The Integration of Information and Communication Technologies in Technical and Vocational Education and Training: Towards a New Pedagogy in Vocational Education.

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Declaration

I declare that this research report is my own unaided work. It is submitted for the degree of Masters of Education at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination to any other University.

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Abstract

Technical and Vocational Education and Training (TVET) Colleges are an avenue that allows individuals to take control of their lives. Within the context of South Africa, they aim to support social and economic development, create national wealth, and eradicate poverty. According to the Department of Basic Education (DBE), TVET institutions play a fundamental role in developing knowledgeable and highly skilled citizens, who will be able to contribute effectively to the social, political, and economic development of our country. As a result of that it could be noted that:

> "The demand for TVET and other forms of education and learning are changing. Educational systems are not independent of the rest of the society. When society changes, the educational system also changes" (Varis, 2011, p.3).

Therefore, it is imperative for programs that are offered in TVET Colleges to provide students with relevant, real-world working skills that are required by both the public and private job sectors. This is because the socio-economic growth of our country relies heavily on the development and maintenance of a viable, responsive, and effective TVET sector.

Consequently, the TVET College system that our students are in also needs to be transformed. This transformation will ensure that TVET Colleges can equip students with the necessary knowledge and skills that will allow them to compete with their counterparts in the workplace on both a national and global scale.

One of the key skills that students are required to have in this current technology based world is the ability to use technology. The building of confidence and competence in terms of technology usage should ideally begin in the education system, afore students enter or get absorbed into their respective careers/ industries. Specifically, within the context of Vocational Education, where students are required to be able to use various forms of technology/ technologies that are associated with their respective trades. Essentially this is important to note because technologies, and particularly digital technologies and media are not only shaping our social, educational,

and cultural contexts, but they are also transforming approaches, and environments for learning (Loveless, 2011).

If the impact of the TVET sector is to be felt and for the TVET sector to increase, new ways of developing and delivering courses must be explored. TVET must be taken outside of the classroom and into the communities, the workplaces, and homes of the students. Traditional ways of thinking about TVET must be put aside and different ways of packaging and delivering knowledge and skills must be developed. This is particularly, critical in meeting the skill demands of countries with depressed economies and in countries where people are separated by water (as in islands states) by terrain or by distance.

This study was designed and conducted using the qualitative approach to unearth a new vocational pedagogy. Through conducting this research, the researcher wanted to formulate an understanding of whether lecturers in TVET Colleges are ready to integrate ICTs into their existing pedagogical practices.

For this study, two TVET Colleges in Johannesburg within the Ekurhuleni region were purposively sampled to take part in the study. Convenient /Judgmental sampling methods were utilized to select these five Automotive Repair and Maintenance lecturers, as well as their students, in NC (V) stream. These lecturers formed the sample that was utilized to conduct this study.

Findings from this study revealed that there is indeed “slowness” when it comes to ICT integration in the TVET system. In addition to that, the findings also revealed that the TVET sector is plagued by various hindrances and challenges when it comes to ICT integration. These challenges include: the absence of a detailed ICT integration policy and framework for the TVET sector (which should stipulate how ICT integration should take place in the TVET space), limited access to technology and other forms of infrastructure, and lecturers not being equipped with all the necessary skills and knowledge that would make ICT integration possible. In addition to that, the researcher noted that Lecturers were attempting to integrate technologies into their pedagogical practices. However, this was very surface-level integration, which is mainly evident in the practical classroom (during workshop sessions), and not necessarily

in the theory classroom. Whilst the lack of a detailed ICT integration policy and framework and access to appropriate modern-day technologies are amongst some of the other key challenges that contribute to this slowness in integration in the TVET sector.

Consequently, the researcher proposes a new pedagogy that integrates and encourages the usage of technology deemed as; Smart Technology/ Technologies in Vocational Education. This integration is in reference to TVET Colleges on a general level and specifically, within a subject in the National Certificate Vocational NC (V) programme known as Automotive Repair and Maintenance. Smart Technology is a synonym and a slight paradigm shift from general ICTs. It is advancement in terms of vocabulary that can be further utilized as a synonym for the term ICT. However, it also encapsulates all forms of ICTs, technologies and specialized tools and technology/ technologies that can be used in various subjects offered in the TVET curriculum.

Furthermore, the researcher also advocates for intervention strategies such as: the procurement of modern digital technologies, tools and other forms of equipment in the TVET sector and making them available in TVET institutions, enhancing lecturer's knowledge and skills through training and upskilling programmes like the Advanced Diploma in TVT which will be offered at the University of the Witwatersrand in 2021.

Keywords

Technical Vocational Education and Training, Automotive Repair and Maintenance, Information Communication Technology/ Technologies, Smart Technology, readiness, integration, and pedagogy.

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Key Abbreviations and Definitions Used in the Study

ANC	African National Congress
CAI	Computer-Assisted Instruction
CBI	Computer-Based Instruction
CBT	Competency-Based Training
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
ICTs	Information Communication Technologies
LMS	Learning Management Systems.
MOOC	Massive Open Online Courses
NATED	National Accredited Technical Education
NC (V)	National Certificate Vocational
NQF	National Qualification Framework
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
PSET	Post School Education and Training
SETA	Sector Education and Training Authority
TCK	Technological Content Knowledge
TK	Technological Knowledge
TPACK	Technological Pedagogical and Content Knowledge
TPACK	Technological Pedagogical Content Knowledge
TPK	Technological Pedagogical Knowledge
TRI	Technology Readiness index
TVET Colleges	Technical Vocational Education and Training Colleges
UK	United Kingdom
UNESCO	United Nations Educational Scientific and Cultural Organization
VE	Vocational Education

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CHAPTER 1: ORIENTATION OF THE STUDY

1.1. Background of the Study

Technical and Vocational Education and Training (TVET) Colleges as they are broadly known in South Africa play a fundamental role in developing knowledgeable and highly skilled citizens that will be able to contribute effectively to the social and economic development of our country (DHET, 2013).

Furthermore, TVET Colleges play a very significant role in mediating, acting as a bridge between the knowledge and skill base learners leave secondary school with, and the knowledge, skill base that they will be required to have when they enter the 'world of work. Therefore, it is imperative for the programs that are offered in TVET Colleges to provide authentic, real-world working skills that are required by both the public and private job sectors nationally and globally.

Despite significant growth in TVET Colleges, it has been noted that TVET Colleges still enroll fewer students when juxtaposed to Universities. Which is a challenge, as this is not ideal for the development of a mid-skilled, educated workforce. Nor is it adequate to meet the needs of an economy, which has an undeniable shortage of individuals that have mid-level technical, vocational skills (DHET, 2013).

Currently, one of the DHET's key mandates and top priorities when it comes to TVET is: to strengthen and expand TVET Colleges, so that they can become attractive institutions for students who wish to exit the Basic Education system and for students who want to pursue vocational education. This expansion would ideally see about 2.5 million students being registered within the South African TVET College system by 2030. The process of strengthening TVET Colleges would include the process of improving the management and governance of all TVET Colleges, increasing TVET College responsiveness to the local labour market (this could be achieved through consolidating partnerships between TVET Colleges and potential employers), improving student support services, developing the infrastructure in TVET Colleges and most importantly through improving the quality of teaching and learning that takes place in TVET Colleges (DHET, 2014).

The quality and efficacy of TVET education relies on various factors. These factors include teaching and learning that occurs in the classroom (this is in reference to infrastructure) which is inclusive of workshops and laboratories (Makgato,2019). In addition to this, it also relies on another factor that amalgamates all the factors mentioned above into one, and that factor is essentially known as pedagogy. Pedagogy is of utmost importance in the process of transformation in TVET because, it is important for lecturers, to have a sound understanding of the various the teaching and learning methods that would work best for this particular context in education (Makgato, 2019).

We live in an intensely globalized world and because of that, the economy in which we function in, is highly competitive as well. Consequently, the schooling system that our students are in also needs to be transformed. This transformation would ensure that this system can equip students with all the necessary knowledge, skills that will enable them to be part of the workforce, and the economy. ICT competence is one of the key skills that are required in this new economy.

Within the TVET College system, various stakeholders play a central role in the running and maintenance of the infrastructural, financial and academic domains of TVET Colleges. Amongst all these stakeholders there are lecturers. Lecturers are one of the key stakeholders that play a central role in the development, delivery, and execution of the various educational activities that occur in TVET institutions.

In order to guarantee that the TVET College system is fully functioning. The stakeholders within this sector of education need to ensure that its system employs lecturers who are competent and appropriately qualified. This will ensure that lecturers are able to perform this central task, of educating and equipping students in TVET Colleges with the various and relevant conceptual, as well as theoretical knowledge bases. This would also ensure that students are equipped with the essential knowledge and skills they need when they exit the TVET College system, and enter into various occupations, trades and industries.

In addition to that, it is essential for the lecturers who work in TVET Colleges to have both an understanding and expertise in both the academic (theoretical) and the work-related (practical) dimensions of the TVET system. This is because these dimensions of TVET are crucial if the institutions that offer TVET programs are to make the

valuable, critical contributions that they are expected to make, to enable our country to grow.

Furthermore, it is essential for lecturers who work in TVET Colleges to have what are deemed as “21st-century skills”. These are categorized as skills such as: The ability to learn new key issues quickly, the ability to use modern-day technology within the workplace, to have what are deemed as “ICT skills” these can either be at a basic or advanced level. These 21st-century skills are not only essential for lecturers only. But, they are also critical for their students as well, because foundationally these skills “increase employability and mobility in graduates” (UNESCO, 2011, p.1).

With the move towards the fourth industrial revolution, which is also known as the (4IR) and with the need for more ICT based education models; more digital technologies are being introduced into education. This is because “digital technologies radically transform the structure of organizations' employment models including teaching and learning” (Makgato, 2019, p.8). Furthermore, Makgato (2016) also states that the digital revolution is increasing demand for designing and manufacturing are driving the growth of the creative sector, which extends from Arts to Science and Technology and involves cultural creativity and innovation (Makgato, 2019).

Most lecturers who work within the TVET College system have academic (theoretical) knowledge as well as work-related, which is also known as “industry-based knowledge.” But, now with the increased use and integration of technology in our education system, the ability to integrate technology is slowly becoming a prerequisite skill that lecturers need to have to enable them to function and teach students in the TVET space effectively since, “ICT literacy and numeracy are vital for TVET” (Varis, 2011, p.6). With that being said, it now raises a question that is essential for us to think about and that question is: how prepared are TVET College lecturers in integrating ICTs into their teaching or existing pedagogies?

This question is pertinent because institutions that fall under Post Education and Training system such as: Universities and TVET Colleges are slowly adapting the use and applications of various Information and Communication Technologies (ICTs) in their institutions and in their teaching practices, in the endeavor to keep up with current trends and also to accommodate their digitally-savvy students. However, it seems as if lecturers are not always able to keep up with the demands that come with the

introduction, usage and integration of all these various technologies. Especially, when it comes to their pedagogies.

The only policy document that has been drafted which relates to technology integration that mostly speaks to ICT integration in South Africa, within the context of education is the White paper on E-education, which was drafted by the Department of Basic Education in 2004 (DBE, 2004). This document outlines four central themes that govern the emerging implementation of ICTs in the sphere of education. These themes are equity access, capacity building, access to ICT infrastructure and norms and standards. One of the key themes that were mentioned in that document that foreground this study is, Capacity building. The capacity building theme focuses on the need for programmes that instantly address some of the key competencies that lecturers should have, with regards to the use of technology for personal work and their respective classrooms, and in their pedagogical practices" (Cross & Adam, 2007, p.11). However, it is important to note that this document only outlines ICT integration and use in the context of Basic Education.

In this regard, the policy urges the Department of Education (DoE) and Provincial Education Departments to collaborate with institutions of higher learning to design and deliver in-service and pre-service training programs in the field. To cater for these technological advancements that are occurring in the world on a general level, within the workplace, and within the education system. When we talk about technology integration and improving the pedagogical practices that are currently occurring in our TVET Colleges, it is becoming crucial for in-service educators and lecturers to be upskilled through the provision of training programs, and qualifications that will assist them to develop the necessary technological and pedagogical skills required in order for them to be able to integrate ICTs into their pedagogical practices.

However, before the researcher discusses ICT integration and lecturer's pedagogical practices, it will be imperative to provide a short historical account of the background of TVET institutions. As this will help us to establish an understanding of how these institutions functioned historically. As the researcher firmly believes that this will also paint a picture, which will enable us to understand why TVET Colleges are operating in the manner in which they currently are functioning. However, this is discussed in more detail in the literature review of this study.

There is also a strong assertion with regards to Vocational Education, and that assertion is related to one of the most crucial elements that need to be considered in and that is pedagogy. The assertion lies in the fact TVET Colleges cannot deliver their content in the same manner as traditional academic programs because “unlike in general education the way of teaching and learning in Vocational Education and Training (VET) is centered on practical tasks and activities to catch students' interest, attention and motivation" (Makgato, 2019, p.4). Therefore, it can be further postulated, “vocational learning is both cognitive and practical” (Makgato, 2019, p.4). Thus, it can also be proposed that the pedagogy in TVET or Vocational Education is or should be varied. This would assist with achieving the varied occupational outcomes within the dual outcome structure of vocational education, which therefore implies that Vocational Education requires two types of expertise knowledge from teachers/lecturers. “The first type of expertise knowledge is work experience and the second pedagogic/ pedagogical knowledge” (Makgato, 2019, p.4).

The TVET sector in South Africa offers two qualifications. One of the qualifications that are mainly offered in TVET Colleges is known as: the NC (V), which is an acronym that stands for National Certificate Vocational. This program is aimed at Grade 9 learners who have decided that they want to pursue Vocational Education (VE). The foundational base of this program aims to offer students with solid knowledge, skills, and learning that will assist to build the foundational knowledge base that prepares students for vocational work.

Additionally, this program is also geared towards allowing students to access expert knowledge, attitudes, and values that will encourage, enforce lifelong learning and enable training. Furthermore, the NC (V) provides students with the option to access other forms of higher education (for example Universities of Technology) to pursue self-employment or employment opportunities within the world of work. The academic aspect of education in TVET Colleges is comprised of a combination of theory and practice. This is a vital feature that distinguishes education that is offered in TVET Colleges and sets it apart from other programs that are offered in conventional high schools, and traditional tertiary institutions.

NC (V) was introduced in 2007. The introduction of the NC (V) occurred in stages, following the: National Qualifications Framework (NQF) levels. This process saw NQF

level 2 (which is equivalent to Grade 10) being introduced in 2007, NQF level 3 (which is equivalent to Grade 11) being introduced in 2008 and NQF 4 (which is equivalent to Grade 12) being introduced in 2009.

Moreover, this program also overarches as a qualification that also allows students to enter into other higher institutions of learning, like Universities of Technology. Provided that students have the right subject combinations and meet the minimum entry requirements, as set by the various institutions of higher learning. In addition to that, it is important to note that, the NC (V) is inclusive of extensive practical components, based in workshops, rather than actual workplaces (DHET, 2014).

In addition to that, TVET Colleges also offer what are also called: NATED programmes (which qualify the students for an N6 Diploma). NATED programmes these are (commonly known as N-programmes). These programs were specifically designed for industry. These programmes require students to spend 18 months doing theoretical studies at Colleges, and another 18 months doing relevant practical application in workplaces. Engineering studies in the NATED programmes range from N1 – N6 whilst Business Studies range from N4 – N6 (DHET, 2014).

1.2. Significance of the Study

Technology integration, what is also called ICT integration in education is currently a prevalent trend that is being employed in various countries around the world. As a result of this, numerous studies have been conducted concerning technology use/integration. However, a majority of these studies are often restricted to the primary and high school setting in both the world at large and specifically in South Africa.

