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**THE INTEGRATION OF INFORMATION AND
COMMUNICATIONS TECHNOLOGY IN THE TECHNICAL AND
VOCATIONAL EDUCATION AND TRAINING SECTOR IN THE
WESTERN CAPE**

by

RIRHANDZU AFFECTIONATE UBISI

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ABSTRACT

The ubiquity of ICT, as well as its use and application across all industries, has forced TVET colleges to integrate it into the teaching and learning process to ensure that students are well trained for the world of work, which is dominated by technology. However, the use of ICT for teaching and learning does not happen without any challenges as some lecturers in TVET colleges find it difficult to integrate ICT in the teaching and learning process. Thus, an investigation into ICT integration in TVET colleges is crucial in order to gain insight into how lecturers in TVET colleges experience ICT integration and to identify factors that influence their ICT integration in the teaching and learning process.

This research was aimed at exploring ICT integration in order to identify the factors that promote or hinder ICT integration, as well as the extent of ICT integration in the teaching and learning process, through an analysis of personal experiences of lecturers at a TVET college in the Western Cape, South Africa.

A qualitative research design was used for this study. Face-to-face semi-structured interviews were used to collect data. The researcher collected and analysed documents from the participants and the TVET college to determine the extent to which lecturers integrate ICT into the teaching and learning process as well as to identify the most preferred technological tools used by TVET lecturers. The documents review was used to corroborate the findings from the interviews. Purposive sampling was used to select the TVET College as well as the participants for the study.

The findings indicated that effective ICT integration will take place if there are sufficient ICT resources available, technological pedagogical knowledge, ICT policy on ICT integration, as well as a positive attitude towards the use of ICT for teaching and learning. All the lecturers that participated in this study identified several benefits and motivating factors for using ICT for teaching and learning.

DECLARATION

I, **Rirhandzu Affectionate Ubisi**, declare that the contents of this minor dissertation is my own work, and that the minor dissertation has not been submitted for academic examination for any qualification. Furthermore, it represents my own opinions and not necessarily those of the University of Johannesburg.

Student

Date:

5 March 2021

Signature:



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LIST OF ABBREVIATIONS

4IR	Fourth Industrial Revolution
ATM	Automated Teller Machine
CA	Competency Area
CK	Content knowledge
COVID-19	Coronavirus Disease
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
DOC	Document
ETDP-SETA	Education, Training and Development Practices Sector Education and Training Authority
GB	Gigabytes
HEQC	Higher Education Quality Council
ICT	Information and Communications Technology
IT	Information Technology
LMS	Learning Management System
Mbps	Megabytes Per Second
Ms	Microsoft
NATED	National Accredited Technical Education Diploma
NC(V)	National Certificate (Vocational)
NQF	National Qualification Framework
NSF	National Skills Fund
OECD	Organisation for Economic Co-operation and Development
OLC	Open Learning Centre
P	Participant
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
PSET	Post School Education and Training
QTCO	Quality Council for Trades and Occupations
SABEN	South African Broadband Educational Network
SAMR	Substitution Augmented Modification Redefinition
SANReN	South African National Research and Education Network
SDG	Sustainable Development Goals

SETA	Sector Education and Training Authority
SSI	Semi-Structured Interview
TALIS	Teaching and Learning International Survey
TCCP	TVET Colleges Connection Programme
TCK	Technological Content Knowledge
TENET	Tertiary Education and Research Network
TK	Technological Knowledge
TPACK	Technological Pedagogical Content Knowledge
TPK	Technological Pedagogical Knowledge
TVET	Technical and Vocational Education Training
UPS	Uninterrupted Power Supply
Wi-Fi	Wireless Fidelity
WIL	Work-Integrated Learning



CHAPTER 1: RATIONALE AND OVERVIEW OF THE STUDY

1.1 INTRODUCTION

The 21st century has seen an exponential growth in the use and application of information and communication technologies (ICT). ICT has become crucial in everyday life, be it for teaching and learning, working, or leisure. That is, ICT has changed the way people learn, work, and interact. This study investigates the integration of ICT at a TVET college in the Western Cape. In this chapter, the background and rationale, the research problem as well as the research questions for the study will be discussed. Furthermore, the chapter outlines the aims and objectives, significance, as well as the delimitations and assumptions of the study. It also briefly discusses the research methodology, key definitions, terminology, and concludes with an outline of the research study and a chapter summary.

1.2 THE BACKGROUND AND RATIONALE FOR THE STUDY

ICT has become popular in education and other sectors of the economy. It has become one of the major fundamental resources of modern society (Abdelrahman, Ahmed, Zainab, & Mohammed, 2019), which makes its usage crucial in everyday life as well as in teaching and learning. Many countries around the globe now consider ICT an essential part of education, thus it is crucial to incorporate ICT in the teaching and learning process (Abdelrahman et al., 2019). Also, the job demands of the modern economies require individuals who are technologically savvy (Rabah, 2015). Therefore, this presents a need for educational institutions to update their educational curricula and classroom facilities to bridge the existing ICT gap in the education and training environment (Buabeng-Andoh, 2012).

ICT is one of the most important tools in education. While the introduction and incorporation of ICT in the teaching and learning setting is not a solution for all educational issues (Jung, 2005), ICT is a powerful enabling tool that plays an important part in the education and training environment (Chisango, Newlin, Mtsi, & Matyedi, 2019) and is changing the way students learn, socialise and play (OECD, 2015b). This poses a need for TVET lecturers to understand ways in which ICT can make a crucial difference in students' learning (Dorathy & Mahalakshmi, 2014) so that they can integrate it in such a way that leverages its affordances for lecturers and students.

The drive to integrate ICT into the education and training environment has led nations globally to “recognize the affordances of the emerging information age portrayed by ICT,” (Buabeng-Andoh & Issifu, 2015, p. 1282). Educational institutions have invested massive amounts in ICT infrastructure (Youssef & Dahmani, 2008) but the increase in ICT infrastructure has not led to effective integration of ICT in the teaching and learning process. Several researchers (see, Kumar & Daniel, 2016; Opeyemi et al., 2019; Nikolopoulou & Gialamas, 2016) concluded that lecturers are yet to integrate ICT into the teaching and learning process effectively. Despite the usefulness of ICT, and its potential in preparing students for the 21st century economy and society, lecturers still find ICT difficult to integrate into the teaching-learning process (Nikolopoulou & Gialamas, 2016).

Additionally, the introduction of ICTs has changed how people learn. That is, the teacher is no longer the foundation of knowledge with the students being passive recipients. According to Khan and Markauskaite (2017, p. 692), “teachers are facing increased pressures not only to have in-depth subject and general pedagogical knowledge, but also to use ICT in their teaching effectively”, where a deficiency in either area can lead to failure (Ruggiero & Mong, 2015). Therefore, it is important to identify the extent to which lecturers in TVET colleges integrate ICT and the factors that influence the integration of ICT by lecturers in the teaching and learning process. As a result, the aim of this study is to investigate ICT integration at a TVET college in Western Cape.

1.3 THE RESEARCH PROBLEM STATEMENT

The ubiquity of ICT, as well as its use and application across all industries, has forced TVET colleges to integrate it into the teaching and learning process to ensure that students are well trained for the world of work, which is dominated by technology. However, the use of ICT for teaching and learning does not happen without any challenges as some lecturers in TVET colleges find it difficult to integrate ICT in the teaching and learning process. Thus, an investigation into ICT integration in TVET colleges is crucial in order to gain insight into how lecturers in TVET colleges experience ICT integration and to identify factors that influence their ICT integration in the teaching and learning process.

1.4 THE RESEARCH QUESTIONS OF THE STUDY

This study is based on the following research question:

How do lecturers in TVET colleges experience the integration of ICT in the teaching and learning process?

To effectively tackle the main research question, the following sub-questions were formulated:

- a) What are the factors that influence ICT integration in teaching and learning in TVET colleges?
- b) To what extent do lecturers in TVET colleges integrate ICT into the teaching and learning process?

1.5 THE AIMS AND OBJECTIVES OF THE STUDY

1.5.1 The aims of the study

This research was aimed at exploring ICT integration in order to identify the factors that promote or hinder ICT integration as well as the extent of ICT integration in the teaching and learning process through an analysis of personal experiences of lecturers at a TVET college in the Western Cape, South Africa.

1.5.2 The objectives of the study

The objectives of this study are as follows:

- I. To identify the factors that influence ICT integration in the teaching and learning process.
- II. To determine the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process.
- III. To identify the most effective (preferred) technological tools by TVET lecturers.
- IV. To make recommendations on the effective integration of ICT in the teaching and learning process.

1.6 SIGNIFICANCE OF THE STUDY

This study employed a qualitative methodology in the investigation of ICT integration at a TVET college in Western Cape. This research aims at making the following possible contributions to lecturers, college management, policy makers, and potential researchers:

Firstly, the study aims to identify the factors that hinder, or promote, effective ICT integration into the teaching and learning process so that the factors that hinder effective ICT integration can be brought to the attention of college management and policy makers to address these factors.

Secondly, the study seeks to determine the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process. This will assist lecturers and college management to understand the current level of ICT integration and advise them on how ICT integration can be improved in the teaching and learning process.

Thirdly, the study seeks to identify the most effective (preferred) technological tools by TVET lecturers. This will inform the college management and potential investors on how to acquire and upgrade these tools, and how to identify lecturers' training needs in using such tools for teaching and learning.

Fourthly, the results of this study seek to fill the literature gap that exists in the South African TVET sector.

Lastly, by using the Technological Pedagogical Content Knowledge (TPACK) framework as well as the SAMR (Substitution, Augmentation, Modification and Redefinition) framework, the study seeks to model how lecturers can integrate ICT into teaching and learning in TVET colleges.

1.7 DELIMITATIONS OF THE STUDY

The purpose of this study was to investigate the integration of ICT at a TVET college in the Western Cape. The study only focused on a single TVET college; the sample

size was small as a result of the COVID-19 lockdown restrictions, which made it easier to get access to the college. Only post level one lecturers were considered for the sample. Although, the focus was on ICT integration at a TVET college, the researcher considered related literature from national and international non-TVET education institutions in order to have sufficient literature to inform the study.

1.8 ASSUMPTIONS

The researcher believes that there is a need for adequate technological tools for teaching and learning for effective ICT integration to occur. Consequently, this study assumes that if there are insufficient funds, TVET colleges will be unable to acquire the necessary technological resources for teaching and learning, which will result in ineffective ICT integration in the teaching and learning process.

This study assumes that even though lecturers may know how to use ICT, if they lack TPACK, they might be unable to effectively integrate ICT into the teaching and learning process. Which is why it is important for lecturers to receive professional development in TPACK in order to acquire the necessary skills and knowledge to effectively incorporate ICT into their teaching and learning practices.

This study presumes that ICT integration policy is one of the crucial factors that influence the incorporation of ICT into the teaching and learning environment. A lack of ICT integration policy may result in lecturers ineffectively incorporating ICT into the teaching and learning process.

The interpretivist paradigm was used to conduct the study, thus the study assumes that there are multiple subjective realities as experienced by the participants. This research study is context-bound to an urban public TVET college, which means that the realities lecturers face in an urban public TVET college may differ to the realities lecturers face in rural public TVET colleges.

1.9 A BRIEF OVERVIEW OF THE RESEARCH METHODOLOGY

1.9.1 Data collection methods and analysis

A qualitative research design was used for this study. Face-to-face semi-structured interviews were used to collect data. The researcher collected and analysed documents from the participants and the TVET college to determine the extent to which lecturers integrate ICT into the teaching and learning process, and to identify the most preferred technological tools used by TVET lecturers. A documents review was also used to corroborate the findings from the interviews. The data was collected from one TVET college in the Western Cape, South Africa. Purposive sampling was used to select the TVET College as well as the participants for the study. The researcher used an audio recorder to record the data collected from the interviews, and then transcribed it from audio to text. A step-by-step guide to analysing qualitative interviews was used to guide the overall data analysis process as recommended by O'Connor and Gibson (2017). The TPACK framework and SAMR model were used to guide the identification of the main categories and sub-categories that emerged from the data analysis phase. However, the researcher was not limited to these frameworks, but also kept an open mind to other categories that emerged from the data. Thus, the study applied both deductive and inductive data analysis. Any data, which did not fit into categories, was carefully analysed before eliminating it from the findings.

1.9.2 Trustworthiness of the research

To ensure that the results of this study are trustworthy, the researcher used the criteria listed by Trochim, Donnelly, and Arora (2016), namely credibility, transferability, dependability, and confirmability, throughout the study. The researcher recorded the interviews and transcribed the audio to text; thereafter, the transcripts were issued to the participants for approval. The purpose of this study was to investigate the integration of ICT at a TVET college. In order to meet the aims and objectives of the study, a qualitative research methodology was used. According to Merriam and Tisdell (2016), qualitative studies do not need to be generalised. Therefore, findings from this study will not be generalised. Even though the study is not aimed at generalising the findings, the researcher has described all the steps taken throughout the research study in detail to ensure transparency. The researcher triangulated the results by coupling the semi-structured interviews with document review to corroborate the findings.

1.9.3 Ethical consideration and clearance process

Before commencing with data collection, the researcher obtained permission from the TVET College, where the study was conducted. Thereafter, the participants were approached and details pertaining the purpose of the study, namely what is expected of them, as well as an outline of the relevant ethical considerations, were given to them orally and via email. Furthermore, the researcher explained to the participants that their participation was completely voluntary and they had the freedom to withdraw at any stage of the study without any penalty. In summary, the participants gave consent before taking part in the study.

1.10 KEY DEFINITIONS AND TERMINOLOGY OF THE STUDY

Information and Communications Technology (ICT): refers to all technology used for the management and transmission of information and their use, especially in education; this could range from data projectors, interactive whiteboards, desktop computers, laptops, notebooks, tablets, smartphones, system software, application software, internet, intranet, video recording devices, audio recording devices, and other educational technology. These offer vast opportunities and challenges in the teaching and learning environment (Lawrence & Tar, 2018).

Information and Communications Technology (ICT) Integration: refers to technology integration as a process of combining all technological resources (i.e., hardware and software systems and applications) together with each subject-related area of the syllabus to improve learning (*Shelly, Cashman, Gunter, & Gunter, 2008*).

1.11 OUTLINE OF THE RESEARCH STUDY

This section begins with an illustration of the research study (**Figure 1**), followed by a brief discussion of each of the chapters in this research report.

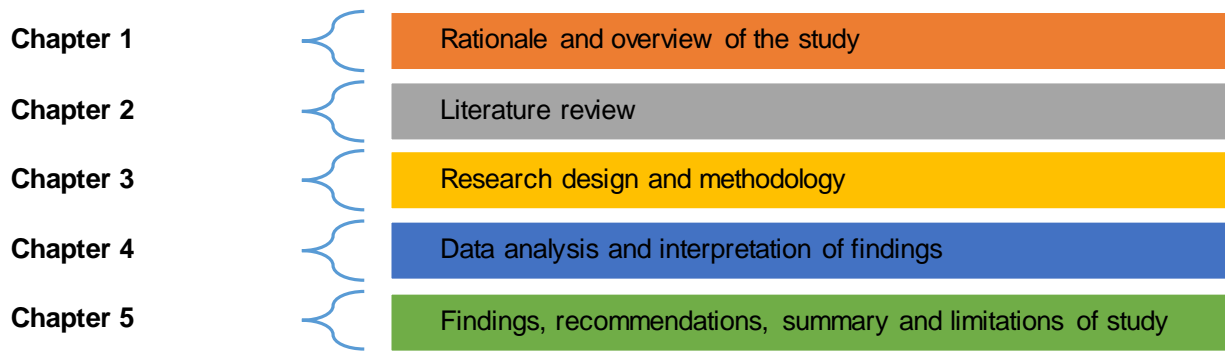


Figure 1: Research outline

Chapter 1 introduces the study by providing the background and rationale for the study, the problem statement, the research questions as well as the main aim and objectives of the study. The chapter further gives a short description of the research design and methodology, as well as steps taken to ensure trustworthiness and ethical conduct throughout the study. Key definitions are provided to orientate the study.

Chapter 2 gives a review of literature related to this study and its context. Furthermore, the TPACK framework and its theoretical underpinnings are explored. Each of the framework's constructs is briefly described. Each of the constructs of the framework is briefly described. This is followed by an introduction of the SAMR model and an explanation of how it will be used in this study.

Chapter 3 coordinates the research paradigm that supports this study, the research design, the methodology, sampling of the TVET college and the participants, the trustworthiness, as well as the ethical considerations of the research. The researcher discusses the research design, how the sample was selected, as well as related components of the research design. The chapter also provides reasons behind the selection of semi-structured interview and document review methods as well as the selection of instruments used for data collection. The steps followed during data analysis are outlined; the chapter concludes with an explanation of the ethical considerations in this study.

Chapter 4 provides a presentation, interpretation, and discussion of the research results of this study. The results are presented in categories comprising sub-categories that emerged during the data analysis stage. Both semi-structured interview data as

well as data drawn from the documents reviewed are given and references from previous studies are presented to substantiate the data findings. The researcher used pseudonyms to protect the integrity of the research participants. The research results are then linked to the theoretical frameworks that advanced this study. The SAMR model of ICT integration is used to measure the extent to which lecturers integrate ICT. The findings suggest that, although, lecturers know how to use the various technological tools and have the application software at their disposal, they lack the pedagogical technological knowledge that would enable them to leverage the full potential affordances of the technology they have at their disposal. There was no significant difference in the extent of ICT integration by lecturers that participated in this study. The findings reveal that the lectures' ICT usage ranges between substitution and augmentation on the SAMR model of ICT integration.

Chapter 5 outlines the summaries of chapters, and discusses the literature findings and empirical findings. The researcher discusses the research findings, limitations of the study as well as the strengths and contributions of the study. Thereafter, recommendations and suggestions for future studies are made based on the research findings. The chapter also conveys several conclusions reached in this study and provides recommendations that can improve the incorporation of ICT into the teaching-learning process. The recommendations are applicable to the TVET colleges in the Western Cape as well as other relevant stakeholders.

1.12 CHAPTER SUMMARY

This chapter introduced the research study by providing the background information and rationale for this study. It also conveyed the research problem, outlined the research questions, the main aim, as well as the research objectives. It also served as an orientation into the research study by providing summaries of the main sections and chapters of the whole study.

In the following chapter, a comprehensive literature review and the frameworks for this research study are presented.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

According to the Organisation for Economic Co-operation and Development (OECD, 2017a), TVET colleges are often characterised by outdated syllabi and technologies, with lecturers lacking sufficient industry experience. This has led to the Department of Higher Education and Training (DHET) planning to redevelop the TVET sector to improve teaching and learning practices. In the DHET's effort to improve the quality of vocational education and training, emphasis has been placed on the incorporation of ICT, lecturer professional development and industry exposure for the students as well as lecturers.

This chapter begins by giving an overview of the TVET sector. It discusses the digital divide and provides a literature review on ICT integration into teaching and learning. Furthermore, the TPACK theoretical framework and the SAMR model that will be used to measure the level of ICT integration are discussed. The chapter concludes with a summary.

2.2 THE SOUTH AFRICAN TVET SECTOR

The Public TVET colleges, previously known as Further Education and Training (FET) colleges, in South Africa were established under the authority of the Continuing Education and Training Act 16 of 2006 (ETDP-SETA, 2018). TVET is classified as Post-School Education and Training (PSET), which is administered by DHET. TVET consists of vocational, occupational, and artisanal education and training as offered by the TVET colleges (DHET, 2020a).

The DHET is responsible for the coordination of the TVET curriculum as well as the development of qualifications nationally, in conjunction with the quality councils, namely Umalusi, Quality Council for Trades and Occupations (QTCO), and Higher Education Quality Council (HEQC) (DHET, 2020a). The subsequent paragraphs discuss the qualification streams offered by TVET colleges, the new direction for TVET colleges, and aspects relating to lecturing staff at TVET colleges.

2.2.1 Qualification streams offered by TVET colleges

The focus of TVET is vocational education. The qualifications offered by TVET colleges are described below:

The National Accredited Technical Education Diploma (also known as NATED or Report 191) offers different programmes with a theoretical and practical component. Some of the programmes include engineering studies and service programmes. The programmes have different N levels (N1 to N6) that are equivalent to the National Qualification Framework (NQF) levels. After completing the theoretical component, students acquire practical experience in the industry for about 18 months (or 2000 hours) to qualify for a National Diploma in the respective programmes (Field, Musset, & Alvarez-Galvan, 2014).

The National Certificate (Vocational) (NC(V)) programme was introduced in 2007 (OECD, 2017a). The NC(V) ranges from NQF Level 2 to NQF Level 4 (NQF Level 4 is equivalent to Grade 12). The NC(V) programmes include three fundamental subjects as well as four core subjects. The programme has a mandatory practical component, which can be completed in a real or simulated workplace environment. When students complete NC(V) Level 4, they can enrol in the NATED (N4 to N6) courses or apply to study at the one of the universities in South Africa.

The NC(V) programme was introduced with the aim of phasing out the NATED programme but due to the high dropout rate in the NC(V), the NATED programmes were retained (OECD, 2017a). Field et al. (2014) found that the NC(V) and NATED programmes were criticised due to the lack of clearly articulated work experience components, the struggle TVET students experience in finding work placement, and most NC(V) students eventually graduating without any workplace experience. Some difficulties encountered in placing students in the industry relate to a lack of well-structured guidelines for employers on recruitment, management, funding, and mentorship to ensure a meaningful workplace experience for the students (ETDP-SETA, 2018).

2.2.2 A new direction

The quality of TVET education and training in South Africa is commonly perceived to be of a low standard (OECD, 2017a). Improving the TVET sector will help tackle the skill shortages in South Africa (OECD, 2017b). Therefore, the White Paper for Post-School Education and Training of 2013 outlined a vision for the Post-School Education System (PSET) in which the DHET (2013) aims to prioritise the strengthening and expansion of the public TVET colleges through the improvement of the following areas:

- Management and governance,
- Quality teaching and learning,
- Student support services, and
- Infrastructure.

The TVET sector is set to increase its enrolment capacity, which was over 345 000 in 2010, to about 2.5 million by 2030 (DHET, 2013), and thus making it more appealing to school-leavers. According to Field et al. (2014), it may be challenging for the TVET sector to realise expansion unless they work on decreasing the dropout rate and thereby increasing the number of students who complete their studies and graduate. Field et al. (2014) further raise concerns regarding the lack of data, which makes it harder to justify a large-scale expansion of the TVET sector without concrete evidence that the programmes offered by the TVET colleges have a positive impact on young people.

