear implementation strategies and ongoing user training, lecturers were more likely to perceive ICTs as valuable tools for teaching and learning. Conversely, in the colleges where ICTs were introduced without adequate support structures, affordances remained underutilised, and ICTs were often repurposed for administrative rather than pedagogical functions. This finding extends Affordance Theory by illustrating that technological functionality alone does not drive adoption; rather, affordances must be embedded within institutional cultures and workflows to be effectively realised.

8.4.3. *Institutional design theory*

The indication from the study is that decision-making structures significantly influence ICT adoption, reinforcing IDT's emphasis on the role of organisational processes in shaping ICT integration. The study found that centralised decision-making streamlined ICT implementation but often resulted in rigid policies that limited grassroots innovation among lecturers. In contrast, institutions that fostered participatory decision-making – where lecturers and students had input in ICT strategies – demonstrated higher engagement in digital learning adoption.

Additionally, the findings highlight the role of authority innovation-decisions and collective innovation-decisions in ICT adoption. In some TVET colleges, ICT policies were formulated at the administrative level with limited input from lecturers, which sometimes led to resistance and low uptake. In other cases, colleges that engaged lecturers in the decision-making process saw greater buy-in and smoother transitions to digital learning. This underscores the importance of aligning decision-making models with institutional cultures and end-user needs.

Moreover, the study revealed that ICT decision-making is often influenced by external stakeholders, including government agencies, funding bodies, and industry partners. While external influences can provide financial and technical support, they may also impose rigid frameworks that do not fully align with the institutional realities of TVET colleges. This dynamic suggests that IDT should be expanded to account for multi-level influences on decision-making, particularly in public institutions where governance structures are complex and multi-tiered.

Overall, the study extends DOI by illustrating the non-linear nature of ICT diffusion in TVET colleges, refines Affordance Theory by emphasising the role of institutional affordances in shaping technology use, and builds on IDT by highlighting the tensions between centralised and participatory decision-making models. These contributions provide a more nuanced understanding of ICT adoption in vocational education settings and offer insights into how institutional structures, technological affordances, and user engagement interact to shape digital transformation.

8.5 Reflection on methodology

The study employed a mixed-method, multiphase research design, which allowed for a comprehensive examination of ICT adoption in TVET colleges. This approach integrated both qualitative and quantitative methods to explore ICT distribution patterns, institutional adoption processes, and user engagement. By structuring the study into two phases – an ICT survey (Phase 1) and institutional case studies (Phase 2) – the research captured both broad trends across multiple colleges and in-depth insights from selected institutions. This design provided a holistic view of ICT adoption, balancing statistical data with rich, contextualised narratives from TVET stakeholders.

8.5.1. *Strengths of the research design*

The mixed-method approach was particularly effective in triangulating findings, ensuring that patterns identified in the quantitative ICT survey were validated and contextualised through qualitative case studies. The survey data provided measurable indicators of ICT availability, while the case studies offered a deeper understanding of how institutional policies, infrastructure, and user perceptions shaped ICT adoption. This methodological synergy strengthened the study's internal validity and enabled a more nuanced interpretation of the findings.

The multiphase methodology allowed for an iterative research process, where insights from the first phase informed the direction and focus of the second phase. By first mapping ICT distribution across TVET colleges and then conducting case studies to investigate institutional decision-making and adoption strategies, the study was able to systematically unpack the layers of ICT integration. This sequential approach ensured that the research addressed both macro-level trends and micro-level institutional dynamics.

Another advantage of this approach was its ability to capture diverse institutional perspectives across multiple stakeholders. The study incorporated input from college administrators, IT personnel, and policy documents, ensuring a well-rounded analysis. This diversity of perspectives enriched the findings by revealing not only infrastructural and policy challenges but also the lived experiences of lecturers and students in navigating digital transformation.

8.5.2. *Methodological challenges and limitations*

Despite the strengths of the research design, the study faced several methodological challenges. One notable limitation was the generalisability of findings. While the ICT survey provided a province-wide snapshot of ICT distribution, the case study component was limited to three institutions. Although these institutions were selected to represent diverse geographic and socioeconomic contexts, the findings may not fully capture the experiences of all TVET colleges in KwaZulu-Natal or beyond. Future studies could expand the sample to include a wider range of colleges to enhance the generalisability of the results.

Another limitation was the temporal nature of ICT adoption, as the study examined a specific period of digital transformation within TVET colleges. Given the rapid pace of technological change, institutions may have undergone further ICT developments since the data collection period. A longitudinal approach, tracking ICT adoption over time, would provide deeper insights into how digital strategies evolve in response to policy changes, funding shifts, and technological advancements.

Additionally, data collection challenges emerged in securing participation from key stakeholders. Some administrators and lecturers expressed reluctance to discuss institutional ICT challenges, particularly regarding resource constraints and decision-making bottlenecks. This required building rapport with participants and ensuring confidentiality to encourage open dialogue. Despite these efforts, certain gaps remained, particularly in securing comprehensive institutional records on ICT investments and policies.

8.5.3. *Implications for future research*

The study's methodological approach underscores the value of mixed-method, multiphase designs in educational technology research. The combination of broad-scale surveys and in-depth case studies provided a richer, more layered understanding of ICT adoption processes. Future research could build on this model by incorporating additional data sources, such as longitudinal tracking of ICT initiatives, experimental interventions to measure digital learning outcomes, or comparative studies across provinces.

Furthermore, given the importance of institutional decision-making in ICT adoption, future studies could explore participatory action research (PAR) approaches, where stakeholders actively contribute to shaping ICT policies and implementation strategies. This would allow researchers to move beyond observational analysis and directly engage with TVET institutions

in developing and testing innovative digital strategies.

While the study's methodological design successfully captured the complexities of ICT adoption in TVET colleges, expanding its scope, incorporating longitudinal elements, and engaging in participatory approaches could enhance future research on digital transformation in vocational education.

8.6 Contributions to knowledge and practice

This study contributes to the growing body of knowledge on ICT adoption in TVET institutions by offering a nuanced analysis of how institutional, technological, and user-related factors shape digital transformation within this sector. By applying DOI, Affordance Theory, and IDT, the study provides a theoretical lens through which ICT adoption processes can be understood within diverse institutional contexts. Beyond its theoretical contributions, the study offers practical and policy-relevant insights that inform decision-making within TVET colleges, addressing both systemic barriers and opportunities for enhancing ICT skills development initiatives.