The general emphasis in the bulk of these research studies that have been conducted on ICT integration in Education in the past always seems to be on those specific phases of education. As a result of that there seems to be less focus on Post School Education/ Higher Education in relation to ICT integration. Particularly, within the context of the TVET College space and that, is essentially what inspired the research that was conducted by the researcher.

It appears that ICT/ technology integration has not received sufficient attention in Higher Education. The use of basic ICTs has not been prioritized because the main goals and principles of the Higher Education Policy framework, do not place much

emphasis on the use of technology in institutions of higher learning, especially within the TVET sector at both systemic and institutional levels (Cross & Adam, 2007).

This statement is very true, particularly within the context of the TVET College sector. That is essentially what inspired the researcher to conduct a study of this nature. Through the process of conceptualizing this study, the researcher was stirred by the realization of the fact that there is a limited amount of literature that is written, with regards to how lecturers (in TVET Colleges) integrate or are integrating ICTs into their pedagogical practices. This is in particular reference to the South African context. In addition to that, the researcher also wanted to illustrate the extent of this lack of research and literature on technology integration in TVET Colleges. Moreover, the researcher sought to investigate how lecturers are currently integrating ICTs into their current pedagogical practices.

There is limited research on an acceptable and agreed 'vocational pedagogy' in TVET. Most of the research conducted in TVET is mainly focused on TVET on a systematic level. That research mainly focuses on issues such as skills needed/shortages and qualification/curriculum enhancement/ development in TVET (UNESCO & UNEVOC, 2014).

This study was categorically geared towards helping the researcher to identify the key challenges and gaps that exist within the TVET sector when it comes to ICT integration. This was done in the endeavor to inform the New Technical Vocational qualification that will be offered at the University of the Witwatersrand in 2021, which is the Advanced Diploma in Technical and Vocational Teaching (TVT). In addition to that, this study also sought to provide possible recommendations that could be utilized to assist enhance the ICT integration process in institutions of higher learning, and particularly within TVET Colleges.

Furthermore, this study was also geared towards finding gaps that exist with the process of technology integration. Specifically, with regards to ICTs in the endeavor to inform the curriculum (for the methodology and pedagogical aspect) of Automotive Repair and Maintenance as a subject that is taught in TVET Colleges, and also as a course that will be offered in the Advanced Diploma (TVT) in 2021.

Automotive Repair and Maintenance is a subject that falls under the category or programme is known as the Engineering and Related Design (ERD) programme. This subject is offered in conjunction with other subjects such as Engineering Graphics and Design, which is also known as (EGD), Fitting and Turning as well as Metalwork. Automotive is offered from NQF level 2 to NQF level 4 (DoE, 2007).

The predominant long-term goal with this subject is: to equip students with all the necessary knowledge, skills that they will need to be able to execute tasks and meet requirements as set by industries, the workplaces that they want to pursue once they are done with their studies.

In addition to that, Automotive Repair and Maintenance enables students to be more self-reliant and marketable. Automotive Repair and Maintenance is offered as a full-year module that is comprised of 200 hours of learning and teaching, which consist of both theoretical as well as practical components (DoE, 2007).

Krasilchik as cited in Simão, Lima, Heck, Coelho, Bilessimo and Silva (2016) state that practical activities are of the utmost importance

> "Because laboratory work motivates learning, leading to the development of technical skills and, especially, helping to consolidate the knowledge about physical phenomena. Practical activities are known for being an effective method in the teaching-learning process, providing research situations and increasing the interest of the student for training and the acquisition of knowledge" (Simão, Lima, Heck, Coelho, Bilessimo, & Silva, 2016, p.176).
>
> They also note that "the reality of laboratory education has been deeply changed by the Information and Communication Technologies, and even hands-on labs are many times mediated by computers and other devices. Tools such as simulations, virtual reality, and remote laboratories have been used to make classes more interactive. Furthermore, the use of new technologies lessens the costs associated with classroom and laboratory space" (Simão et al., 2016, p.176).

1.3. Rationale for the Study

This study was motivated by the need to gain insight into how ICTs are being used in the teaching of Automotive Repair and Maintenance in TVET Colleges. Additionally,

the researcher wanted to establish how the use or integration of ICTs affects the pedagogical practices that lecturers at TVET Colleges, take on in their Automotive Repair and Maintenance classrooms, when they utilize/ integrate these ICTs in their lessons.

Furthermore, this study also attempted to unearth some of the key issues and challenges that lecturers face as they embark on the process of integrating ICTs, into Automotive Repair and Maintenance classrooms in TVET Colleges. Since, the use of ICTs is changing every sphere of our lives including the political, economic and academic sphere. The researcher had a hunch that education should be at the heart of this change particularly, TVET Colleges. Since, they are supposed to equip millions of youths with both theoretical and practical knowledge and skills, which they will need when they enter industry in either the public or private labour markets.

Competence in the use of ICTs is increasingly becoming a prerequisite skill that all students are required to have when they enter the world of work. However, this skill can only be acquired through exposure, through interacting and working with ICTs. If students are expected to be able to use ICTs at work, they should acquire the foundational skills and the knowledge base that they will need within the TVET space prior to entering the industry. Most importantly, beyond just being enhancements to the skill and knowledge sets that students have or should have. ICTs play a fundamental role in improving the quality of teaching and learning that takes in TVET Colleges (DHET, 2014).

In the new vocational qualification that Wits intends to offer to TVET College lecturers, in 2021. One of the key competencies that this qualification will aim to cultivate and equip lecturers with is- the ability to use and incorporate various Technologies into their teaching practices. A lecturer's ability to fully and effectively integrate ICTs into their pedagogical practices is underpinned by so many underlying factors, that need to be carefully thought of such as a lecturer's personal beliefs about how they perceive the process of ICT integration in their teaching, their current technological competencies and access to ICTs, just to name a few.

1.4. Problem Statement

The world is forever evolving, and progressively becoming more information and technology based. This is mainly driven by the introduction, integration, and infiltration of ICTs into all spheres of our daily lives. Since, TVET Colleges play a major role in the process of developing the knowledge and skill base that South African students require to be able to function and find employment in both public and private labour markets. Essentially, in an ideal world, all these competencies that students need to enter the labour market would be cultivated in them whilst, they are still in the TVET sector.

Lecturers are key stakeholders who are in charge of developing, initiating and executing all the academic activities that take place in the TVET College system. Moreover, Makgato (2019) also states “There is a need for academically and professionally qualified lecturers at TVET Colleges. This implies that lecturers should possess appropriate pedagogical knowledge, vocational/occupational knowledge, content knowledge, and industrial experience” (Makgato, 2019, p.5). Therefore, it becomes evident that lecturers in TVET Colleges must begin the journey towards integrating various ICTs such: as virtual learning, virtual learning environments (which are also known as VLE’s, Smart boards, and simulations (just to name a few) into their pedagogical practices.

Furthermore, Makgato (2019) also states that it is important to consider pedagogy because “The quality and effectiveness of all education systems, largely depends on the quality of teaching and learning that takes place in classrooms, workshops, laboratories and other spaces in which education takes place. Good teaching and learning, active engagements of students, well-designed courses and resources are necessary for the excellent provision of education” (Makgato, 2019, p.3).

There also seems to be what is considered as “slowness” to adapting when it comes to ICTs in TVET Colleges in South Africa and in other African countries. Hayes as cited in Saud (2011) states that teacher's “slowness to adopt technology reflects their effort to discern how best to incorporate new technologies into their old teaching practices” (Saud, 2011, p.6).

TVET Colleges are all-inclusive institutions, that refer to the comprehensive term referring to those aspects of the educational study of technologies and related sciences, that lead to the acquisition of practical skills, attitudes, understanding, and knowledge, relating to occupations in various sectors of the economic and social life of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of the economic and social spheres of life (Saud, 2011).

Saud (2011) also posits that the use of ICTs in the training, upgrading, and re-training of workers is of paramount significance, and it is an essential aspect of teaching's cultural toolkit in the twenty-first century, because it affords new and transformative models of development in education (Saud, 2011).

Essentially, the integration of ICTs in TVET Colleges remains a huge challenge. Bearing in mind the impact that ICTs can have in the world and within our current labour market. Which is a market that requires a skilled and knowledgeable workforce that can use information technologies.

What has been stated above, therefore, implies that: TVET Colleges need to take action steps that will assist them to further, thoroughly, organize and strengthen their commitment towards training and producing "technologically capable/savvy" graduates. This will ensure that the TVET sector can assist students to live up to the demands and possible technological challenges that they might encounter in their workplaces, as they enter this new modern, technology-driven job market. Which might be made up of various virtual workplaces.

One of the biggest factors that contributed to the formulation of this study was a pattern that was noted by Makgato (2019) based on findings from (UNESCO & UNEVOC, 2014) which states that: Most of the research that is conducted in or about TVET tends to be focused on systematic issues and deals with them on a systemic level. Hence, the research is in most instances focused on looking at aspects like skills needed and qualification/curriculum development, which feed into vocational pedagogy (or a specific pedagogy that is to be used in TVET).

However, the core of this research is not focused on developing the TVET teaching model. Rather, it is based on suggesting action steps that can be used and adapted to create a new pedagogy that is lead and influenced by ICTs in TVET Colleges, and

to establish whether lecturers that work in TVET Colleges are ready to fully integrate ICTs into their pedagogical practices and to provide feasible recommendations that could be used to assist with the integration process in TVET. Based on that it becomes evident that there is a need to generate a well-grounded and useful theoretical underpinning for vocational pedagogy, that will provide a structure in which vocational teachers can use to develop quality, effective teaching and learning in their various programmes (Makgato, 2019).

The establishment of a vocational pedagogy is imperative Moghamsi (2016) as cited in Makgato (2019) states that pedagogy contributes to what is deemed as the learning equation. The learning equation “it is what teachers know, do and they care about which is very powerful in [the] learning equation” (Makgato, 2019, p.2).

This learning equation is governed by what is deemed as the principal of teaching and learning. Which states that: by doing and making, lecturers and teachers enable learners and students, to know how to apply knowledge in various contexts, including workplaces Makgato (2019).

Overall, this study endeavored to assist the researcher to be able to:

- Gain an understanding of how lecturers in TVET Colleges view the use of ICTs in the Automotive Repair and Maintenance subject.
- To recognize and provide thick descriptions, of the various factors that influence how lecturers integrate ICTs into their Automotive Repair and Maintenance pedagogical practices.
- To assist the researcher to gain in-depth insight into how lectures that teach Automotive Repair and Maintenance, are integrating ICTs into their current pedagogical practices.
- Generate an understanding of lecturer's understanding of the concept of ICT integration.
- To provide the researcher with an understanding of how TVET College lecturers feel about the prospect of getting upskilled, through the new vocational program and qualification that will be offered at the University of the Witwatersrand in 2021.

Ultimately, the researcher utilized the findings from this research study to help to identify the technological skill gaps that lecturers (who teach Automotive Repair

Maintenance) have in the current TVET system. These gaps were used to create recommendations, which could be considered when designing the new Vocational Education program that will be offered at the University of the Witwatersrand in 2021.

1.5. Main Research Question

The main research question that this study will answer is phrased as follows:

How ready are TVET College lecturers from Ekurhuleni in integrating ICTs into their pedagogical practices, in Automotive Repair and Maintenance classrooms?

1.5.1. Sub Research Questions

1. What types of ICTs do lecturers have access to in their respective TVET Colleges? (This is in relation to the theory and practical classrooms).
2. What are lecturers' understanding of the various roles that ICTs have or play in the TVET College system? Particularly, in the teaching of Automotive Repair and Maintenance classroom.
3. How are lecturers in TVET Colleges currently blending ICTs into their pedagogical practices when teaching Automotive Repair and Maintenance?
4. What factors influence the pedagogical practices that lecturers take on when they integrate ICTs into their Automotive Repair and Maintenance lessons?

1.6. Conclusion

This chapter of the study strived to provide a synopsis of the key aspects that are the focal points of this study. This was mainly accomplished through providing the background, significance, the rationale, problem statement, main research and sub-questions that were all utilized to conceptualize this study.

CHAPTER 2: LITERATURE REVIEW & CONCEPTUAL FRAMEWORK

2.1. Introduction

In the previous chapter, the researcher provided a brief outline of the research study that was conducted. The outline was utilized to set the context for most of the foundational elements of the research study that the researcher needed to be cognizant of in the journey of conducting this study. Foundationally, this chapter will endeavor to provide a detailed expose of two other central elements that constituted this study. Those two elements are the literature review and the theoretical/conceptual framework of this study.

The literature review is a central chapter in any piece of research. The core purpose of this chapter is to highlight, to shed some light on some of the core conceptual knowledge that builds the foundation of a study, to identify some of the issues, key debates as well as the knowledge that is enclosed in this study. This was accomplished through engaging with various existing pieces of research, which were related to the researcher's research topic. In addition to that, this chapter also endeavored to provide insight into the theoretical and conceptual framework that was utilized for this study, which was fundamentally the backbone of this study.

According to Winchester and Salji (2016), a literature review is an evidence-based comprehensive analysis, a critical appraisal, of a collective of a body of academic/ conceptual knowledge on a subject, or topic that a researcher seeks to research. The following are the common characteristics of a literature review: Firstly, a literature review should endeavor to be enlightening. Secondly, it should also be a personal, but unprejudiced synopsis of an existing body of information related to the researcher's study. Thirdly, it should seek to provide an amalgamation of views and findings that agree and support a researcher's findings.

This amalgamation should be a consolidated set of information from various sources. Most importantly, a literature review should help the researcher to identify inconsistencies/contradictions. As well as crucial gaps that exist within the knowledge within contemporary literature that has been published, that is related to a researchers' subject or research topic.

2.2. Post School Education, Training, and the Role That TVET Colleges Play within South Africa's Education System

Throughout the years, the Post School Education and Training (PSET) system in South Africa has progressed in a sturdy, exponential manner. This progression has made it possible for clear distinctions to be made, in terms of the various roles that are played by the several institutions that fall under this system.

The PSET system in the context of South Africa is defined: as a schooling system that encompasses all education, and training that is provided to people who have either completed school or on the journey to doing so. Post School Education institutions cater to an extensive and varied target market. With the scale spanning from people who have a matric certificate or an equivalent. In addition to that, they also cater to those who did not complete school and for those who have never attended school (DHET, 2013).

This is how the PSET system is structured. There are two main systems or umbrella bodies of institutions, which are currently utilized to categorize Post School Education and Training in South Africa. With the first category/system being the University system and with the second system being the College system. TVET Colleges categorically fall under the College system. Historically, they were known as FET Colleges. Colleges can be further classified either as being: Public, Private Colleges or Community Colleges.

Principally, the TVET College system is a gateway route that students can take, if they want to obtain a qualification and acquire skills that they will require if they want to get into specific trades or occupations. With that being said, it also is very important to note that TVET Colleges do not only cater to learners who leave the traditional high school or Basic Education system after Grade 9. They also cater for learners who have matriculated, who would like to acquire skills and knowledge that will enable them to get into an occupation or a trade of their choice.

Moreover, TVET Colleges are also recognized as institutions that are an alternative avenue that students can utilize if they want to access what is a vocational equivalent of high school education, and eventually tertiary education. Like all institutions of Higher Education, TVET Colleges are regulated by the DHET.

The qualifications that students obtain from TVET Colleges grant them the prospect of entering into various occupations within the job market. However, this is only limited to the scope of jobs that do not necessarily require formal university-level education. But, that requires a certain level of practical technical skills. These are not just any kind of skills. These are special skills that are called; specialized technical skills that can only be provided by the TVET system, through TVET Colleges. Besides offering skills, TVET Colleges are also an excellent alternative for people who are viewed as being not necessarily "academically inclined" but who are good with executing practical skill sets.