Another objective involves increasing the TVET sector's responsiveness to the needs of the local market, this has given rise to the need for the TVET sector to work in collaboration with private industries (DHET, 2013; OECD, 2017a). This would enable the TVET sector to adjust its curriculum to the skills needed in the industry (Murtin, 2013; OECD, 2017a). It would also enable the TVET colleges to provide placement opportunities for students to gain work-integrated learning (WIL) experience, and to provide opportunities for the TVET lecturers to gain exposure to the developments taking place in the industry. According to Field et al. (2014), this process does not only enable TVET lecturers to gain from spending time in industry, but it could also encourage industry practitioners to take on lecturing and training roles. This would bring in industry knowledge and experience into the TVET sector.

2.2.3 TVET lecturing staff

The current shift in technology and skill trends, which is happening around the globe, places much emphasis on improving the quality of education to meet the demands that have arisen as a result. Lecturers play a key role in improving the quality of education and training, which means lecturers are expected to have a deeper and broader understanding of the subject content as well as their students (OECD, 2018).

According to Field et al. (2014), in certain aspects, TVET lecturers' jobs are more challenging than those of academic teachers. TVET lecturers do not only have to be equipped with the various skills, knowledge, and experience required by certain professional occupations, but they also need to be able to instil those skills in their students while keeping abreast with the developments of the ever-changing technology and industry practices.

Some challenges faced by TVET colleges include the large number of unqualified and underqualified lecturers (ETDP-SETA, 2018), as well as reaching a balance between a professional lecturer qualification and industry experience (Field et al., 2014). The initial structure of professional teacher education poses a challenge for the TVET sector to attain lecturers with the necessary combination of an academic qualification and professional experience. Currently, there is an assortment of lecturing staff employed by the TVET colleges. These range from lecturers with technical qualifications and industry experience but poor pedagogical training, while other lecturers have the relevant academic and professional qualification, sufficient subject knowledge, and pedagogical training but lack sufficient industry experience (Field et al., 2014). To address this issue, the DHET (2013) developed regulations regarding the minimum qualification requirements for TVET lecturers; these regulations guide the professional development of staff as well as new employees. This concurs with the suggestion made by Field et al. (2014) of strengthening the TVET sector's lecturing workforce by paying special attention to pedagogical skills and industry experience.

2.3 THE DIGITAL DIVIDE

Digital technologies are redefining the way people do things. Access to digital technologies allows people to have more control over what and how they learn, where and when they work, and how they participate in society (OECD, 2019). However, while

people and regions leverage the affordances of digital technologies, disparities can occur when there are people and areas that have limited or no access to these technologies. This gap is called the “digital divide”. The OECD (2001) refers to the digital divide as a gap that exists between demographics and geographical areas that have access to ICT and internet or those that have no access due to socio-economic issues.

In TVET colleges, the digital divide would exist where some colleges have access to ICT and internet for administrative, teaching, and learning activities, while other colleges may have limited access only. One of the most common cases in South Africa is that a significant number of students enrolled at TVET colleges are students from low socio-economic backgrounds, whose tuition and travelling fees are covered by the National Student Financial Aid Scheme NSFAS (DHET, 2020b), Sector Education and Training Authority (SETA) or other bursaries accessible in the TVET sector (Field et al., 2014). Even though these students may be enrolled in colleges with sufficient ICT and internet access for educational activities, the digital divide may exist between home and campus. This means students who have no access at home would only have access to ICT and the internet when they are on campus, which would affect how the lecturers design learning activities to accommodate students who cannot access ICT outside the college premises. In the 2018 Teaching and Learning International Survey (TALIS) report, the percentage of South African teachers who indicated that they ‘frequently’ or ‘always’ let students use ICT for assignments or class activities were 38 percent, which was below the OECD average of 53 percent (OECD, 2018). This could be caused by various factors. One of those factors could be the digital divide among students, or a lack of access to ICT infrastructure (Chigona, Chigona, Kayongo, & Kausa, 2010).

The OECD (2019) indicates that the digital divide is not just caused by a lack of funds to buy ICT infrastructure or lack of access to ICT but also due to the lack of skills to take advantage of the affordances of ICT and the internet. Socio-economic levels also have an influence on how people use the internet (OECD, 2015a). Van Deursen and van Dijk (2014) reported that people from lower educational backgrounds mainly use the internet for social interaction and for playing games while people from medium to higher educational backgrounds use the internet for personal development, e-commerce, news, etcetera. This is also in line with findings revealed in the 2015 PISA

report where the socio-economically advantaged students were said to likely use the internet as a resource for obtaining information whereas the socio-economically disadvantaged students mainly used the internet for recreational purposes (OECD, 2015a). Thus, when bridging the digital divide, acquiring digital infrastructure becomes the first step. There is a risk of exacerbating the inequalities if people with lower educational backgrounds mainly use the internet for recreational purposes, while people with higher educational backgrounds take advantage of the affordances of the internet to improve their knowledge, access various online services, and look for jobs (OECD, 2019). The next step would be to ensure that people have the necessary skills to take advantage of the affordances of technology and the internet. Furthermore, an awareness of how to use ICT and the internet productively would help lessen the divide.

2.4 BRIDGING THE DIVIDE IN THE TVET SECTOR

The White Paper for Post-School Education and Training of 2013 (DHET, 2013) recognised ICT as an essential resource for meaningful participation in a globalised world along with its vital importance for effective education provision in the post-schooling sector. The South African Broadband Educational Networks (SABEN), founded in 2015, is a not-for-profit organisation that serves school networks and the TVET sector in South Africa (SABEN, 2020a). In recent years, under the auspices of the DHET, SABEN was tasked in collaboration with the National Skills Fund (NSF), Tertiary Education and Research Network (TENET) to provide high speed connectivity to the South African National Research and Education Network (SANReN) and TVET colleges through DHET's TVET Campus Connection Programme (TCCP) (SABEN, 2020a; SABEN, 2020b). SANReN is a purpose-built network, which is completely detached from the commercial internet; it was created to provide high speed connectivity to scientists, academics, teachers and researchers (SABEN, 2020a). SANReN can accommodate bulk data transfers, collaboration between users, and can be used in the international research, teaching, and learning community (SABEN, 2020a). Through DHET's TVET Campus Connection Programme (TCCP), all the campuses throughout the country will have fibre connection (SABEN, 2020b), which enables lecturers and students to connect to high speed internet in the computer laboratories or to connect via Wi-Fi (SABEN, 2020a).

2.5 LITERATURE REVIEW ON ICT INTEGRATION IN THE TEACHING AND LEARNING SITUATION

According to Lawrence and Tar (2018), ICT covers all technology used for the management and transmission of information and their use, especially in education. This could range from data projectors, interactive whiteboards, desktop computers, laptops, notebooks, tablets, smartphones, system software, application software, internet, intranet, video recording devices, audio recording devices, and other educational technology, which offer vast opportunities and challenges in the teaching and learning environment.

Ramorola (2013) and Shelly et al. (2008) refer to technology integration as a process of combining all technological resources (i.e., hardware and software systems and applications) together with each subject-related area of the syllabus to improve learning. Ramorola (2013) defines technology integration as a process of “combining technology with teaching and learning strategies in order to meet the curriculum standards and learning outcomes of each lesson, unit, or activity,” p. 656). According to Mereku and Mereku (2015), (as cited by Padayachee, 2017), ICT integration is not just the supply of ICT tools, it also involves the pedagogically informed use of ICT to design learning activities. For this study, the definition provided by Shelly et al. (2008) will be adopted.

One may ask, why incorporate ICT into the teaching and learning environment? According to Chisango et al. (2019), ICT is a powerful aiding tool that can play an important part in the teaching and learning process. The world is dominated by technology. Lecturers need to incorporate ICT into the teaching and learning environment so that students can learn to use technology, not only to create content on social media but also to solve problems. Ghavifekr, Razak, Ghani, Ran, Meixi and Tengyue (2012) state that, in keeping up with the digital era, there is a need for lecturers to replace traditional teaching techniques and tools through the incorporation of ICT in their teaching and learning practices. Therefore, ICT integration into education and training should be used to transform teaching and learning practices (Karagiannidis, Politis, & Karasawidis, 2014) to fit the demands of the modern era.

The incorporation of ICT in the teaching and learning environment will play a crucial role in the development of students' skills (Umar & Hassan, 2015, p. 2016). The OECD, (2015b) argues that "as long as computers and the internet continue to have a central role in our personal and professional lives, students who have not acquired basic skills in reading, writing and navigating through a digital landscape will find themselves unable to participate fully in the economic, social, and cultural life around them," (p.16). Hence, if teachers incorporate ICT effectively, students can be prepared for life in the 21st century (Ghavifekr et al., 2012).

2.5.1 Advantages of integrating ICT in the teaching and learning process

Incorporating ICT into the teaching and learning environment can provide lecturers with supportive features that will enable them to give students individualised feedback and instruction in well-designed learning situations while also enabling student-oriented formative assessment (OECD, 2015b). Additionally, ICT provides better opportunities for student engagement (Kumar & Daniel, 2016); it allows for cognitively challenging and engaging activities (OECD, 2015b, p. 74) as well as "efficient ways to develop aspects of students' thinking, which would not be possible when employing traditional teaching practices" (Chigona et al., 2010). Also, the integration of ICT in the learning environment will enable students to take part in interactive activities with extensive information and knowledge during their learning process (Ghavifekr et al., 2012).

ICT can also play an important role in improving the administrative responsibilities of lecturers. With ICT, lecturers can conduct teaching and learning activities as well as administration. This would ease up the burden of having to do menial tasks and it would enable lecturers to focus their attention and efforts on improving teaching and learning. For instance, they could use ICT to store data (Chigona et al., 2010) and ICT could also enable them to access open source information for designing learning activities.

Professional development in ICT integration plays a role in the effective incorporation of ICT into the teaching and learning environment. According to Masingila et al. (2018), inadequate professional development and training may lead to ineffective ICT integration; their study also suggested that lecturers need more support to help them integrate ICT into the curriculum and in using ICT as a tool for engaging students. The

assumption that buying and using ICT will automatically improve teaching practices is not true. However, one can agree that “ICTs are powerful enabling tools that play a significant role in the teaching and learning process” (Chisango et al., 2019, p. 1). In contrast, the OECD (2015b) states that “technology can amplify great teaching, but great technology cannot replace poor teaching,” (p. 190). This is in agreement with the argument presented by Karagiannidis et al. (2014), who stated that the introduction of ICT in education will transform teaching and learning practices.

2.5.2 Factors that influence ICT integration in the teaching and learning process

2.5.2.1 Personal factors

The integration of ICT into teaching and learning is influenced by personal factors such as gender (Buabeng-Andoh, 2019), age, level of education (Rubang-doctor, Pa-alisbo, & Allanic 2019), ICT capability (Naidoo, Madida, & Rugbeer, 2019), and content knowledge (Ndebele, Mbodila, & Mbodila, 2019). Dei (2019) conducted a study to assess the adoption and use of ICT in teaching and learning in secondary schools in Ghana. The findings revealed that age and gender were the main factors that affect the participant’s decision to adopt and use ICT. Consequently, most of the younger teachers and men showed more interest in incorporating ICT while the older teachers and women showed less interest.

2.5.2.2 ICT training and ICT support

When it comes to ICT incorporation into education and training, one has to consider the training needs of lecturers because simply equipping each lecture room with ICT is not enough to ensure that ICT will be incorporated effectively. Also lecturers who graduated recently may find it less challenging to incorporate ICT into their lecturing and training practices compared to lecturers who graduated before ICT gained the focus it has now. Koehler and Mishra (2009) state that teachers who acquired their qualifications before the advancement of ICT often perceive themselves to be insufficiently prepared to incorporate technology into their teaching and learning practices. Even though the percentages may vary per country, in the 2018 TALIS report, all countries who participated in the survey indicated that the ‘use of ICT for teaching’ was included in their formal education or training (OECD, 2018). Over half (below the OECD average of 60 percent) of the South African teachers who

participated in the TALIS (2018) survey indicated that they received formal training in the use of ICT for teaching (OECD, 2018). However, the TALIS (2018) report indicates that South African teachers were among the countries that also indicated a high need for training in the use of ICT for teaching. Therefore, based on the TALIS (2018) report's findings, the OECD (2018) concluded that when teachers indicate a high need for training in specific areas, it does not necessarily mean that they never received training in those areas. Firstly, it could mean that, although, they received training in those specific areas, they were not satisfied with the quality of the initial training; secondly, it could mean that they want to invest more time in that particular area of training. This concurs with the study of Chingona et al. (2010), which was carried out to investigate the factors affecting the integration of ICT into teaching and learning in disadvantaged schools in the Western Cape. One of the findings was that teachers who received only once-off training struggled to incorporate ICT into their teaching while schools that arranged for further training in addition to the initial training were able to incorporate ICT into their teaching. ICT is ever developing, so it makes sense for teachers who received initial training in ICT to request further training so that they can stay abreast with its development.

2.5.2.3 The matter of pedagogy

The success of ICT incorporation into TVET “depends largely upon lecturers, their professional knowledge, pedagogical and technological knowledge and the relationship between their beliefs about these constructs” (Naiker & Makgato, 2018, p. 25). In the same way teachers are at the core of improving the quality of an education system, pedagogy is at the centre of teaching and learning (Paniagua & Istance, 2018). Paniagua and Istance (2018) refer to pedagogy as specific configurations which involve a combination of theory and practice, ways of thinking, as well as implementing learning design in teaching and learning.

The emphasis on the need for lecturers to incorporate ICT into teaching and learning, and students acquiring 21st century skills, requires a shift in pedagogical practices. According to Naiker and Makgato (2018), “there is a need for TVET lecturers to be competent in both content and pedagogical aspects of the teaching and learning process” (p. 25) if ICT integration is to be successful. Padayachee (2017) conducted a study to establish the scope of ICT usage in South African schools and found that

teachers mainly preferred ICT tools related to delivering content over pedagogical ones. The teachers frequently used ICT for lesson preparation and administrative tasks. This concurred with Ghavifekr et al. (2012), whose study focused on the incorporation of ICT in education; their study revealed that there were more teachers who frequently used ICT in their preparation for teaching in contrast to teachers using it during the teaching and learning process. This could be caused by teachers being uncertain of how to progress with ICT incorporation in the classroom (Padayachee, 2017) as well as insufficient ICT and pedagogical competencies for effective ICT incorporation in the teaching and learning process (Bytheway, Cox, Dumas, & van Zyl, 2012). Therefore, as the TVET sector aspires to improve the quality of teaching and learning and to align its curriculum with the needs of the industry and society, a shift in pedagogy is required. To achieve such aims, ICT has to be efficiently incorporated into teaching and learning. Furthermore, for students acquire the relevant skills as required by industry and society, “rather than being left to emerge by accident, then pedagogy must be deliberately designed,” (Paniagua & Istance, 2018, p. 20).

2.5.2.4 Lecturer perception and competency

The effective incorporation of ICT into teaching and learning can be influenced by how teachers, or lecturers, perceive ICT (Buabeng-Andoh, 2019), their technical knowledge of, and competency in using, ICT (Naidoo et al., 2019) as well as how they view their level of ICT competency (Sipilä, 2014). These elements play a role in how ICT will be incorporated into the teaching and learning environment. Teachers’ ICT competencies are crucial in leveraging the affordances of technology to improve students learning (Suárez-Rodríguez, Almerich, Orellana, & Díaz-Garc, 2018). The need for teachers to have ICT competency goes beyond knowing ICT tools, it requires the teacher to incorporate ICT with critical thinking and problem solving skills (Hewagamage & Hewagamage, 2015).

If lecturers perceive ICT integration as useful in achieving educational goals (Buabeng-Andoh, 2012), and as easy to use (Chisango et al., 2019), they will be likely to incorporate it in their teaching and learning environment. According to Ghavifekr et al. (2012), “without teachers’ competency and mastery skills of ICT integration, which is appropriate to their needs, ICT could not be put into good use for instructional delivery,” (p.4). Also, if lecturers have a negative perception of ICT, it will be unlikely for them to

incorporate it into the teaching and learning environment. Incorporating ICT entails changing the teaching and learning dynamics, so some lecturers may perceive this as giving up control and authority in the teaching and learning environment (Chisango et al., 2019).

Furthermore, teacher perception goes beyond being classified as a positive or negative perception of ICT integration. A positive perception of ICT, and an understanding of what effective ICT integration entails, will enable lecturers to determine if they are effectively incorporating it into their teaching and learning activities. Even though a lecturer may have a positive perception of ICT but without a good understanding of what effective integration entails, ICT is more likely to be used as a tool to support traditional teaching practices without actually transforming teaching and learning for the better. For instance, Padayachee (2017) conducted a study to establish the scope of ICT usage in South African schools and found that teachers mainly preferred ICT tools that deliver content to pedagogical tools. Padayachee's (2017) study revealed that teachers were uncertain how to continue with ICT integration in the teaching and learning environment. Instead, the teachers used ICT for lesson preparation and administration tasks. A case study by Kafyulilo and Keengwe (2014), which focused on teachers' perspectives on ICT usage in Tanzania, revealed that most teachers perceived that they use ICT for administrative purposes, while only a few perceived to be incorporating ICT in their teaching and learning practices.

On the other hand, when lecturers have a limited view of the potential of ICT, they are more likely to maintain the status quo. A study done by Chisango et al. (2019), which aimed to explore teachers' perceptions of adopting ICTs in the teaching and learning process in three South African quintile 1 high schools (schools in disadvantaged communities), revealed that "teachers who perceived ICTs to be of no use" did not incorporate it into their teaching and learning practices; they argued that they were able to achieve good results without using ICT, so they did not realise its potential. The study also revealed that some teachers perceived ICTs to be disruptive and the teachers believed that learners did not concentrate in class if mobile technology is used because learners would use it for socialising instead of learning in the classroom.

2.5.2.5 Lecturer attitude

According to Dorathy and Mahalakshmi (2014), teacher attitude plays a role in influencing technology integration in the classroom. A positive attitude towards ICT and its affordances can be a motivating factor for teachers to incorporate ICT into their teaching and learning practices. Contrastingly, a negative attitude towards ICT can lead to teachers not integrating it into their teaching and learning practices. This was also confirmed by the research done by Chisango et al. (2019).

2.5.3 Barriers to ICT integration

While ICT has the potential to improve teaching and learning, the literature reveals that there are some barriers in integrating ICT into the teaching and learning environment. Vadachalam and Chimbo (2017) conducted a study that focused on researching the 'barriers, opportunities, and impact that ICT has on the teaching and learning of mathematics in South African schools.' The study revealed that, although, the participants indicated to have the necessary technology and time to incorporate it, they reported inadequate technical support and insufficient training as barriers in the incorporation of ICT for their subject matter. According to Chisango et al. (2019), "limited digital skills prevent teachers from using technology in teaching and learning," (p. 14). This corresponds with Khatete, Wanjala, Njenga, Khatete and Akala (2015) who conducted their research focusing on the readiness of secondary schools in integrating ICT to improve teaching and learning. In their study they found that, although, schools had the capacity to incorporate ICT into the teaching and learning environment, the principals and teachers were unable to effectively incorporate ICT due to lack of ICT skills. According to Masingila et al. (2018), teachers need more support to help with integrating ICT into the curriculum and in using it as a tool for engaging students.

In research done in the Western Cape, Chingona et al. (2010) found that teachers were unable to effectively incorporate ICT into the teaching and learning environment due to inadequate training, lack of technical support, insufficient time, and high computer-to-student ratio. Students with low ICT skills also presented a challenge, which led to teachers spending more time teaching students how to use ICT instead of using ICT themselves.

The subsequent section will discuss the theoretical frameworks that underpin this study.

2.6 THEORETICAL FRAMEWORKS

2.6.1 The TPACK theoretical framework

The Technological Pedagogical Content Knowledge (TPACK) framework guides this study because the framework enables the researcher to make sense of the complex connections that exist as lecturers make an effort to incorporate ICT into their teaching and learning practices. The TPACK framework will also be useful to identify components of the lecturers' knowledge that affect effective ICT integration into the teaching-learning process.

TPACK was developed by Mishra and Koehler (2006) as a theoretical framework for teacher knowledge pertaining to technology integration in their pedagogy. It was built on Shulman's (1986) formulation of Pedagogical Content Knowledge (PCK) with the extension of the technology knowledge component, as depicted in **Figure 2**.

The framework (see **Figure 2**) has three main components of teachers', or lecturers', knowledge, namely Content, Pedagogy, and Technology (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009). The framework also shows other equally important components, including Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and the Technological Pedagogical Content Knowledge (TPCK), which is where all the components intersect.

The above-mentioned components will be used as a guideline in the study of effective ICT integration into the teaching and learning environment. The definitions of the framework components according to Schmidt *et al.* (2009, p. 1026-1029) and Mishra, Koehler, Thompson, Schmidt-Crawford, and Baran (2006) are given below.

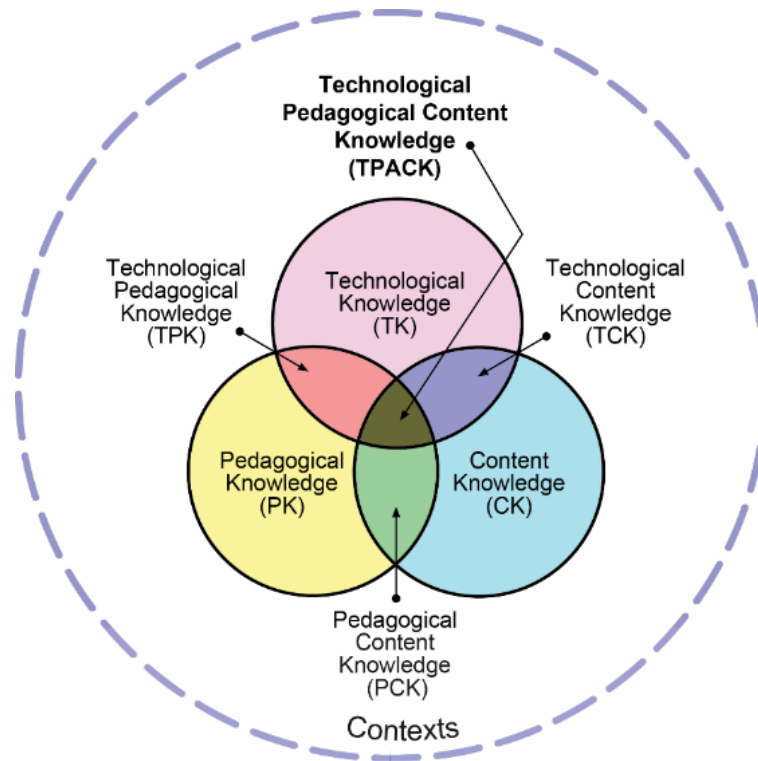


Figure 2: Technological Pedagogical Content Knowledge (TPACK) Framework (Schmidt et al., 2009:63)

Technological knowledge (TK) involves the knowledge of how to use technological tools, system software, and application software (Mishra et al., 2006) for information processing, communication, problem solving, lesson planning, sharing information, and other teaching and learning practices.

Content knowledge (CK) refers to the “lecturers’ knowledge about the subject matter to be learned or taught” (Mishra et al., 2006 p. 1026).