8.6.1. *Theoretical contributions*

The study extends the application of DOI theory by demonstrating how systemic barriers – such as infrastructural deficits, uneven resource allocation, and user resistance – can slow down ICT diffusion despite institutional efforts to drive adoption. While DOI traditionally assumes a linear diffusion process, this study illustrates how TVET colleges experience non-linear and fragmented adoption patterns, where contextual constraints disrupt expected innovation cycles. This reinforces the need for context-sensitive diffusion models that account for institutional diversity and resource disparities.

From the perspective of Affordance Theory, the study highlights the interaction between ICT availability and institutional capability. The findings suggest that while technology presents multiple affordances – enhanced connectivity, digital teaching tools, cloud-based services – the extent to which these affordances are realised depends on institutional preparedness, lecturer agency, and infrastructure reliability. This underscores the necessity for bridging the gap between perceived and actual affordances through targeted interventions such as professional development, technical support, and sustainable ICT investment.

IDT contributions emerge in the analysis of decision-making structures within TVET colleges. The study reveals that centralised ICT governance can enhance policy consistency but may stifle grassroots innovation, whereas decentralised approaches encourage adaptability but may lack coherence. These findings call for a hybrid governance model, where strategic ICT decisions align with national policies while allowing flexibility for institution-specific adaptations.

8.6.2. Policy contributions

One of the most significant contributions of this study lies in its policy recommendations for digital transformation in TVET institutions. The findings underscore the need for a nationally coordinated ICT policy that ensures equitable resource distribution across colleges. The existing disparities in ICT access between urban and rural institutions highlight the necessity for targeted funding mechanisms that prioritise under-resourced colleges, ensuring that digital education does not exacerbate existing inequalities.

Furthermore, the study advocates for integrated policy frameworks that align ICT adoption with broader workforce development and digital skills initiatives. Given that TVET institutions serve as critical pipelines for vocational and technical education, their ICT strategies must be embedded within national economic and skills development policies. The findings suggest that ICT adoption in TVET colleges should not be treated as an isolated educational reform but as a key component of South Africa's broader digital and economic transformation agenda.

A crucial policy insight is the need for structured professional development initiatives that go beyond basic ICT training for lecturers. The study indicates that lecturer digital literacy remains a bottleneck in ICT adoption, particularly in institutions where pedagogical support is limited. Policies must stipulate mandates for continuous ICT training that integrates both technical skills – using Learning Management Systems – and pedagogical strategies – digital content development and online engagement techniques. Without structured capacity-building efforts, ICT infrastructure investments may yield limited educational impact.

8.6.3. *Pedagogical and curriculum contributions*

This study also makes a critical contribution to pedagogical practice and curriculum development by demonstrating how ICT adoption intersects with teaching and learning methodologies in TVET colleges. The findings highlight that digital integration is not just a technological shift but a pedagogical transformation, requiring lecturers to rethink instructional strategies and align them with digital learning environments.

One of the key insights is that ICT adoption remains highly subject-dependent. Certain vocational subjects – particularly practical and hands-on training programmes – face greater challenges in digital integration compared to theoretical courses. This suggests the need for curriculum-specific digital strategies that ensure ICT implementation enhances, rather than disrupts, learning outcomes. For instance, blended learning models that combine online theoretical instruction with in-person practical training could be a viable approach for balancing digital innovation with the hands-on nature of vocational education.

Moreover, the study calls for greater emphasis on digital literacy within TVET curricula, ensuring that students are not only passive consumers of ICTs but active participants in a technology-driven economy. ICT-related skills should be embedded within TVET programmes, equipping graduates with competencies in digital collaboration, online research, and industry-relevant software applications. This is particularly important in addressing the digital divide between students from technologically advanced urban institutions and those from under-resourced rural colleges.

8.6.4. *Practical contributions for institutional strategies*

From an institutional perspective, the study underscores key strategies that can enhance ICT adoption and sustainability in TVET colleges. One of the most critical findings is the importance of investing in scalable ICT infrastructure that accommodates long-term institutional growth. Many colleges face challenges due to short-term solutions that require frequent reinvestment, leading to inconsistent digital integration. By adopting infrastructure that allows for phased upgrades and future expansion, institutions can build sustainable digital ecosystems that evolve alongside technological advancements.

Another essential institutional strategy is the development of in-house digital support teams to reduce reliance on external ICT service providers. Many colleges currently depend on third-party vendors for network maintenance, system upgrades, and troubleshooting. While outsourcing can provide short-term benefits, it often limits institutional autonomy and responsiveness. By investing in dedicated ICT teams, TVET colleges can enhance their internal capacity, ensuring that digital systems are maintained efficiently and that technical issues are resolved with minimal disruption to teaching and learning activities.

Aligning ICT adoption with student needs and industry demands is also essential to ensuring that digital strategies contribute directly to employability and skills development. The study found that successful ICT implementation is not just about technology provision but also about ensuring that ICTs are relevant to the curriculum and responsive to labour market expectations. Institutions that integrate ICT strategies with industry partnerships and sector-specific training programs create stronger linkages between digital learning and workplace readiness, ultimately improving graduate employability.

Furthermore, the study highlights the importance of participatory decision-making in ICT implementation. Effective digital transformation requires more than just administrative directives; it benefits from the active engagement of lecturers, students, and technical staff. When ICT adoption is approached collaboratively, stakeholders feel a greater sense of ownership, which enhances uptake and innovative use. Institutions that involve lecturers and students in shaping digital strategies – rather than merely expecting them to adapt to top-down directives – are more likely to see higher levels of engagement and more meaningful integration of technology into pedagogical practices.

These insights reinforce the need for strategic, inclusive, and forward-thinking institutional policies that position ICT as an enabler of education rather than just a technical requirement. By investing in long-term solutions, building internal capacity, aligning digital strategies with industry needs, and fostering participatory decision-making, TVET colleges can create an ICT ecosystem that is both sustainable and transformative.