Furthermore, TVET Colleges provide training for a variety of careers ranging from: Engineering, where they offer students an opportunity to study: Electrical Engineering, Motor Mechanics/Automotive Repair and Maintenance, Industrial and Mechanical Engineering. Students can also study in other areas such as Tourism and Hospitality, Agriculture, Office Administration, Management, Marketing, Information Technology, Computer Sciences, Primary Health care, Transport, and Logistics just to mention a few careers that the TVET college system caters for.[1]

Moreover, TVET Colleges are also responsible for preparing and equipping students with mid-technical skills that they will need if they want to become Artisans. Artisans are the workforce that is inclusive of Motor Mechanics, Electricians, Mining specialists and Repair people - just a list of a few occupations. However, it is also very important to be mindful of the fact that the mid-technical skilled occupations are not only limited to the list provided above. The list provided simply indicates some of the mid-technical occupations that are currently high in demand in South Africa. [2]

However, in as much as we have TVET Colleges, it is also vital for us to be cognizant of the fact that not everybody qualifies to get to the TVET system. Many people might ask the question of how? Nevertheless, the answer to this is quite simple because, we live in a country, society whereby not everybody either has access or has ever accessed school or formal education. This is often due to financial constraints, or

[1] (https://www.news24.com/You/Archive/everything-you-need-to-know-about-sas-tvet-colleges-20170728-2)

[2] https://www.news24.com/You/Archive/everything-you-need-to-know-about-sas-tvet-colleges-20170728-2)

because they do not have or meet the minimum academic requirements that are required to have to get into the TVET College system.

The minimum requirements that students need to meet to gain admission in the TVET College system is that: they need to be at least 15 years old. The learner should have completed Grade 9. This is mainly because education in the Basic Education system, compulsory schooling ends at age 15 or upon the completion of Grade 9, depending on which event occurs first (South African Schools Act, No 84 of 1996). In addition to that, students who wish to enter into a TVET College need to ensure that- they choose the appropriate subject combinations, which will gain them admission into the trades they want to specialize in, within their studies.

Figure 1 below dissects and illustrates how Post School Education and training in South Africa, in the form of a hierarchy. It starts by showing that the Department of Higher Education as the mother body that houses all the institutions that are within the Post School Education and training in South Africa in the institutions are represented by the fourth row in the figure. Furthermore, the functions of each of the institutions briefly (and created from the White Paper on Post School Education). This illustration was created by the researcher to serve as a physical representation to illustrate how Post School Education and training is structured in the context of South Africa.

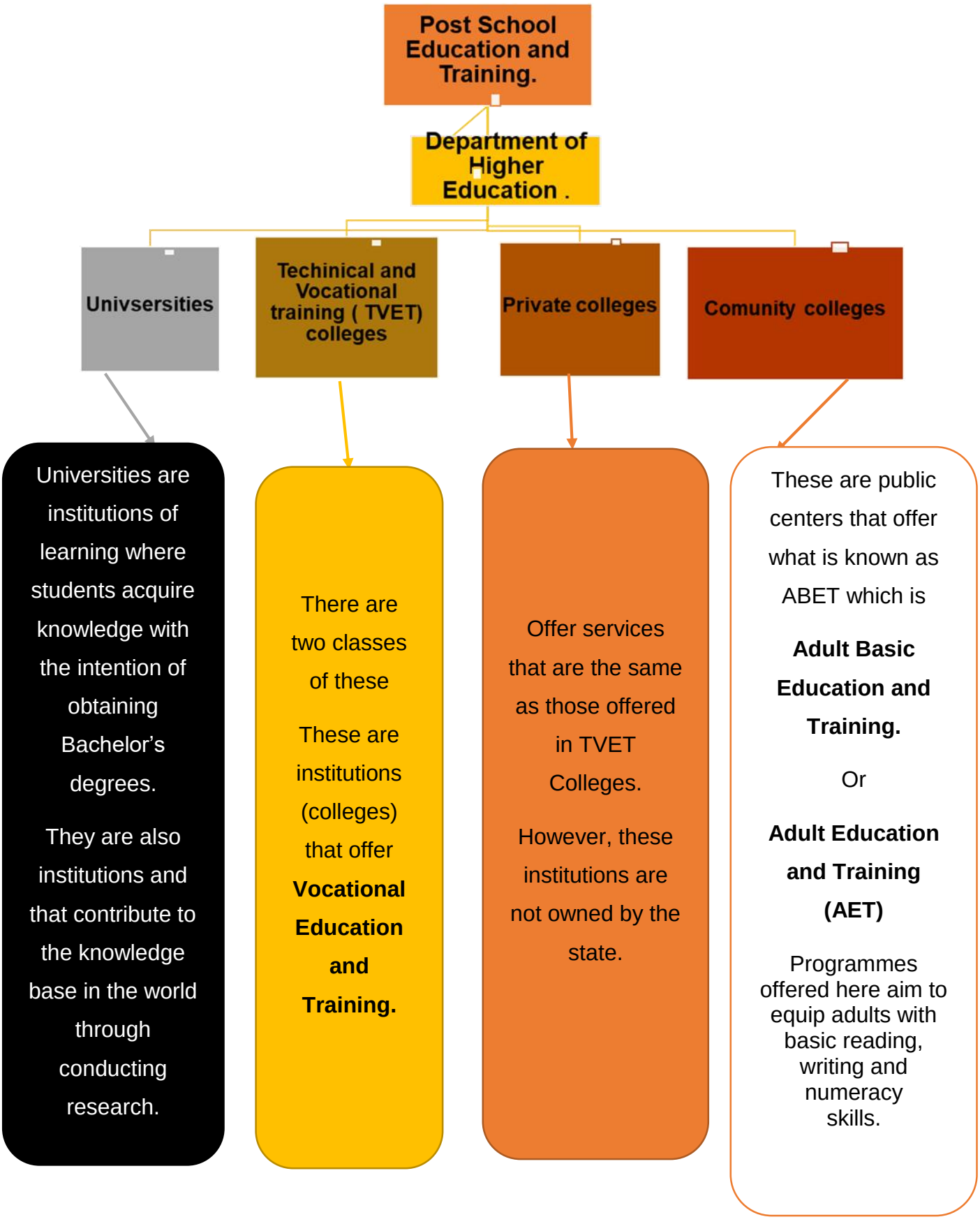
Post School Education and Training.
Department of Higher Education .
Univsersities
Techinical and Vocational training (TVET) colleges
Private colleges
Comunity colleges
Universities are institutions of learning where students acquire knowledge with the intention of obtaining Bachelor's degrees.
They are also institutions and that contribute to the knowledge base in the world through conducting research.
There are two classes of these
These are institutions (colleges) that offer Vocational Education and Training.
Offer services that are the same as those offered in TVET Colleges.
However, these institutions are not owned by the state.
These are public centers that offer what is known as ABET which is
Adult Basic Education and Training.
Or
Adult Education and Training (AET)
Programmes offered here aim to equip adults with basic reading, writing and numeracy skills.

FIGURE 1: POST SCHOOL EDUCATION AND TRAINING IN SOUTH AFRICA

2.3. What is Technical Vocational Education and what are its Functions?

Before getting into a detailed discussion about what happens in the TVET system. The researcher thought that it would be vital and befitting to dissect the entire concept of TVET education. This was done to assist the researcher to formulate a comprehensive understanding of TVET education in terms of its aims, structure and the role that it plays in the education system, in our society, and within the broader South African context.

Numerous terms are used in various parts of the world to denote what we call Technical Vocational Education and Training in the South African context. Terms such as Vocational Education (VE), Vocational Technical Education (VTE), Technical Education (TE) and Technical Vocational Education (TVE) are all synonymous terms. However, regardless of the difference in the placing of the words, it is important to note that all these terms are synonymous terms that are utilized to refer to Vocational Education. For this paper, it is important to note that the researcher chose to utilize the term TVET and Vocational Education (VE) interchangeably.

According to Roberts (1965) as cited in Ikpe (2010) Vocational Education is “An aspect of education that is designed to assist students to develop skills, attitudes, work habits, aspirations, encompass knowledge and information needed by workers to enter and make progress in employment on a useful and productive basis. He further describes Vocational Education, as being an integral part of a total education programme that contributes towards the development of good citizens by developing their physical, social, civic, cultural and economic competencies” (Ikpe, 2010, p.27).

The main objective of Vocational Education is to prepare youth and adults for useful occupations. Which are particularly aligned to what we also call skilled trades and semi-professional careers. Institutions that offer Vocational Education may also assist with updating workers' or students’ knowledge and skills base. This is mainly for those who are in-service who are already functioning in these occupations that require these specialized technical skills with more skills and knowledge. Vocational Education predominantly offers “in-service” workers with new knowledge they can use to enrich their existing knowledge base (Ikpe, 2010). This process is known as upskilling. Upskilling is defined as the process of assisting people who already have particular

skill sets to update their current skills so that they can meet the changing job market so that they can remain relevant in their field or trade.

Furthermore, the UNESCO document of 1974 posits that:

Vocational Education is used as a comprehensive term referring to those aspects of the educational process involving accumulation to general education, the study of Technologies and related Sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. Technical and Vocational Education is a phase of general education, which is a means of preparing individuals for an occupational field or an aspect of continuing education. TVET offers instruction in a wide range of trades and occupations to enable students to fit into the world of work (UNESCO, 1974).

According to the Department of Higher Education and Training in South Africa, Technical Vocational Education and Training refers to the 'middle level' provision of knowledge and skills. This level of education assists people to enter the economy through a general broad orientation in vocational areas, as well as through general learning in essential areas such: as language and mathematics (DHET, 2012).

Descy and Tessaring (2000) further define Vocational Education and Training (VET)

> "As all forms of organized or structured activities, which aim to provide people with knowledge, skills, and competencies that are necessary and sufficient for them to perform a job or a set of jobs. It is independent of the venue, age, or other characteristics of the participants and their previous level of qualification. The content that is taught in VET can be job-specific or directed at a broader range of jobs or occupations." (Descy & Tessaring, 2000, p.3).

Additionally, Clark and Winch (2007) propose that the aim of Vocation Education is restricted to training and educating young people for working life. They cite that it is a process that is regarded as being more technical and practical in nature when contrasted to other forms of education. In addition to being just a form of education, this sector is also more concerned with individual development, fulfilment, and civic education. Which is more concerned with preparing students to become citizens that will be active participants in the economy.

For the greater society VE is seen as a means of producing a more productive force (Clarke & Winch, 2012). Likewise, as cited in Terblanche (2017) Clarke and Winch (2012) also describe “VE and training as social development of labour, nurturing, advancing and reproducing particular qualities in labour to improve the productive capacity of society” (Clarke & Winch, 2012, p.3). A “successful TVET system has to provide diversified programme offerings that promote the knowledge, skills, attitudes and values required by South Africans as individuals, citizens, as lifelong learners and as economically productive members of society. Such a system should provide the vital intermediate for all higher-level skills and competencies the country needs to chart its course in the globally competitive world of the 21st century" (Terblanche, 2017, p.3).

When contrasted to normal traditional classifications or streams of education. Vocational Education has two main orientations to teaching and delivering content knowledge. That is essentially what makes vocational institutions different from Basic Education and other traditional institutions of Higher Education, like Universities. Perhaps, this is the main reason behind why TVET Colleges are deemed being institutions that offer students specialized technical knowledge that has dual purpose (Makgato, 2019).

Vocational knowledge unlike school or academic knowledge is the knowledge that always endeavours to point students to major directions. With these directions being firstly the direction, that points students towards the more academic disciplines of knowledge. Then the second direction being: the knowledge base that students encounter, which points them to the skills dimension. That is why the workplace is such an integral component of vocational knowledge and eventually of vocational education (DoE, 2007).

These forms of knowledge are essential for two reasons. Firstly, the disciplinary (academic) component of knowledge is meant to arm students with knowledge that will enable them to grow beyond their specific immediate workplace or occupation. Secondly, workplace knowledge is a component of knowledge that seeks to equip students with broad occupational skills that they will need when they eventually start working in the workplace. The ultimate goal with these forms of knowledge is to lead students to dual qualifications (DoE, 2007).

Therefore, it becomes evident that Vocational Education has two main functions. The first function is to equip students with the skill and knowledge base that will enable them to become highly competent and technically skilled practitioners, who can execute their jobs well, with little to no difficulty. Secondly, Vocational Education is also tasked with the job of equipping its students with theoretical knowledge.
This form of knowledge (theoretical knowledge) is essential for students because it assists students to be able to understand the various seasons of change. Particularly, during this season of technological change and innovation that is happening within the economy. Moreover, this type of knowledge will encourage learners to become active participants, who are not just participants but also key contributors within this modern, technology and knowledge-based economy (DoE, 2007).

Initially, when Vocational Education was introduced, the disciplinary knowledge that was offered within its curriculum was based primarily on two subjects, which were: Mathematics and Physical Science. These were subjects that typically channeled students into Engineering or Engineering related careers. But, with time Vocational Education evolved and broadened, to the extent where it now includes other sciences of knowledge such as the: Biological, Human and Social Sciences which branch out into administration, Marketing, Finance and Tourism sectors of both education and work (DoE, 2007).

2.4. An Overview of the Historical Foundations of Technical Vocational Education and Training in South Africa

In a general sense VE is considered to be a form of education that has been around forever, for as long as mankind has been around it is seen to be as old as mankind (Gregoire, 1967). Moll, Steinberg, and Broekmann (2005) state that for us to understand the South African TVET college system, we need to draw distinctions between two forms of Vocational Education that are offered in South Africa and those are general post-school VET and occupationally directed VET.

The key distinction between the two is that: General post-school Vocational Education and Training (VET) is vocational education, which takes place in what are formally known as FET Colleges or training institutions (which are now known as TVET Colleges). The programs that are offered in these institutions intend to equip young school leavers with specialized vocational knowledge and skills. Whilst General post-

school VET programs are based on set national curricula and offer general vocational skills and knowledge. While occupationally directed VET is aimed more directly at adults and employed workers in the workplace, and generally falls outside of the nationally stipulated curriculum (Terblanche, 2007).

Whilst occupationally directed VET is another subdivision of Vocational Education that is also offered in South Africa, occupationally directed VET takes place in the workplace or is directed more at adult learners (Terblanche, 2007).

With that in mind, it is vital to note that the main aim of this portion of this discussion is to set the context (historically) for this paper. So, that we can formulate a comprehensive understanding of the historical roots/ foundations of Vocational Education within the South African context. This knowledge is vital if we want to understand how Vocational Education functions in South Africa. Furthermore, it will paint a picture that will help us to understand why Vocational Education is structured in the manner in which it is, currently in South Africa. This is a daunting task because there is so much to be said about the foundational roots of the TVET system in South Africa. However, the researcher will not get into great detail about the historical foundations of our TVET college system. The main aim of this portion of the literature review, is to provide a synopsis that will attempt to build a contextual understanding of our TVET College system.

Foundationally, Vocational Education has its roots in various countries around the world such as: France, America, Germany, England, Australia and the United Kingdom (UK). One major key contributing factor that led to the high demand for Technical Vocational Education in South Africa is linked to the industrial developments, which transpired in South Africa during the late 1800s. During this time, there was a lot of activity surrounding the mining industry. Similarly, there was also a lot of activity surrounding the development of railways, harbours, and small engineering workshops. This meant that there was an increase in the demand for skilled people in urban areas, who would be able to meet these demands. To meet these demands, a branch of education known as Technical Education was fashioned (Terblanche, 2017).
Technical and Vocational Education and Training was a sub-division of education that was a type of education, which was orientated and had foundational pedigrees that were related to manufacturing and industrial pursuits. Historically, it was associated

with working-class white people. But with time it was considered to be a form of education that was extremely appropriate for black people. As this type of education would provide the industry with the labour force that was needed to meet their demands.

With time it became an integral part of the Bantu Education system. Which was a system of education that was created with the intent to equip black students, with skills basic literacy, numeracy, and agriculture. This would, in turn, would train black students, who would then become a part of the semi-skilled labour force, which would work either in the manufacturing industry or the agricultural sector. The Manufacturing sector was said to require semi-skilled workers, with basic literacy and numeracy, while the agricultural and mining sectors relied heavily on manual labour (Terblanche, 2017).