Pedagogical knowledge (PK) consists of “lecturers’ deep knowledge about the processes and practices or methods of teaching and learning. They encompass, among other things, overall educational purposes, values, and aims. It includes knowledge about techniques or methods used in the classroom, the nature of the target audience, and strategies for evaluating student understanding,” (Mishra et al., 2006, p. 1026).

Pedagogical Content Knowledge (PCK) involves the knowledge of what teaching methods are suitable for the content as well as the knowledge of how to constructively

incorporate pedagogy and content to enable better teaching. PCK varies from the knowledge of a disciplinary expert because it involves knowledge of factors such as students' prior knowledge, misconceptions, and learning challenges. This knowledge makes use of suitable conceptual representation that takes these factors into consideration thereby fostering meaningful learning (Mishra et al., 2006).

Technological Content Knowledge (TCK) refers to the subject knowledge and the way in which the subject content can be presented using appropriate technology (Koehler & Mishra, 2009).

Technological Pedagogical Knowledge (TPK) refers to “knowledge of the existence, components, and capabilities of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as a result of using particular technologies” (Mishra et al., 2006 p. 1028).

Technological Pedagogical Content Knowledge (TPCK) “is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones,” (Mishra et al., 2006 p.1029).

2.6.2 The SAMR model used to measure the level of ICT integration

According to Chisango et al. (2019), “ICTs are powerful enabling tools that play a significant role in the teaching and learning process” (p. 1), which is why lecturers need to understand the ways in which ICT can make a crucial difference in students' learning (Dorathy & Mahalakshmi, 2014). Students do not need to continue to learn the same way students learned 20 years ago; there is now technology that enables lecturers to use innovative pedagogies to design learning that fits the context of the modern world's skills demand. It is not enough to use textbooks that were written 10 years ago as the main source of information when there is a vast amount of information available that can be accessed through the use of ICT. For instance, Bladergroen and Chigona

(2019) mention that “a large number of lecturers still use information overloaded PowerPoint presentations, or upload information on learning management systems as a substitute for textbooks,” (p. 23). Traditional methods like these are no longer effective (Khatete et al., 2015) because students who lack critical skills will struggle to participate effectively as long as digital technologies continue to advance and influence every aspect of life. Hence there needs to be a shift in the way teaching and learning takes place in, and outside of, the classroom. The use of ICT brings an element that makes learning possible for students to learn even when they are outside college borders. This makes it crucial for lecturers to take advantage of the affordances that ICT offers by designing learning activities for learning 21st century skills.

The Substitution Augmentation Modification Redefinition (SAMR) model for ICT integration was developed by Dr Ruben Puentedura (Puentedura, 2009). The SAMR model consists of four constructs (see **Figure 3**), which are divided into two sections. The first section, namely ‘Enhancement’, consists of Substitution and Augmentation. The second section, ‘Transformation’, comprises Modification and Redefinition. The first two levels, which are classified under the Enhancement section, allow for easy use of ICT. Yet, as the lecturers progress to the subsequent levels, which fall under the Transformation section, ICT integration becomes more complex and lecturers are required to design learning in such a way that it takes place in authentic contexts. Each level of the model is discussed below.

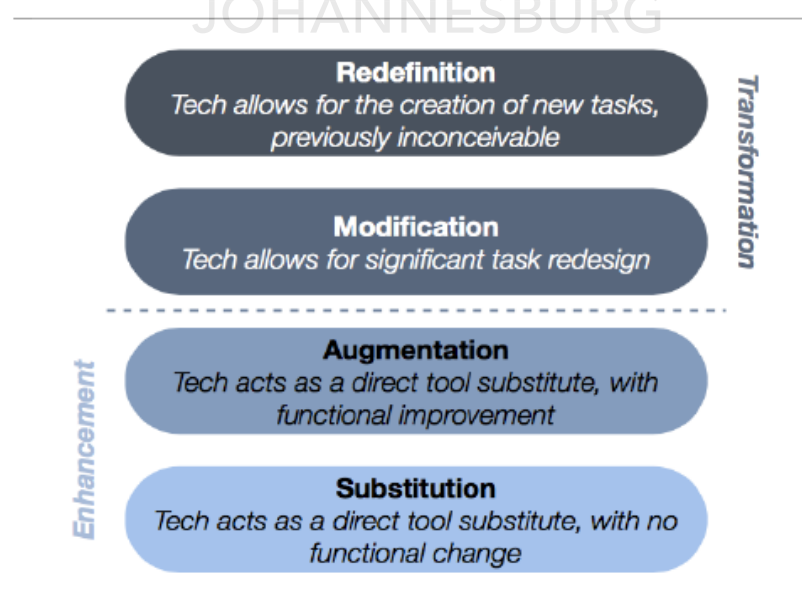


Figure 3: Puentedura’s SAMR Model (Puentedura, 2009)

2.6.2.1 Substitution

The first level of the SAMR model is Substitution. In this step, lecturers substitute old technology with modern technologies (Puentedura, 2009); for example, using Google forms to make a quiz instead of distributing hardcopy questions. The activity has remained the same, but the tool is different. Another example is using eBooks instead of hardcopy textbooks. The content is the same, yet the accessibility is different. Students will be able to access eBooks anywhere, anytime, as long as they have access to their device. Consequently, this step becomes one of the most basic ways to incorporate technology.

2.6.2.2 Augmentation

The second step of the SAMR model is Augmentation. This step still makes use of substitution but with a considerable amount of enhancement regarding the student learning experience (Puentedura, 2009). Assuming the above example of Google forms to design a quiz, Google forms offers more functionalities like autosaving, spell check, auto-synchronisation, copy, and paste. This makes it easier for the lecturers to share the link for the quiz with the students and students can access the quiz on their mobile devices or computers.

2.6.2.3 Modification

The third level on the SAMR model is Modification. At this level, the lecturers incorporate technology in such a way that it transforms teaching and learning and brings elements to the designed learning activities that would not have been possible without it (Puentedura, 2009). For example, enabling the comments section for collaboration on Google forms, auto marking, providing instant feedback on the activities, drawing statistics from Google forms to moderate student performance on the quiz, and taking steps to assist students on sections where they performed poorly.

2.6.2.4 Redefinition

The fourth and highest step on the SAMR model is Redefinition. At this level, the lecturers design learning activities that would not be possible to create and complete without using technology (Puentedura, 2009). For example, a collaborative assignment where students interact and share information with other students from other learning

institutions across the world using an online discussion forum where students write an account of the same event, discuss with their counterparts, and then analyse the comments on the discussion forum. Thereafter, the students could use the discussion to write an article discussing their findings and post it on the classroom's Learning Management System (LMS).

According to McGinnis (2019), as teachers initially start to incorporate ICT into their teaching and learning environment, it is normal to start with substitution and augmentation because integration at this level does not change much of the teaching and learning activities, it just enhances it. However, by designing learning in a way that aligns with modifying and redefinition, ICT can be incorporated in such a way that transforms learning because at this level the students are challenged to engage in critical thinking and problem solving. Kihzoza et al. (2016) state that, "technology integration means redefining how teaching and learning should be carried out using new technologies to do things that could have never been accomplished without technology," (p. 110). When teachers use this model to design learning activities, learners could be guided to think differently in a technology enabled environment (Kihzoza et al., 2016).

Kurbaniyazov (2018) states that even though the SAMR model is hierarchical in nature, the lecturers can still choose which level they opt for when they incorporate technology into their teaching and learning activities. Similarly, Davis (2020) suggests that the SAMR model be perceived as a spectrum as opposed to a hierarchy. It is not wrong to view the SAMR model as a hierarchy but if one sees it as a spectrum, then the focus shifts from trying to reach the highest level on the hierarchy. Lecturers have the freedom of analysing the teaching and learning goals that need to be achieved and then design learning activities to achieve these goals. Therefore, if the teaching and learning activities call for ICT to be incorporated in the substitution and augmentation, lecturers will do so without the pressure of feeling they have to move up the hierarchy all the time. However, the model also provides an opportunity for lecturers to evaluate how they have been incorporating technology thus far. If they have only been incorporating it by means of substitution and augmentation, they can be inspired to incorporate technology to transform teaching and learning activities to meet educational goals and improve what students learn and how they learn.

2.7 CHAPTER SUMMARY

This chapter served to provide the reader with an overview of the TVET sector, its qualification streams, and the new direction the DHET has taken to improve the quality of education and training in the TVET sector. The digital divide is briefly discussed. A literature review on ICT integration in the teaching and learning process is provided in light of the advantages, factors, and barriers that are associated with the integration of ICT into the teaching and learning environment. The chapter ends with an overview of the TPACK framework and its theoretical underpinnings. Each of the constructs on the framework is briefly described. This is followed by an introduction of the SAMR model and an explanation of how it will be used in this study. The next chapter (Chapter 3) discusses the research design and methodology for this study.



CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

Chapter 3 focuses on the research design and methodology applied in this research study. The qualitative research study, approached from the interpretivist paradigm, focused on how lecturers in Technical and Vocational Education and Training (TVET) colleges experience the integration of ICT in the teaching and learning process. Through this study, the researcher aims to gain more insight into how lecturers experience ICT integration by investigating the factors affecting effective ICT integration, the types of technological tools mostly used by the lecturers, as well as the extent to which lecturers integrate ICT into the teaching and learning process. This will be done through an analysis of personal experiences of lecturers at a selected TVET college in Western Cape, South Africa. The TPACK framework and SAMR Model of ICT integration guided the researcher during the data analysis phase.

3.2 RESEARCH DESIGN

According to Kumar (2011, p. 95), a research design entails a planned structure of a research study conceived in such a way to attain responses to research questions or problems. This study's research questions are centered around gaining insight on how TVET lecturers experience ICT integration in the teaching and learning process; the factors that influence ICT integration in teaching and learning in TVET colleges, as well as the extent of their ICT integration in the teaching and learning process. The study also explores the types of technological tools mostly used by the TVET lecturers in the teaching and learning process. The qualitative research approach will enable the researcher to gain insight into the personal experience of TVET lecturers when integrating ICT into the teaching and learning process, gain understanding of the factors that promote or hinder it, while also gaining in-depth data within the context of a TVET college.

The following figure (**Figure 4**) illustrates the research approach for this study.

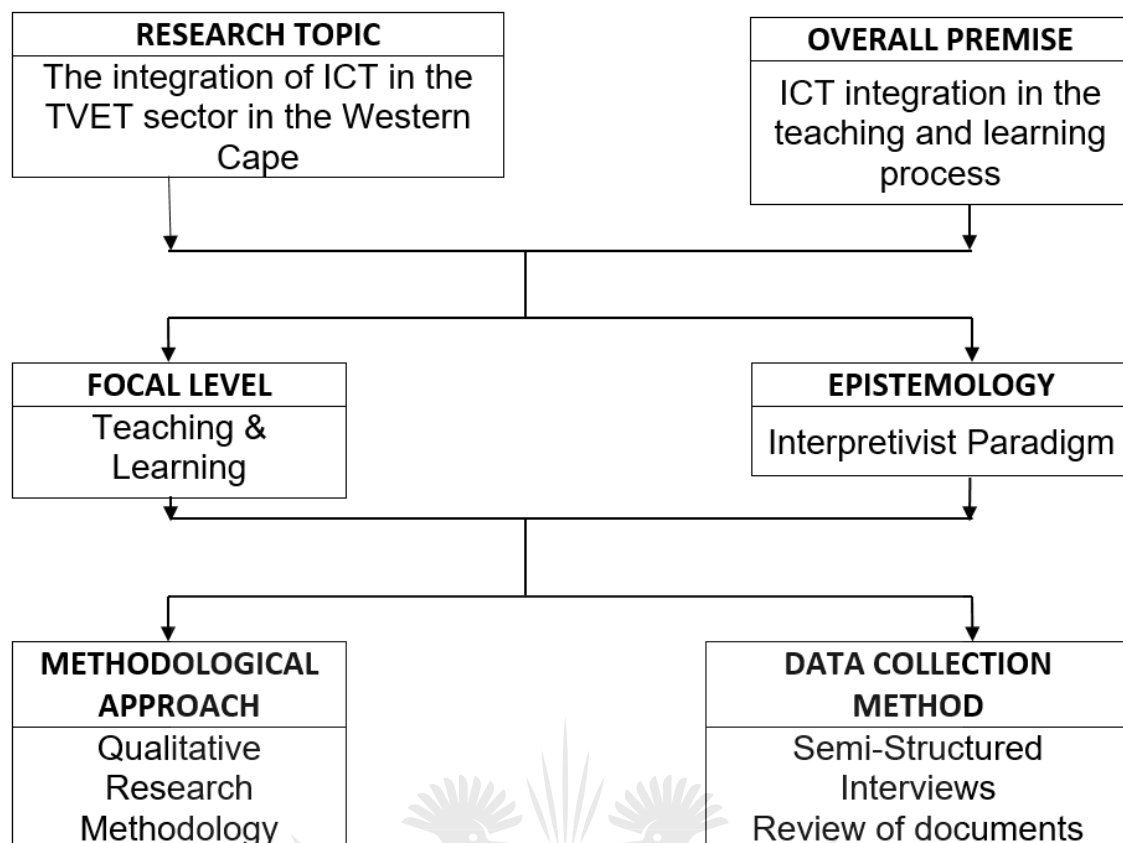


Figure 4: Research approach outline (Adapted from Walsham, 1993, p. 22).

3.3 SYNCHRONIZING EPISTEMOLOGICAL APPROACH, RESEARCH PROCEDURES, AND METHODOLOGY

In research, paradigms play a crucial role. The term ‘paradigm’ was coined by Thomas Kuhn in 1962, and it refers to a cluster of beliefs that dictate action (Vosloo, 2014). The concept of a ‘paradigm’ is mainly used in natural sciences; in social sciences a paradigm is most likely to be considered to be a “worldview or research tradition” (Bezuidenhout, Davis, & Du Plooy-Cilliers, 2014). There are three main research traditions that can guide a research study, namely positivism, interpretivism, and critical realism. The subsequent section discusses interpretivism because it provides a compound lens for this study.

3.3.1 Interpretivist research paradigm

Interpretivism is concerned with understanding the social aspects of the world. The interpretivist paradigm recognises that social phenomena fundamentally differ from natural phenomena in that social phenomena involves human beings that cannot be

studied in the same way as objects. Kivunja and Kuyini (2017) state that the interpretivist paradigm:

“makes an effort to ‘get into the head of the subjects being studied’ so to speak, and to understand and interpret what the subject is thinking or the meaning s/he is making of the context. Every effort is made to try to understand the viewpoint of the subject being observed, rather than the viewpoint of the observer” (p. 33).

Interpretivists believe that “truth and reality are created, not discovered,” (Rehman & Alharthi, 2016, p. 55). Their perspective is that “facts are fluid and what is factual depends heavily on the context and people’s interpretation of information,” (Bezuidenhout et al., 2014, p. 29). For interpretivists, truth relies on the interpretation of facts and they believe that there is not a single reality, but multiple versions of reality exist and are context bound. Truth can be discovered through interaction with the reality being studied and not in isolation. Interpretivism places emphasis on researchers to get involved with the participants, or aspects of society, they are studying.

According to Kivunja and Kuyini (2017, p. 33), research approached from an interpretivist paradigm assumes a:

- subjective epistemology,
- relativist ontology,
- naturalistic methodology, and
- balanced axiology.

The researcher of this study aims to gain in-depth understanding of the social reality in which the phenomenon exists (Bezuidenhout et al., 2014). In interpretivism, interaction between the researcher and participants is necessary to enable the researcher to gain an understanding of the participants’ experiences and the context that shaped it. The researcher will interact with the participants and engage in an interactive process, which requires the researcher and participants to “dialogue, question, listen, read, write, and record data,” (Kivunja & Kuyini, 2017, p.33).

The ontological position of interpretivism is the belief that “reality is fluid and subjective and is socially constructed through human interaction,” (Bezuidenhout et al., 2014, p. 29; 34). The researcher believes that reality is socially created and relies on the

meanings that the participants attach to their own experiences along with their interactions with other people and their environment. The word “fluid” means that as the aspects of the environment in which the participants exist change, their perspectives will change as well. It is noteworthy that different researchers have different perspectives of the same phenomenon, therefore they approach research from various angles and paradigms (Rehman & Alharthi, 2016). This research approach is used because the researcher is not only interested in whether the TVET lecturers are integrating ICT in their teaching and learning practices, but aims to gain insight and understanding of the participants’ interpretations of the social phenomena and how they experience these within their social contexts.

Interpretivism maintains that “theory should not precede research but should follow it,” (Cohen, Manion, & Morrison, 2007, p. 22). The researcher will work closely with the participants to gain in-depth knowledge and understanding of the participants’ lived experiences as well as their interpretation of the context in which they find themselves. According to Cohen et al. (2007, p. 22), “theory so generated must make sense to those to whom it applies”. Therefore, the researcher will use rich detailed descriptions and direct quotes from participants. The researcher will also continuously check in with the participants to ensure that there are no misunderstandings during data collection or in the research findings.

The methodology used in interpretive research is qualitative. The qualitative research approach will enable the researcher to understand the social phenomenon “through the eyes of the participants rather than the researcher,” (Cohen et al., 2007, p. 21). The aim of using the interpretive research method is to gain understanding of the participants’ reaction to social phenomena (Rehman & Alharthi, 2016). The researcher will collect qualitative data from the participants and then analyse the data to identify patterns and then arrange them into categories; detailed descriptions of this process are discussed below (see *section 3.5*). According to Rehman and Alharthi (2016), data collection methods used to collect qualitative data include open-ended interviews (namely structured interviews, semi-structured, and informal conversational interviews), observations, field notes, and documents. The researcher used open-ended, semi-structured interviews and document review to collect data from the participants (see *section 3.5 for data collection method*).

“Interpretive epistemology is subjective,” (Rehman & Alharthi, 2016, p. 55). The researcher acknowledges that viewpoints expressed in this research study are subjective. The researcher also acknowledges the ontological position of the interpretivist paradigm, that is, truth is open to interpretation and truth will differ according to the context of the social reality being studied. Therefore, the researcher will interact with the participants to gain an in-depth understanding of what is happening. By interacting with the participants, the researcher can find out what truth means to the participants. The details of the interactions that took place between the researcher and the participants of this study will be discussed below (see *section 3.5*).

3.4 SAMPLING

The study is targeted at public TVET colleges in the Western Cape. There are 55 public TVET colleges in South Africa, and six of these are in the Western Cape. Due to constraints such as time, finances, and COVID-19 lockdown restrictions, the researcher was not able to gather data from the whole population. As a result, a smaller sample of the population was selected. According to Bezuidenhout et al. (2014), a sample is a “subset of a population that is considered to be a representative of the population,” (p. 135). Factors that were considered during the sampling process are discussed below.

3.4.1 The sample size

The researcher selected one public TVET college from the six public TVET colleges in Western Cape. This sample was selected from a location that is convenient to the researcher (Kumar, 2011). The study was conducted during COVID-19 lockdown restrictions, which along with time and financial constraints, played a role in selecting the sample size. Moreover, Cohen et al. (2007) state that the sample size is influenced “by the style of the research” (p. 102), making it more likely for qualitative research sample sizes to be small. Also, in the case of qualitative studies where the characteristics of a sample are similar, a researcher can select a smaller sample (Kumar, 2011). The aim of this study, namely to gain an in-depth understanding of the experiences of TVET lecturers with regard to integrating ICT in teaching and learning, will be achieved through the selected sample size. This is sufficient if the researcher

does not aim to generalise the findings beyond the scope of the study (Cohen et al., 2007).

Prior to the selection of a sample, the researcher compiled a list of TVET colleges, in rank order of accessibility and then contacted the sampled TVET college(s). Once a college agreed to participate in the study, negotiations with other colleges ceased. Contact details of TVET colleges were available on the TVET college websites.

3.4.2 Sampling strategy used

There are two main sampling methods, namely probability sampling, also called random sampling, and non-probability sampling, also called purposive sampling (Cohen et al., 2007; Bezuidenhout et al., 2014; Kumar, 2011). The difference between the two is that probability sampling gives every member of the wider population an equal opportunity to be included or excluded in the representative sample, while non-probability sampling requires the researcher to “purposely select a particular section of the wider population to include or exclude from the sample,” (Bezuidenhout et al., 2014; Cohen et al., 2007, p. 110). Probability sampling is useful when making generalisations about the wider population because it selects samples randomly (Cohen et al., 2007). However, a non-probability sampling method can be used when it is difficult to gain access to members of the population, or when findings cannot be generalised (Bezuidenhout et al., 2014). Therefore, this research applied a non-probability sampling method because it is most suitable for small-scale research where the researcher does not aim to generalise the findings, and it is inexpensive and less complicated to set up (Cohen et al., 2007).

There are several types of non-probability sampling, namely accidental sampling, quota sampling, purposive sampling, snowball sampling, and volunteer sampling.

- **Accidental sampling** “does not have a sampling frame; instead, the sample consists of elements that were included purely because they happen to be in the right place at the right time,” (Bezuidenhout et al., 2014, p. 142).
- When using **Quota sampling**, the researcher is guided by characteristics of the study population, therefore participants will be asked to participate in the study

based on their characteristics and the process stops once the number of participants are reached (Kumar, 2011).

- The **purposive sampling** strategy is based on the researcher's judgement as to which participants can provide the best information to achieve the objectives of the study (Kumar, 2011).
- When **snowball sampling** is used, the researcher identifies a few participants who have the required characteristics; thereafter, the participants are used as informants to identify and connect the researcher with other potential participants (Cohen et al., 2007). This process continues until the researcher has reached the desired number of participants.
- **Volunteer sampling** "is a sample put together from people who volunteer to participate in the research. This method is not reliable and tends to provide a lot of erroneous research results," (Bezuidenhout et al., 2014, p. 144).

From the sample methods mentioned above, the researcher chose the purposive sampling strategy for this research. This sampling method enabled the researcher to select the participants and assemble a sample that could best assist with understanding the research problem, answer the research question, and thereby achieve the objectives of this study. The benefits of using this sampling method is that it is less expensive, and it guarantees the inclusion of members of the population suited to the study (Kumar, 2011). This method can enable the researcher to ensure that each element of the sample that will assist in achieving the objectives of the research, are present (Bezuidenhout et al., 2014). Therefore, the researcher purposefully selected four TVET lecturers who would best assist with understanding the research problem, answering the research questions, and thereby achieving the objectives of this study. These lecturers comprised post level one lecturers who are responsible for managing the classroom environment as well as conducting teaching and learning activities at the TVET college. These lecturers have been in the TVET sector for a substantial number of years (see **Table 1**), which makes them suitable in providing insight into experiences, perspectives, and thoughts concerning ICT integration in the teaching and learning process.