Overall, this study advances both theoretical and practical understandings of ICT adoption in TVET colleges. The theoretical contributions refine existing models of digital diffusion by incorporating context-sensitive, institutionally embedded perspectives. The policy contributions emphasise the need for equitable, coordinated ICT strategies, while the pedagogical insights

stress the importance of aligning digital integration with curriculum demands. Practically, the study offers evidence-based recommendations for institutional ICT governance, ensuring that digital transformation in TVET colleges is systematic, inclusive, and sustainable.

8.7 Recommendations

The findings of this study indicate that ICT adoption in TVET colleges is influenced by a complex interplay of institutional, environmental, and user-related factors. Addressing these challenges requires multi-level interventions, including policy reforms, institutional strategies, and further research. The following recommendations provide a roadmap for improving ICT adoption and integration in TVET colleges, ensuring that ICTs enhance teaching, learning, and institutional efficiency.

8.7.1. Policy recommendations

A nationally coordinated approach to ICT adoption in TVET colleges is necessary to reduce institutional disparities and enhance digital transformation. Developing a nationally coordinated ICT strategy would ensure equitable access to digital resources across all TVET institutions, particularly for colleges in rural and under-resourced areas. This strategy should align with national education and economic development goals to ensure that TVET graduates are equipped with the digital competencies required in modern workplaces. In addition to a coordinated ICT strategy, targeted funding models are needed to support ICT infrastructure development in rural and peri-urban colleges. Differentiated funding mechanisms would help address disparities in connectivity, hardware availability, and access to digital learning tools. Government funding should also encourage public-private partnerships, enabling TVET colleges to leverage external expertise and financial resources. Furthermore, ICT adoption should not be treated as a standalone initiative but should be embedded within broader TVET policies. ICT strategies should be closely aligned with workplace skills training, competency-based education models, and industry partnerships to ensure that digital learning directly enhances students' employability.

8.7.2. *Practical recommendations*

Beyond policy-level interventions, institutional strategies should focus on improving ICT infrastructure, lecturer capacity, and student access to digital resources. Establishing ongoing professional development programmes for lecturers is crucial to addressing digital literacy gaps and enhancing pedagogical integration of ICTs. These programmes should be structured and continuous, equipping lecturers with both technical skills, such as using LMS platforms and digital content creation tools, and pedagogical strategies, such as blended learning techniques and digital assessment tools. The training should also be tailored to specific subject areas, particularly for practical and hands-on disciplines where ICT integration presents unique challenges. In addition to capacity-building initiatives, colleges must invest in scalable and sustainable ICT infrastructure. Many TVET institutions face issues related to aging hardware and bandwidth limitations, which necessitate long-term planning. Prioritising cloud-based solutions can reduce reliance on local servers, while expanding internet bandwidth would accommodate increased online activity. Strengthening technical support structures is also necessary to ensure efficient ICT maintenance and troubleshooting.

Enhancing student access to ICTs and resources is another critical area that requires attention. Digital exclusion remains a significant concern, particularly for students from low-income backgrounds who lack access to personal devices or stable internet connections. TVET colleges should expand student access to ICT resources through initiatives such as laptop and tablet loan schemes, subsidised mobile data packages, and the creation of dedicated digital learning spaces on campuses. Ensuring that students have equal opportunities to engage with digital learning is essential for bridging gaps in ICT adoption and fostering inclusive digital education environments.

8.7.3. *Research recommendations*

Although this study provides valuable insights into ICT adoption in TVET colleges, further research is needed to deepen our understanding of long-term digital transformation trends. One key area for future investigation is conducting large-scale studies on ICT adoption across multiple provinces. This study focused on TVET colleges in KwaZulu-Natal, and while the findings provide important insights, expanding the scope to include institutions in different regions would help identify province-specific trends and challenges. A broader national study would contribute to a more comprehensive understanding of ICT adoption patterns and inform evidence-based policymaking at the national level.

Another important avenue for future research is exploring the long-term impact of digital transformation on teaching and learning outcomes. ICT adoption is an ongoing process, and its full effects may take years to materialise. Longitudinal studies should assess how digital learning strategies evolve over time, examining their impact on student engagement, academic performance, and employability. Understanding these dynamics would enable policymakers and institutional leaders to make more informed decisions about sustaining and improving digital learning initiatives.

Finally, further research should investigate the role of industry partnerships in shaping ICT adoption in TVET colleges. Given that TVET institutions serve vocational and technical sectors, examining how collaborations between colleges and industries influence digital skills training would be highly valuable. Research should explore how industry-driven ICT initiatives contribute to curriculum development, work-integrated learning opportunities, and student preparedness for digital workplaces. Understanding these dynamics would provide actionable insights for enhancing ICT adoption strategies in a way that aligns with the evolving needs of the labour market.

A multi-faceted approach is necessary to ensure that ICT adoption in TVET colleges is equitable, sustainable, and impactful. Policy interventions must address funding disparities and institutional support structures, while practical strategies should focus on capacity building, infrastructure development, and student access. Additionally, future research should examine long-term trends and industry partnerships to inform more targeted and effective ICT policies.

8.8 Conclusion

This chapter has provided a comprehensive synthesis of the study's findings, theoretical contributions, methodological reflections, and implications for policy and practice. The study set out to explore the distribution of ICTs across TVET colleges in KwaZulu-Natal, the institutional factors influencing ICT adoption, and the ways in which lecturers engage with ICTs in their teaching. The findings highlighted significant disparities in ICT access and infrastructure, shaped by geographic, economic, and institutional constraints. While some colleges demonstrated progress in digital integration, others struggled with persistent infrastructural and capacity-related barriers, reinforcing systemic inequalities in digital education.

By applying DOI, Affordance Theory, and IDT, the study has contributed to a deeper understanding of how ICT adoption unfolds within TVET institutions. The findings reinforced the importance of both structural and agency-driven factors in shaping digital transformation. Institutional policies, leadership, and resource allocation play a crucial role in facilitating or hindering ICT adoption, while individual user engagement is influenced by perceived affordances, digital literacy, and pedagogical orientation. The study also underscored the need for a coordinated national ICT strategy, targeted funding models, and sustained professional development initiatives to ensure equitable access to digital learning opportunities across TVET colleges.