The rise in the demand for Vocational Education in South Africa started at the cusp of what was known as; The industrial revolution This is a movement that was ushered by the discovery of diamonds in the 1800s. During this time, there was an increase in railway activity, mining, and construction. Consequently, there was a higher demand for a labour force that would be able to meet this demand. This type of labour force that had to be created needed to be one that would be able to meet the increased demand for these specialized, technical skills. Education was one of the chief systems that were utilized to assist equip the potential labour force, with all the necessary skills and knowledge that they would require to fulfill this mandate. That is essentially what laid the foundation for Technical Vocational Education and Training in South Africa (Terblanche, 2017).

In 1926 The Association of Technical Colleges was established, to assist in the process of establishing TVET Colleges in South Africa. When Technical Vocational Education and Training was introduced in South Africa it focused on three aims, Vocational Education acted firstly as a firm foundation for practical knowledge. Secondly, as a form of compensatory education, with a hands-on aim and approach. Finally, as a form of industrial education that focused on the imparting of skill in some form of handcraft, to instill the values of discipline, obedience, regular work habits and professionalism in students (Terblanche, 2017).

After the first democratic elections in 1994, the African National Congress (ANC), which was the ruling party at the time, drafted numerous policies that were aimed at addressing the numerous political, educational, social and economic challenges that were faced by the country. With that came the formulation of a framework for education and training, which was known as the White Paper 4 on Education, and Training in 1998. That paper gave birth to a movement known as apprenticeships. Apprenticeship programs were hosted in various provinces. They were mostly operational in Durban, Salt River in the Cape, in the Witwatersrand and Johannesburg.

This move led to Vocational Education being a system of workplace apprenticeships. Whereby students were placed in actual workspaces to learn the knowledge and skills of their trade. The main emphasis in the traditional apprenticeship program was on getting the apprentice (the student) to master their trade or occupation whilst on-the-job. This mastery was not gained through formal learning in the classroom, but by "learning-through-doing" in the workplace.

However, when technology began to change in the early 20th century. The state realized that learning on-the-job was becoming inadequate. That saw the apprenticeship route of Vocational Education being transformed, to a more formal theory-based curriculum. This new curriculum placed more emphasis placed on the Sciences, and the development of knowledge with little or no application of the knowledge in the workplace. That subsequently led to the end of apprenticeships in Vocational Education in South Africa.

In 1998, The Skills Development Act no 97 of 1998 was introduced in South Africa and that substituted apprenticeships with learnerships. A learnership was an amalgamation of standard-based structured learning and practical work experience that lead to the obtainment of a qualification. Additionally,

> "Learnerships extended the old apprenticeship system into new areas, and with approval of the relevant SETA (Sector Education and Training Authority). The practical work experience component of the learnership could be obtained at one or more workplaces. The learnership was a contract signed between the employer, learner/ student and registered training provider. The training provider specified the unit standards to be achieved by the learner at a certain level of the NQF (National Qualification Framework) and set out the times at

which the structured learning component would be provided" (Moll et al., 2005, pp.18-19).

The introduction of Learnerships led to the introduction of National Accredited Technical Education (NATED) N1 to N6 courses. The majority of these Nated courses provided students with foundational knowledge that would allow them to specialize in a specific trade. These courses were offered in what were known as Technikons and FET Colleges. The courses that were offered in these institutions consisted of theory subjects such as electrical, mechanical and civil engineering, business studies and general study programs (Terblanche, 2017).

The NATED program was offered for a few years and within that period it faced various challenges, which eventually led to the DHET to formulate and introduce a new Vocational Education program in South Africa. The new Vocational program that was introduced is the current program that is being offered in TVET Colleges. This program is known as the National Certificate Vocational NC (V) program. This programme offers courses from NQF (National Quality Framework) levels 2-4. These programs are offered for various careers such as Engineering, Hospitality, Tourism, Business, Information Technology (IT) and Computer Sciences, and Safety in society. The main objective of these qualifications is to: enhance employment and self-employment and to enable students to gain access to Higher Education (Terblanche, 2017).

2.5. The Role that TVET Colleges Play in the South African Education System

TVET Colleges play a pivotal role in the development of a knowledgeable and highly skilled population that will be able to efficiently, contribute to the social and economic development and growth of South Africa. Therefore, TVET Colleges must ensure that they offer quality educational programs that will provide and equip their students with what are deemed as; real world working skills that are required by both the public and private job sectors (DHET, 2013).

This is mainly because secondary education cannot equip students with all the necessary knowledge, and skills that students are required to have when they enter the job market. This is mainly because secondary education simply does not have space, nor does it have the capacity to offer students an education that will guarantee

them employment (UNSECO, 2011). Therefore, equipping students with key skills and knowledge that they will need to become more employable, becomes one of the core responsibilities of the TVET sector of education.

In addition to that, it is important to note that not all students who complete high school are eligible to enter into universities – this is due to various reasons. With the demand for tertiary education being on the rise in South Africa, that is basically where TVET Colleges come in. TVET Colleges have over the years, become the solitary and ultimate way to respond to the growing demands for a workforce that has the relevant, theoretical and specifically practical knowledge base (UNESCO, 2011). According to the: United Nations Educational, Scientific and Cultural Organization (UNESCO) TVET "Colleges play a very imperative role in terms of helping to assist students to transition from school to the world of work" (UNESCO, 2011, p.1). That is essentially an important aspect of transitioning that secondary schools and traditional universities battle to mitigate in the kind of education that is offered at these institutions.

Four main goals are outlined by UNSECO that are associated with TVET Colleges. The first goal "is to empower individuals, promote employment, decent work and lifelong learning. Secondly, to promote inclusive and sustainable economic growth. Thirdly to promote social equity. Lastly, to promote environmental sustainability" (UNESCO, 2011, p.5). The TVET sector provides learning spaces that enable students "to acquire the practical skills, the know-how and understanding necessary for employment in a particular occupation, trade or group of occupations or trades." (Obadara & Adenaike, 2009, p.160).

Obadara & Adenaike (2009) also posit that TVET education is used as an all-inclusive term referring to those aspects of the educational process that involve the addition to general education. Likewise, they also cite that the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding, and knowledge relating to various occupations in the various sectors of economic and social life (Obadara &Adenaike, 2009).

Furthermore, they also state that the TVET College education system is first, an integral part of general education. Secondly, they also mention that TVET Colleges serve as a means or avenue for preparing for occupational fields for effective participation in the world of work. Thirdly, they mention that TVET Colleges are an

aspect of lifelong learning that prepares students for responsible citizenship. Fourthly, they are an instrument for promoting environmentally sound sustainable development; and lastly they act as a method of facilitating poverty alleviation (Obadara & Adenaike, 2009).

With the transformation that the economy and education is going through presently, facts and information about the creation, exploitation of ICTs are critical to the present day. One of the possible means of adjusting the TVET college system, when it comes to the development of human resources, and labour force for this ever-dynamic world of work, requires focus and investment in the integration of ICTs. This integration should be linked to the curriculum particularly, in the implementation process of integration, which should mainly focus on teaching and learning with technology (Saud et al., 2011).

Saud et al. (2011) further emphasized the fact that; information and technology are increasingly becoming ubiquitous. They predicted that by 2015, virtually all people living in industrial countries will have access to multimedia services based on mobile or other terminals. In addition to that, they also forecasted that the same trend would take place in the developing world. Services based on ubiquitous computing, telecommunications, and information retrieval are developing very rapidly.

Therefore, in other words, that society is becoming more knowledgeable and is slowly transforming into an information centre. Meaning that society that is not purely or exclusively dependent on agriculture and the production of goods and services. But the economy is becoming an economy where information will be used as a highly valued currency of exchange.

In most countries especially in Africa, the TVET College system is still underestimated. It is often perceived as a second option as opposed to other traditional tertiary institutions like universities. That is one of the biggest challenges that face the South African TVET College system. A key factor that contributes to this type of thinking is the lack of resources that is often found in TVET Colleges (Obadara & Adenaide, 2009). In addition to that, it has been noted that in the past students have been reluctant to choose TVET Colleges because of the so-called poor training programs' that cannot be furthered into higher qualifications in universities (Obadara & Adenaike, 2009).

One of the key issues that are required on the journey to ensuring that TVET College education is valued lies in transforming the attitudes of key stakeholders in the TVET College system. Those key stakeholders include policymakers, service providers, teachers, lecturers, parents and the general public (UNESCO, 2011).

With all being said, it is also crucial to be aware of the fact that TVET Colleges are not the only core solution to the skill and knowledge as well as unemployment gaps that currently exist in our society. That is essentially because TVET Colleges cannot create jobs. They are simply avenues that can merely assist with equipping students with the necessary skills that they will need to enter the labour market. Yet these benefits can only be noted if the programs that are offered at TVET Colleges correspond with the needs of both the current and future labour markets (Obadara &Adenaike, 2009).

UNESCO considers technology as being a crucial part of increasing access, improving quality and enhancing the relevance of TVET education. It further explores the potential of technology, including multimedia, online learning, mobile technology, Massive Open Online Courses (MOOCs) and open educational resources in enhancing TVET education. UNESCO is one key organization or centre that advocates for change, for the use and integration of ICTs in the TVET education system.

In addition to that, it also has a specialized center that is dedicated to developing and refining technical and vocational education through consistent networking with various stakeholders. “This specialized center is dedicated to developing and improving technical and vocational education through networking and the exchange of information in all Member States worldwide, has placed the use of ICTs at the top of its agenda and fosters their use through workshops, seminars and online communications” (Latchem, 2017, p.27).

2.6. TVET Teacher Education in what are Called Emerging Societies

Lecturer training within the context of the TVET College education system is imperative, as it prepares or should strive to address a phenomenon known as globalization. The sustainability of the use of the advances in ICTs and other forms of rapid technology obsolescence and generic skills are important because they provide basic foundations for shaping teacher education (UNESCO, 2011).

Correspondingly, lecturer training should equip teachers with what are called 21st century skills. These are skill sets that allow lecturers to have the flexibility and to learn new key skills quickly; they are inclusive of ICT skills and generic skills that increase employability and mobility (UNESCO, 2011). Hence, the creation of this new qualification that will cater for TVET lecturers at WITS School of Education (WSoE). One of the goals that we hope to reach with these qualifications is to instill in our lecturers; is the ability to adequately incorporate ICTs into their pedagogical practices. In addition to that, we want lecturers to have the knowledge and skills that will assist them to be able to switch swiftly in terms of technology usage between, both the practical and theoretical aspects of teaching Automotive Repair and Maintenance.

2.7. The Relationship between Globalization, the Economy, Technology and TVET Colleges

Globalization has created the need for us as humans to feel like we need to consistently communicate, understand and build relationships with each other regardless of our different cultures and circumstances. Therefore "education within a global scale should aim to capture the uniqueness of global things by locating the roots of local things within a global context" (UNESCO, 2011, p.3). Additionally, this process of globalization has created what we call a network economy and within this economy, every graduate from TVET programmes is expected to possess these essential and generic ICT usage skills (Chinien & Boutin, 2005).

This networked economy is characterized by six distinct attributes that make it unique, these characteristics include: climate for growth, knowledge, and brainpower, industrial and occupational change, the Information Technology revolution, Dynamism and competition and globalization (Chinien, 2003). Within this economy, ICTs are viewed as being the engine that drives the economy that works in conjunction with human capital which functions as the fuel of the economy. Furthermore, the ICT revolution makes knowledge a competitive resource. In this new economic era, economic prosperity depends on the brain rather than physical strength and its value is created "by employing knowledge workers and continuous learning" (Chinien, 2003, p.10).

New job sectors are emerging within the labour market and many of these job sectors are reliant on the use and production of technological products and services, including

the internet. All these new sectors demand new skills and competencies, including personal skills and ICT competencies. By the same token, education and training programs are also expected to respond to these new demands; which are related to both the ICTs and the changing dynamics within work organizations (Obadara & Adenaike, 2009).

Furthermore, UNESCO (2011) also hypothesized that economists could identify and utilize three factors that lead to economic growth, and these factors are based on increased human capacity. These three factors are: capital deepening, high-quality labour, and technological innovation. Capital deepening is characterized as the ability that a labour force has to use new high-tech equipment to increase productivity when compared to ancient versions of the technology.

> "as High-quality labour is another factor that impacts economic growth, and it is defined as the ability to produce a more knowledgeable workforce that will be able to add value to the economic output within a country. Most of the onus to perform this specific duty is placed on institutions of learning and particularly on institutions of higher learning and that is essentially where TVET Colleges come in" (UNESCO, 2011, p.9).

Then lastly, technological innovation is the last key factor that the researcher will discuss. Technological innovation is defined as the ability of a labour force to use, share, distribute, create, and use knowledge in innovative ways that will lead to increased production and efficiency in their workspaces, occupations or within their respective trades (UNESCO, 2011). Furthermore, UNESCO also advocates for technology literacy. Technology literacy is an approach "that seeks to enable learners, citizens and the labour force to use technology to support social development and to enhance economic productivity" (UNESCO, 2011, p.9).

2.8. Automotive Repair and Maintenance within the TVET College Space

This section of the study will endeavour to shed some light on the subject Automotive Repair and Maintenance and how it is offered in South Africa's TVET Colleges. This will be achieved through utilizing the subject guideline for Automotive and Repair which was created by the Department Of Higher Education in 2007.

Automotive Repair and Maintenance is a subject that falls under the category or programme known as the Engineering and Related Design (ERD) programme alongside or in conjunction with other subjects such as Engineering Graphics and Design, which is also known as (EGD), Fitting and Metalwork. The subject is offered from NQF level 2 to NQF level 4.

The predominant long-term goal with this subject is to equip students with all the necessary knowledge and skills that they will need to be able to execute tasks and meet requirements as set by industries, the workplaces that they want to get into once they are done with their studies.

In addition to that, Automotive Repair and Maintenance enables students to be more self-reliant and marketable. Automotive Repair and Maintenance is offered as a full-year module that comprises of 200 hours of learning and teaching, which consist of both theoretical as well as practical components. In terms of weighting for marks the theoretical component counts 40% and the practical counts 60 %. Moreover, Automotive Repair and Maintenance may also be offered on a part-time basis (DHET, 2007).

Automotive Repair and Maintenance focuses on providing students with a type of knowledge that is known as “special vehicle maintenance knowledge.” Automotive Repair and Maintenance specifically looks at automotive transmission, fuel injection, computer electronic system, body construction, and the characteristics of specialized automotive systems. In the subject students are also taught how to identify and explain these systems in terms of their properties and functions, they are also required to identify common problems occurring within the system are identified in terms of how they manifest (DHET, 2007).

Furthermore, students are also taught to give solutions to the problems they have identified and how to address them according to the manufacturer’s specifications. Moreover, they are also taught to ensure that the solutions that they provide and the work that they conduct are in accordance with workplace safety requirements and current legislation (DHET, 2007).

Within the broader educational space, this subject aims to acquaint students with basic knowledge of vehicle technology. It also seeks to equip them with the necessary skills

and confidence that they will require to enable them to perform tasks related to working with the various components of a vehicle, engines, gearboxes, fuel systems, body components, and electronics. These tasks are mainly restricted to the removal, cleaning, servicing (replenishing of fluid) and fitting. Students who complete this subject can progress and study towards another qualification. In addition to that, students with knowledge in this subject can also progress to a stage that enables them to assist other students to understand the specialized jargon that is used in the manufacturing and assembly industry (DHET, 2007).

Additionally, students who study Automotive Repair and Maintenance, are also taught crucial skills, such as being able to recognize faults and solve various problems related to the automotive field. However, for a student to be able to achieve this student they will be expected to work effectively, individually or in teams to record the requirements to fix faults, using the communication and writing skills that are utilized within Automotive Repair and Maintenance.