Table 1: Description of the research participants

Participant	Post Level	Subjects	Number of Years as a TVET Lecturer	Industry Experience
P1	1	Financial Management Management Practice	7 years	3 years as a Retail Purchasing Manager
P2	1	Natural Science	12 years	1 year as a Research Technician
P3	1	Information Systems	10 years	7 years as a Systems Analyst
P4	1	Mathematical Literacy	6 years	1 year as a Data Analyst

The researcher emailed a consent form (see **Appendix C**), which outlined the purpose of the study as well as ethical considerations, before commencing with data collection. The email also included the interview questionnaire. The purpose of sending the consent form and the interview questionnaire ahead of time was to enable the participants to read through the consent form so that they could understand the purpose of the study. It also gave them the opportunity to study the interview questions so that they could make an informed decision on whether they would be able to respond to the interview questions or not. The researcher followed this process to ensure the collection of trustworthy data from the participants.

3.4.3 External validity sampling

Trochim et al. (2016, p. 83-84) identify two approaches to external validity in sampling, namely the sampling model and the proximal similarity model. The sampling model requires the researcher to identify the population, which is suitable for making generalisations, and select a representative sample from that population and carry out the research study with the selected sample. Since the sample is representative of the population, the researcher is able to use the findings to make generalisations about the population. The other approach considered is the proximal similarity model, see **Figure 5**.

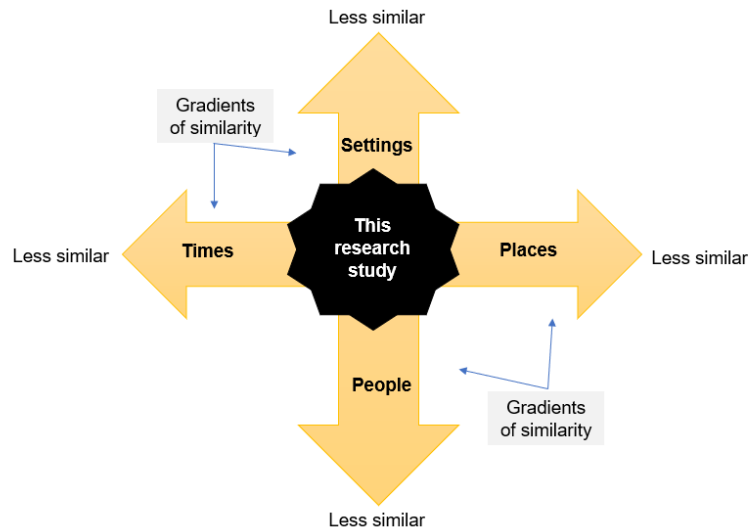


Figure 5: The Proximal Similarity Model (Adapted from Trochim, Donnelly, & Arora, 2016, p.84)

Trochim et al. (2016) state that the proximal similarity approach requires the researcher to consider different contexts that will be used to make generalisations. Furthermore, the researcher needs to consider the gradient of similarity, which means the potential contexts used for generalisation are graded according to the dimension of proximity on the proximal similarity model. Also, the proximity of similar contexts will differ based on time, place, people, and setting. Some of the contexts will be more similar to the sample and closer to the gradient, while other contexts with less similar samples would be further away along the gradient (see **Figure 5**).

This study has a small sample size and the nature of the study is qualitative and subjective. Thus, considering the two approaches to external validity, the traditional sampling model is not applicable to this study. The proximal similarity approach can, however, be applied in any study (Trochim et al., 2016). Accordingly, the researcher will use the proximal similarity model to identify the gradient of similarity (by means of the proximal similarity model) to make generalisations. This approach will also enable the researcher to identify likely contexts from this study that are closer, and more similar, as well as ones that are further away, and less similar, along the gradient of similarity on the proximal similarity model.

3.5 DATA COLLECTION

According to Bezuidenhout et al. (2014), “qualitative research deals with the underlying qualities of subjective experiences and the meanings associated with phenomena,” (p. 173). As mentioned before, this study employed the interpretivist paradigm, which believes that aspects of human behaviour, their lived experiences, as well as their shared meanings of the social reality are difficult to investigate using quantitative methods. Interpretivist research advocates for the use of qualitative methods that will enable the researcher to gain rich and in-depth data from phenomena in certain social contexts (Bezuidenhout et al., 2014). The researcher is interested in gaining an understanding of the subjective experiences of TVET lecturers when incorporating ICT into the teaching-learning process. Therefore, the researcher will use two qualitative methods to collect data, namely interviews and document review. The subsections below discuss the respective types of interviews and documents used as data collection methods for this study.

3.5.1 Interviews

According to Cohen et al. (2007):

“Interviews enable both participants - be they interviewers or interviewees - to discuss their interpretations of the world in which they live, and to express how they regard situations from their own point of view,” (p. 349).

The interview as the main data collection method will be useful because the main research question is concerned with gaining insight into how TVET lecturers experience the incorporation of ICT in the teaching and learning process. This method thereby enables the researcher to gather data that will give insight in understanding the phenomenon from the participants’ perspectives and experiences. Kumar (2011) states that interviews are most appropriate for collecting in-depth data because the researcher can use prompts to encourage the participants to elaborate further, thus enabling the researcher to gain rich data. Furthermore, interviews can enhance the information given through the observation of non-verbal communication. Interviews can also minimise the misunderstanding of questions because the researcher can use prompts, repeat the question, or phrase it in a way that the participant can understand.

Interviews are seen as expensive and time consuming. Additionally, they may induce bias. As mentioned before, this study applied the interpretivist paradigm approach, which emphasises investigating a phenomenon within the context of its social reality. When conducting interviews, it is crucial for the researcher to take contextual factors of the participant's life experience into consideration. Lichtman (2014) does not see the researcher's role as biased but as an essential part of the research procedure.

The subsequent paragraphs discuss the different types of interviews, the type of interview selected for this study, as well as the document review process.

In qualitative research, there are three main types of interviews, namely unstructured, semi-structured, and structured. An unstructured interview allows the researcher to have a conversation with the participants without any specific predetermined questions, which allows for flexibility regarding how the interview progresses (Bezuidenhout et al., 2014). Unstructured interviews are also referred to as "informal conversational" (Cohen et al., 2007; Bezuidenhout et al., 2014), "in-depth" (Johnson & Rowlands, 2012; Lichtman, 2017) interviews. In a semi-structured interview (SSI), the interviewer has some predetermined questions at hand, yet there is a considerable amount of freedom and flexibility to cover additional topics (Bezuidenhout et al., 2014). For structured interviews, "the researcher predetermines the set of questions, using the same wording and order of questions as specified in the interview schedule," (Kumar, 2011, p. 138).

Since unstructured interviews have no predetermined set of questions, the data collected through this method will be less systematic and comprehensive (Patton, 1980 cited in Cohen et al., 2007). Consequently, data collected through this method will be problematic to organise, which will make analysis more challenging. While structured interviews enable the researcher to ask a "predetermined set of questions, using the same wording and order of questions as specified in the interview schedule" (Kumar, 2011, p. 138), "they lack flexibility and the standardised wording may constrain and limit naturalness and relevance of questions and answers" (Patton, 1980, cited in Cohen et al., 2007, p. 353). In Lichtman's (2014) view, structured interviews are more suited to quantitative research. After considering the factors of these types interviews as well as the nature and objectives of the study, the researcher opted for the semi-structured interview.

For the research design, the researcher selected face-to-face, semi-structured interviews as the main method of collecting qualitative data from the participants. This method is appropriate for this study because it allows the researcher to gain insight into the participants' perspectives concerning an experience relating to the research question (McIntosh & Morse, 2015). This type of interview consists of "a question stem to which a participant may respond freely" (Morse, 2012). As McIntosh and Morse (2015) explain, it is crucial that questions asked in SSI are open-ended in order to encourage discussion. While the questions are mostly structured and asked of each participant in the same order, a semi-structured interview will enable the researcher some liberty to deviate slightly from the script, which will enable the researcher to make use of probes to encourage further discussion as well as gain clarity of the participants' responses. Cohen et al. (2007) elaborate that interviews enable verbal, non-verbal, spoken and heard multi-sensory channels to be used. The face-to-face interview approach benefits the study since both the researcher and the participant are communicating directly. The researcher has the opportunity to collect verbal responses, as well as observe non-verbal communication, in response to each question throughout the interviewing process. By observing the participants' non-verbal communication, the researcher can prompt participants and clarify questions and thus avoid ambiguity. Moreover, if the participant's non-verbal actions convey any form of discomfort, the researcher can offer appropriate support to ensure that the proceedings of the interview are conducted in the most ethical way possible.

The following factors were used in the design of the interview questionnaire:

- Open-ended questions to allow for individual responses from participants and to eliminate researcher bias;
- Simple language to avoid ambiguity and leading questions; and
- The scope of questions ranged from broad to narrow, which allowed the researcher to prompt and encourage the participants to elaborate (Bezuidenhout et al., 2014).

The interview questionnaire included two sections (see **Appendix D**). The first section consisted of questions regarding, among other things, the participants' qualifications (professional, academic, or vocational), teaching experience, subjects they teach, and industry experience. This section was designed to develop an understanding of the context in which the participants find themselves and for the researcher to establish

rapport with the participants. The second section of the interview questionnaire consisted of open-ended questions that emerged from the research questions and objectives of the study. Thus, this section sought to answer the research question, and thereby achieving the objectives of the study.

Once the research reached the data collection stage, the researcher sought permission to conduct the study from the TVET college (see Section 3.4). Thereafter the participants were deliberately selected. The selected participants comprised post level one TVET lecturers who were involved in the teaching and learning process within the sampled TVET college at the time of the study.

The participants were contacted telephonically and via email to make arrangements regarding the venue, date, and time of the interviews. The researcher allowed each participant to specify the venue, date, and time to prevent discomfort during the face-to-face, semi-structured interviews. Thereafter the consent forms, which outline the research question, purpose of the study, ethical considerations, and interview schedule, were sent to the participants. The forms were sent in advance to give the participants time to peruse the questions to ensure that they were comfortable participating in the study. This also allowed the participants to prepare for the interview. At the beginning of the interview, the researcher briefed the participants about the purpose and relevance of the study, what it entails to participate in the study, and other aspects of the study, such as giving consent to record the interview process. The researcher assured the participants that their names and the information shared would be kept confidential and anonymous.

At the start of the interviews, the researcher sought permission from the participants to use an audio recorder to record the interview. The recordings were intended for use during the data analysis stage (see Section 3.6). Once transcribed, the interview audio recordings will be kept as evidence on the cloud and an external hard drive. The advantage of recording the interview is that it enables the researcher to transcribe the interview responses more accurately. This allows the researcher to focus on interviewing the participants, reading their non-verbal cues, and making notes.

After the interviews, the researcher transcribed the responses and issued them to the participants for validation and approval. An example of a transcribed interview is

attached (see **Appendix E**). The shortest interview was chosen to provide a brief, yet thorough, demonstration of the transcription process.

3.5.2 Document source

In addition to collecting data through interviews, the researcher will collect documents from the participants. Corbetta (2003) defines documents as any material that offers information on a given social phenomenon and that exists independently of the researcher's actions. Documents fall among the less obstructive data sources in the qualitative research (Beaudry & Miller, 2016), they may include letters, email messages, newsletters, lesson plans, among others (Lichtman, 2014). Consequently, the researcher identified the participants' lesson plans, Moodle learning management system, subject work scheme, the TVET college's IT Policy and Procedure, as well as the Talent Management and Development Policy as documents that will be suitable in meeting the study's objectives of identifying the most effective(preferred) ICTs by TVET lecturers as well as determining the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process. Linking the interview with the review of documents will enhance the data collected. If a participant was not entirely truthful in an interview, they may be more likely to be sincere in the information that they provide in their lesson plans (Corbetta, 2003). Therefore, the researcher will collect the documents from the participants and the college, analyse them (see Section 3.6), and thereafter triangulate the findings from these documents with those of the interviews.

The next section discusses the data analysis procedure followed in this research study.

3.6 DATA ANALYSIS

Once the researcher has collected data through interviews and documents from the participants, the next step in the research process will be to analyse the data. Data analysis is crucial for dividing data into manageable units, so that the researcher can make sense thereof and provide a well-integrated summary and interpretation of the results (Beaudry & Miller, 2016). The researcher will use O'Connor and Gibson's (2017) step-by-step guide to analyse qualitative interviews (see **Figure 6**: steps to analyse qualitative interviews).

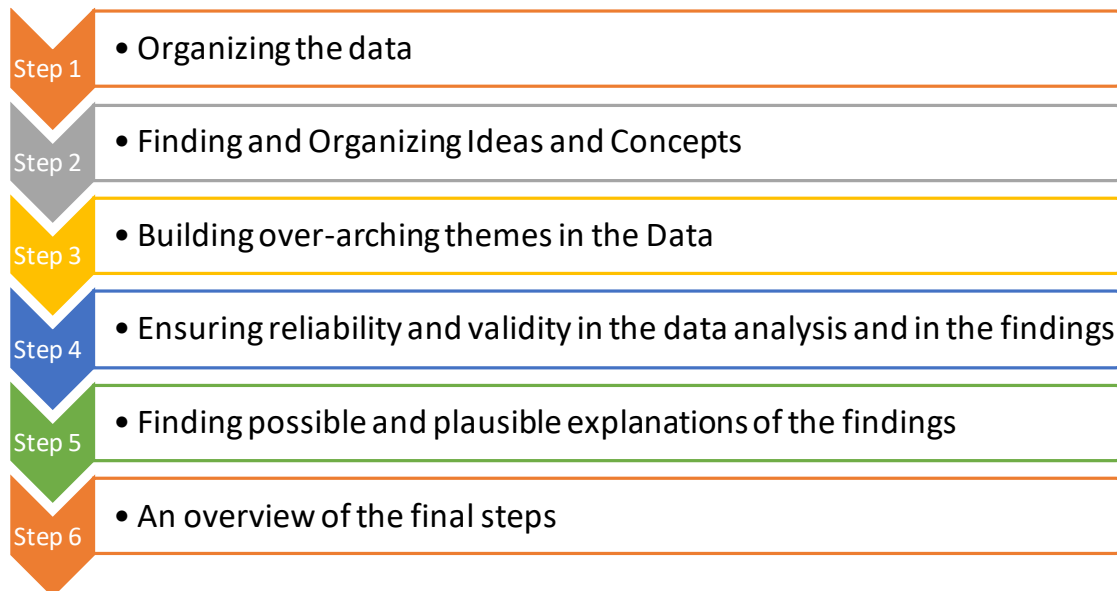


Figure 6: Steps to analyse qualitative interviews (Adapted from O'Connor and Gibson, 2017)

The researcher collected data through audio recordings and transcripts from the interviews, as well as through document review. First, the researcher will listen to the audio recordings, transcribe the interviews from audio to text, and read through the written transcripts. And then edit the data to ensure that the data has no inconsistencies and that it is not incomplete. According to Kumar (2011), “editing consists of scrutinising the completed research instruments to identify and minimise, as far as possible, errors, incompleteness, misclassification and gaps in the information obtained” (p. 228) from the participants. After editing the data, the researcher coded the responses and arranged them into categories comprising sub-categories. Each category was analysed to identify categories that give deeper meaning to the data. In this step, the TPACK and SAMR theoretical frameworks, discussed in Chapter 2, were used to guide the researcher on the types of knowledge factors and the level of ICT integration that exist. Thereafter, the researcher will make comparisons with the data collected for a more wide-ranging interpretation of the research results. The researcher was not limited to just the theoretical frameworks but was also be open to any new categories that emerged naturally in the research process. Thus, both deductive and inductive analysis were used.

Furthermore, as categories emerge from the data, the researcher will go through the data, carefully searching for any outliers that do not fit into the categories of the data and carefully analyse them before eliminating them from the findings.

Thereafter, the researcher will make a summary of the findings and the categories. And then discuss the findings in terms of the context of the population being studied and the implications as well as recommendations for that population.

3.7 TRUSTWORTHINESS

The description of the term trustworthiness originated with Lincoln and Guba (1985) who referred to it as follows: “how can an inquirer persuade his or her audiences (including self) that the findings of an inquiry are worth paying attention to, worth taking to account of? What arguments can be mounted, what criteria invoked, what questions asked, that would be persuasive on this issue?” (p. 290). According to Trochim et al. (2016, p. 72), criteria for judging qualitative research involve the following:

Credibility criterion involves establishing that the findings of the research are believable from the participant’s perspective (Trochim et al., 2016). To ensure credibility, the researcher issued the transcripts to the participants so that they could judge the credibility of the findings.

Transferability “refers to the degree to which the results of the research can be generalised or transferred to other contexts,” (Trochim et al., 2016, p. 72). This research investigated how TVET lecturers experience ICT integration into teaching and learning using a qualitative methodology of study, therefore the study was not aimed at generalising the findings. However, the researcher made use of rich descriptions to ensure transparency of any assumptions that were applicable to this research study.

Dependability in qualitative research is similar to the concept of reliability in quantitative research: “it is concerned with whether you would obtain the same results if you could observe the same thing twice” (Trochim et al., 2016, p. 72). The researcher will keep a detailed record of the process followed during the research study and will describe any changes that occur during the research and how these changes affect the way the research study is approached.

Confirmability “refers to the degree to which the results could be confirmed or corroborated by others” (Trochim et al., 2016, p. 72). The researcher will triangulate by using different sources, such as semi-structured interviews and document review to collect data and corroborate the findings. Furthermore, the researcher will be immersed in the data collected to minimise potential bias in the study findings.

The following table (**Table 2**) describes the actions to be taken by the researcher to enhance the trustworthiness of the research design process.

Table 2: Approaches applied to enhance trustworthiness

Approach	Actions taken to apply the approach
Multiple data sources	The researcher will use two data sources to collect data and then triangulate the data to corroborate the findings.
Credibility	The SSI will be conducted in English. The whole process will be recorded and then the SSI will be transcribed verbatim. The findings will be reviewed first and thereafter approved by the participants.
Consistent methods	The researcher will apply consistent methods throughout the research process, that is, in the sampling methods, data collection, data analysis and reporting of findings.
Record keeping	An audio recording device will be used to record the SSI and the audio stored on the researcher’s laptop as well as on the cloud. Both storage spaces used are password protected. The documents that will be collected from the participants and the college will be stored on the researcher’s laptop as well as on the cloud.
Research process audit	The researcher will continuously audit the data collection and analysis process to identify and limit potential researcher bias. The researcher will also continuously check with the participants throughout the data collection process for accuracy and for clarification of any potential misunderstandings.
Review by participants	The researcher will ensure that the participants’ review the SSI transcripts to ensure an accurate representation of the research findings.
Identification of discrepant data	During data analysis, the researcher will identify and exclude outlying data.

Transparency	The researcher gave rich description of the context of the study as well as the research design process to ensure transparency in the steps taken and methods applied in this research study.
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3.8 ETHICAL ISSUES

In research, one of the most important aspects researchers need to take into consideration throughout the research study is research ethics. In qualitative research design, there are multifaceted ethical issues that researchers need to take into consideration when they use qualitative data collection methods (Mertens, 2018). In this type of research approach, the researcher is an integral part of the research, hence it is important for researchers to conduct themselves in an ethical manner throughout the research process, especially during data collection (Mertens, 2018). According to Leedy and Ormrod (2005), “ethical issues can be classified into one of the following categories: informed consent, protection from harm, right to privacy as well as honesty with professional colleagues” (p. 101). According to Kumar (2011), “informed consent implies that subjects are made adequately aware of the type of information you want from them, why the information is being sought, what purpose it will be put to, and how they are expected to participate in the study,” (p. 220).

The following table, **Table 3**, describes the ethical considerations made by the researcher during the research process.

Table 3: Ethical considerations

Ethical aspects	Description of actions taken by the researcher
Ethical clearance	Prior to data collection the researcher requested ethical clearance (see Appendix A) from the university’s Science and Technology Department.
Permission from the TVET college	In line with the DHET’s research policy, the researcher requested permission from the sampled TVET college to collect data from the stipulated number of lecturers. The TVET college academic programmes were not interrupted during the course of data collection.
Informed consent from the participants	Participation in this study was voluntary. The participants freely chose to participate in this research study. The researcher communicated the following to the participants prior to obtaining consent: <ul style="list-style-type: none"> • Title of the research study;

	<ul style="list-style-type: none"> • The purpose of the research; • The data collection method; • Potential benefits for participating in the study; and • Ethical considerations to be observed during the research study. <p>This information was communicated telephonically and thereafter an email with the letter (see Appendix C) was sent to each participant. In the same email, a consent form and interview questionnaire were attached so that the participants could review the questions that will be asked before giving informed consent. The interview questionnaire was given beforehand to enable the participants to review the questions so that they can ensure they will be able to answer the questions. The participants were made aware of their freedom to voluntarily participate in the study. They were also notified of their freedom to withdraw from the study without any penalties.</p>
Protection from harm	The participants were not placed under duress during the data collection process. Their mental and physical health was taken into consideration during this study.
Right to privacy	The researcher used pseudonyms to protect the identities of the participants and the college. The data collected from the participants has been store in password restricted storage facilities.

The researcher followed a research ethical code throughout the research process. The research findings reported are truthful and unbiased and will not be used in any inappropriate manner.

3.9 CHAPTER SUMMARY

This study followed a qualitative approach framed from an interpretivist paradigm. Interpretivism influenced data collection methods: semi-structured interviews, and document review. This chapter discussed the research methodology, data analysis procedure, trustworthiness, and ethical issues in detail. In the subsequent chapters, the research results will be presented and discussed in line with the research question and sub questions:

- How do lecturers in Technical and Vocational Education and Training (TVET) colleges experience the integration of ICT into the teaching and learning process?
- What are the factors that influence ICT integration into the teaching and learning in TVET colleges?

- To what extent do lecturers in TVET colleges integrate ICT into the teaching and learning process?

The next chapter, Chapter 4, presents the research results in line with the above research questions.



CHAPTER 4: DATA ANALYSIS AND INTERPRETATION OF FINDINGS

4.1 INTRODUCTION

This chapter focuses on the presentation and discussion of the findings of the research study. The study focused on exploring how lecturers in TVET colleges experience the integration of ICT in the teaching and learning process by identifying the factors that hinder or promote effective ICT integration into the teaching and learning process in TVET colleges, and determining the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process. This qualitative study was carried out through the lens of the interpretive paradigm. Data for the study was collected through semi-structured interviews of the participants (TVET lecturers) paired with the review of documentary evidence at a TVET college in the Western Cape.

The study was conducted during the COVID-19 lockdown during which lecturers were conducting teaching and learning remotely. Thus, some of the interview questions were structured to find out how the participants are conducting their teaching and learning in the lockdown. However, this was not a limitation in the research, it was merely a way to include contextual factors that were at play during the data collection stage. The researcher could not do classroom observation but expanded the data collection to include a review of the participants' lesson plans, Moodle Learning Management System, subject work scheme, the TVET college's IT Policy and Procedure, and Talent Management and Development Policy.