While the study has addressed key research questions, it also identified areas for further investigation. Future research should examine the long-term impact of digital transformation on teaching and learning, explore the effectiveness of different ICT implementation strategies, and assess how policy interventions influence institutional ICT adoption. The evolving nature of digital education necessitates ongoing inquiry into the intersection of technology, pedagogy, and institutional dynamics.

As the final chapter of this thesis, Chapter 8 has sought to bring together the study's key insights, positioning them within broader debates on ICT adoption in TVET education. The study has demonstrated that while technology holds immense potential to enhance learning and institutional efficiency, its impact is mediated by contextual realities that require careful consideration. Moving forward, a holistic and context-sensitive approach to ICT integration in TVET colleges will be critical to ensuring meaningful and sustainable digital transformation.

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APPENDICES

Appendix A: HSSREC Ethical Clearance Certificate



18 March 2022

Zolile Nicholas Zungu [REDACTED]
School Of Education
Pietermaritzburg Campus

Dear ZN Zungu,

Protocol reference number: HSSREC/00003910/2022

Project title: The use of Digital Technologies at Technical and Vocational Education and Training Colleges in KwaZulu-Natal: A Comparative Case Study

Degree: PhD

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 02 March 2022 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 18 March 2023.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag X54001, Durban, 4000, South Africa

Telephone: +27 (0)31 260 8350/4557/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/Research-Ethics>

Founding Campuses: ■ Edgewood ■ Howard College ■ Medical School ■ Pietermaritzburg ■ Washfile

INSPIRING GREATNESS

Appendix B: Gatekeeper Permission Letter – Elangeni TVET College



An ISO 9001 and ISO 45001 certified organisation

07 November 2021

Dear Mr Z N Zungu

RE: REQUEST FOR USING COLLEGE AS SITE OF RESEARCH

Your communication dated 12 November 2021 refers:

Elangeni TVET College has no objection to you using our campuses as sites of research for *"The use of Digital Technologies at TVET Colleges in KwaZulu-Natal: A Comparative Case Study"*

However, the following conditions for external research apply:


The college will have the right to approve content with regard to research instruments and research analysis.

- The relevant documents must be forwarded to the Rector and approval of usage will be given by the Rector in writing
- The name of the college or any of its sites cannot be used in any documents.
- The name/s of staff employed by the college cannot be used.
- The use of any findings that reflect negatively on the College, its partners or any related body must be approved in writing by the Rector.

Please note that failure to comply with all of the above conditions will result in the necessary legal action being taken against you.

Your cooperation in this regard will be highly appreciated

Yours sincerely


T.J. Aryetey
Principal

I have read the contents of this letter and I accept the conditions

NAME

SIGNATURE

DATE

Appendix C: Gatekeeper Permission Letter – Majuba TVET College



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

DHET 004: APPENDIX 1:
**APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN
PUBLIC COLLEGES**

1. APPLICANT INFORMATION

1.1.	Title (Dr /Mr /Mrs /Ms)	Mr.	
1.2	Name and surname	Zolile Nicholas Zungu	
1.3	Postal address	[REDACTED]	
1.4	Contact details	Tel	[REDACTED]
		Cell	[REDACTED]
		Fax	[REDACTED]
		Email	[REDACTED]
1.5	Name of institution where enrolled	University of KwaZulu-Natal	
1.6	Field of study	Education	
1.7	Qualification registered for	<i>Please tick relevant option:</i>	
		Doctoral Degree (PhD)	<input checked="" type="checkbox"/>
		Master's Degree	<input type="checkbox"/>
		Other (please specify)	<input type="checkbox"/>

2. DETAILS OF THE STUDY

2.1	Title of the study
	The use of Digital Technologies at TVET Colleges in KwaZulu-Natal: A Comparative Case Study

2.2	Purpose of the study
	To conduct a comparative case study across three TVET colleges in KZN (Elangeni TVET College, Majuba TVET College, Mthashana TVET College) where I will:
	1. document the distribution of digital technologies across TVET colleges in KZN.
	2. explore the institutional factors that have an influence on the adoption process of digital technologies in TVET colleges.
	3. interrogate how lecturers make use of the digital technologies available for teaching and learning.

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

3. PARTICIPANTS AND TYPE/S OF ACTIVITIES TO BE UNDERTAKEN IN THE COLLEGE

Please indicate the types of research activities you are planning to undertake in the College, as well as the categories of persons who are expected to participate in your study (for example, lecturers, students, College Principals, Deputy Principals, Campus Heads, Support Staff, Heads of Departments), including the number of participants for each activity.

3.1	Complete questionnaires	Expected participants (e.g. students, lecturers, College Principal)	Number of participants
		a)	
		b)	
		c)	
		d)	
3.2	Participate in individual interviews	Expected participants	Number of participants
		a) Deputy Principal Academic Services	1
		b) Lecturers	24 (3 per campus)
		c) Deputy Director ICT/IT Manager	1
		d)	
3.3	Participate in focus group discussions/ workshops	Expected participants	Number of participants
		a) Lecturers	24 (3 per campus)
		b)	
		c)	
		d)	
3.4	Complete standardised tests (e.g. Psychometric Tests)	Expected participants	Number of participants
		a)	
		b)	
		c)	
		d)	
3.5	Undertake observations <i>Please specify</i>	During selected lessons I will sit in and observe how the lecturers use digital technologies in their teaching. The observations will focus on how lecturers interact with digital technologies in their classrooms.	1 per campus
3.6	Other <i>Please specify</i>	N/A	

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

4. SUPPORT NEEDED FROM THE COLLEGE

<i>Please indicate the type of support required from the College (Please tick relevant option/s)</i>			
Type of support		Yes	No
4.1	The College will be required to identify participants and provide their contact details to the researcher.	✓	
4.2	The College will be required to distribute questionnaires/instruments to participants on behalf of the researcher.	✓	
4.3	The College will be required to provide official documents. <i>Please specify the documents required below</i> - Policy documents related to implementation and integration of digital technologies in teaching and learning. - Reports documenting digital technology usage across the college. - Lecturer guides/lecturer feedback on digital technology in the classroom	✓	
4.4	The College will be required to provide data <i>(only if this data is not available from the DHET)</i> . <i>Please specify the data fields required, below</i> Inventory list of IT infrastructure at the college	✓	
4.5	<i>Other, please specify below</i>		