2.9. What Is Readiness in the Context of Technology Integration?

The concept of readiness is a concept that is often very complex and difficult to define because it cannot be quantified, it is not tangible, and one can never fully give details of its physical attributes. Based on the literature that the researcher engaged with Summak, Bağlıbel and Samancıoğlu (2010) were a part of a group of very limited researchers who were adequately able to define the term readiness in relation to technology. They call it; technology-readiness which they view as:

A construct which refers to people's propensity to embrace and use new technologies for accomplishing goals in their home life and at work (Parasuraman, 2000). The construct can be viewed as an overall state of mind resulting from a gestalt of mental enablers and inhibitors that collectively determine an individual's propensity to experiment and use new technologies (Summak et al., 2010).

In addition to that, they also attempt to give the foundations of the term by citing that, technology readiness is a term that emerged from studies of how new technologies are adopted in various spaces. At the time this term was coined, it wasn't used within the context of education. It was used in other professions and it was traditionally associated with the studies of telecommunications (Summak et al., 2010).

Furthermore, they also state that technology readiness, as a concept, is widespread particularly in the domain of business marketing. Where research focuses on identifying sectors of the market that are more likely to adopt new technologies such as: mobile data services, distance education, and online insurance just to name a few. Interestingly, in each of those studies, the researchers found that the Technology Readiness Index can also be used as a model that can be effectively used to study respondents' propensity to adopt new technologies (Summak et al., 2010). Hence, the creation of a model known as the TRI (Technology Readiness Index). The TRI is a model that is used to assess the technology readiness of employees, in any given context (Summak et al., 2010). Hence its usage in the context of education.

In addition to that, Kotsik, Tokareva, Boutin and Chinien (2009) also suggest that there are four core components to ICT readiness in TVET. These components are strategic readiness, pedagogical readiness, organizational readiness and lastly technical readiness.

> "Strategic readiness is achieved by developing a comprehensive master plan for the integration of ICTs into TVET. This plan should include the vision, mission, values, objectives, strategies, timeframe and the evaluation scheme for ICT initiatives. It should also outline the budget to cover costs related to hardware and software, connectivity, maintenance and staff training. The plan should clearly delineate the purposes of ICT-mediated learning with respect to current practices. It should be widely disseminated amongst all key stakeholders" (Kotsik et al., 2009, p.1880).

Pedagogical readiness focuses on the alignment between ICTs and current teaching and learning practices. To be pedagogically ready, TVET institutions must ensure that their usage of ICTs is compatible with their current philosophy of learning and teaching. Additionally, they have to explore opportunities for including ICTs in TVET, the technological proficiency requirements for teachers and students, ensure that ICTs will meet learners' educational needs, and ensure that instructors are competent to facilitate ICT-mediated learning (Kotsik et al., 2009).

Whilst organizational readiness focuses on teachers' involvement in integrating ICTs into TVET. The following key questions are used to assess organizational readiness:

- To what extent do TVET institutions embrace innovation and change?
- Do teachers support the integration of ICTs in TVET?
- Has the necessary leadership been provided to champion and rally support for ICT integration?
- Has the existence of training support systems been communicated to TVET teachers?

Organizational readiness also assists with establishing whether the necessary action steps have been taken to ensure that TVET lecturers possess the necessary ICT competencies. These actions include conducting needs assessments to determine the ICT comfort level of teachers, establishing minimum training standards, developing training plans and establishing appropriate mechanisms to monitor training and improve results. Whilst technical readiness addresses issues related to infrastructural requirements for ICT integration (Kotsik et al., 2009).

2.10. What is Pedagogy in the Context of TVET?

Loveless (2011) generically, defines pedagogy as a “relationship, conversation, reflection and action between teachers, learners, subjects and tools” (Loveless, 2011, p.301). The word pedagogy has various connotations that are often associated with it. Additionally, there tends to be a high level of complexity when exploring it and also with trying to define the concept of pedagogy, especially in the TVET space.

This can be largely attributed to “The lack of agreement on specific vocational pedagogy. So, the ground rules for occupational education change. There is also misunderstanding about who the sole beneficiary of vocational education is, there is often rift in establishing whether the students or their potential employers are the beneficiaries of the skills that students have as they enter the world of work" (Makgato, 2019, p.1).

In essence for any form of pedagogy to be effective, it needs to speak to the academic needs of the institution in which it is being utilized. The concept of pedagogy is also viewed as an area of Vocational Education that is often under-researched and under-theorized. This is due to the ever-changing environment in the sector (Makgato, 2019).

Vocational pedagogy is an under-researched and under-theorized area, due to the lack of agreement about the universal purpose of Vocational Education. With the challenges that already exist with vocational pedagogy has to also deal with what are,

viewed as contemporary challenges. Which include aspects such as: changing demands from employers from students who attend TVET Colleges, new qualifications, the transformation of TVET institutions as well the ever-growing number of specific attempts to understand e-pedagogy and the role of digital technology in teaching and learning within the TVET space (Makgato, 2016).

There is also an urgent need to develop well-grounded and useful theoretical underpinnings for vocational pedagogy. This will ensure the structure is provided for vocational pedagogy, which will intern ensure that vocational teachers/lecturers can develop provide and quality, effective teaching and learning programmes. TVET lecturers should be informed by an adequate theory of vocational pedagogy, to take the best possible decisions in their many different ‘designed teaching and learning environments (Loveless, 2011).

The notion of pedagogy is often linked to what seems to be a European approach known as didactic which is also spelt "Didaktik” which is a “process that focuses on the planned support for learning” (Loveless, 2011, p.303).

Since Vocational Education is made up of two components that are the theoretical element as well as the practical element (workshop session). Makgato (2019) goes on to further state that the pedagogy that is being currently used to teach theoretical elements of vocational subjects is often more traditional. When contrasted with the pedagogies that are used in the workshop sessions, that tends to be more practical. The relationship between the theoretical and the practical forms of pedagogy that is offered in TVET Colleges, and this pedagogy has a dual-nature. This dual nature can be defined as the connection and relationship between theory and practice. With the main emphasis being on providing students with knowledge and skills that will lead them too “know-how.” Rather, than declarative knowledge of “knowing that.” In addition to that, he also notes that both forms are important and cannot be separated in TVET (Makgato, 2019).

Generically, Vocational Education is seen as having its establishments in constructivism. It is further characterized by the practices of teaching and learning that cut across various areas of scientific knowledge areas. In conjunction with that, it also gathers all its didactic approaches to teaching students from industry. This is essentially what should guide the knowledge and the skill base that students will be

taught. This didactic is mostly based on problem solving, which requires students to apply both theoretical knowledge and practical skills. Additionally, learning in TVET Colleges has tacit and informal learning (Makgato, 2019).

Therefore, the key emphasis of the introduction of ICTs should not be placed on the actual technologies. But rather on how these technologies can be used to bring about a change, in how both students and lecturers/teachers engage with information, and to create new learning experiences. This is because when technology is integrated into the practice of teaching and learning it assists in changing the dynamics in the classroom (Makgato, 2019).

The integration of digital technology in pedagogy can be used to create new learning experiences that are more fluid, interactive and multimodal. Loveless (2011) postulates that ideally ICT integration from the lens of pedagogy should be looked at using the following lenses “ICTs should be integrated as a tutor, resource or an environment. These lenses are also referred to as being metaphors for ICT and pedagogy. These metaphors are used to “describe the roles of ICT in pedagogical designs and activities. In addition to that they also offer insights into how teachers and software designers understand the relationship between learners, teachers, knowledge and digital technologies” (Loveless, 2011, p.306).

2.11. Why Use ICTs in TVET Colleges?

Firstly, ICT is a broad, all-encompassing term that is used to denote the usage of “*inter alia* radio, television, the Internet and the Web, satellite and Wi-Fi systems, mobile telephony, computer hardware, and software, audio- and video-conferencing, virtual reality, social media, wikis, 3D printers. All of these are technologies that enable individuals and communities to find, analyse, transfer, and present information, knowledge, skills, ideas, and experiences” (Latchem, 2017, p.28).

Obadara and Adenaide (2009) cite that ICTs can accelerate management trends and changes in the world of work and the world in general. In addition to that power, ICTs also have the potential to immensely improve people's access to quality education and training, through equipping people with certain skills that they will need to effectively function in the workplace.

Since, every sector, space, sphere of our lives is being infiltrated by technology through a process known as digitalization – which is a process of integrating digital technologies into every aspect of work and life. It is believed that this process will create endless opportunities for reshaping and improving economies and societies in the near future (Latchem, 2017). Furthermore, UNESCO (2011) have also formulated a global goal in terms of ICT integration in education and that goal is to create a "world without boundaries where technologies support education and build inclusive knowledge societies" (Latchem, 2017, p.27).

Additionally, ICTs can also be used to educate people at a distance (what is known as distance learning). They can also be utilized to create rich teaching and classroom learning experiences or workplace learning. However, it is always important to remember "that ICTs are merely just tools that can be used in the teaching and learning process. Essentially the quality, practicality or effectiveness of ICT that enables teaching and learning is determined by the amount of attention that is given to the issues of accessibility and equitability, principles of adult learning and instructional design and appropriateness of the delivery and support services of ICT" (Latchem, 2017, p.28).

In as much as ICTs can help to enhance and make the learning and teaching process more efficient, it is important to note that technologies have their inclinations, potentials, affordances, characteristics and limitations that make them more suitable for certain tasks and subjects than others (Koehler & Mishra, 2009).

Hence, it is essential for educators, trainers, and lecturers who work within the profession of teaching to develop a thorough understanding of how these affordances and limitations which we often term as "constraints" of specific technologies, influence the choice of pedagogical practices that teachers utilize in their classrooms. This is in specific reference to how lecturers integrate technology into their classrooms, as this is not a straightforward linear process. It is a process that may require teacher education intervention programs for pre-service lecturers and professional development programs for in-service lecturers (Koehler & Mishra, 2009).

2.12. The Roles of ICTs in The Process of Learning and Teaching in TVET Colleges

ICTs can serve various roles during the learning and teaching process in TVET Colleges. "They can be used as a delivery mechanism: this occurs when technology

is used as an instrument in the endeavour to deliver course content. The core focus when using technology as a tool is in seeking ways to package course content for digital delivery. Common examples include Computer-Assisted Instruction (CAI), Computer-Based Instruction (CBI)" (Chinien, 2005, p.21).

In addition to that, technology can also be used to complement instruction: this occurs when technology is used to supplement instruction. The key emphasis during this process is on providing students with opportunities to practice skills taught and on extending learning by working with specific software applications. Likewise, technology can support students' learning process and can assist students to build their understanding, meanings of content taught during a lesson and increase students' academic success.

The utilization of ICTs during the teaching process can also assist to explain abstract concepts and make abstract concepts more accessible and tangible. Technology can also contribute to student motivation and cooperation in the classroom, which can assist them to improve their creativity, critical thinking and problem-solving skills (Yalcin, Kahraman & Yilmaz, 2011).

Simulators are an example of an ICT that can be used in TVET Colleges. This is mainly done "to address safety concerns during the initial phase of training and also to offset the cost of renting equipment for training crane operators and truck drivers. In its simplest form, technology can be used for drill and practice to complement instruction" (Chinien, 2005, p.21).

Furthermore, ICTs can also be used as an instructional tool. Since the human learning process is a very complex process and limited. Lecturers do not have full knowledge of the scope and the limitations of the learning process, because of this, lecturers often opt to use what they know about the learning process. To assist them to engage their students when teaching. During this process, lecturers strive to use the little that is known about human learning, whenever they engage in the act of teaching and learning. The learning process can be divided into two broad categories. The first category relates to learning conditions that are internal to the students. "This is the area where the potential to improve learning outcomes is the highest. It is undoubtedly the area that is most difficult to affect examples of this include web-based, what is also

known as web-based instruction and open distance learning programmes" (Chinien, 2005, p.21).

On the other hand, technology can also be utilized to create communities of practice that cultivate the culture of sharing/ exchanging information. This leads to the formation of what are known as; communities of practice amongst lecturers and among students who are studying towards the same trade it can create learning communities (Lloyd, 2005). Communities of practice normally encourage the sharing of resources, best practice, advice, teaching and learning materials.

Equally, ICTs can assist in facilitating a transition in the role of a lecturer in the classroom into that of an instructional manager. This transition could potentially lead lecturers to be mediators that guide students through personalized learning pathways, identifying relevant learning resources, creating interactive learning opportunities, and providing insight. Additionally, this could see lecturers support their students during both formal class time and outside of contact time. This would also be inclusive of both theoretical and practical aspects of Vocational Education. Unfortunately, most professional development programmes tend to concentrate on teaching lecturers how to use the technology itself. Whereas Professional development in relation to technology should strive to focus on teaching lecturers how to mentor and guide learners using technology in this environment (Lloyd, 2005).

2.13. Factors That Hinder the Use of ICTs in TVET Colleges

Vinh, Hoa and Binh (2010) hypothesized that one of the key factors that hinder ICT integration in TVET Colleges is: indeed, the lack of strict, structured policy and mechanisms that encourage, guide and helps to support lecturers in their endeavours to integrate ICTs into their pedagogical practices.

The statement above is in direct concurrence with one of the findings that emerged in a study that was conducted by (Cross & Adam 2007) which revealed "That Many institutions of Higher Education in South Africa do not yet have an existing institutional vision or strategy that addresses ICT integration in Higher Education at both national and individualistic levels (Cross & Adam, 2007, p.74). Hence, the integration and use of technology in activities within these institutions are limited to somewhat isolated pockets driven by particular projects. Which poses a problem because in Higher institutions of learning it is very difficult to have a dichotomous or one size fits all

approach to ICT integration. This is essentially because the policy and approaches that institutions will take on in terms of integration will differ in each institution, within each department/ faculty and also within each subject offered within these institutions of Higher Education" (Cross & Adam, 2007, p.74).

Furthermore, Cross and Adam (2007) mentioned a key policy document in Higher Education, which is: The White Paper on Higher Education and critiqued how the policy document does not provide clear directives on how ICT integration should occur within the context of institutions of higher learning, and specifically within TVET Colleges.

On the contrary, they do recognize the fact that the White Paper on Higher Education calls for an enhancement in teaching and learning. However, the paper barely makes mention of technology in that regard. The White paper does have a mandate that requests for enhancement in teaching and learning strategies used in institutions of higher learning. The mandate calls for an improvement in the quality of teaching and learning that takes place in higher institutions of learning. But once again, it does not suggest nor imply that technology should be used for this purpose (Cross & Adam, 2007).

The only reference to technology that is made in the White Paper for Higher Education is concerning the concept of resource-based distance learning. In that a call for the improvement in the use of teaching and learning strategies, to improve the quality and quantity of education offered at higher institutions of learning. Interestingly, the White paper does not undertake that technology should be utilized for this purpose.

This is fundamentally a sharp contrast to the stipulations made in the e-Education White Paper (on Schooling that is used in Primary and High schools). "The e-Education White Paper takes on a very Techno centric view, which assumes that technology can enhance teaching and learning practices and support problem solving and critical thinking development. The Higher Education White Paper refrains from making assumptions about the relationship between technologies, teaching, and learning issues. Furthermore, the White Paper on Higher Education does not provide firm directives on ICTs and its relationship to higher education (Cross & Adam, 2007).

In addition to that, a study conducted by Vinh et al. (2010) also revealed that there is lack of financial support/ commitment from key stakeholders, when it comes to the

purchasing and maintenance of infrastructure and other ICT related equipment within TVET Colleges.

The lack of financial support/ commitment is not limited to infrastructure. But, it also impacts lecturers as there is a lack of funding for capacity building and the training of lecturers, to equip them with the various skills that they will need to be able to incorporate ICTS and other forms of ICTs into their pedagogical practices (Vinh et al., 2010).