This report begins with a brief overview of the data collection and data analysis process. It presents the summary of the research findings, which is then followed by a presentation of the research finding categories comprising sub-categories. Under each category, the researcher discusses the findings per sub-category and makes use of direct quotes from the participants to bring the interpretation of the findings into context and support the stance with the relevant literature. The report then ends with a chapter summary.

4.2 RESEARCH FINDINGS

As explained in the previous chapter, semi-structured interviews were conducted with four lecturers from the sampled TVET college (refer to **Table 1** in Chapter 3 for the

description of the participants). The researcher used a voice recorder to record each interview and then saved the audio recordings on the laptop for safe keeping. Each interview was then transcribed from audio to text. Through the transcription of the interviews, the researcher felt immersed in the data, which helped in understanding the participants' experiences regarding the integration of ICT into the teaching and learning process. The researcher listened to the interviews a few times to ensure that the audio interviews were consistent with the transcripts and that every detail of the interview was captured verbatim. To ensure the trustworthiness of the data, their respective interview transcript was sent to each participant so that they could note any inaccuracies. Once the participants validated the interview transcripts, the researcher read through each transcript with the research questions and objectives in mind and then summarised and organised the coded responses per participant, according to the topics covered in the interviews. This was important in order to present the findings in the most understandable way, the researcher classified the coded responses per participant and grouped them according to their relevant topic (see **Table 4**), and it enabled the researcher to capture how each lecturer experiences ICT integration in their teaching and learning process. Also, the small sample made it possible to present the coded responses for each participant in one table; this was important for easy cross-comparison analysis of the coded responses and for the formulation of categories and sub-categories.

Data analysis enabled the emergence of sub-categories from each main category. As described in Chapter 3, during data analysis, the TPACK framework and SAMR model of ICT integration were applied to the identification of categories and classification of codes into sub-categories related to the research questions and objectives. It is important to note that the frameworks were mainly used to guide the process; thus, the data analysis was not limited to the use of the frameworks. The researcher allowed any naturally occurring sub-categories to be considered as well; thus, inductive and deductive methods were used. Each of the data sources were analysed separately during an initial stage, and later sub-categories were classified according to their categories (see **Table 5** for the research categories and sub-categories).

The following section presents the summarised findings from the interviews (See **Table 4**).

Table 4: Presentation of research findings

Main topics covered in the interview	Participant 1	Participant 2	Participant 3	Participant 4
Tools that lecturers have for teaching and learning.	Interactive whiteboard, Internet, YouTube, WhatsApp, Moodle.	Interactive whiteboard, Internet, Ask Archie, WhatsApp, Moodle.	Interactive whiteboard, Internet, WhatsApp, Moodle.	Interactive whiteboard, Internet, YouTube, MS Application Software, WhatsApp, Moodle, laptop, iEnabler.
Lecturer industry experience and its perceived usefulness.	3 years as a purchasing retail manager. Helps integrate theory into practice. Knowledge of what industry requires students to know. Gained in-depth content knowledge.	1 year as a research technician. Helped with content knowledge.	7 years as a systems analyst. IT is dominating every sphere. It helps to gain experience in IT.	1 year as a data analyst. Helps with content knowledge.
Lecturers' motivating factors for integrating ICT in their teaching and learning.	We are living in the 4IR. We cannot shy away from using technology. Things are changing. Use online lessons. Have to adapt to use ICT to remain relevant.	The whole system is evolving towards technology. Student activities are highly technological. Capture students' attention. Need to be in line with what interest students.	ICT is driving everything you can think of. It makes things easier. It is quicker. It saves time. It is important for every student to understand ICT. You can do mobile learning.	The world is changing now. It is moving towards a different era. It is evolving towards ICT. Everything is going digital. Students must be exposed to technology. To stay abreast with the times. Can do self-learning.
The lecturers' perceived benefits and effectiveness of integrating ICT in teaching and learning.	Have online lessons. ICT encourages collaboration. It motivates learning. Students can learn on their own. Students can explore, research, and learn autonomously.	Helps students understand the content better. When students do not understand, the lecturer can use videos, animations from YouTube to help students understand better. Increases the speed of understanding subject matter. Technology challenges your thinking.	It prepares our students (for) with the 21 st century skills. Encourages collaboration. Brings children together. Leads to language development.	Helps gain cognitive skills. Helps gain manipulative skills. Enables active learning. Helps gain creative skills. Enables students to interact and collaborate. Makes teaching & learning more learning centred. Enables learning beyond the classroom. Can do electronic lesson plans.
Factors that influence the integration of ICT in teaching and learning process.	Can use ICT to aid students with disabilities. Can use technology to realign outdated elements of the curriculum. Can use ICT to make demonstrations for the students.	ICT can make learning better. Help students learn better. ICT can help make learning inclusive for students with disabilities.	ICT allows effective differentiation of instruction. ICT provides opportunities for everyone to learn differently. ICT has strategic importance in education. ICT offers greater flexibility, interactivity, and accessibility. We live in the knowledge economy.	Availability of time to learn how to use ICT. No time to learn may result in poor implementation. Technical skills. Some software is not easy to learn and to use. Lack of facilities. Poor connectivity Lack of computers in the classroom

			Preparing for life after college.	Insufficient resources in the OLC.
Limitations lecturers experience when integrating ICT in the teaching and learning process.	Lack of technological pedagogical training. Stick to one method-WhatsApp. No Wi-Fi for students. Lack of resources. Insufficient funds for data. Some lecturers do not have interactive whiteboards. High student computer ratio. Some students do not have computers at home.	Not everyone can afford technology. Sometimes the college takes long to pay for Ask Archie user rights. Sometimes students do not take Ask Archie seriously, they just click and view the answers at the end of the activity without reading the questions properly.	Cannot easily access YouTube. When there's load shedding, you have to suspend your classes (no UPS).	Software. Cost to acquire new ICT skills not covered by the college. Lack of data for students. Lack of Wi-Fi in the community. Poor Wi-Fi connectivity on campus.
Lecturer professional development in ICT integration.	Workshops not always aligned to the subject you are teaching. Currently studying further (enrolled for M. Ed.). Received college training at intervals for Moodle & Interactive whiteboards	Received college training at intervals for Moodle & Interactive whiteboards.	Received college training at intervals for Moodle & Interactive whiteboards, Cisco training, IT essentials.	Self-learning on the internet: Google sites, Google docs, content material. No formal ICT training. Received college training at intervals for Moodle & Interactive whiteboards, Camtasia, iEnabler. College training has been effective.
The lecturers' perceived effectiveness of the college ICT support.	eLearning support is adequate. IT support -if things are broken, they fix.	They try support us informatively and technically. If a lecturer needs software, the IT support will come and install it and show you how to use it. The problem is that they restrict access to certain websites like YouTube.	The support they give is effective. The IT support teams come and sort out any technical issues experienced. Everyone is being encouraged by the college to do online training in IT essentials. eLearning centre where programmes are run from time to time. We will say it is moving somewhere in the right direction.	The support they give is effective. They are embracing the 4IR. They have a sense of direction.
Recommendations	Students should get laptops. Each lecturer must get an interactive whiteboard. Lecturers need to upgrade themselves to keep up with developments of technology. Technological pedagogy for lecturers and for students. Give students and lecturers gadgets.	Update lecturers through training. Data must be cheap.	Lecturers and students should have access to YouTube without any restrictions. They must make Wi-Fi free and readily available.	Lecturer professional development in ICT integration. Technical ICT training lecturers and students. Provide tools for students.

The subsequent section gives an outline of the categorised research findings, which is then followed by a discussion of the sub-categories under each category in order to answer the research questions, thereby meeting the research objectives.

4.3 RESEARCH FINDINGS CATEGORIES AND SUB-CATEGORIES

In order to answer the research questions and meet the research objectives, the findings are organised into four categories comprising sub-categories, as summarised in **Table 5** below.

Table 5: Outline of the research findings categories and sub-categories

Categories	Sub-categories	Data Sources
1. Lecturer-level features	1.1 Lecturers' attitude towards ICT for teaching and learning 1.2 Lecturers' technological pedagogical content knowledge 1.3 Lecturers' motivation for using ICT for teaching and learning	Semi-structured interviews Lesson plans Subject work schemes Moodle LMS platforms
2. ICT factors influencing ICT integration	2.1 Lecturers' experience with the benefits related to ICT use for teaching and learning 2.2 Perceived ease of ICT use 2.3 ICT promotes inclusivity 2.4 Poor connectivity	Semi-structured interviews
3. Institution-level features	3.1 Accessibility of ICT resources 3.2 ICT support 3.3 ICT training and professional development of lecturers 3.4 The college's direction in terms of ICT use for teaching and learning	Semi-structured interviews IT Policy and Procedures document Talent Management and Development Policy
4. Preferred ICT for teaching & learning	4.1 Interactive whiteboard 4.2 Moodle as a Learning Management System 4.3 WhatsApp as a Learning Management System	Semi-structured interviews Lesson plans Review of Moodle LMS platform

The subsequent sections discuss the research findings under each of the categories and sub-categories shown in **Table 5**. The researcher will provide comments and quotes from the participants as well as literature in order to support the findings.

4.3.1 Category 1: Lecturer-level features

4.3.1.1 Sub-category 1.1 Lecturers attitude towards ICT for teaching and learning

A positive attitude is perceived to be an important factor that encourages lecturers to incorporate ICT into the teaching-learning process (Player-Koro, 2012; Hannaway, 2019). A positive perception of technology will enable the probability to devise innovative strategies to improve learning (Zamir, 2019). All the lecturers that participated in this study showed positive attitudes regarding the importance of ICT in education. As in previous studies (see, Aslan & Zhu, 2018; Daya & Laher, 2019; Ghavifekr et al., 2012; Adukaite et al., 2016; Isman et al., 2012) the lecturers showed a positive attitude towards ICT integration. P1 said that ICT can be used to do “...online lessons...”; P3 said that “you can do your mobile learning...[on] WhatsApp”. P2 said that technology can be used “...to convey learning material to the students and make them understand better”. And P4 felt that it is “...motivating him to do self-learning”. This result is in line with Lawrence and Tar, (2018) as well as few other researchers (Habibi, Razak, Yusop, Mukminin, & Yaqin, 2019), who found that the teachers participating in their study had a positive attitude towards the use of ICT for teaching and learning. Similarly, Umugiraneza, Bansilal and North (2018) said, despite the extent of their ICT incorporation in the teaching-learning process, the lecturers showed a positive attitude towards using technology for educational purposes. This is key because a positive attitude enables the lecturers to keep an open mind when trying new strategies for teaching using technology, which will have a positive impact on teaching and learning.

4.3.1.2 Sub-category 1.2 Lecturers' Technological Pedagogical Content Knowledge (TPACK)

One of the components that is highlighted in the TPACK framework for lecturers to effectively incorporate ICT into the teaching and learning environment is Content Knowledge (CK). The first few questions of the interview were centred around finding out about the qualifications, teaching experience and industry experience of the participants. In terms of

the lecturing experience, all the lecturers have been working in the TVET sector for a substantial number of years, none of the lecturers had less than five years of lecturing experience. All the lecturers had the relevant qualifications, none of the lecturers were lecturing subjects in which they did not specialise at university. All the lecturers indicated that they had industry experience. One of the questions asked whether the lecturers felt the experience they gained through industry exposure was relevant to what they were lecturing, and all the participants indicated it was helpful to the subject they were lecturing. One participant (P2) specifically mentioned that it helped in enriching his content knowledge while another participant (P3) mentioned that we live in a world dominated by ICT so it is important for one to gain experience in this sphere; lastly, one participant (P1), who lectures financial management, stated that industry exposure:

“... is very useful, because I will be integrating theory into practice because I have practical experience of what is needed in the industry. So, the moment I am talking about management, I know exactly what I’m talking about because I was a manager. The moment I talk about finance I know what it is about in industry because I was a finance officer, doing all the cash-up for the Super Spar and also balancing. So, I really know how it is.”

The interview data and Moodle LMS review revealed that the lecturers have limited technological pedagogical knowledge (TPK). The data revealed that all the lecturers that participated in this study have received training on how to use the technological tools they have in their classrooms, namely the interactive whiteboard, Moodle, and other application software. However, during the analysis of the interview data, it emerged that the way they view the interactive whiteboard and Moodle reveals a lack of knowledge and understanding of the pedagogical potential these resources can offer for teaching and learning. For example, P2 said:

“We use a smartboard as a medium for the students to increase the speed of understanding of the subject.” “Technology is used as a medium just to convey the learning material to the students and make them understand better.”

Furthermore, P4 acknowledged that the way he used the smartboard is not to its full pedagogical potential, and said:

“Actually, if I can say about a smartboard, we are using it like a board, where we write electronically, do our teaching electronically on the smartboard. So, actually we are integrating partially, or passively, ICT into our learning.”

This is confirmed by Adukaite et al. (2016), where some of the teachers acknowledged that they were not using the interactive whiteboard to its full potential. And seconded by a study conducted by Pamuk et al. (2013), where they found that teachers perceived the interactive whiteboards as internet-enabled projection devices, which led to them using the interactive whiteboards mainly to demonstrate lecture presentations. Isman et al. (2012) also found that a considerable number of teachers used an interactive whiteboard as a substitute for a normal whiteboard. One could argue that this is caused by the nature of the ICT training that the lecturers receive from the college where the training is mainly associated with equipping lecturers with skills to use the technology and not equipping them with TPACK (Hannaway, 2019; Kreijns et al., 2013). When asked about the use of the interactive whiteboard, P3 said, *“I explain the notes on the whiteboard, then I explain the notes, then I give my students time to copy the notes into their notebooks.”* This finding is in agreement with Uluyol and Şahin (2016) who revealed that, even though, teachers have access to various technological tools, their ICT integration was limited to lecture presentation. P1 identified this as a need for training, he said:

“Yeah, the problem is lack of training on ICT also makes things tough. We end up sticking to one method of teaching using WhatsApp whilst we are supposed to explore. We are supposed to use Microsoft Word; we are supposed to use Zoom. We are supposed to use Skype.”

Chigona's (2018) study finding confirms that a lack of digital fluency as well as resources paired with inadequate TPACK makes it difficult for teachers to effectively incorporate technology into their teaching and learning practices. Türel and Johnson's (2012) study findings suggested that teachers get training on using effective teaching strategies for interactive whiteboards to transform their pedagogy to be more interactive and student-centred. Because just knowing how to use the technology is not sufficient for teachers to effectively integrate ICT into their pedagogy (Chigona, 2018). However, Asamoah and Oheneba-Sakyi (2017) argue that, even though, the need for teachers' training is clear,

empowering them to adapt their pedagogical logic and methods in response to learning affordances provided by ICT may turn out to be a challenging and complicated process.

4.3.1.3 Sub-category 1.3 Lecturers' motivation for using ICT for teaching and learning

All the participants were asked what motivates them to integrate ICT into the teaching and learning process. The responses from the interview revealed a general consensus behind ICT usage in the teaching and learning process. The most frequently occurring motivation to use ICT was because the participant perceives the world to be revolving around it. P1 stated that “we are living in the new world, the Fourth Industrial Revolution... so we cannot shy away from using technology.” P3 observed that:

“ICT now is driving everything that you can think of. So many companies have migrated from a manual system to ICT. So, ICT makes things very simple, its quicker and it saves time. So, it is vitally important for every student to be able to understand what ICT is.”

P2 stated that:

“the students that we are teaching, most of the time, most of their activities [are] highly technological, they are always on the phone, they are always on the internet, and for us to be able to capture their attention, we need to align ourselves with such things that interest them.

P4 said that:

“...what motivates me is that I know my students are leaving here going outside the workplace and these are some of the requirements that they must be at least exposed to technology.” Furthermore, “...as a teacher, I must also be abreast with times to know what is currently happening to keep up with the pace at which technology is evolving.”

These quotes reveal that there is agreement on the influence of ICT in education as well as in the workplace. So, the lecturers use ICT in the teaching and learning process to remain relevant in face of the needs of the Fourth Industrial Revolution. In Mooketsi and Chigona's (2014) study, teachers also mentioned that their personal reasons for using technology was to keep up with the demands of the era. For example, P1 said that “the world of work is also looking at technology. Things are changing, we have to adapt to what is happening currently if we are to survive in this world”. This is in line with the perceptions of teachers in the study

presented by Adukaite et al. (2016), where ICT is perceived to be important for students' future success.

4.3.2 Category 2: ICT factors influencing ICT integration

4.3.2.1 Sub-category 2.1 Lecturers' experiences about the benefits related with ICT use for teaching and learning

Throughout the interviews, all the participants showed a positive attitude towards the use of ICT for teaching and learning. On the question of whether integrating ICT in the teaching and learning is effective and beneficial, P3 stated that "...it develops ICT capability and it prepares our students [with] the 21st century skills...". Furthermore, the responses revealed that using ICT is perceived to encourage student interaction and collaboration, which leads to language development. P4 said that

"... integrating technology, it gives that child the opportunity to [be] actively involve[d] in the teaching and learning process. So, when the child is actively involved in the teaching and learning process, it gives them that child that joy to become creative and that is all what the world is about today, creativity."

This finding is confirmed in the literature (see, Bytheway et al., 2012; Uluyol & Şahin, 2016; Gamira, 2019), where teachers perceived ICT to be beneficial for improving students literacy levels and for enabling students to become independent thinkers. It is seconded by Adukaite et al. (2016) who state that "ICT facilitates more authentic learning experiences" (p. 59).

The findings also revealed that the lecturers perceived ICT to save time, P3 stated that "ICT makes things very simple, it's quicker and it saves time". The findings are in line with Bytheway et al., (2012) and Uluyol and Şahin (2016). Lecturers mentioned typing up lesson plans so that they can just be edited the following year. P4 said, "those days will be using pen and paper to write lesson plans. Now I have my electronic lesson plans. Normally I just modify it". This is confirmed by Gamira, (2019) who states that ICT enables lecturers to design teaching and learning activities and enables access to various resources from the internet that can be downloaded for future use. ICT is also perceived as beneficial to do

follow-up activities that would not have been covered in class due to the limited time for teaching and learning in the classroom.

The main point raised regarding the alignment of ICT with the curriculum was the issue of the outdated elements of the curriculum. In response to this question, the benefit of using ICT in the teaching and learning process emerged. One of the participants (P1) mentioned that he uses technology to realign the outdated elements of the curriculum and show the students the up-to-date elements. He said:

“Let me give you one example, I’m teaching Level 2 Financial Management, and you go to a chapter, banking, right? You see what they are covering. They are talking about cheques. Who is using cheques in this world, in this era? They are talking about deposit slips, who is using deposit slips in this world? If you are using a smartboard, now you can show the kids that these days we are no longer using the cheques. You show an automatic teller machine (ATM) on the screen, someone taking money from the ATM. Someone depositing money on the ATM. Some of them know now. Some of them don’t even know what is a deposit slip, what is a cheque. Because people are no longer using cheques. So, technology will help now”.

4.3.2.2 Sub-category 2.2 Perceived ease of ICT use

Kumar and Daniel (2016) noted institutional support and availability of resources as factors that influence the perceived ease of ICT use. If lecturers perceive the technology to be difficult to use, they may refrain from using it in their teaching in fear of looking clueless in front of their students (Opeyemi et al. 2019). The participants generally viewed the technologies that they have for teaching and learning as easy to use due to the training they have received. This confirms the statement by Naidoo et al. (2019) that the usefulness and ease of use of technology depend on one’s ICT skills. P1 said, “at first I had problems but in time I saw that this is user friendly,” with regard to the perceived ease of the use of the interactive whiteboard. Baydas and Goktas (2016) investigated influential factors on preservice teachers’ intents to use ICT in future lessons and found that the preservice teachers perceived ICT positively for teaching and showed strong intentions to incorporate it in their teaching and learning environments.

4.3.2.3 Sub-category 2.3 ICT promotes inclusivity

When asked about the factors that influence ICT integration into teaching and learning, one of the themes that emerged was how lecturers can use ICT to improve learning. P3 stated that “ICT allows effective differentiation of instruction with technology, we all learn differently and at different rate and technology provides the opportunities for this to occur.” Cabus, Haelermans, and Franken (2017) explored the effects of in-class-level differentiation using an interactive whiteboard to establish math proficiency, their study found that this had a “significant positive effect on the math exam results” (p. 155).

During a follow-up interview, the aspect of teaching disabled students was brought up and one of the participants (P1) mentioned that he has a deaf student in one of his classes; when he conducted remote teaching during lockdown, he stuck to communicating through written messages on WhatsApp in order to ensure inclusivity for all his students. Another participant(P2) stated the following:

“Students with the disabilities can struggle, especially if it’s direct contact with the lecturer and say for example, a student who has got a problem with eyesight, they might not be able to read a handwriting that some of the lecturers print on the board. So, with the inclusion of technology, you can actually make it much better, by making audio presentation where a student will not just need to read but also listen...There are certain students who have got hearing disabilities and some incorporated with the problem of eyesight, they can use a smartboard to zoom in and enlarge the size of the font and students can be able to read even if they have a poor eyesight. You can change the colour if they are colour blind or if they struggle with certain colours”.

This finding is similar to Rabah (2015) who found that technology increased the inclusivity rate of special needs students among English Quebec high schools. Ferreira-Meyers and Martins (2020) also state that WhatsApp enables inclusion where students “who have visual limitations can access the materials through voice messages or those who have hearing problems can read all content” (p. 2), while those with attention deficit will be able to read or hear the information as well as be able to read it as many times as they wish at their own pace.

4.3.2.4 Sub-category 2.4 Poor connectivity

The use of internet for academic activities plays a vital role in the accessibility and quality of education (Matlala & Kheswa, 2019). According to Adukaite et al. (2016), teachers considered the accessibility of a stable internet connection to be a necessity. All the participants in this study were from different campuses and only half of the participants mentioned that their campus had Wi-Fi connection for the students. Regarding Wi-Fi, P1 said, "...we have Wi-Fi but it is not open to students. It is only open to lecturers." The participants that indicated that they had Wi-Fi connection at their campuses, yet when they were asked if the Wi-Fi works properly, one participant (P3) said that the Wi-Fi does not connect to all network service providers, which is a setback for the students. P4 said that:

"The Wi-Fi is working but the only problem with the Wi-Fi is just fluctuating. You connect, after five minutes you have to reconnect. It means you with your phone, you have to remind yourself my Wi-Fi is off my Wi-Fi is off, that's the problem".

Türel and Johnson (2012) also identified poor internet connection to be one of the major barriers to ICT integration.

All the lecturers indicated that their interactive whiteboards were connected to the internet. However, half of the lecturers said there were some websites that are blocked, which they cannot access from their interactive whiteboards. P2 said,

"So, sometimes you find that things like internet access, it will not provide exactly what we need. They have to block some websites for us, of which sometimes we need to use those websites. But anyway, if it does not allow, we just use alternative stuff".