5. DOCUMENTS TO BE ATTACHED TO THE APPLICATION

<i>The following 2 (two) documents must be attached as a prerequisite for approval to undertake research in the College</i>	
5.1	Ethics Clearance Certificate issued by a University Ethics Committee
5.2	Research proposal approved by a University

6. DECLARATION BY THE APPLICANT

I undertake to use the information that I acquire through my research, in a balanced and a responsible manner. I furthermore take note of, and agree to adhere to the following conditions:

- a) I will schedule my research activities in consultation with the said College/s and participants in order not to interrupt the programme of the said College/s.
- b) I agree that involvement by participants in my research study is voluntary, and that participants have a right to decline to participate in my research study.
- c) I will obtain signed consent forms from participants prior to any engagement with them.
- d) I will obtain written parental consent of students under 18 years of age, if they are expected to participate in my research.
- e) I will inform participants about the use of recording devices such as tape-recorders and cameras, and participants will be free to reject them if they wish.
- f) I will honour the right of participants to privacy, anonymity, confidentiality and respect for human dignity at all times. Participants will not be identifiable in any way from the results of my research, unless written consent is obtained otherwise.
- g) I will not include the names of the said College/s or research participants in my research report, without the written consent of each of the said individuals and/or College/s.
- h) I will send the draft research report to research participants before finalisation, in order to validate the accuracy of the information in the report.
- i) I will not use the resources of the said College/s in which I am conducting research (such as stationery, photocopies, faxes, and telephones), for my research study.
- j) Should I require data for this study, I will first request data directly from the Department of Higher Education and Training. I will request data from the College/s only if the DHET does not have the required data.
- k) I will include a disclaimer in any report, publication or presentation arising from my research, that the findings and recommendations of the study do not represent the views of the said College/s or the Department of Higher Education and Training.
- l) I will provide a summary of my research report to the Head of the College/s in which I undertook my research, for information purposes.


I declare that all statements made in this application are true and accurate. I accept the conditions associated with the granting of approval to conduct research and undertake to abide by them.

SIGNATURE	
DATE	10/11/2021

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

FOR OFFICIAL USE

DECISION BY HEAD OF COLLEGE

<i>Please tick relevant decision and provide conditions/reasons where applicable</i>		
Decision		<i>Please tick relevant option below</i>
1	Application approved	<input checked="" type="checkbox"/>
2	Application approved subject to certain conditions. <i>Specify conditions below</i>	<input type="checkbox"/>
3	Application not approved. <i>Provide reasons for non-approval below</i>	<input type="checkbox"/>
NAME OF COLLEGE		MAJUBA TVET COLLEGE
NAME AND SURNAME OF HEAD OF COLLEGE		S. J. MLOTSHWA
SIGNATURE		
DATE		16/11/2021

Appendix D: Gatekeeper Permission Letter – Mthashana TVET College



higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

DHET 004: APPENDIX 1:

APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

1. APPLICANT INFORMATION

1.1.	Title (Dr /Mr /Mrs /Ms)	Mr.	
1.2	Name and surname	Zolile Nicholas Zungu	
1.3	Postal address	[REDACTED]	
1.4	Contact details	Tel	[REDACTED]
		Cell	[REDACTED]
		Fax	[REDACTED]
		Email	[REDACTED]
1.5	Name of institution where enrolled	University of KwaZulu-Natal	
1.6	Field of study	Education	
1.7	Qualification registered for	<i>Please tick relevant option:</i>	
		Doctoral Degree (PhD)	<input checked="" type="checkbox"/>
		Master's Degree	<input type="checkbox"/>
		Other (please specify)	<input type="checkbox"/>

2. DETAILS OF THE STUDY

2.1	Title of the study
The use of Digital Technologies at TVET Colleges in KwaZulu-Natal: A Comparative Case Study	

2.2	Purpose of the study
To conduct a comparative case study across three TVET colleges in KZN (Elangeni TVET College, Majuba TVET College, Mthashana TVET College) where I will:	
1. document the distribution of digital technologies across TVET colleges in KZN.	
2. explore the institutional factors that have an influence on the adoption process of digital technologies in TVET colleges.	
3. interrogate how lecturers make use of the digital technologies available for teaching and learning.	

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

3. PARTICIPANTS AND TYPE/S OF ACTIVITIES TO BE UNDERTAKEN IN THE COLLEGE

Please indicate the types of research activities you are planning to undertake in the College, as well as the categories of persons who are expected to participate in your study (for example, lecturers, students, College Principals, Deputy Principals, Campus Heads, Support Staff, Heads of Departments), including the number of participants for each activity.

3.1	Complete questionnaires	Expected participants (e.g. students, lecturers, College Principal)	Number of participants
		a)	
		b)	
		c)	
		d)	
3.2	Participate in individual interviews	Expected participants	Number of participants
		a) Deputy Principal Academic Services	1
		b) Lecturers	24 (3 per campus)
		c) Deputy Director ICT/IT Manager	1
		d)	
3.3	Participate in focus group discussions/ workshops	Expected participants	Number of participants
		a) Lecturers	24 (3 per campus)
		b)	
		c)	
		d)	
3.4	Complete standardised tests (e.g. Psychometric Tests)	Expected participants	Number of participants
		a)	
		b)	
		c)	
		d)	
3.5	Undertake observations <i>Please specify</i>	During selected lessons I will sit in and observe how the lecturers use digital technologies in their teaching. The observations will focus on how lecturers interact with digital technologies in their classrooms.	1 per campus
3.6	Other <i>Please specify</i>	N/A	

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

4. SUPPORT NEEDED FROM THE COLLEGE

<i>Please indicate the type of support required from the College (Please tick relevant option/s)</i>			
Type of support	Yes	No	
4.1	The College will be required to identify participants and provide their contact details to the researcher.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.2	The College will be required to distribute questionnaires/instruments to participants on behalf of the researcher.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.3	The College will be required to provide official documents. Please specify the documents required below - Policy documents related to implementation and integration of digital technologies in teaching and learning. - Reports documenting digital technology usage across the college. - Lecturer guides/lecturer feedback on digital technology in the classroom	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.4	The College will be required to provide data <i>(only if this data is not available from the DHET)</i> . Please specify the data fields required, below Inventory list of IT infrastructure at the college	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4.5	Other, please specify below	<input type="checkbox"/>	<input type="checkbox"/>