Likewise, Yalcin et al. (2011) also suggest that lecturers' pedagogical beliefs are an essential variable that needs to be considered when speaking about integration, as this influence's teachers' use of technology in the classroom. Teachers' attitudes and beliefs about and toward technology are of great importance in their decisions to adopt and use technology in the classroom. This concurs with what Voogt, Fisser, Paria, Tondeur and Van Braak (2013), who stated that teacher beliefs about pedagogy and technology are intrinsically intertwined. Therefore, they can determine whether a lecturer integrates or teaches with ICTs/ technology in their classroom.

A study that was conducted by Voogt et al. (2013) that looked at educators' pedagogical practices in relation to the TPACK model (which will be discussed in more detail in chapter 3). Revealed that educators may have the necessary knowledge and skills that enable them to use technology and particularly ICTs. However, this ability does not always translate or is not reflected in their pedagogical practices. They also posit that educator pedagogical decisions during the preparation and execution stage of their lessons are based or guided by their own personal pedagogical beliefs. These beliefs are mainly about the relation between content and technology. These beliefs are not necessarily guided by their knowledge of the affordances that technology can bring into the classroom.

In addition to that, Koehler and Mishra (2009) also propose that new, digital, ICTs, are changeable, unstable, opaque, and present new challenges to lecturers. When compared to the more traditional, conventional technologies. Which is perhaps one of the main contributing factors that would explain the reason behind the fact that lecturers are struggling to use more technology in their pedagogies.

Subsequently, The White Paper for Post Education and Training also cites that a majority of the areas of study within TVET Colleges offer institutional workshop learning. This is characterized as a type of learning that can be easily controlled and that is in line with the Vocational Education curriculum. However, one of the biggest challenges, with the education offered in TVET Colleges is within these institutional workshops. The main challenge lies in the fact that TVET Colleges cannot afford to upgrade these workshops with some of the latest ICTs and equipment that is available in the market and that is used in industries.

In some instances, the content, as well as the skill base that is taught to students in the workshops in TVET Colleges, is not always authentic, or in line with real-life, industry-based experiences. Therefore, one of the key tasks that TVET Colleges need to heed to, especially in the programs is to provide vocational training. This will help with ensuring that the training systems (which are mainly offered to students through the workshop sessions), the curriculum and what is happening in industry are all aligned. This would assist students to build connections between various forms of knowledge and skills that need to be learned in each sphere. Hence, the White Paper for Post Education and Training calls for a partnership between TVET Colleges and potential employers in the planning and designing of curricula within Vocational Education (DHET, 2014).

2.14. Unpacking the Integration of ICT in the Classroom

Integration can be simply defined as the process of using technology/ ICTs effectively and efficiently in all dimensions of the educational process mainly for teaching and learning. For integration to be possible it requires the necessary infrastructure, curriculum and teaching-learning environments (Badri, Al Rashedi, Yang, Mohaidat & Hammadi, 2014).

Similarly, Chinien and Boutin (2005) also presuppose that “the integration of ICTs in education requires considerable investment in the form of time and resources. Consequently, when planning to integrate ICT in education and training policymakers should be able to use evidence-based information for making sound decisions” (Chinien & Boutin, 2005, p.11).

This is not an easy process, it is a complex process that requires readiness and, in the bid, to doing so both institutions and individuals may come across or are often

confronted by several difficulties. A study conducted by (Summak et al., 2010) cited the following difficulties as possible factors that hinder ICT integration and they cited: lack of technological devices, poor funding for the implementation and maintenance of technology, resistance to change (this could be at the state or institutional levels), low levels of computer literacy from educators/ lecturers, technology misalignment in relation to the curriculum, as some of the chief hindrances that impact ICT integration in institutions of higher learning.

Additionally, their study also identified factors such as; poor training opportunities for lecturers', the lack of a comprehensive vision with regards to how technology should be integrated into learning processes. Furthermore, in their study lecturers unpacked the various difficulties/ challenges that they face as they attempt to integrate technologies into their lessons. In their study lecturers cited various challenges such as negative attitudes, beliefs, and reluctance towards the use of technology as being factors that hinder ICT integration. Overall, their study revealed and acknowledged the fact that educators, lecturers, and others within the profession of education, were more hesitant and less likely to embrace computer technology usage when juxtaposed to other professionals (Summak et al., 2010).

Moreover, other studies also revealed that success in technology integration and the effective and efficient use of technology in education habitually depends on teachers' willingness to adopt, and their attitudes toward technology. In addition to that, Voogt et al (2013) also contend that technology integration does not take place in isolation. But they postulate that it is positioned and that lecturers need to develop the flexibility to incorporate knowledge about students, the school, and the infrastructure that that school has, as well as know the environment to efficiently integrate technology into teaching.

Statistically, research studies that have been conducted around the world with regards to ICT usage in TVET institutions establish that: ICTs integration in TVET Colleges is often either moderate or low.

Alazam, Bakar, Hamzah and Asmiran (2012) state that integration is a dynamic process that requires the consideration of other factors such as:

- Lecturer's skills
- Lecturer's experience in the field

- Lecturer's technological competencies/ abilities in relation to ICT usage
- Lecturer's age as this might have a bearing on the relationship that a lecturer has with technology
- The lecturer's level of education, training in terms of ICT integration and how to utilize ICTs effectively and efficiently in their pedagogical practices.
- The number and types of ICTs available at the TVET college
- Administration support

In addition to that, they also suggest that the integration of technology in classroom teaching amongst lecturers in Vocational Education is to help store, transmit, create, store and exchange information. Hence, they propose that the integration process would involve "using instructional software during the teaching process of both practical and theoretical elements of a course, when making presentations and when carrying out several tasks in laboratories, workshops or application services" (Alazam et al., 2012, p.70).

Similarly, they also hypothesized that technology integration in TVET Colleges is significantly different from that in normal traditional institutions of higher learning, and within the primary and high schools. As integration in TVET Colleges requires cautious, intentional thinking, and it needs to be done in a manner that is appropriate for each specific technical/vocational subject (Alazam et al., 2012).

So, for example, the simple usage of a PowerPoint presentation in a practical engineering lesson would not be adequate for the type of knowledge and skills and lecturers are teaching students. They would require ICTs in the form of "computer-aided drawing and design, what is generally known as (CAD), 2 and 3D modelling, simulation products, diagrams, hyperlinked texts, videos related to concepts taught in Engineering" (Alazam et al, 2012, p.71).

Koehler, Mishra and Yahya (2007) also suggest that teacher preparation is an essential characteristic of technology integration. However, in addition to that, they note that teacher preparation is only the genesis of technology integration and this is all based on a finding that came up in their study.

Their study also revealed that teacher training programs on a general level do not adequately equip instructors/lecturers with the kinds of experiences that prepare them

to use technology in their classrooms. Additionally, they also found that formal standalone Information Technology (IT) course work does not equip lecturers with the necessary technological skills, that they will need to enable them to integrate technology into their teaching practices. Meaning that IT coursework is unable to provide educators with the necessary knowledge and skills that will enable them to adequately integrate technology into their teaching.

This is due to the fact that IT coursework lacks an essential type of pedagogical knowledge that is required by educators and lecturers to enable them to integrate technology into their teaching. That form of knowledge is known as Technological Pedagogical Content Knowledge (TPACK).

Essentially TPCK "is a dynamic transactional relationship between content, pedagogy, and technology" (Koehler et al., 2007, p.741). Technology integration requires this specific type of knowledge, because for lecturers to be able to be good lecturers who can integrate technology into their pedagogical practices. They need to be able to understand how "mutually reinforcing relationships between all three of these elements, can eventually lead to the development of appropriate, context-specific strategies and representations, that educators can use when they fuse technology into their classrooms and that cannot be offered by general IT coursework" (Koehler et al., 2007, p741).

2.15. Key Elements Required When Integrating ICTs into Education, Particularly Vocational Education

According to an article titled *ICTs for Africa* by the World Bank Group, five crucial elements are required when integrating technology into education. However, the researcher chose four of those as those elements, as those were relevant for this study and those elements are:

- A robust policy environment that supports the ICT in education policy is an enabling, but is not always sufficient, for ICT roll-out.
- National budget support, as well as nationally driven partnerships with the private sector.
- A transformation of focus from computer literacy for teachers to understanding ICT integration in education from the pedagogic perspective.

- Lecturer training: because the delivery of quality of the education offered in TVET Colleges is heavily dependent on the competence of the lecturer – lecturer competence can be measured in terms of theoretical knowledge, technical and pedagogical skills as well as being well-informed about new technologies in the workplace. Since:

> "Training for high-quality skills requires appropriate training equipment and tools, adequate supply of training materials, and practice. Other requirements include relevant textbooks and training manuals and qualified instructors with experience in enterprises" (African Union ,2007, p.9).

2.16. Types of Knowledge and Competencies That Lecturers are required to have to teach in a TVET College

Clark and Holingsworth (2002) as cited in Chua and Jamil (2012), conjectured that lecturers who work in TVET Colleges, need to possess what is known as professional knowledge. Professional knowledge within the context of TVET is categorized as specialist knowledge that lecturers are required to have to enable an individual to perform a specific type of job. It is the knowledge base that distinguishes a TVET College lecturer, from an engineer. Like in any other profession TVET College lecturers are expected to have specific professional knowledge, which includes knowledge of concepts, what is also called content knowledge. This also consists of knowledge of practical applications of concepts, methods to expand knowledge and create new knowledge (Chua & Jamil, 2012).

In addition to that, lecturers also need to have Technological knowledge. Technical knowledge overarches and acts as both a form of knowledge and as a competency that is required by lecturers, as it allows them to produce "alternative instructional methods" (Chua & Jamil, 2012, p.1 540). Subsequently, technological knowledge also becomes more than a tool that is used to facilitate the process of teaching and learning. It becomes a prerequisite form of knowledge, and competency that all lecturers in TVET Colleges need to have.

To be able to foster and facilitate ICT integration in the TVET system, lecturers are also required to have a form of knowledge known as TPACK. TPACK also has a dynamic/dual function as well. This is based on the fact that TPACK is also a form of knowledge and competency. TPACK also forms the foundational base of professional knowledge that all lecturers need to have, because of the nature of the content that they teach in TVET Colleges. This is a type of knowledge that comprises of high-tech machinery and specialized technical equipment. The subjects in TVET Colleges also encourage practical training that requires high technological knowledge, because of its hands-on component that focuses on building practical experience and on promoting collaboration (Chua & Jamil, 2012).

Additionally, TPACK is a framework by Mishra and Koehler (2006) that emphasizes the importance of Technological knowledge. This framework suggests that TPACK is the highest dimension of knowledge that an educator needs to master, to be able to integrate ICTs into their pedagogical practices. The framework consists of seven dimensions of knowledge. For a lecturer to have TPACK, they need to be fluent in all 7 dimensions of knowledge, and not just in some of the dimensions. When a lecturer has mastered all 7 dimensions this is known as multi-disciplinary integration.

The seven forms of knowledge that a lecturer needs to have mastered are Pedagogical Knowledge (PK), Content Knowledge (CK), Technical Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK) and Technological Pedagogical Content Knowledge (TPACK). The usage of TPACK requires the usage of the features that will be illustrated in the diagram below.

Figure 2 below was created by the researcher and it is a cycle that illustrates how 5 key features of TPACK should be utilized in the TPACK model. Furthermore, it summarizes the core areas in the TPACK model that need to be considered concerning the implementation of the TPACK model.

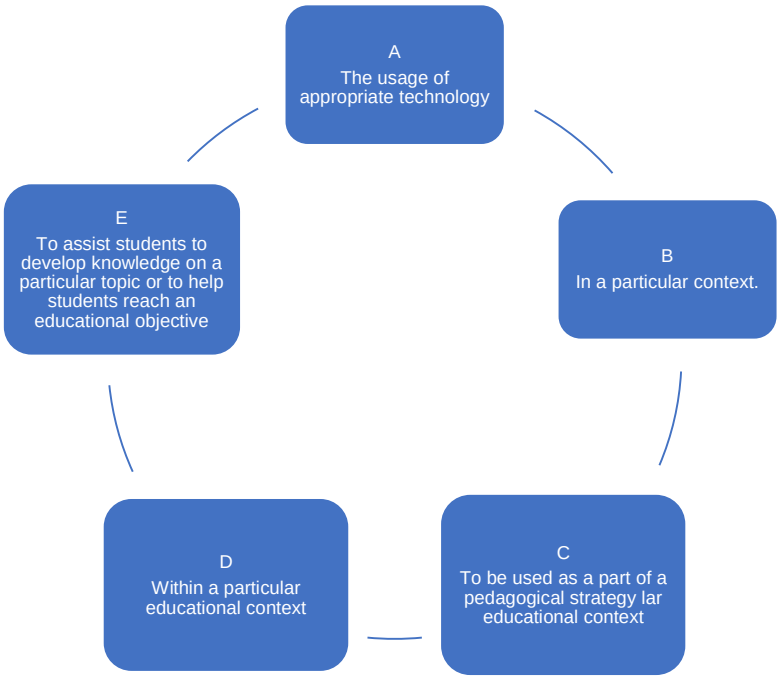

FIGURE 2: THE 5 KEY FEATURES OF TPACK TO BE CONSIDERED FOR INTEGRATION

Lastly, Naiker (2017) proposes that lecturers, who work in TVET Colleges, also need to be specialists in Technical curriculum delivery. He further emphasizes that lecturers who work in TVET Colleges need to be specialists who possess knowledge that is related to specific occupational fields such as Engineering and Related Design (ERD). (Naiker ,2017).

2.17. Conceptual Framework of the Study

This study consisted of both a theoretical and conceptual framework. However, before discussing these two essential aspects of this study. The researcher started by attempting to set the context. This context would assist with creating links that would briefly discuss some of the theoretical underpinnings that influenced this conceptual and theoretical framework. This was achieved through dissecting the theoretical backgrounds of concepts and theory in relation to research. Additionally, the context was set through using theory as the main element that underpins both, the theoretical and conceptual frameworks. This is done in an attempt to assist locate the importance of theory within a study.

Mills (1993) as cited in Anfara and Mertz (2006) states that it is impossible to observe and describe the way things are, free of any prior conceptual scheme or theory. Through reading the above, it becomes evident that theory is the essence of any theoretical framework, and it is often difficult to define without covering its significance.

Struss as cited in Anfara and Mertz (2006) define theory as being a model or map of why the world is the way it is, it's a simplification of the world that is aimed at clarifying and explaining some aspect of how the world works (Anfara & Mertz 2006).

Similarly, theory can be viewed as a movement, a linear type of movement that affects, influences a person's thinking from concrete, perceptible lived experiences and sensations to a level of abstract, intangible descriptions. Theory moves humans through levels of abstractions, the higher the level of abstraction you have of your experiences, sensations the closer you became to formulating a theory.

According to Mills (1993) as cited in Anfara and Mertz (2006) a theory is an analytical and interpretive framework that helps a researcher make sense of what is going on in the social setting being studied (Anfara & Mertz, 2006). Furthermore, according to Anfara and Mertz (2006), theory comprises three main elements which are: concepts, constructs, and prepositions. Concepts are the most concrete component of a theory, they are the first level of conception of a theory, because by definition a concept is the foundational base of a theory or of all theories that exist in the world, a concept is an experience, event, sensation that a human's experiences (Anfara & Mertz, 2006).

Furthermore, concepts assist humans to distinguish different events or sensations from each other; they also assist us to relate past events and sensations to present and future ones. They also help to form the base of what is deemed as being a higher level of thought (Anfara & Mertz, 2006).

Whereas constructs are a component of a theory that assists with the process of consolidating concepts past, present, and future, by incorporating them with knowledge. These constructs include things like the concept of age and intelligence.