Kunda et al. (2018) conducted quantitative research to investigate factors that influence Zambian higher education lecturers' attitude towards ICT integration into research and teaching. They found that insufficient internet bandwidth was among one of the factors that hindered ICT integration into the teaching and learning process. Ramorola (2013) also noted that internet connection was a barrier to ICT integration. Pamuk et al. (2013) found that the lack of internet connection in, and outside of, school can diminish the interest of teachers and students to use technology.

4.3.3 Category 3: Institution-level features

4.3.3.1 Sub-category 3.1 Accessibility of ICT resources

For lecturers to incorporate ICT effectively into the classroom, the availability of ICT infrastructure is a necessity (Aslan & Zhu, 2018). Adukaite et al. (2016) and Chigona et al. (2010) note the lack of resources as a factor that hinders ICT integration. Although the participants indicated that they had interactive whiteboards and internet access, they still raised the issue of the lack of resources. P1 stated that “the lack of technology” makes it difficult for the students. P1 said, “not all of us have got a smartboard. I’m just fortunate that I have got a smartboard. In my department, I think we are two out of six lecturers who have smartboards.”

Power cuts and Eskom’s implementation of load shedding created another problem because there is no Uninterrupted Power Supply (UPS) in place for the computers and interactive whiteboards to work. Khatete et al. (2015) identify the availability of electricity as a key enabling feature for ICT integration in the learning environment. They found that from all the schools that experienced power outages, only a few had back-up generators, while most of the other schools had no power back-up during power cuts. A lack of UPS, or back-up generators, means that lecturers will not be able to use technology when there are power outages, and this has a negative impact on teaching and learning.

4.3.3.2 Sub-category 3.2 ICT support

When lecturers are using ICT for teaching and learning, they expect it to happen without any issues (Chigona et al., 2014). Any technical issues that arise during teaching and learning may hinder the incorporation of ICT into the teaching and learning process. So, the ICT support department is responsible for maintenance of ICT infrastructure and for offering ICT support to the users in the institution, thus they play a vital role in supporting ICT integration (Maina et al., 2016). During the interviews, the participants were asked about the ICT support that they receive from the TVET college. The college has two types of ICT support, they have IT support that focuses on the maintenance and technical aspects of the ICT, and eLearning support for training the lecturers on how to use ICT (this will be

discussed under the sub-category 3.3 ICT training and professional development of lecturers). Regarding IT support, P3 said that:

“if we lecturers have any problem; we log a ticket then we email to IT support. Because if we run out of cartridge, they come out and replace the cartridge. If you are having problems to log in, then come and rectify the problem but we ourselves, we don't have access to that.” “...what happens is as the students enrol after enrolment, we give a list of those students to IT support. They are the ones who supply us with usernames and passwords, which the students cannot change, which the lecturer cannot change.”

Half of the participants felt that the IT support they were receiving in terms of ICT integration was satisfactory, while the other half felt that their ICT use would be better if some of the websites like YouTube were not blocked on their interactive whiteboards. Restricted internet access hinders ICT integration and being unable to access certain websites on the interactive whiteboards makes the interactive whiteboard less interactive. Thus, this may lead to lecturers with limited internet access to use the interactive whiteboard just like they would use a traditional chalk board, which results in ineffective ICT integration.

4.3.3.3 Sub-category 3.3 ICT training and professional development of lecturers

According to the literature, training is seen as a factor that influences ICT integration in the teaching-learning process. Training would enable lecturers to learn new things and stay up-to-date with the knowledge and skills demand for lecturers (Ghavifekr et al., 2012). Lecturers should be equipped with ICT skills to improve the teaching and learning situation (Aslan & Zhu, 2018). Thus, a lack of training can hinder effective ICT integration into the teaching and learning process (Lawrence & Tar, 2018; Chigona et al., 2010). In the interviews, the participants were asked questions related to ICT training and professional development. In terms of professional development, P1 said:

“Yeah, the college at times, they send us for workshops there, but mostly at times, you go for a workshop which you don't benefit. You go to a workshop where the workshop is not concerned about the subject you are teaching.”

This is similar to a finding by Chigona (2018), where teachers attended professional development training that was not sufficient to enable them to effectively incorporate ICT into the teaching and learning process.

The college has eLearning support facilitators that offer training to the lecturers at the college. The findings from the interview responses revealed that the lecturers have received training on how to use a smartboard. The participants were also asked if they were able to use the smartboard without any difficulties, and P1 said:

“In fact, at our campus there is a guy who is an IT guru. He trains us each and every week. He comes to us doing anything. Then you explore.”

Other ICT trainings that were mentioned during the interviews included Moodle, Camtasia, Ask Archie, iEnabler, and Cisco training. The participants were also asked if the training they had received was effective and P4 stated that:

“It is effective because we are using it (ICT), so I will say it is effective. Without support, I wouldn't know in the first place how to use a smartboard, how to use the iEnabler to mark my register, to capture my marks. So, it is effective because I'm using it (ICT).”

When it comes to training and professional development, all the participants showed a positive attitude towards receiving training. Regarding his professional development, P4 said the following:

“I have to do self-learning on the internet. So, as I've mentioned, I have to learn how to use, even how to create even Google sites, how to use the internet to create content material, interactive material how to use the Google doc on the Google drive to also create content material and interactive material. So, I will say it is coming back to, it is coming back to my professional development. Not necessarily going through formal ICT integration teaching and learning.”

This is similar to findings from Adukaite et al. (2016), where teachers who felt they lacked knowledge in certain aspects of their professional demands used the internet and other resources to acquire those skills on their own.

The college developed a '*Talent Management and Development Policy*' in order to ensure that the quantity and quality of staff meet the current and future business priorities. According to the policy:

“The technological effect also presents threats and opportunities for the TVET. Staff that must manage under the above-described environment must be attuned to operating under conditions posed by constant change,” (P. 4).

Furthermore, the policy included a need for capacity building of staff but there was no specific plan pertaining to how the college would go about building up the capacity of lecturers to ensure that they effectively incorporate ICT into their teaching and learning practices.

4.3.3.4 Sub-category 3.4 The college's direction in terms of ICT use for teaching and learning

According to Mooketsi and Chigona (2014), institutional-based strategies, to support lecturers to systematically integrate ICT, are vital for success. On the other hand, the lack of ICT policy and strategic planning comprises factors that hinder ICT integration in any educational institution (Ramadan & Chen, 2018; Ramolorola, 2013). The data collected from the interviews revealed that the college has a few initiatives to encourage ICT incorporation in the teaching and learning environment, and some of the participants also alluded to the direction the college has taken to embrace the Fourth Industrial Revolution. P4 said:

“We have Wi-Fi now. So that's some of the steps that the college is taking to embrace the era. So, with the implementation providing laptops, providing smartboard, providing the software, subscribing to some of the software because you pay for it and they are paying for it and giving training to teachers on how to use it. It means that they are embracing it. They have that sense of direction in this technology, in this new 4IR.”

P3 said, “...everyone is being encouraged by the college to do online training in IT essentials. So, the college, we'll say it's moving somewhere in the right direction.”

The findings from the TVET college's IT Policy and Procedures document revealed that its policy only focused on the guidelines and limitations related to staff usage of the college ICT resources. However, in the IT Policy and Procedures document, there were no details to guide lecturers on how ICT should be incorporated into the teaching and learning process. According to Asamoah and Oheneba-Sakyi (2017), ICT policy should be in place to improve the learning environment. That is why, even though, the college is putting effort into training its staff and investing in technology, if there are no clear guidelines for ICT integration into teaching and learning, this might have a negative impact on its efforts of ICT adoption. Furthermore, it becomes difficult for the lecturers and the TVET college to measure the success, or failure, of ICT integration in the teaching and learning activities of the institution.

4.3.4 Category 4: Preferred ICT for teaching and learning

One of the objectives of this study was to identify the most preferred ICT tools used by TVET lecturers. The participants were asked to mention the tools that they have at their disposal for the teaching and learning process. The main technological tools and software applications that each participant said they use for teaching and learning were interactive whiteboard, WhatsApp, and Moodle.

The researcher reviewed the subject work schemes as well as the lesson plans that were collected from the participants. The data collected from the lesson plan review revealed that the main ICT that the participants included under resources in their lesson planning was the interactive whiteboard followed by the internet.

Table 6 shows the technological tools that the lecturers have at their disposal for teaching and learning. The participants were asked how they use the various technological tools and it is incorporated in the table and the usage of each tool was analysed against the SAMR model to determine the level of ICT integration, which is shown in the last column of the table.

Table 6: Technological resources for use in the teaching and learning process

Technological software	How do the lecturers use it?	Level of ICT integration on the SAMR Model
Ask Archie	Educational software for mathematical literacy.	Augmentation
eBooks	Lecturers can access electronic textbooks for teaching. Students use hardcopy textbooks.	Substitution
YouTube	Subject related YouTube videos used as part of the introduction or conclusion of a lesson.	Augmentation
Internet images	Subject related images used to illustrate certain sections of the content on the smartboard, e.g., an image of the motherboard for the Information System Subject.	Substitution

Internet browser	Search for information on Google. Download subject related content, like images used to illustrate certain sections of the content on the interactive whiteboard, for example, an image of the motherboard.	Augmentation
Ms Excel	Used to record student attendance and marks	Substitution
iEnabler	Used to record marks and student attendance	Substitution
Ms Word	Used to display notes, tests, exam papers, memorandums and shapes on the interactive whiteboard.	Substitution
Clock/ watch	Used as a resource to teach certain topics in mathematical literacy in conjunction with an interactive whiteboard.	Augmentation
Ms PowerPoint	Used to display notes on the interactive whiteboard and do lesson presentations.	Substitution

Notes:

The technological tools that lecturers have at their disposal for teaching and learning activities, how they use it for teaching and learning and the level of ICT integration according to the SAMR model.

Participant P2 mentioned that Ask Archie is currently not being used due to the COVID-19 restrictions and students have no data to access it from their phones.

Two of the participants indicated that they do not have access to YouTube videos from their interactive whiteboard, but they access them through alternative means.

The level of ICT integration by the lecturers, shown in **Table 6** ranges between substitution and augmentation on the SAMR model of ICT integration. Substitution and augmentation represent lower-level constructs of ICT integration, while modification and redefinition represent higher-level constructs of integration on the SAMR model. Although, the lecturers have access to ICT that can be used to design teaching and learning activities that would meet the higher constructs of ICT integration on the SAMR model, there was no evidence of this in the interview data, Moodle LMS, or lesson plans. Bladergroen and Chigona (2019) found that in spite of pre-service teachers having access to ICT, they used ICT as a substitute for traditional instructional methodologies. Rabah (2015) also found that teachers only incorporated ICT into teaching and learning that are in line with the first two level constructs of the SAMR model. Aslan and Zhu (2018) also found that lecturers used ICT in the teaching and learning to a moderate extent. They mainly used basic ICT skills such as

using an internet browser to search for information related to the subject content instead of using integrated ICT skills like creating simulated tasks to explore, learn, and experience.

4.3.4.1 Sub-category 4.1 Interactive whiteboard

The responses from the interviews revealed that all the participants use an interactive whiteboard in the teaching and learning process. All the participants perceived themselves to be confident in using the interactive whiteboard without any difficulties and all the participants displayed a positive attitude towards the use of the interactive whiteboard for teaching and learning. This is in line with what Türel and Johnson (2012) and Isman et al. (2012) found that teachers had a positive attitude towards the usefulness and usability of the interactive whiteboards. However, it is important to point out that the way the participants perceive the interactive whiteboard can be limiting in terms of realising its full pedagogical potential. Although, the interactive whiteboard is interactive by nature and the lecturers indicated they used the internet browser to play YouTube videos, there is no interactivity between the technological tool that the lecturer is using, that is, the interactive whiteboard, and the students. This makes teaching and learning more teacher-centred. In a study that Pamuk et al. (2013) conducted, the teachers pointed out that a lack of interactivity between the interactive whiteboard and students' devices created an environment in which students are less engaged in the lesson, which means that learning occurred passively.

The findings of how the Microsoft application software (see **Table 7**) in the interactive whiteboard is used for mathematical literacy is also similar to what Chigona et al. (2014) found, where teachers used ICT for plotting graphs and charts. Prior to the introduction of interactive whiteboards, the lecturers had to draw the shapes and graphs manually on the whiteboard, which is time-consuming.

The following table (**Table 7**) provides a summary of the findings with regard to how the lecturers use the interactive whiteboard for teaching and learning activities as well as the level of ICT integration on the SAMR model.

Table 7: Interactive whiteboard

Participant	Does it have full internet access?	How do they use it?	Level of integration on the SAMR Model
P1	Yes	Use it as a chalk board (they write on it). Project content through the visualiser (built-in projector).	Substitution and augmentation
P2	Some websites like YouTube are blocked	Show YouTube videos. Present their lessons and display notes using PowerPoint, Microsoft Word or eBook.	
P3	Some websites like YouTube are blocked	Take class register using Microsoft Excel or iEnabler. Illustrate images. Use Microsoft Word shapes to teach certain topics in Mathematic Literacy.	
P4	Yes		

Ghavifekr et al. (2012) experienced that teachers mainly used technology to display teaching content, pictures, multimedia prepared in Ms PowerPoint or from the internet and projected it on the screen for students to see. From the literature, the most common software applications used by lecturers are Microsoft's Word, Excel and PowerPoint software (Umar & Yusoff, 2014; Mooketsi & Chigona, 2014; Isman et al., 2012). Uluyol and Sahin (2016) noted that teachers also used downloaded subject-related visuals during lesson presentations. According to Matlala and Kheswa (2019), this could be because the lecturers perceive the information and content attained from the internet to be more accurate and current than the textbooks. The use of an internet browser to browse YouTube videos, images, and other subject-related information were also reported by all the participants that participated in this study.

4.3.4.2 Sub-category 4.2 Moodle as a Learning Management System

Another software application that came up during the interviews was Moodle. Moodle is usually used for distributing "course content, course progression plan, grading, creating

activities, collecting course feedback and communicating with course participants” (Deepak, 2017, p. 127). Most of the participants gave the researcher access to their Moodle Learning Management System (LMS). One of the participants (P3) mentioned that he does not use Moodle for the subject he is currently teaching. The researcher reviewed the content that was uploaded to the Moodle LMS and found that the LMS had clearly marked sections for each module. Learning outcomes were listed for each module and PDF notes were uploaded for most of the modules. However, no learning activities were created or uploaded to the platform and there was no record of students’ activity on the LMS. Thus, their level of ICT integration on the SAMR model is substitution, which is the lowest level of the SAMR model.

During the interviews, the participants mentioned that they do not use Moodle frequently because not all students have access to this LMS. Another finding from the interviews is how the participants view the Moodle LMS. Some of the lecturers view it as a system where they post notes to be downloaded by the students. They have not realised the value of interactivity that the Moodle LMS can offer to both lecturers and students in the teaching and learning process. In another instance during the interviews, a participant (P2), who has not taken advantage of all the affordances of Moodle, showed a positive view of Moodle LMS, when he said:

“... you can give students a task on Moodle and then they can complete that task wherever, I am, I can use the Moodle to assess the performance of the students to see whoever has done and who hasn’t done or completed a certain task”.

Esnaola-Arribillaga and Bezanilla (2020) explored the levels of Moodle use to support university face-to-face teaching. They classified the levels of interactivity into five groups, namely no interactivity, informative interactivity, advisory interactivity; communicational interactivity, and transactional interactivity, where *no interactivity* represents the lowest level of interactivity and *transactional interactivity* represents the highest level of interactivity. They found that most lecturers’ Moodle interactivity was classified under the *informative interactivity* level, while a significantly lower number of lecturers indicated that they do not use Moodle, thus falling under the *no interactivity* level. The lecturers mainly used Moodle to upload teaching material for their students to download, enable the submission of papers,

and to make announcements. Similar to the practices of the lecturers in this study, Moodle was not used to foster student interaction and collaboration.

4.3.4.3 Sub-category 4.3 WhatsApp as a Learning Management System

According to Matlala and Kheswa (2019), smartphones as social media devices are commonly used for educational purposes in most countries. Kumar and Daniel (2016) found that their participants showed a general consensus to use social media for teaching because students have wide exposure to many aspects of it outside the classroom, thus making social media useful for learning purposes. It was no different in this study, all the lecturers who participated used WhatsApp to communicate with their students. P4 stated that:

“..., if you are using WhatsApp, if you put extra questions on the WhatsApp group for the children to do it at home and they share it with each other, so at the end of the day, you will use the that as a tool to assess if the students assimilated what you've taught in the classroom”.

Nagaletchimee (2015) argued that WhatsApp can support pedagogical practices instantaneously, which is difficult to achieve with desktop computers. This is in line with Elhay and HersHKovitz (2019), who explored teachers' perceptions of out-of-class communication and found that the majority of the teachers preferred to communicate with students through WhatsApp. According to Nuraeni and Nurmalia (2020), WhatsApp offers many features that support the teaching and learning process, such as sending and receiving texts, images, audios, videos, and documents. WhatsApp is a simple and quick means of communication between lecturers and students (Nuraeni and Nurmalia, 2020).

In **Table 8** the findings of how the lecturers use WhatsApp are summarised and the extent of each lecturer's usage was then classified according to the SAMR model of ICT integration.

Table 8: WhatsApp as a Learning Management System

Participant	How is the platform setup?	What do they put on WhatsApp?	How do students respond/ prove that the activity is complete?	How is feedback given to the student?	Level of integration on the SAMR Model
P1	Lecturers create group chats for each class where students are added as participants.	Activities	Once the activity is completed students send a picture of the activity directly to the lecturer.	The lecturer gives individual feedback directly to each student upon receipt of the students' completed activities.	Augmentation
P2		Videos, PowerPoints presentations, Pdf documents	Follow up done in class.	Feedback done in class.	Substitution
P3		Activities, notes, images, photos	Completed activities are posted on the class group chat.	All students discuss one another's activity answers on the group with the lecturer as a facilitator.	Augmentation
P4		Notes, Previous exam question papers, group discussion.	Completed activities are posted on the class group chat.	All students discuss one another's activity answers on the group with the lecturer as a facilitator.	Augmentation

The overall level of lecturers' ICT integration when analysing the type of activities that were carried out through the use of WhatsApp ranged between substitution and augmentation on the SAMR model of ICT integration. There was no significant difference between the levels of integration between the lecturers. When it comes to the usage of WhatsApp as a Learning Management System, P3 said, "WhatsApp, it has been very, very effective during this lockdown period, where there was no face-to-face contact". P1 stated that WhatsApp has a 'Message Info' option where he monitors the group activity and checks how many of the students have read his message, and he further said:

“...from there you can always judge by the response if 20 people opened the message and you see 2 people responded then there is a problem which you need to check. But if 20 people opened the message and 12 or 15 people respond to your message, then it means there is something happening”.

The findings in this study indicate that WhatsApp was used to share videos, PowerPoint presentations, PDF documents, as well as gap-filling and multiple choice question activities. Shahid and Shaikh (2019) found that WhatsApp as a means of communication was most convenient for students and made it easier for them to access important messages, notes, and presentations.

According to Ferreira-Meyers and Martins (2020), WhatsApp groups can be used to facilitate teaching and learning by fostering discussions in and outside of class. Lecturers can use it to give individualised feedback to students, share learning resources and activities, as well as assess students' participation in order to motivate them to reach learning outcomes. The study in question shows that half of the lecturers gave activities to students through their respective WhatsApp groups and then expected the students to post their answers on the respective WhatsApp groups. Afterwards the lecturers discussed the answers. Only one lecturer mentioned using WhatsApp to give individual feedback to students when they submit an activity. A few scholars, namely Nagaletchimee (2015) and Shahid and Shaikh (2019), raised issues about WhatsApp groups that might have a negative impact on student's learning, which include information overloading and the timing of messages.

4.4 CHAPTER SUMMARY

In this chapter, the main findings with regard to how TVET lecturers experience ICT integration, the factors that influence ICT integration, as well as the extent to which the lecturers integrate ICT into the teaching and learning process were presented and discussed in line with other research findings. The findings were presented in categories and sub-categories that emerged during the data analysis stage. Semi-structured interview data as well as data drawn from the documents reviewed were given and references from previous studies were made to substantiate the data findings. The researcher used

pseudonyms to protect the integrity of the research participants. The research results were then linked to the theoretical frameworks that underpin this study. The SAMR model of ICT integration is used to measure the extent of ICT integration by lecturers. The findings suggest that, although, lecturers know how to use the various technological tools and application software at their disposal, they lack the pedagogical technological knowledge that would enable them to take advantage of the full potential affordances of the technology they have at their disposal. There was no significant difference in the extent of ICT integration between the lecturers that participated in this study. The findings reveal that the lectures' ICT usage ranges between substitution and augmentation on the SAMR model of ICT integration.



CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The study investigated the integration of ICT at a TVET college in the Western Cape. The study sought to identify the factors that influence ICT integration in teaching and learning in TVET colleges, and to determine the extent to which lecturers effectively integrate ICT into the teaching and learning process. The study also aimed to identify the most effective (preferred) ICTs by TVET lecturers and, subsequently, make recommendations on the effective integration of ICT in the teaching and learning process. From the findings in Chapter 4, it is concluded that effective ICT integration will take place if there are sufficient ICT resources available, lecturers have technological pedagogical knowledge as well as a positive attitude towards ICT, and the college has a policy for ICT integration. All the lecturers that participated in this study identified several benefits and motivating factors for using ICT for teaching and learning. The study confirmed that the Fourth Industrial Revolution is one of the motivating factors for using ICT for teaching and learning.

5.2 SUMMARY OF CHAPTERS

Chapter 1 provided the background and rationale for this study and presented the problem statement. This research was aimed at exploring ICT integration in order to identify the factors that promote or hinder ICT integration. Furthermore, it explored the extent of ICT integration in the teaching and learning process through an analysis of personal experiences of lecturers at a TVET college in the Western Cape, South Africa. To achieve this aim, the research focused on answering the following questions:

- How do lecturers in TVET colleges experience the integration of ICT into the teaching and learning process?
- What are the factors that influence ICT integration into teaching and learning in TVET colleges?
- To what extent do lecturers in TVET colleges integrate ICT into the teaching and learning process?

The following research objectives, which are consistent with the research questions, were formulated to:

- I. Identify the factors that influence ICT integration into the teaching and learning process.
- II. Determine the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process.
- III. Identify the most effective (preferred) ICTs by TVET lecturers.
- IV. Make recommendations on the effective integration of ICT into the teaching and learning process.

The chapter also provides an outline of the significance, delimitations and assumptions of the study and ends with an overview of the rest of the research report.

The second chapter begins by giving an overview of the TVET sector, it briefly discusses the digital divide and efforts made by the DHET to bridge the divide in the TVET sector. The chapter also provides a literature review on ICT integration in teaching and learning. In this chapter, it is argued that TVET education in South Africa is commonly perceived to be of a low standard. This has led to DHET's aim to strengthen and expand the TVET colleges by improving factors such as the management and governance, quality teaching and learning, student support, and infrastructure to make it more attractive for school-leavers, which will result in an increase in enrolments.