5. DOCUMENTS TO BE ATTACHED TO THE APPLICATION

<i>The following 2 (two) documents must be attached as a prerequisite for approval to undertake research in the College</i>	
5.1	Ethics Clearance Certificate issued by a University Ethics Committee
5.2	Research proposal approved by a University

6. DECLARATION BY THE APPLICANT

I undertake to use the information that I acquire through my research, in a balanced and a responsible manner. I furthermore take note of, and agree to adhere to the following conditions:

- a) I will schedule my research activities in consultation with the said College/s and participants in order not to interrupt the programme of the said College/s.
- b) I agree that involvement by participants in my research study is voluntary, and that participants have a right to decline to participate in my research study.
- c) I will obtain signed consent forms from participants prior to any engagement with them.
- d) I will obtain written parental consent of students under 18 years of age, if they are expected to participate in my research.
- e) I will inform participants about the use of recording devices such as tape-recorders and cameras, and participants will be free to reject them if they wish.
- f) I will honour the right of participants to privacy, anonymity, confidentiality and respect for human dignity at all times. Participants will not be identifiable in any way from the results of my research, unless written consent is obtained otherwise.
- g) I will not include the names of the said College/s or research participants in my research report, without the written consent of each of the said individuals and/or College/s.
- h) I will send the draft research report to research participants before finalisation, in order to validate the accuracy of the information in the report.
- i) I will not use the resources of the said College/s in which I am conducting research (such as stationery, photocopies, faxes, and telephones), for my research study.
- j) Should I require data for this study, I will first request data directly from the Department of Higher Education and Training. I will request data from the College/s only if the DHET does not have the required data.
- k) I will include a disclaimer in any report, publication or presentation arising from my research, that the findings and recommendations of the study do not represent the views of the said College/s or the Department of Higher Education and Training.
- l) I will provide a summary of my research report to the Head of the College/s in which I undertook my research, for information purposes.



I declare that all statements made in this application are true and accurate. I accept the conditions associated with the granting of approval to conduct research and undertake to abide by them.

SIGNATURE	
DATE	23/11/2021

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

FOR OFFICIAL USE

DECISION BY HEAD OF COLLEGE

<i>Please tick relevant decision and provide conditions/reasons where applicable</i>	
Decision	<i>Please tick relevant option below</i>
1 Application approved	✓
2 Application approved subject to certain conditions. <i>Specify conditions below</i>	
N/A	
3 Application not approved. <i>Provide reasons for non-approval below</i>	
N/A	
NAME OF COLLEGE	MIHASHANA VET COLLEGE
NAME AND SURNAME OF HEAD OF COLLEGE	
SIGNATURE	
DATE	26/01/2022

Appendix E: Informed Consent Form For Deputy Principals, ICT Managers, Lecturers and ICT Support Staff

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC) APPLICATION FOR ETHICS APPROVAL

For research with human participants

INFORMED CONSENT RESOURCE TEMPLATE

Note to researchers: Notwithstanding the need for scientific and legal accuracy, every effort should be made to produce a consent document that is as linguistically clear and simple as possible, without omitting important details as outlined below. Certified translated versions will be required once the original version is approved.

There are specific circumstances where witnessed verbal consent might be acceptable, and circumstances where individual informed consent may be waived by HSSREC.

Information Sheet and Consent to Participate in Research

Date: 25 February 2022

Dear Sir/Madam

My name is Zolile Nicholas Zungu from UKZN's School of Education on the Pietermaritzburg campus. My contact details are; zunguz1@ukzn.ac.za (email), 033 260 6454 (office telephone), [REDACTED] (mobile). My research supervisor is Prof. Wayne Hugo, who can be contacted on; hugow@ukzn.ac.za (email) and 033 260 5567 (office telephone).

You are being invited to consider participating in a study that involves research into the adoption and integration of ICTs in TVET colleges for teaching and learning purposes. The aim and purpose of this research is to; explore the factors that influence digital technology selection and integration at the TVET college, document the distribution of ICTs, and learn how TVET lecturers use ICTs in their teaching and learning activities. The study is expected to enroll 1 Deputy Principal for Academic Services, 1 Deputy Director for ICT/IT Manager, and 24 lecturers (3 per campus) from the TVET college. It will involve the following procedures; semi-structured interviews, focus group discussions and lesson observations. The duration of your participation if you choose to enroll and remain in the study is expected to be over 2 face-to-face/virtual sessions, each totaling 1 hour and 1 hour of lesson observation.

The information sought by the study is potentially not harmful or sensitive to you. However, you may be asked to share details of your teaching practice and working environment, which may contain details that you might deem to be confidential or sensitive. In this regard, I will seek additional permission from both yourself and the TVET college to use any information that may be deemed confidential, harmful or sensitive. The study will provide no direct benefits to you and it is hoped that the study will provide insights into; the distribution of ICTs across the TVET sector, the factors that influence digital technology selection and integration at TVET colleges, and the application of ICTs in TVET classrooms. Should you choose to participate in the study but are unavailable for the contact sessions; you can submit your inputs and responses in writing or as an audio recording to the researcher.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number: HSSREC/00002910/2022).

In the event of any problems or concerns/questions you may contact the researcher via email at zunguz1@ukzn.ac.za and mobile phone [REDACTED]; or the research supervisor via email at hugow@ukzn.ac.za; or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Participation in this study is voluntary and you may withdraw your participation at any point, in the event of refusal/withdrawal of participation, you will not incur penalty. Should you decide to withdraw from the study you should; inform the researcher (Zolile Zungu) in writing, by submitting a signed letter of your intent to withdraw from the study. Following receipt of your intent to withdraw, I will notify the TVET college as well as my research supervisor (Prof Hugo) and request for another participant to be sought. No costs will be incurred by you as a result of participation in the study or withdrawal from the study.

The study does not seek any personal, sensitive or harmful information from you; however, in order to protect the confidentiality of your personal information, and the nature of your work, I will make use of pseudonyms and limit exposure of any details you may deem as being sensitive or confidential as much as possible in any dissemination of the information. This will be done in consultation with the TVET college and yourself. The audio recordings, transcripts and research notes will be submitted to my research supervisor and stored according to the UKZN's research ethics rules and regulations.