Propositions are the most abstract aspect of a theory are expressions of relationships that cut across numerous constructs, they are new inventions that need to be carefully defined when explained to others, because a single preposition is inadequate to explain or bring insight about a particular aspect of reality, in research researchers utilize a set of propositions that constitute to the formation of what is called a: Theory. They can move in a linear, hierarchical manner, moving from a lower level to a higher level.

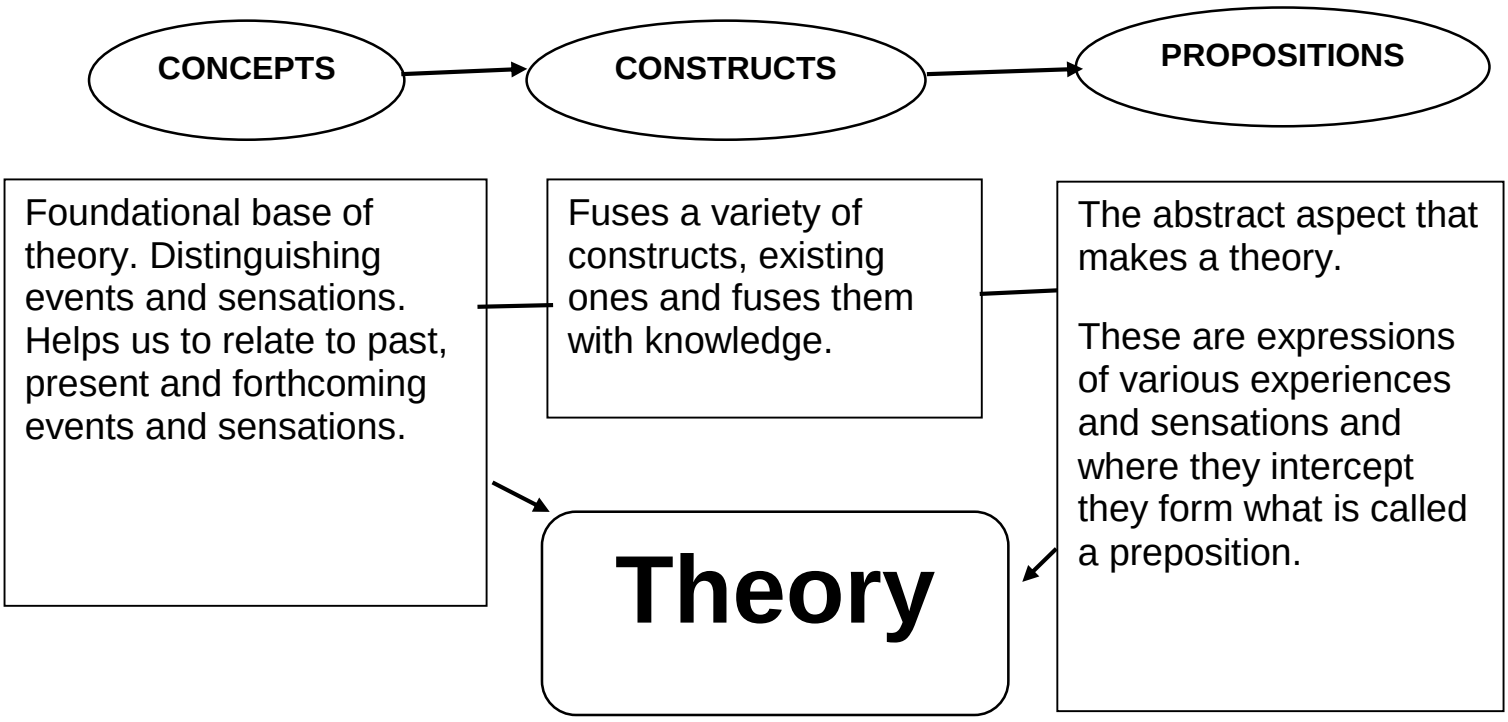

FIGURE 3: CATEGORIZATION OF A THEORY

Figure 3 is a graphical representation of the information that is written above it was created by the researcher in the attempt to make sense of the key components that make up a theory. Figure 3 is also a summary that seeks to explain how we get what is categorized as a theory.

The introductory part of this discussion sought to illustrate how the use of a sole explanation of a theory in a study, is not always sufficient to answer a research question. Or to help a researcher to understand what certain phenomenon occurs in society or the classroom in the researcher's case that is primarily where the theoretical or conceptual framework comes in.

According to Grant and Osanloo (2014) a theoretical framework is the "blueprint" for a research study. It serves as a guide for a researcher. It also helps to shape and support a study. In addition to that, it also provides a structure that should be used to express how a researcher would approach a study from a philosophical, epistemological, methodological, and analytical approach. The theoretical framework comprises of selected theory (or theories) that undergirds a researcher's conceptual thinking, and that assists the researcher to make sense of their research topic.

On the other hand, a conceptual framework according to Maxwell (2005) is a system of concepts, assumptions, expectations, beliefs, and theories that support and inform

a research study — the conceptual framework is also a key component of research design and of the entre study which seeks to comprehend the actual ideas, theories and beliefs that a researcher has about the being phenomena studied in their study, whether these are written down or not.

The definition given above corresponds with the definition of a conceptual framework that is provided by Miles and Huberman (1994) as cited in Maxwell (2005) which states that a conceptual framework is “a visual or written product, one that explains, either graphically or in narrative form, the main things to be studied” (Maxwell, 2005, p.39).

Maxwell also noted that it is important to note that the most significant thing to understand about a conceptual framework is the fact that “it is primarily a conception or model of what is out there that you plan to study, and of what is going on with these things and why—a tentative *theory* of the phenomena that you are investigating. The function of this theory is to inform the rest of your design— to help you to assess, refine your goals, develop realistic and relevant research questions, select appropriate methods, and identify potential validity threats in a study” (Maxwell, 2005, pp.39-40).

Initially, when the researcher conceptualized this study, the intention was to utilize one theory, which was going to form the bases of the theoretical framework of this study. The ideal theory was Technological Pedagogical Content Knowledge (TPACK). This framework was ideal because its focal point is on the various forms of knowledge that educators need to have, to successfully integrate ICTs and other forms of technology, into their pedagogical practices. Since this study was focused on lecturers and their pedagogical practices in relation to technology, it was only befitting for the researcher to utilize this theory. However, through the process of progression and refining the study, the researcher realized that this theory was not going to be adequate to address all the variables that needed consideration in the study.

Essentially, TPACK was meant to assist the researcher to understand and dissect the pedagogical aspect of this study. Which is the essence of this study. The researcher realized the fact that this framework neglected two other central variables within this study. Foundationally, this study focuses on three concepts or consists of three variables. The first variable being integration, then the second one is readiness and the last one is pedagogy. It was during this point that the researcher decided to restructure and create a conceptual framework as opposed to just a theoretical

framework. This move from just merely using a theoretical framework to incorporating a conceptual framework was a strategic move that was intentionally done by the researcher to help cater to all three the variables that are featured in this study.

Hence, the new conceptual framework, which makes use of TPACK, the UNESCO's integration model as well as the Technology Readiness Index, which is also known as (TRI). Utilizing all these theories assisted the researcher to establish the diverse aspects that impact technology integration and lecturers' pedagogical practices. Using these three theories also assisted to ensure that this study addressed all the variables that were utilized in this study. However, with that being said, it is vital to note that the TPACK model is still the main overarching theoretical framework that is the backbone of this entire study.

The following figure, figure 4 illustrates the relationship between various theories and the variables that the researcher concentrated on in this study**.**

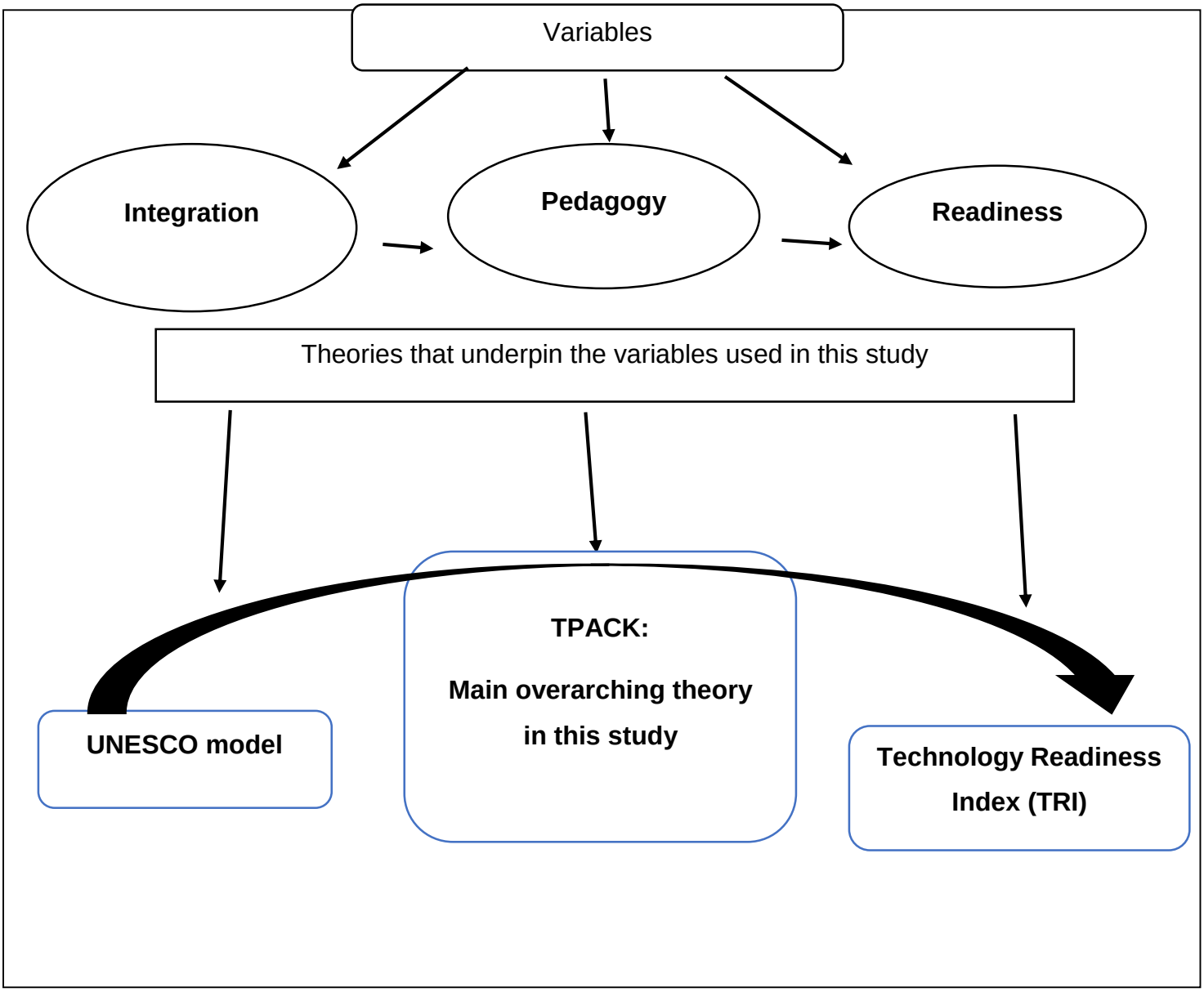

FIGURE 4: RELATIONSHIP BETWEEN VARIOUS THEORIES AND THE VARIABLES

This is how the figure above is relevant for this study: Using all these theories mentioned within both the theoretical and conceptual framework assisted the researcher to gain insight into the diverse aspects of knowledge that impact technology integration, as well as lecturer's decisions concerning their pedagogical practices when teaching. Through using these three theories the researcher was able to address all the apparent variables and that need to be addressed in this study.

This is a brief breakdown of how each theory/framework assisted the researcher in this study as seen on figure 4.

The TPACK model assisted the researcher to address the pedagogical element variable/s of this research. This was achieved through assisting the researcher to establish or gauge the types of knowledge that lecturers have mastered and the ones they have a deficit in. This was largely related to lecturers and their pedagogical practices. Whilst the UNESCO integration model assisted the researcher to develop a comprehensive understanding of the general stages that occur when ICT integration is executed, within the context of education.

Lastly, the Technology Readiness Index (TRI) model assisted the researcher with the Readiness variable of this study. This variable sought to understand the lecturer's readiness in relation to their attitudes and beliefs about ICT integration. That was mainly in specific reference to the various factors that are either enabling or inhibiting ICT integration in TVET Colleges.

The first framework that is discussed within the researcher's conceptual framework is the UNESCO model. Which is an integration framework. Before discussing the UNESCO model. It was essential to discuss the aims of ICT integration frameworks as this assisted with formulating an understanding of the importance of these can be formulated.

To assist the researcher to understand, analyze and dissect the concept of readiness, the UNSECO model was utilized. This is an integration model that was developed with the aim of assisting teachers integrate technology into their classrooms to enhance the processes of teaching and learning (Strydom, Thompson & Williams, 2005). If we are to go back into chapter 1 and read the main research question, we would be reminded that the main research question was phrased in the following manner:

How ready are TVET College lecturers from Ekurhuleni in integrating ICTs into their pedagogical practices, in Automotive Repair and Maintenance classrooms?

Since the researcher was looking at the concept of readiness, it was essential to be cognizant of the fact readiness in itself is a very abstract concept. It is not a concept that can be quantified in terms of numbers; only access can be measured in that

manner. Readiness can only be understood using the lens of integration and that is essentially, where the UNESCO model comes in.

2.18. Aims that are associated with ICT Integration Frameworks

Trinidad et al. (2006) posits that are five core aims that are associated with the use of technology integration frameworks. The first aim is to define quality pedagogy in the use of ICTs to effectively support student learning in schools. Secondly, these frameworks are destined to assist educators when planning to integrate technology into their learning and teaching environments.

Thirdly, these frameworks are meant to describe the progress made by educators as they move towards integrating technology, in an attempt to provide quality pedagogy. The fourth aim is to assist educators in the development of their practices in the use of ICTs to support student learning and to provide a tool for teacher dialogue for ICT integration. That consists of good pedagogy and that can provide topics or questions that describe the various concerns those teachers may have with regards to ICT integration in the classroom (Trinidad et al., 2006).

2.19. UNESCO's Four Stages of Integration

ICT integration comes in various forms as cited in UNESCO (2002). Strydom, Wilson and Williams (2005) outline a four-stage continuum model of ICT integration. The four stages that are found in the model is the emerging stage, the applying and infusing and transformation stage.

The emerging stage

The emerging stage is the beginning, infancy stage of integration. This stage is characterized by the purchase of ICTs: typically, both hardware and software equipment. During this stage, key stakeholders in institutions of learning like administrators, educators and lecturers are starting to explore the possibilities and the possible consequences that come with using ICTs in the classroom (Strydom et al., 2005). Educators in the emerging phase of integration are characterized as being very grounded and rooted in the traditional, more educator centered methods of teaching.

The application stage

The secondary stage in the integration process is the application stage. This stage is mainly characterized by the integration of ICTs into the curriculum. Schools in this

phase of integration are schools that are beginning to develop an understanding of the numerous contributions, affordances that ICTs can have on the learning and teaching process. In addition to that, educators who are functioning within this phase of integration can be seen consciously integrating ICTs into their pedagogical (Strydom et al., 2005).

The infusion stage

The infusion phase of integration is more of the intermediate phase of the process of integration. It involves the integration and embedding of ICTs across the curriculum. Teachers in this phase of integration can explore new, innovative ways in which ICTs can change their productivity, and professional, pedagogical practices and productivity as well (Strydom et al., 2005).

The transforming stage

The final stage of integration is known as the transforming stage. “In this stage, schools use ICTs to rethink their organizational structures creatively. In addition to that, ICTs became an integral, invisible part of daily personal productivity and teachers’ professional practices” (Strydom et al., 2005, p.74).