Furthermore, the literature established that the world is dominated by technology, which results in a need for lecturers to incorporate ICT into their teaching and learning environment in order to prepare students for life in the digital era. ICT incorporation in the teaching-learning process is associated with providing better opportunities for student engagement and provides better supporting features for both students and lecturers. Personal factors, ICT training and support, pedagogy, lecturer perception and competency, as well as lecturer attitude were identified as some of the factors that influence ICT integration in the teaching and learning process. Insufficient time, lack of technical support, inadequate training, lack of resources, and limited technical skills were identified as barriers that could hinder ICT integration into the teaching and learning process.

The Technological Pedagogical Content Knowledge (TPACK) framework enabled the researcher to make sense of the complex connections that exist as lecturers make an effort to incorporate ICT into their teaching and learning practices. The TPACK framework was also useful in the identification of components of lecturers' knowledge that affect effective ICT incorporation into the teaching and learning process.

One of the objectives of the study was to determine the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process. To achieve this objective, the Substitution Augmentation Modification Redefinition (SAMR) model for ICT integration, which was developed by Dr Ruben Puentedura, was used to measure the lecturers' level of ICT integration (Puentedura, 2009). The SAMR model consists of four constructs, which are divided into two sections (see **Figure 3** in Chapter 2). The first section, namely 'Enhancement', consists of Substitution and Augmentation. The second section, 'Transformation', comprises Modification and Redefinition. The first two levels, which are classified under the Enhancement section, allow for easy use of ICT. Yet, as the lecturers progress to the subsequent levels, which fall under the Transformation section, ICT integration becomes more complex.

Chapter 3 coordinated the research paradigm that underpins this study, the research design, the methodology, sampling of the TVET colleges and participants, the trustworthiness, and the ethical consideration of the research. The researcher used a qualitative research design and applied an interpretivist research paradigm. The data was collected through semi-structured interviews and document review. The sample consisted of four lecturers from the sampled TVET college (refer to **Table 1** in Chapter 3 for the description of the participants). The researcher used a voice recorder to record each interview and then saved the audio recordings on the laptop for safe keeping. Each interview was then transcribed from audio to text. Through the transcription of the interviews, the researcher was immersed in the data, which helped in understanding the participants' experiences regarding the incorporation of ICT into the teaching and learning process. The researcher listened to the interviews a few times to ensure that the audio interviews were consistent with the transcripts and that every detail of the interview was captured verbatim. To ensure the trustworthiness of the data, the respective interview transcripts were sent to

the participants so that they could note any inaccuracies. Once the participants validated the interview transcripts, the researcher read through each transcript with the research questions and objectives in mind, and, thereafter, summarised and organised the coded responses according to the topics covered in the interviews, per participant. Data analysis enabled the emergence of sub-categories from each main category. During data analysis, the TPACK framework and SAMR model of ICT integration were applied in the identification of categories and classification of codes into sub-categories related to the research questions and objectives. It is important to note that the frameworks were mainly used to guide the process; thus, the data analysis was not limited to the use of the frameworks. The researcher allowed any naturally occurring sub-categories to be considered as well, thus inductive and deductive methods were used.

The following section discusses the main research findings of this study.

5.3 DISCUSSION OF THE RESEARCH FINDINGS

The discussion of the main research findings for this study will be summarised and structured according to the order of the research questions.

5.3.1 How do lecturers in TVET colleges experience the integration of ICT in the teaching and learning process?

The literature review called attention to the fact that the world is dominated by technology, which raises the need for lecturers to incorporate technology into the teaching and learning process. The aforementioned is supported by the findings of the study because it is evident that teachers are incorporating ICT into their teaching and learning practices. It is important to note that there was a general consensus between the lecturers on what motivates them to incorporate ICT into the teaching and learning process. The main motivation for lecturers to incorporate ICT into the teaching and learning process is the Fourth Industrial Revolution and they alluded that it is important for students to be exposed to technology in order to prepare them for the workplace, which is dominated by technology.

As in the literature review, the findings confirmed the potential benefits of ICT to equip students with 21st century skills, which provide opportunities for better student engagement, active learning, and creativity.

5.3.2 What are the factors that influence ICT integration in teaching and learning in TVET colleges?

According to the research findings, various factors affect ICT integration into the teaching and learning process. Some factors are at an institutional level, some at an individual (lecturer) level, while others are contextual factors (see **Figure 7**).

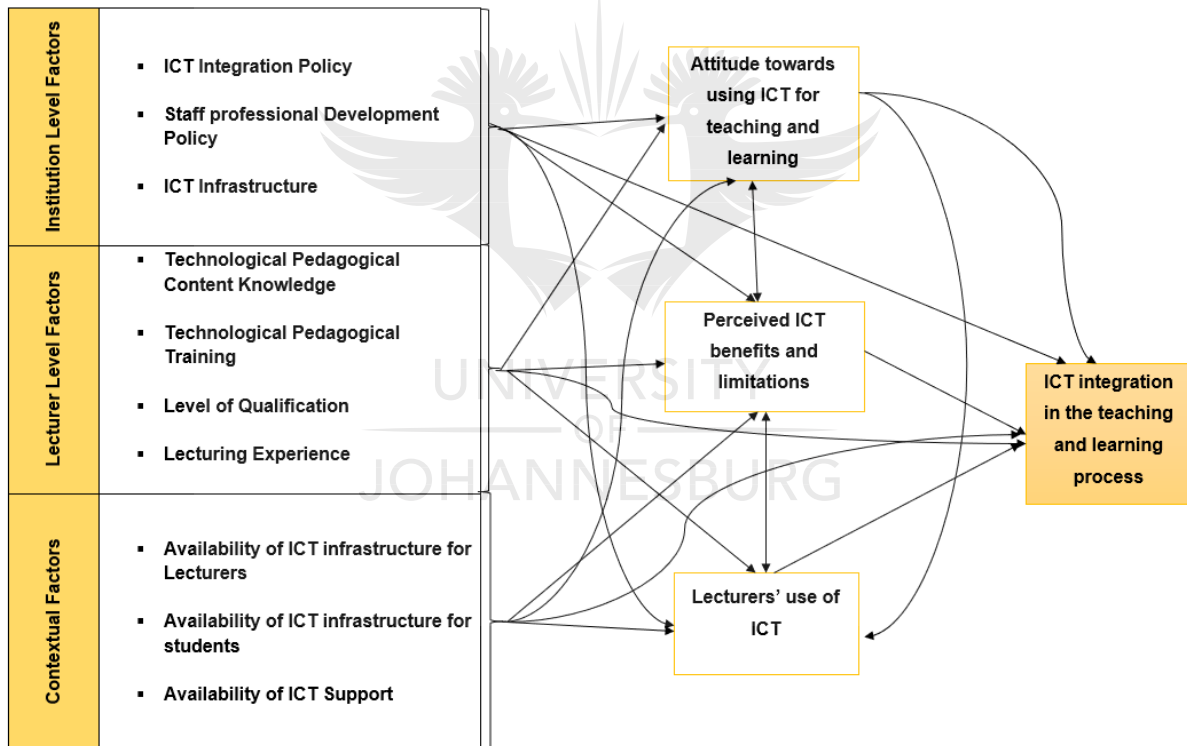


Figure 7: Factors that influence ICT integration

5.3.2.1 Lecturer factors

In the literature, factors that influence ICT integration include personal factors such as qualifications, gender, and age. In this study, the participants were all males of diverse ages

and qualifications and all of them showed interest in incorporating ICT into their teaching and learning practices.

5.3.2.2 Lecturers' attitudes towards technology

According to the literature, attitude influences the incorporation of ICT into the teaching and learning process. A positive attitude towards technology will promote ICT integration while a negative attitude will hinder it. In this study, it was observed that all the lecturers had a positive attitude towards the use of technology for teaching and learning. This resulted in them showing interest in incorporating ICT into the teaching and learning process.

5.3.2.3 ICT training and support

ICT training was one of the most important factors covered in the literature because without sufficient training lecturers may not feel confident and equipped to incorporate ICT into the teaching and learning process. The findings revealed that the college provides on-site IT support and eLearning support. The IT support deals with maintenance and ICT technical support whilst the eLearning provides ICT training. All the lecturers stated that they have received training in how to use ICT. However, all the lecturers also raised an interest in receiving more training in using ICT, which is in line with the findings from the TALIS 2018 report where teachers who received ICT training indicated a need for additional ICT training (OECD, 2018). Therefore, this means that once-off training sessions are insufficient and may result in lecturers not feeling sufficiently equipped to integrate ICT. It can be surmised that institutions need to provide ongoing training in ICT integration. Furthermore, ICT is continually changing and software is continually being updated, hence ongoing ICT training will enable lecturers to keep up with the developments of technology.

5.3.2.4 TPACK

Through the literature review, it was established that for effective ICT incorporation into the teaching and learning process, lecturers need technological pedagogical content knowledge. In the study, it was found that lecturers have received training in the use of the technology they have at their disposal, they have sufficient content knowledge from their

initial post-school training and from industry exposure, but a gap lies in the pedagogical use of the technology they have at their disposal. The findings indicate that lecturers have limited technological pedagogical knowledge which influences the way they incorporate ICT into their teaching and learning practices.

5.3.2.5 The availability of ICT resources

The availability of ICT resources is just as important as ICT training. Without the necessary resources, it will not be possible to incorporate it into the teaching and learning process. The findings revealed poor internet connectivity, inadequate computers for students, inadequate interactive whiteboards for lecturers, and lack of UPS as factors that hinder the integration of ICT into the teaching and learning process. Therefore, for effective ICT integration, a stable internet connection and availability of electricity are of vital importance (Gamira, 2019). This is echoed by Asamoah and Oheneba-Sakyi (2017), who suggest that managers should deal with poor internet connection, power cuts, insufficient computers, and Wi-Fi challenges to improve the learning environment.

5.3.3 To what extent do lecturers in TVET colleges integrate ICT into the teaching and learning process?

It was discovered that lecturers mainly use an interactive whiteboard and WhatsApp for teaching and learning activities. The lecturers use the interactive whiteboard to project lesson presentations, play YouTube videos, and show pictures. WhatsApp is used for class discussions, sharing PDF notes, question papers, memoranda, etcetera.

The researcher then reviewed all the teaching and learning activities that emerged from the interviews, lesson plans, subject work scheme, Moodle LMS, WhatsApp, as well as the teaching and learning activities that took place on the interactive whiteboard. The aforementioned activities were then measured against the SAMR model and the level of ICT integration ranged between the lower-level constructs of the model, namely Substitution and Augmentation (see **Figure 8**). From these findings, several arguments can be made.



Figure 8: Adaptation of the SAMR model of ICT integration

Firstly, poor connectivity may be one of the influences of the level of ICT integration because mobile data (or airtime) is expensive and if students cannot connect to the internet, it makes it difficult for them to complete learning activities that are technology-based.

Secondly, Moodle was identified as one of the learning management systems that the college has adopted. From the findings, the Moodle LMS was mainly used to upload PDF documents and Ms PowerPoint presentations but there was no learner activity on the platform. This may be caused by lack of internet access, which results in the LMS being used as a substitute instead of using its full potential to create learning activities that fall within the higher-level constructs of the SAMR model.

Thirdly, the limited number of computers, which students can access, has an impact on whether students can or cannot access the LMS. This could be one of the other factors influencing how the technology is used for teaching and learning.

Fourthly, the technological pedagogical knowledge of the lecturers influences the way ICT is being incorporated into the teaching and learning process. The findings clearly indicate that the lecturers have received ICT training; however, the lecturers' pedagogical use of the technology is limited. This means that lecturers need to receive more training focused on the pedagogical use of technology so that they may be able to take full advantage of the technology they have at their disposal.

Fifthly, one of the participants mentioned that parts of the curriculum content is outdated. Therefore, one can conclude that the curriculum possibly does not initiate the creation of technology-based learning activities, which influences how lecturers use ICT to complete curriculum activities. If this is the case, it is not wrong to design teaching and learning activities that fall on the lower-level constructs of the SAMR model. However, it does raise concerns for equipping students with 21st century skills. The higher-level constructs are better suited to enable students to complete more technologically challenging learning activities, which would arguably prepare them for life in the Fourth Industrial Revolution.

Lastly, it was found that the TVET college's ICT policy provides no guidelines as to how ICT may be used in the teaching and learning process. Therefore, this may also influence how the lecturers use the technology because there are no clear guidelines that all the lecturers can follow to establish goals with regard to the level of ICT integration in the teaching and learning process within the institution.

5.4 LIMITATIONS OF THE STUDY

Most research studies have limitations, especially when it concerns the scope of the study and time constraints. The current study would have benefited from more resources and time, which would have yielded a bigger sample.

One of the major limitations of this study is the small scale under which it was carried out. The study presented findings based on data collected only from one public TVET college in a province with about six public TVET colleges. This means that not all factors that influence ICT integration in public TVET colleges were covered. Also, the study presents experiences

and perspectives of ICT integration based on interviews with post level 1 TVET lecturers. Other groups like senior lecturers, programme managers, heads of departments, campus managers, eLearning facilitators, TVET college policy makers could have provided different perspectives and experiences on the factors that influence ICT integration in public TVET colleges. In order to cover different perspectives and experiences on the factors that influence ICT integration in public TVET colleges holistically, future research should have a larger sample size and include as many groups as possible.

The study was conducted in 2020 during the COVID-19 lockdown where lecturers also had to do remote lecturing from time to time. This will impact the findings if a similar study was conducted using a similar sample at a different time due to the current transformations and initiatives taking place in TVET colleges to adapt to the current situation. Hence, the context and time in which the study was conducted limits the transferability of the study findings.

The literature review was limited as a result of the limited availability of published articles on TVET colleges in South Africa. Thus, the researcher supplemented this with literature from international and national non-TVET educational literature.

The COVID-19 lockdown had an impact on the size of the sample due to social distancing as well as travelling restrictions during the data collection phase. Furthermore, the COVID-19 restrictions also had an impact on the methods used to collect data, thus it was not possible to do classroom observations as a result of restrictions on the number of people that could be in a class. By the time some of the restrictions lifted, lectures had concluded and students were preparing to write the semester's national NATED exams.

5.5 STRENGTHS AND CONTRIBUTIONS OF THE STUDY

The researcher has limited knowledge of the extent to which lecturers in TVET colleges incorporate ICT into the teaching and learning process as well as the factors that affect effective ICT integration. Thus, the researcher hoped to gain more insight into the aforementioned aspects from this study. The TVET college where this study was carried out will gain more insight with regard to ICT integration in the teaching and learning process

within the institution. This study will afford its participants an opportunity to reflect on their current teaching and learning practices and identify gaps for professional development. The research aimed at making the following possible contributions to lecturers, college management, policymakers, and potential researchers.

Firstly, the study aims to identify the factors that hinder or promote effective ICT integration into the teaching and learning process. This will allow the factors that hinder effective ICT integration to be brought to the attention of college management and policymakers so they can address these factors.

Secondly, the study seeks to determine the extent to which lecturers in TVET colleges effectively incorporate ICT into the teaching and learning process. This will assist lecturers and college management to understand the current level of ICT integration and advise them on how ICT integration can be improved in the teaching and learning process.

Thirdly, the study seeks to identify the most effective (preferred) technological tools used by TVET lecturers. This will inform the college management and potential investors in terms of acquisition and upgrading of the tools, as well as identify lecturers' training needs in using such tools for teaching and learning.

Fourthly, the results of this study seek to fill the literature gap that exists in the South African TVET sector.

Lastly, by using the Technological Pedagogical Content Knowledge (TPACK) framework as well as the SAMR (Substitution, Augmentation, Modification and Redefinition) model, the study seeks to model how lecturers can integrate ICT into the teaching and learning in TVET colleges.

5.6 RECOMMENDATIONS

The findings of this study revealed a few factors that affect ICT integration into the teaching and learning process. Based on the findings and literature review, a few recommendations are made for improving ICT integration into the TVET colleges.

This study revealed that the TVET college has no ICT policy on ICT integration into the teaching and learning process. Currently, every lecturer is using ICT in teaching and learning, as they see fit. This means that the college has no standard to measure whether each lecturer is incorporating ICT into their teaching and learning practices. Because there is no policy, it is difficult for lecturers to identify gaps in the training (apart from general ICT training) to incorporate ICT effectively into the teaching and learning process. Therefore, it is recommended that the college design an ICT policy to guide lecturers on ICT integration in the teaching and learning process. It is suggested that the policy not only focus on ICT integration in the classroom, but also guide the use of ICT for flipped as well as online learning.

The findings of this study revealed that lecturers do receive ongoing training in ICT use and the training seems to focus on the technical aspects of ICT use. Therefore, it is recommended that the college expand the focus of the training that the lecturers receive to include technological pedagogical training so that lecturers can effectively leverage the pedagogical affordances of the technological resources at their disposal. Furthermore, it is recommended that the college include lecturers' TPACK training strategy and guidelines to ensure the future sustainability of the training measures that have been implemented. The policy could also serve as measuring stick for the college to gauge if the implemented training has served its designated purpose.

Another issue found in this study was the lack of access to the internet and poor Wi-Fi connectivity. Many ICT resources currently function well when there is internet connection, lecturers can implement flipped learning or blended learning more effectively if the students can connect to the internet. It is suggested that a reliable internet connection is made available to lecturers and students and on college grounds.

To bridge the digital divide that exists for students who do not have access to computers, it is suggested that colleges consider the option of allowing students to access computers after college hours. This will allow students the opportunity to access computers and the internet for research purposes, complete technological learning activities, and access Moodle and other LMS, which may be useful for the students' learning process.

Not all classrooms are equipped with interactive whiteboards, thus, it is suggested that all classrooms be equipped with interactive whiteboards that have full internet access.

5.7 SUGGESTIONS FOR FUTURE STUDY

This section suggests how future studies can build on this research. While this study uses semi-structured interviews and document review data as collection methods, another study could be carried out by means of classroom observation to provide a practical indication of how lecturers integrate ICT into the teaching and learning process.

This research study is context-bound to an urban public TVET college, which means that the realities lecturers face in an urban public TVET college may differ to the realities lecturers face in rural public TVET colleges. This means that the findings of the study may be not be applicable to public TVET colleges in rural towns, small towns and underdeveloped cities. A similar study could be conducted by including more TVET colleges across the different provinces in the country to enable a generalisation of findings. Also, a comparative study can be conducted between the urban TVET colleges and rural TVET colleges, in the various provinces, to identify the level of ICT integration into the teaching and learning process.

The findings of the this research study may be more applicable to lecturers who lecture similar subjects to that of the sample and less applicable to other lecturers who lecture subjects that are not similar to the ones of the sample. But this may be limited to those with similar characteristics as described in this study. Therefore, it is suggested that future research include TVET college management and students to gain a deeper understanding of how the various stakeholders experience ICT integration in the TVET sector.

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APPENDICES

Appendix A: Ethics clearance

NHREC Registration Number REC-110613-036



ETHICS CLEARANCE

Dear Rirhandzu Affectionate Ubisi,

Ethical Clearance Number: Sem 1-2020-014

Topic: The integration of Information and Communications Technology in the Technical and Vocational Education and Training sector in the Western Cape

Ethical clearance for this study is granted subject to the following conditions:

- If there are major revisions to the research proposal based on recommendations from the Faculty Higher Degrees Committee, a new application for ethical clearance must be submitted.
- If the research question changes significantly so as to alter the nature of the study, it remains the duty of the student/researcher to submit a new application.
- It remains the student's/researcher's responsibility to ensure that all ethical forms and documents related to the research are kept in a safe and secure facility and are available on demand.
- Please quote the reference number above in all future communications and documents.

The Faculty of Education Research Ethics Committee has decided to

- Grant ethical clearance for the proposed research.
- Provisionally grant ethical clearance for the proposed research
- Recommend revision and resubmission of the ethical clearance documents

Sincerely,

A handwritten signature in black ink, appearing to read "Mdu Ndlovu".


Prof Mdu Ndlovu
Chair: FACULTY OF EDUCATION RESEARCH ETHICS COMMITTEE
4 February 2020

Appendix B: Permission from the TVET college

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 type="checkbox"/>
2	Application approved subject to certain conditions. <i>Specify conditions below</i>	<input checked="" type="checkbox"/>
	1. Compliance with any Covid-19 rules in force at the time.	
3	Application not approved. <i>Provide reasons for non-approval below</i>	<input type="checkbox"/>
NAME OF COLLEGE		College of Cape Town
NAME AND SURNAME OF HEAD OF COLLEGE		Louis van Niekerk
SIGNATURE		pp. 
DATE		7 April 2020

Appendix C: Letter of permission to participants

Email: affectionate.ubisi@gmail.com
Cell: 072 84 123 86

Unit 505 Pinedale flat
Main road
PLUMSTEAD
7800

Dear Participant

CONSENT TO TAKE PART IN A RESEARCH STUDY

I am currently enrolled at the University of Johannesburg as a postgraduate masters' student in the Faculty of Education. I am doing a research study in fulfilment of my qualification study in **M Ed: ICT in Education (coursework & minor dissertation)**.

Please read the following before giving consent:

The title of my research study is:

An investigation into the integration of Information and Communications Technology (ICT) at a Technical and Vocational Education and Training (TVET) College in the Western Cape

The purpose of the study:

This research is aimed at exploring ICT integration in order to identify the factors that promote, or hinder, ICT integration as well as the extent of ICT integration in the teaching and learning process through an analysis of personal experiences of lecturers at a TVET college in the Western Cape, South Africa.

This study's objectives are to:

- Identify the factors that influence effective ICT integration in the teaching and learning in TVET colleges.
- Determine the extent to which lecturers in TVET colleges effectively integrate ICT into the teaching and learning process.
- Identify the most effective (preferred) ICTs by TVET lecturers.
- Make recommendations on the effective integration of ICT in the teaching and learning process.

Possible benefits:

It may provide TVET lecturers with new philosophical and realistic perspectives underscored by the integration of technology into the teaching and learning process that may result in a shift in the use of technology.

Learn best practice on integrating ICT in the teaching and learning process.

Share best practice in the integration of ICT in the teaching and learning process.

The following ethical considerations will be observed and implemented by the researcher:

- Informed consent, in writing, will be obtained from the participants.
- I will inform participants what the purpose of the research study is, and the participants must indicate that they participate willingly.
- Participants will not be placed under duress during the research study.
- Informed consent by participants will be a prerequisite in data collection of this study and this includes the assurance of confidentiality and anonymity of the institution and participants and will not be compromised during the research process.
- I will explain that participants may withdraw at any time without any penalty and that I will remove their data.
- I intend to focus on the research in question and will not interfere in any manner that may jeopardise the integrity of the data and study.
- I intend to communicate the purpose, nature, and future use of findings to participants prior to the commencement of data collection.

I trust that this information will enable you to make an informed decision with regard to my request.