CONSENT

I _____ have been informed about the study entitled; The use of ICTs at TVET Colleges in KwaZulu-Natal: A Comparative Case Study by Zolile Nicholas Zungu.

I understand the purpose and procedures of the semi-structured interviews, focus group discussions and lesson observations.

I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at zunguz1@ukzn.ac.za or _____ and the research supervisor at hugow@ukzn.ac.za.

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Additional consent, where applicable

I hereby provide consent to:

Audio-record my interview / focus group discussion YES / NO
Video-record my interview / focus group discussion YES / NO
Use of my photographs for research purposes YES / NO

Signature of Participant

Date

**Signature of Witness
(Where applicable)**

Date

**Signature of Translator
(Where applicable)**

Date

Appendix F: Interview Schedule for Deputy Principals



1. How has the scope of the teaching and learning at the college changed since the introduction of ICTs into the classroom?
2. During this time, have the individual skills/competencies you require from lecturers changed?
3. If yes, describe.
4. How does the college assist lecturers develop these required skills/competencies?
5. What sets the college apart from colleges in its approach ICTs in teaching and learning?
 - 5.1. Describe the college's approach to ICTs in teaching and learning [Strategic/operational/policy objectives].
 - 5.2. Describe the provisions that the college has put in place to facilitate the integration of ICTs into teaching and learning [Implementation of strategy].
6. Do you think that the experiences from COVID-19 have changed perceptions within the college about the role/potential of ICTs in teaching and learning? Explain.
 - 6.1. Lessons learnt
 - 6.2. Differences in the approach to ICT integration pre & post pandemic.
7. How has the integration of ICTs affected/impacted on the college's ability to provide teaching and learning support?
 - 7.1. How have ICTs affected/impacted on the existing teaching and learning structures?
 - 7.2. How have ICTs affected/impacted on lecturers' ability to complete teaching and learning activities?
 - 7.3. Is this affect/change the same across all the campuses?
8. Does the college currently have an ICT system (LMS or other) in place to facilitate/manage e-learning? Describe.
9. Do you think that the current system is sufficient for the college's current teaching and learning needs? Explain.
 - 9.1. Do you think that the current system is applied/utilised equally across all campuses? Explain.
10. Does the current system cater to the college's teaching and learning context? Explain.
11. What aspects of the system make this particular system different/unique from others that are available on the market?
 - 11.1. What advantages/opportunities does it offer for teaching and learning?
 - 11.2. How frequently do you experience downtime (of any kind) on the system?
 - 11.3. What challenges/obstacles does this downtime create for teaching and learning?
 - 11.4. How has the installation of the current system changed how teaching and learning work is evaluated at the college?

12. How has the introduction of ICTs impacted the quality of teaching and learning at the college? Explain.
13. What type of structures has the college put in place to assist lecturers with integrating ICTs into their teaching?
14. Are there recurring issues/challenges in the system that affect teaching and learning? Describe.
15. Describe the process(es) used to select the system.
 - 15.1. What type of input did the academic services have in the process of selecting the current system?
 - 15.2. Which technical factors did the college consider when selecting the current system?
 - 15.3. Which pedagogic factors did the college consider when selecting the current system?
 - 15.4. How much of a role did affordability play in selecting the current system? Explain.
 - 15.5. What other operational factors did the college consider when selecting the current system?
16. What type of training/onboarding did lecturers receive when the system was launched?
 - 16.1. Who facilitated this training/onboarding?
17. What type of feedback are you getting from the lecturers about the system?
 - 17.1. Which aspects of the system have the most impact on teaching and learning?
 - 17.2. Which aspects of the system have the least impact on teaching and learning?

Appendix G: Interview Schedule for ICT Managers and ICT Support Staff



1. How has the scope of the IT department's role at the college changed over the years?
2. During this time, have the individual skills/competencies (IT personnel) required to do the job changed?
3. If yes, describe.
4. Do you think that individuals outside of the IT department understand the role/potential of ICTs in teaching and learning? Explain.
5. In your opinion, did the experiences from COVID-19 change perceptions within the college about the role/potential of ICTs in teaching and learning? Explain.
 - 5.1. Lessons learnt
 - 5.2. Pre & post-pandemic differences in ICT use for teaching and learning
6. How have these changes affected/impacted on the IT department's ability to execute its tasks?
7. Beyond providing technical support, what role does the IT department play in teaching and learning activities?
8. Does the college currently have an ICT system in place to facilitate/manage teaching and learning? (If not specified, check who the service provider is.)
9. If yes, please describe how the system works. (to be supported by inventory list)
 - 9.1. Technical specs
 - 9.2. User requirements (lecturer competence/skill)
 - 9.3. Support [internal/external (service provider)]
10. In your opinion, is the current system sufficient for the college's current teaching and learning needs? Explain.
11. If no, what kind of system is the college considering?
 - 11.1. Technical specs
 - 11.2. User requirements

12. How does not having an ICT system for teaching and learning affect teaching and learning activities at the college?
13. What makes this particular system different/unique from others available on the market?
 - 13.1. What advantages/opportunities does it offer (technical & non-technical)?
 - 13.2. On a scale of 1 – 5 (unreliable-reliable), how would you rate the level of technical dependability of your current system? Explain. (highly unreliable, unreliable, on & off, reliable, highly reliable)
 - 13.3. How frequently do you experience downtime (of any kind) on the system?
 - 13.4. What challenges/obstacles does it create (technical & non-technical)?
 - 13.5. How similar/different is it from the previous system?
 - 13.6. How has the installation of the current system changed how work (both administrative & academic) in the college is allocated?

*If the system itself has not changed but has undergone upgrades over time.