Thanking you in advance,
Ubisi, R. A. (Ms)

Appendix D: Interview questions for semi-structured interviews with participants

Thank you for allowing me to interview you today. My questions will focus on your own development of becoming confident with the use of ICT and the decisions that you make when you integrate technology in the teaching and learning process. I will record the interview for accuracy. This interview will be kept confidential.

Section A

1. Which subject(s) do you currently teach?
2. How long have you been teaching?
3. Do you have industry experience?
4. Which ICT (tools or technologies) do you use for teaching and learning?

Section B

5. What motivates you to integrate ICTs in your teaching and learning process?
6. Do you think that integrating ICTs in teaching and learning is effective and beneficial?
How?
7. When you plan a new lesson, do you design teaching and learning activities that require technology?
8. Do you experience any limitations when integrating ICT in the teaching and learning process?
9. Have you undertaken professional development in how to integrate ICT into lessons?
10. Describe the type of ICT support that your institution offers for lecturers.
11. Is there anything else that has not been discussed in this interview that you feel is relevant? Do you have any recommendations to the college and lecturers regarding ICT integration?

Appendix E: Interview with participant 4

Researcher: read the objectives of the study and thanked Participant 4: for availing himself for the interview.

Which subjects do you currently teach?

Participant 4: I'm teaching **Mathematical Literacy**

Commented [AU1]: Teaches Mathematical Literacy

Researcher: Which faculty are you based?

Participant 4: **Fundamental**

Commented [AU2]: Based In Fundamentals Department

Researcher: And then, the subjects you teach now is that what you studied at university?

Participant 4: No because I did **statistics and mathematics**. So, we are now **forced** to teach **Maths Lit**. So, Maths Lit has become something for this new generation. So, we are forced to convert to Maths Lit.

Commented [AU3]: Specialised In Statistics & Math In University

Researcher: How long have you been teaching?

Participant 4: **Teaching Maths Lit is 6 years** this year but I've been teaching for more than **20 years** mathematics but teaching Maths Lit is **6 years** at the college.

Commented [AU4]: Been teaching Math Lit for 6 years

Commented [AU5]: Taught pure math for 20 years

Commented [AU6]: Been working for the college for about 6 years

Researcher: and then, do you have industry experience?

Participant 4: Yes, I **have industry experience** but not in the subject I'm teaching. I will say I did my attachments in the **hospital** and with the electoral commission.

Commented [AU7]: Has Industry Experience: worked for a hospital

Researcher: What did you do?

Participant 4: Basically, in the hospital I was working in the **data department**. So we do **data analysis, data capturing, data collection and data analysis** with regards to this numerical data. **How many patients have been admitted, how many patients discharged**. So we take (calculate) **how many death mortality all those thing** and we do the analysis and provide management with the stats.

Commented [AU8]: Hospital data department

Commented [AU9]: Did data collection, data capturing and data analysis

Commented [AU10]: Part of his responsibilities

Researcher: And then, do some of these things that you used to do in industry, do you find that it helps in your teaching and learning?

Participant 4: **Yes, it helps** in the teaching because in a **Maths Literacy** we are **doing data analysis**. We have a **subtopic called data analysis**. So, we do all this a, **data analysis, the interpretation of the data, the data representations through graphs**. So, we do all those things. I would say **it's got some relationship or some link**.

Commented [AU11]: Industry experience helps with subject content

Commented [AU12]: Content relationship to what he did in his previous job

Commented [AU13]: There is some link b/in the subject content and his previous job

Researcher: And then, which ICT tools or technologies do you use for teaching and learning?

Participant 4: Actually, the tool that we have currently in our classes is a **smartboard** and besides that we use, a **laptop**. I have a laptop that I use.

Commented [AU14]: Smartboard

Commented [AU15]: Also uses a laptop

Researcher: Is it a personal laptop or did you get it from the college?

Participant 4: I **got one from the college**, but I **haven't started using it**. But over the years I've **been using my own personal laptop**.

Commented [AU16]: Recently gone a laptop from the college but haven't used it yet

Commented [AU17]: Before that he used his own laptop

Researcher: So how do you use the smartboard in your class?

Participant 4: The smartboard. Actually, if I can say about a smartboard, **we are using it like a board, where we write electronically, do our teaching electronically on the smartboard**. Not to use it as a

Commented [AU18]: They use a smartboard like a normal board

teaching tool, uh we are using it like a blackboard. There are other software that we also use. For instance, if I'm teaching something like shapes, I'm just giving an example. If I'm teaching something like shapes, so when you go to the software, you have Ms Word, Excel, Access. You have all those shapes under it. You have rectangular,square which you can also use to teach the students instead of drawing it on the board. And the software is also connected to the internet, so some of the information, we just go to YouTube and just play it for the students to just listen. So actually we are integrating partially or passively ICT into our learning.

Commented [AU19]: He uses the smartboard to write & teach

Commented [AU20]: Uses the smartboard like a blackboard

Commented [AU21]: Makes use of other software

Commented [AU22]: Use Word, Excel to teach shapes

Commented [AU23]: Uses shapes from Word/ Excel instead of drawing them on the board

Commented [AU24]: Software/ smartboard has internet

Commented [AU25]: Accesses some of the info from YouTube & plays it for students

Commented [AU26]: Perceives the ICT integration to be partial

Researcher: So, looking at the smartboard, do you have internet on the smartboard?

Participant 4: Yes, we are fully connected into the internet.

Commented [AU27]: Smartboard has internet access

Researcher: And then, so when you use a smartboard, what are the software you mostly use when you teach on the day to day basis?

Participant 4: We have the projector (meaning a "Visualiser Software" on the smartboard) to project the visuals. So sometimes if you have a note on a hardcopy, if the students don't have you can use a smartboard to project it. There is a software that does that. Then on the direct whiteboard itself, it has also got other software incorporated into the board which you can also use to teach the students.

Commented [AU28]: Can use a Visualizer to project notes on the screen

Commented [AU29]: The smartboard also has other software

Researcher: Ok, so what are the ones you use on a normal basis?

Participant 4: Normally, that's what I've earlier on mentioned. If I'm teaching for instance graph, we have the grid, there is no need for you to be drawing using a ruler just to be drawing a graph so you can use a the tools in the.. I don't know whether it's in the Ms Excel or Ms Word, but it's integrated in the whiteboard where you can recall it from either Ms Word or Ms Excel. You just draw a graph, draw a simple graph to show how a graph is drawn and use it to show how a graph is drawn. Basically, that is how I use it. I use it for showing shapes and graphs.

Commented [AU30]: Uses a smartboard for drawing shapes & graphs

Researcher: and do you have like another special software especially for the subject you are teaching?

Participant 4: You mean a special software also installed on the interactive whiteboard? We have eBooks then apart from the eBooks I don't think, there is the normal Microsoft that we have. For the other software then we have to go to the internet, online

Commented [AU31]: Have eBooks

Commented [AU32]: Have Ms office

Commented [AU33]: Accesses additional software from the internet

Researcher: What are eBooks?

Participant 4: The eBooks, the electronic books. The students have their own textbooks but we have the electronic copies it. Where now there is no need for me as a teacher if I want to refer to something from the textbook, I go to the online, the eBook and just show it to them if there is a certain example I want to show to the students.

Commented [AU34]: eBooks = electronic textbooks

Commented [AU35]: project eBooks on the IWB while students use textbooks

Researcher: Ok. And then, so videos. How do you use the videos?

Participant 4: The videos, I use the YouTube, since it's connected. So, if I want some, if I find some interesting lesson somewhere related to the topic I want to teach as an introductory lesson. I do play the video for them to just listen (meaning watch) just to catch the attention of my classes.

Commented [AU36]: accesses videos from YouTube

Commented [AU37]: uses YouTube videos as an intro to catch the attention of the students

Researcher: Ok. And then, do you also use like other platforms like WhatsApp or Moodle?

Participant 4: We use other platform, we use WhatsApp, I have created a WhatsApp group for my students. Where I send them materials through the WhatsApp, previous question papers and sometimes we also use it for interaction. So, I give them question, they work it out at home, they put it on the WhatsApp group then we all contributing. Both the teacher and the student, we all contribute. If a child having problem they put it on the WhatsApp group, and we all contribute (meaning help the child solve the problem). And then also, I also created a content material which I've put on Moodle for students to assess, so we are using the Moodle and WhatsApp. And also but not frequently which is the Google doc but there's a bit of challenge there so I'm not. I tried it once and it couldn't work so..

Commented [AU38]: Has a WhatsApp group for his students

Commented [AU39]: Sends Materials, QP & for Interaction

Commented [AU40]: Do activities & post answers on WhatsApp

Commented [AU41]: Students can be assisted through WhatsApp

Commented [AU42]: Uploaded content on Moodle

Commented [AU43]: Uses Moodle & WhatsApp

Commented [AU44]: Tried Google doc but experienced challenges

Researcher: Ok. So, what motivates you to integrate ICT in your teaching and learning?

Participant 4: What motivate me, you know we are in the world where the world is now changing now. We are moving towards different era. The world is now revolving around technology. In the marketplace, unlike our time where there wasn't technology, the use of computer but now with this 4IR we are talking about, now everything is going digital. So, what motivate me is that I know my students are leaving here going outside the workplace and these are some of the requirements that there must be at least exposed to technology. So that is one of the things that motivate me to integrate technology. And also, as a teacher, I must also be abreast with times to know what is currently happening to keep up with the pace at which technology is evolving. So, it's also motivating me to do self-learning and so on and so forth. Also integrating it in my lesson.

Commented [AU45]: The world is now changing

Commented [AU46]: Moving towards a different era

Commented [AU47]: The world is now revolving around technology

Commented [AU48]: Now all is going digital

Commented [AU49]: Students are going to the workplace

Commented [AU50]: Students must be exposed to ICT

Commented [AU51]: Stay abreast the dev of ICT

Commented [AU52]: To do self-learning

Commented [AU53]: Integrate ICT in the lesson

Researcher: Do you think that integrating ICTs in teaching and learning is effective and beneficial?

Participant 4: Yes, I believe integrating ICT into teaching and learning is beneficial because when you.. Let me put it this way, when you look at the theories of education. I believe in constructivism theory. So, the constructivism theory, they believe in knowledge production not knowledge processing. They believe that a child learns through discovery for a child to produce knowledge, they must learn through self-discovery. So how do we discover using technology? So as technology give the child that independence to collaborate and to interact with other people. And to develop his creative thinking but learning with this method is not all the time one on one, someone will feed the child. So, if I give a child work to do, go in the net and research, so it helps the child to develop his cognitive skill. And not only the cognitive skill a child, remember in education we are talking about the three

Commented [AU54]: Child can collaborate & interact using technology

Commented [AU55]: Develops creative thinking

Commented [AU56]: Research on the net help develop the child's cognitive skills

domains. The cognitive domain, psychomotor domain and affective domain. The cognitive domain deals with the development of the brain. The psychomotive domain develop with your manipulative skills, how you use your hand to do this on your own. And the affective domain deals with the heart, the passion, the enthusiasm that the child has. So, integrating technology, it gives that child the opportunity to actively involve

in the teaching and learning process. So, when the child is actively involved in the teaching and learning process, it gives them that child that joy to become creative and that is all what the world is about today, creativity. So, I would say it's beneficial. It's beneficial also in the sense that it also enables our students to also interact and collaborate. It's no longer one person where..teacher centered teacher centered. Now teaching and learning is no longer centered, is no longer learner centered. It is learning centred. Where the teacher meet the student also halfway. We all work together to achieve what we want to achieve. So, I would say it's beneficial to integrate technology in our teaching and learning.

Commented [AU57]: Integrating ICT affords active involvement of the child

Commented [AU58]: Active involvement results in creativity

Commented [AU59]: ICT enables collaboration & interaction

Commented [AU60]: Teaching & learning becomes learning centered

Researcher: Ok. Still on the benefits, you as a lecturer, do you find that it benefits you in doing your job as a lecturer?

Participant 4: Yes. That's what I've mentioned earlier on about the creativity.

You see, it also make my work also easy for me. Because sometimes it's not enough time. It's not enough for you to teach students based on the limited, specified time you are given in a class. So using technology, if you are using WhatsApp if you put extra questions on the WhatsApp group for the children to do it at home and they share it with each other, so at the end of the day, you will use the that as a tool to assess if the students assimilated what you've taught in the classroom. Unlike before where you only depended on the classroom time to mark and all those things. So it's beneficial to me. Also when it comes to my lesson planning and all those things. Those days will be using pen and paper to write lesson plans. Now I have my electronic lesson place. Normally I just modify it. It makes life very easy easier for me.

Commented [AU61]: Makes work easy

Commented [AU62]: Uses WhatsApp for extra activities to assess if students assimilated what was taught in class

Commented [AU63]: Can do electronic lesson plans

Researcher: Ok. What factors influence the integration of ICT in teaching and learning process?

Participant 4: Yeah, the teaching and learning process, the factors, one I would say time. Time is a major factor because is a traditional teaching, we are given time to teach now we are integrating ICTs so it means it will require extra time. So, if that extra time is not there, it means it's gonna be a problem. The implementation is gonna be a problem. Then also, we talk about the technical know-how. The technical know-how, you see ICT has come to stay and we those, we who had our education some years ago, we never went through this ICT. Now we have to teach, we have to integrate ICT into... So, one, we need a time to go study it. We need a time to practice it of which the limited time have and other things it's all becoming a problem. So thus, I've talked about time. Then also the software, some of the software are not easy. They are not easy to learn and to use. They are very complicated. Then we also talk about the facility itself, if it is not there, how do you use it. If it is not there, you can't use it. And also talk about connectivity, it's also another major problem. The cost, sometimes you ask, you want to. You have that interest to integrate technology into almost all your lessons but the access to internet, accessibility, access to internet. The part of now, the school with the teachers, will say now we have access but the children, they don't have access because they don't have enough, we don't have computers in the classroom where when we are teaching, the kids will be by the computer, fully connected to the internet. So, connectivity also another problem. Then yeah, that's it.

Commented [AU64]: Time

Commented [AU65]: Integrating ICT will require extra time

Commented [AU66]: Lack of extra time can cause challenges in implementation of ICT

Commented [AU67]: Technical know how

Commented [AU68]: Require time to learn ICT

Commented [AU69]: Need time to practice ICT

Commented [AU70]: Some software not easy to learn & use

Commented [AU71]: Lack of facilities/ resources

Commented [AU72]: Connectivity is a challenge

Commented [AU73]: Even if interested in integrating ICT but without internet...

Commented [AU74]: Teachers may have access but the students lack access to computers

Researcher: So, you mentioned connectivity and stuff. So, if you send things to your students to do research are they, what is the return rate? Are they able meet all your demands?

Participant 4: Unfortunately, the subject I'm teaching. We don't give practical work where the students have to go and research and do parts. From my observation from the other discipline where they are given, they do it but they do struggle. So, as I'm talking to you now, they are doing their practical test now and one of the major challenge is, the tools to use. So, you see as a result of that they are not attending classes for the other discipline. They are in the resource centre and that limited resources, computer, so you see students are crowding in the computer lab. Not enough computer to accommodate all of them. So, they end up not attending classes for the whole week. For the whole week they don't attend classes. So, it's a major challenge. That's from my observation from other discipline where they are doing practical work using the computer.

Commented [AU75]: Doesn't give ICT based assessments

Commented [AU76]: There's a challenge of tools to use for assessments

Commented [AU77]: Students end up skipping classes

Commented [AU78]: There are limited computers in the resource centre

Commented [AU79]: Students crowd in the computer labs

Commented [AU80]: Insufficient PCs to accommodate all the students

Commented [AU81]: Results in students skipping classes for the whole week

Commented [AU82]: Participant's observation from other disciplines where students are doing practical assessments using computers

Researcher: Umm, so this also continues from that question. Do you experience any limitations when integrating ICT in the teaching and learning process? This could be problems based on you or the students or the college as a whole.

Participant 4: Yeah, let me first talk about myself. There is a problem, one I'm talking about the software. The use of the software, maybe I may discover for instance, during the lockdown I have to learn about how to use the cadet, uh the kahoot and all those things. It took a whole lot of time for me to, I will not say fully understood it how to use the tool, that is one thing. Now coming to the college part, it's the support, if the support is not enough, yeah the college is giving support but the support is not enough because the college had it on policy in terms of implementation of ICT into, so they don't go beyond that boundary. So, if you as a teacher want to go beyond it, then it means that the additional cost or the extra cost you incurred which most are just not willing to do that. So the college have provided the Moodle for us to use, so if you're not comfortable to use it, it means that you are obliged to use their software which there are other educational technological resources to use. So, the college part is the policy. If the college also have that interest in integrating technology,

Commented [AU83]: Software

Commented [AU84]: Takes time to learn software

Commented [AU85]: The college does give support but sometimes it's not enough

Commented [AU86]: If a teacher requires additional support i.e. extra cost

Commented [AU87]: College offers Moodle

Commented [AU88]: Policy

If the college also have that interest in integrating technology, then integrating technology is fine but glad that the college has embraced the use of technology. So once in a while they train us how to use Moodle and other programmes like the Camtasia, Ask Archie, you know they are the interactive resources, and some are just content resources. Moodle is just a content resource, where you put material for students to just download and just read. So, I believe some of the resources that are interactive resources that the college asked students to register would be like the Ask Archie. It's an interactive resource but the question is data. Is the college ready to provide data to all students? And the other thing is the community will also be a factor. So, in the community, where there is no WIFI, there is no access, the community are not enlightened about the importance of ICT in this current generation. Then the community where the children are coming from will also be a factor. So, it's also a big problem.

Commented [AU89]: The college has embraced the use of technology

Commented [AU90]: College trains them on intervals

Commented [AU91]: They get trained on Moodle, Ask Archie, Camtasia & other programmes

Commented [AU92]: Classification of the programmes: Interactive v/s content resources

Commented [AU93]: Views Moodle as just a content resource platform

Commented [AU94]: SAMR Model level- Substitution

Commented [AU95]: Views Ask Archie as an interactive resource platform

Commented [AU96]: SAMR model level -Augmentation

Commented [AU97]: The challenge with accessing these platform is data

Commented [AU98]: WIFI access is a challenge in the community

Commented [AU99]: Community not aware of the importance of ICT integration

Commented [AU100]: The community where the students come from is a factor

Researcher: Umm, do you have WIFI on campus?

Participant 4: Yes, we do have WIFI. We had WIFI since the beginning of the year, Cell C. We have WIFI now. So that's some of the steps that the college is taking to embrace the era.

Commented [AU101]: The campus has WIFI

Commented [AU102]: Steps taken to embrace the era=WIFI

Researcher: Umm, about the WIFI, is there any issues or is it working fine for the students?

Participant 4: The WIFI is working but the only problem with the WIFI is just fluctuating. You connect, after five minutes you have to reconnect. It means you with your phone, you have to remind yourself my WIFI is off my WIFI is off, that's the problem. But besides that, it's working.

Commented [AU103]: The WIFI is unstable

Commented [AU104]: WIFI require reconnection every few minutes

Researcher: And then when you plan a new lesson do you design teaching and learning activities that require technology?

Participant 4: Yes, I so. I do, every time I plan a new lesson, I think it depends on the topic. It depends on the topic and the time available. For example, I've given an example already. The use of the WhatsApp, so if I have extra work to give to the students I do communicate through WhatsApp, giving them extra work. So, to also face (expose/ give) students with the question rather than always spoon feeding them. So, I do.

Commented [AU105]: Gives extra work on WhatsApp

Researcher: So, have you undertaken professional development in how to integrate ICT?

Participant 4: Yes. The college. I will not say professional development that is self-learning. So that is not for, to build my professional career but not officially. I have to do self-learning on the internet. So as I've mentioned, I have to learn how to use, even how to create even Google sites, how to use the internet to create content material, interactive material how to use the Google doc on the Google drive to also create content material and interactive material. So, I will say, it's coming back to, it's coming back to my professional development. Not necessarily going through formal ICT integration teaching and learning.

Commented [AU106]: Has done self-learning

Commented [AU107]: Did self-learning on the internet

Commented [AU108]: Learned how to create Google Sites; Interactive content material; Google doc

Commented [AU109]: Not formal training

Researcher: And then the college, do they provide any training in terms of ICT?

Participant 4: Yeah, we have an ICT technical person who always once in a while take us through some of the use of software like the Moodle, Camtasia. That's what I.. I mention Moodle and Camtasia because that's what we have. And even now we are using even a software to mark our register. So, we were taken through all those things. So, I will say the college is providing us with that support.

Commented [AU110]: ICT training facilitator trains them on Moodle, Camtasia at intervals

Commented [AU111]: Uses a software to mark the attendance register

Commented [AU112]: SAMR Model level - Substitution

Commented [AU113]: They get support from the college

Researcher: Is it effective?

Participant 4: yeah. It is effective because we are using it, so I will say it is effective. Without support, I wouldn't know in the first place how to use a smartboard. How to use the iEnabler to mark my register, to capture my marks. So, it is effective because I'm using it.

Commented [AU114]: Perceive the college support to be effective

Commented [AU115]: Knows how to use iEnabler to take attendance register and to record marks

Commented [AU116]: Uses iEnabler

Researcher: Do you think the college has a clear sense of direction in terms of ICT use?

Participant 4: Yes. As I alluded earlier on. If they have no sense of direction in

ICT, they wouldn't in the first place implement it. So with the implementation, providing laptops, providing smartboard, providing the software, subscribing to some of the software because you pay for it and they are paying for it and giving training to teachers on how to use it. It means that they are embracing it. They have that sense of direction in this technology, in this new 4IR.

Commented [AU117]: Perceives the college to have a clear sense of direction in terms of ICT use

Commented [AU118]: The college provides laptops, smartboards, software, subscriptions to softwares

Commented [AU119]: The college pays for software subscriptions & in training lecturers on how to use it

Commented [AU120]: The college is embracing the 4IR

Researcher: And then yeah, do you have anything else that you wanna mention?

Participant 4: In terms of, in line with ICT. I have said all.

Researcher: And then, any recommendations? In terms of going forward.

Participant 4: I would recommend that for effective implementation of ICT/ the integration of ICT into the teaching and learning. First the focus should be on the lecturers. Their professional development, their developing a skill in terms of ICT because you ca not ask someone to integrate ICT into his teaching, without even...that doesn't even know how to operate with a simple Ms Word or so Inservice training. Technical software. Then come to the part of the student, the student must also provide students with the tools. If I say programme, there is a programme, so they are acquiring the skill of how to operate the basics. The students are doing it in their ODP and the other LO Life skills. But the challenge there is the hardware and the connectivity. Both at school and at home.

Commented [AU121]: Focus on lecturers

Commented [AU122]: Professionally develop lecturers

Commented [AU123]: Their development of ICT skills

Commented [AU124]: Have In service training

Commented [AU125]: Provide tools for students

Commented [AU126]: Students learn computer literacy in ODP & LO

Commented [AU127]: The challenge is hardware & connectivity on campus & at home