14. Has the system changed/been upgraded in any way over the years? (Describe the changes)
15. How have these changes impacted the user (lecturer) experience? (Rate on a scale of 1 – 5?)
 - 15.1. Ease/comfort of use
 - 15.2. Efficiency/task completion
 - 15.3. Challenges/difficulties
 - 15.4. Level of support required
16. Are there any challenges that persist in the system from before the upgrade? Describe.
17. Describe the process(es) used to select the system.
 - 17.1. What type of input did the IT department have in the process of selecting the current system?
 - 17.2. How many rounds of consultation did it take to decide on the system to select?
 - 17.3. Which technical factors did the college consider?
 - 17.4. On a scale of 1 – 5 (insignificant-crucial), how would you rate the importance of the technical aspects in selecting the system? Explain. (insignificant, minor, moderate, high, crucial)
 - 17.5. Which pedagogic factors did the college consider?

- 17.6. On a scale of 1 – 5 (insignificant-crucial), how would you rate the importance of the pedagogic aspects in selecting the system? Explain. (insignificant, minor, moderate, high, crucial)
- 17.7. On a scale of 1 – 5 (insignificant-crucial), how would you rate the importance of affordability (installation, maintenance & support) in selecting the system? Explain. (insignificant, minor, moderate, high, crucial)
- 17.8. What other factors did the college consider?
18. What type of training/onboarding did lecturers receive when the system was launched?
- 18.1. Who facilitated this training/onboarding?
19. What type of feedback are you getting from the lecturers about the system
- 19.1. Which aspects of the system are you assisting them with the most?
- 19.2. Which aspects of the system are you assisting them with the least?

Appendix H: Focus Group Discussion Schedule for TVET Lecturers



1. What type of impact has the introduction of ICTs into the classroom had on the skills/competencies required by a TVET lecturer?
2. What types of activities do you use ICTs for in your teaching practice?
3. Which devices/platforms are you currently using in your teaching practice?
 - 3.1. How long have you been using these in your teaching practice?
 - 3.2. What/who prompted you to start using these in your teaching practice?
 - 3.3. How long did it take you to be comfortable/confident using them in the classroom?
 - 3.4. Do you share your experiences using these with your colleagues/peers?
 - 3.5. If yes, describe.
 - 3.6. In your opinion, what advantages do you gain by integrating these into your teaching practice?
 - 3.7. In your opinion, what are the disadvantages of using these in your teaching practice?
 - 3.8. Are you aware of any other devices/platforms on the market that have a similar function to those you are using?
4. Describe the process you went through to familiarise yourself with the devices/platforms you are currently using in your teaching practice.
 - 4.1. What type of support/guidance/training did you receive from the college during this process?
 - 4.2. Did you undergo any other training on the devices/platforms besides the one organised by the college?
 - 4.3. In the beginning, what aspects of the devices/platforms made you hesitant to use them? Explain.
 - 4.4. How did you overcome this hesitation?
 - 4.5. On a scale of 1 – 5 (novice-expert), how would you rate your current level of expertise in these devices/platforms? Explain. (novice, advanced beginner, competent, proficient, expert)

- 4.6. On a scale of 1 – 5 (easy-difficult), how easy/difficult was it to learn how to use these devices/platforms? Explain. (easy, fair, moderate, challenging, difficult)
- 4.7. On a scale of 1 – 5 (low-high), how would you rate your current confidence level in using these devices/platforms in your teaching practice? Explain. (not confident, slightly confident, reasonably confident, highly confident, completely confident)
- 4.8. How long did it take you to reach the current levels of confidence and expertise?
- 4.9. On a scale of 1 – 5 (never-certain), how likely are you to explore other teaching-related devices/platforms on your own? Explain. (never, unlikely, probable, likely, certain)
- 4.10. How likely are you to advise fellow lecturers on how to use ICTs? Why?
5. How have these devices/platforms affected your teaching experience?
 - 5.1. Ease/comfort of use
 - 5.2. Efficiency/task completion
 - 5.3. Challenges/difficulties
 - 5.4. Level of support required
6. Do you think the ability to use ICTs in the classroom has made you a better educator? Explain.
7. Do you think your experiences during COVID-19 have changed your perceptions about the role/potential of ICTs in teaching and learning? Explain.
 - 7.1. What lessons did you learn about the role/potential of ICTs in teaching?
8. Beyond technical support, what type of support do you receive in teaching and learning activities from the IT department?
9. What type of structures do you work with within the college to facilitate ICT integration into your classroom?
 - 9.1. Describe the role of the structure/individual.
 - 9.2. As an individual lecturer, how much input/control do you have in determining how to utilise ICTs in the classroom?
 - 9.3. Does this structure/individual monitor how you use ICTs in the classroom?
 - 9.4. What type of support does this structure/individual provide?
 - 9.5. What type of feedback do you receive from the structure/individual?
 - 9.6. Do you think that this structure/individual empowers you in your efforts to integrate ICTs into your teaching? Explain.
10. What type of feedback are you getting from fellow lecturers about using ICTs in the classroom?

10.1. Which aspects of teaching with ICTs receive the most positive feedback?

10.2. Which aspects of teaching with ICTs receive the most negative feedback?

11. On a scale of 1 – 5 (insignificant-crucial), how would you rate the level of influence that feedback from fellow lecturers has on your approach to ICTs? Explain. (insignificant, minor, moderate, high, crucial)

12. On a scale of 1 – 5 (insignificant-crucial), how would you rate the level of influence that feedback from your students has on your approach to ICTs? Explain. (insignificant, minor, moderate, high, crucial)

13. Outside of the classroom, how often do you interact with ICTs?

13.1. Types of activities

13.2. Comfort/affinity for ICTs

13.3. Network of users

Outside of the workplace, how would you rate your level of interest (low-high) in the developments taking place in Educational Technologies? Explain. (low, slight, medium, major, high)

Appendix I: Turnitin Report

The screenshot displays a Turnitin Match Overview report. The document title is "The use of digital technologies at TVET Colleges in KZN - A comparative c...". The document is from the University of KwaZulu-Natal, authored by Zolile Nicholas Zungu, and dated 2024. The match overview shows a total match rate of 10%. The sources are listed as follows:

Rank	Source	Match Rate
1	researchspace.ukzn.ac... Internet Source	<1%
2	hdl.handle.net Internet Source	<1%
3	www.barnesandnoble.c... Internet Source	<1%
4	uir.unisa.ac.za Internet Source	<1%
5	www.researchgate.net Internet Source	<1%
6	www.simonandschuste... Internet Source	<1%
7	ir.dut.ac.za Internet Source	<1%

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