2.20. Representational and Generative Use and Integration of Smart Technologies

The terms “representational” and “generative” are two key terms that are often used to distinguish between two core kinds of integration or ICT usage in the education space. Representational and generative use ought to be discussed alongside the stages of integration. Representational use is used to describe how technology can be used to merely represent information. This type of Knowledge denotes the symbolic representation of knowledge. In this view, knowledge is viewed as something that “is absolute, definable and re-presentable” (Strydom et al., 2005, p.74).

Within this framework of integration, technology is incorporated within tasks where its purpose is to represent information, and not to generate or construct new information (Strydom & Thompson, 2006).

Meanwhile, generative integration is more concerned with how knowledge, thoughts are generated or constructed. Within generative integration, ICTs are viewed as “cognitive tools” because they have “the power to increase a learner’s cognitive thinking during the process of problem-solving and learning” Therefore, during this

stage of integration learners can be seen as being able to generate some form of knowledge." (Strydom et al.,2005, p.74).

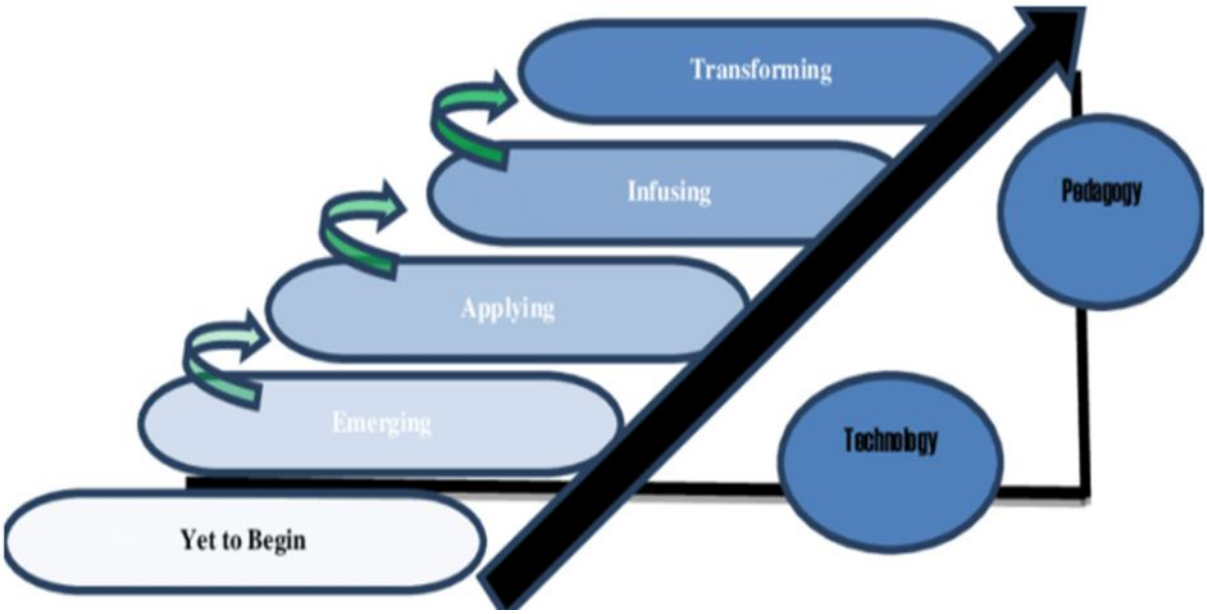

FIGURE 5: STAGES IN THE UNESCO MODEL (2002)

This figure illustrates the relationship between the various stages in the UNESCO (2002) framework and it also illustrates two important variables that need to be considered in the in process of integrating ICTs into the teaching process, which are namely: technology and pedagogy are directly infused into each stage of the four stages of the ICT integration process.[3]

2.21. Introduction to the TPACK Framework

Even though the researcher's conceptual framework was framed using the three theories, it is important to note that TPACK is the main theory underpinned the bulk of this study. The main reason behind the usage of the TPACK model/ framework was that; this framework provided the researcher with insights into foundational knowledge that is important for the process of ICT integration in the classroom. This knowledge is a type of knowledge that could be utilized to assist the researcher to dissect and establish the relationships between various factors and forms of knowledge that an educator is required to have to interact within their endeavor to teach. Especially,

[3] https://www.researchgate.net/figure/Stages-of-ICT-Adoption-and-Use-Source-UNESCO-2010_fig1_284717164

where technology is also involved because, for effective integration to take place in education, particularly within the classroom requires knowledge and this is not limited to knowledge in a general sense, neither is this limited to content knowledge, knowledge of technology and pedagogy. This is knowledge about the relationship that these different elements have with each other within the integration process (Mishra, Koehler & Yahya, 2008).

For purposes of this study, TPACK was used to assist the researcher to establish the relations between the various forms of knowledge that a lecturer is required to have, to enable ICT integration to take place in a classroom. Within the context of TVET Colleges, the focus is on both the theory and practical/ workshop classrooms.

TPACK is a type of knowledge that is formally known as TPCK. This is a framework that was derived from Shulman's construct of PCK. Not only is TPACK derived from PCK but it is also an extension of the construct, which is meant to include the technological aspect of knowledge, what is known as (TK) within the TPACK model (Koehler & Mishra, 2009).

Before the researcher discusses the TPACK framework it is essential to note that, the usage of what is classically categorized as technology or "pedagogical technologies" is not a new practice in the sphere of education/teaching. Originally when the TPACK framework was created, it was intended to be used by pre-service educators. However, the researcher also firmly believes that in-service teachers, instructors and lecturers can also use it. Since, it is a useful framework for thinking about the various kinds of knowledge teaching instructors must have to successfully integrate technology into teaching and how they might develop this knowledge.

If we are to carefully think about it, we will come to realize that technically, educators have always incorporated technology into their pedagogical practices. Yet for many years, educators used what are deemed as; traditional technologies. Examples of traditional technologies that have been used within classrooms are inclusive of: pencils, pens, stencils, television sets, VCR, film/ DVDs, whiteboards, chalkboards, and overhead projectors. This just goes to show that the integration of technology into the classroom is not necessarily a new practice or phenomena. However, what is evolving is the type of technologies that educators are integrating or incorporating into their pedagogical/instructional practices.

Generically, the world is transitioning and slowly starting to use what are called Digital, modern-day technologies include the use of computers, smart boards, and other handheld devices, and other software applications in the classroom (Koehler & Mishra, 2009).

The theoretical foundations of TPACK can be backtracked back to an educational psychologist known as Lee Schulman. Shulman is renowned for constructing the concept of PCK, which is broadly known as (Pedagogical Content Knowledge). This theory is predominantly used within the sphere or context of education. As stated before, TPACK is an extension of the concept of PCK. Hence, TPACK focuses on how the components of PCK, which are - Pedagogical Content Knowledge and knowledge of students can be blended with technology to yield effective teaching (Koehler & Mishra, 2009).

2.22. Pedagogical Content Knowledge

Pedagogical Content Knowledge (PCK) is a construct by Shulman that proposed: that teachers draw on different types of knowledge during preparation and when teaching their learners. The various types of knowledge are curricular/ content knowledge, general pedagogical knowledge, knowledge of aims and purposes, knowledge of learners, educational contexts, settings, and governance. Furthermore, he posits that there is a juncture where these forms of knowledge intersect. That juncture forms the foundational base of a new form of knowledge that is known as Pedagogical Content Knowledge (Gudmundsdottir & Shulman, 1987).

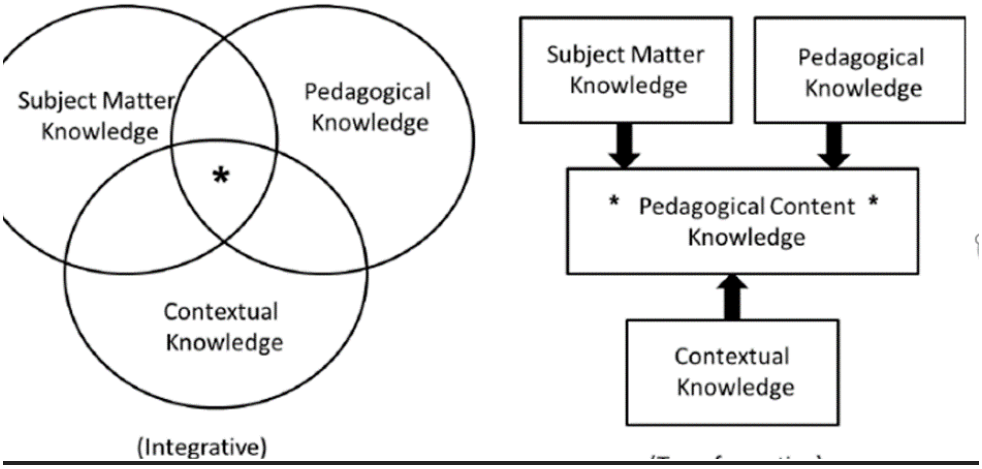

FIGURE 6: PCK

Figure 6 above illustrates all the knowledge bases that constitute the formation of PCK and the relationships between these knowledge bases. The diagram uses two subheadings, which are: integrative and transformative to illustrate this. Under the heading integrative the three forms of knowledge are displayed, which are namely: Subject Matter Knowledge, Pedagogical Knowledge and Content knowledge. The middle point where these entire forms meet, which is represented by the asterisk is where PCK is found or formulated. Under the heading transformative the diagram illustrates how PCK is the knowledge that is in between Subject Knowledge and Pedagogical Knowledge as the foundational base that is then in the latter also influenced by Contextual Knowledge.[4]

Following this, Shulman also suggested that PCK becomes the foundational base for a type of thinking that is peculiar to educators, and those who are in similar roles such as lecturers. That type of thinking is known as pedagogical reasoning. Pedagogical reasoning becomes a source of understanding that makes the process of pedagogical reasoning and action possible (Gudmundsdottir & Shulman, 1987). This is another model that is proposed by Schulman.

This is because being an educator is a complicated practice. Especially, during this technological age as it requires an interweaving of several kinds of specialized bodies of knowledge. Consequently, teaching is a discipline that requires educators to apply complex knowledge structures across different cases and contexts.

It is also a practice that requires educators to practice their craft in highly complex, dynamic classroom contexts that need them to constantly shift and evolve their understanding of their disciplinary knowledge. Thus, effective teaching depends on flexible access to rich, well-organized and integrated knowledge from different domains, including knowledge of student thinking and learning, knowledge of the subject matter, and knowing how to fuse those with technology (Mishra & Koehler, 2009). That is essentially where the TPACK comes in.

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[4] **Source:**

https://www.researchgate.net/figure/Two-models-of-teacher-knowledge-Integrative-Model-on-the-left-and-Transformative-Model_fig11_282330568

2.23. More on TPACK

The three fundamental components that a lecturer interacts within the TPACK model are technology, pedagogy, and content knowledge. At the intersection of these three knowledge types is an intuitive understanding of teaching content with appropriate pedagogical methods and technologies (Mishra & Koehler, 2009). According to Mishra and Koehler (2008) as cited in Jaipal and Figg (2010) teaching with technology is an overlap between subject matter content, technological knowledge, and pedagogical processes used by teachers in their endeavor to promote student learning (Jaipal, & Figg, 2010).

In addition to that, TPACK can also be viewed or defined as a framework that outlines the various relationships and the complexities that exist between all three fundamental components of teacher knowledge specifically: technology, pedagogy, and content knowledge (Mishra & Koehler, 2006). Therefore “At the intersection of these three knowledge types is an intuitive understanding of teaching content with appropriate pedagogical methods and technologies” (Mishra & Koehler, 2006, p.125).

Alternatively, TPACK can also be perceived as more of orientation as opposed to being a solid knowledge base. It is a peculiar, distinct body of knowledge that forms the knowledge base that teachers require, to be able to effectively teach using technology. It also has the potential to indicate an educator’s pedagogical and technological beliefs about teaching and technology (Voogt et al., 2013).

TPACK is a framework by Mishra and Koehler (2008), which focuses on designing and appraising teacher knowledge. It is concentrated on how educators can foster effective student learning in various content areas. Furthermore, it is an instrument that can be used to describe what teachers need to know, to successfully integrate technology into their teaching practices (Mishra & Koehler, 2009).

Voogt et al. (2013) argue that Shulman’s construct of Pedagogical Content Knowledge (PCK) has always recognized technology, the more traditional technologies and not the emerging ICTs. Which are not transparent and ubiquitous. Hence, they suggest that TPACK may assist educators to formulate a better understanding of the potential contributions that emerging technologies and ICTS can bring into the education space because, essentially TPACK is “a teacher’s knowledge of how-to coordinate subject

or topic-specific activities with topic-specific representations using emerging technologies to facilitate student learning" (Voogt et al., 2013, p.113).

According to Koehler & Mishra, TPACK strengthens the act of effective teaching with technology. It demands an understanding of the representation of ideas using technologies; in conjunction with pedagogical techniques that use technologies in productive ways to teach content. Additionally, it also exemplifies how technology can be used in the attempt to, 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 to develop new epistemologies and strengthen old epistemologies (Koehler & Mishra, 2009).

It is also very important to note that when Mishra & Koehler talk about technology in TPACK they were using it generically to refer to traditional, analogue and digital technology. For this study, the focus was mainly on digital technologies, which are also termed ICTs as well as the various tools/equipment used in the TVET sector.

TPACK is not just a concept that exists on its own in a vacuum, it consists of seven other components, bodies of knowledge that are scaffold, amalgamated and that ultimately build into each other to create this body of framework/ body of knowledge within the framework. The seven bodies of knowledge are:

Technological knowledge (TK) "Technological Knowledge refers to teacher's knowledge about various technologies, ranging from low-tech technologies such as pencil and paper to digital technologies such as the Internet, digital video, interactive whiteboards, and software programs." (Mishra & Koehler, 2006, p.125).

This type of knowledge consists of diverse skills that are required to operate particular technologies. In the case of new-age digital technologies knowledge would include:

- Knowledge of operating systems and computer hardware.
- The ability to use standard software tools including web-browsers, email programs, and word-processors.
- Basic knowledge about installing and upgrading hardware and software maintaining data archives.
- Staying up to date about ever-changing technologies.

- Understanding information technology to a point where educators can apply it productively at work and in their everyday lives and recognize when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology.

Content Knowledge (CK) “Content knowledge is the “knowledge about actual subject matter that is to be learned or taught” (Mishra & Koehler, 2006, p125). Teachers must know about the content they ought to teach and how the nature of knowledge is different for various content areas (Mishra & Koehler, 2006). Knowledge of content is of critical importance for educators. As Shulman (1986) noted, this type of knowledge includes knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge. Knowledge and the nature of inquiry differ greatly between fields. Most importantly, educators should comprehend, and be able to recognize the deeper knowledge fundamentals of the various disciplines that teach (Mishra & Koehler, 2009).

Pedagogical Knowledge (PK) Pedagogical Knowledge refers to the methods and processes of teaching that includes knowledge of classroom management, assessment, lesson plan development, and student learning (Mishra & Koehler, 2006, p125).

Pedagogical Content Knowledge (PCK): refers to the content knowledge that deals with the teaching process (Shulman, 1986). Pedagogical Content Knowledge is different for various content areas. It is a unique form of knowledge that blends both content and pedagogy to assist an educator to develop better teaching practices that will allow them to teach their content areas more proficiently.

Technological Content Knowledge (TCK): Technological Content Knowledge “refers to the knowledge of how technology can be utilized to create new representations for specific content” (Mishra & Koehler, 2006, p125). Additionally, it is an understanding of how technology and content can influence and constrain one another in the teaching process. TCK enables educators to develop a deep understanding of how the subject matter (or the kinds of representations that can be constructed) can be changed by the application of particular technologies. “Teachers need to understand which specific technologies are best suited for addressing subject matter teaching and learning in

their domains. Additionally, they need to have an understanding of how the content dictates or perhaps even changes the technology—or vice versa" (Mishra & Koehler, 2009, p.65).

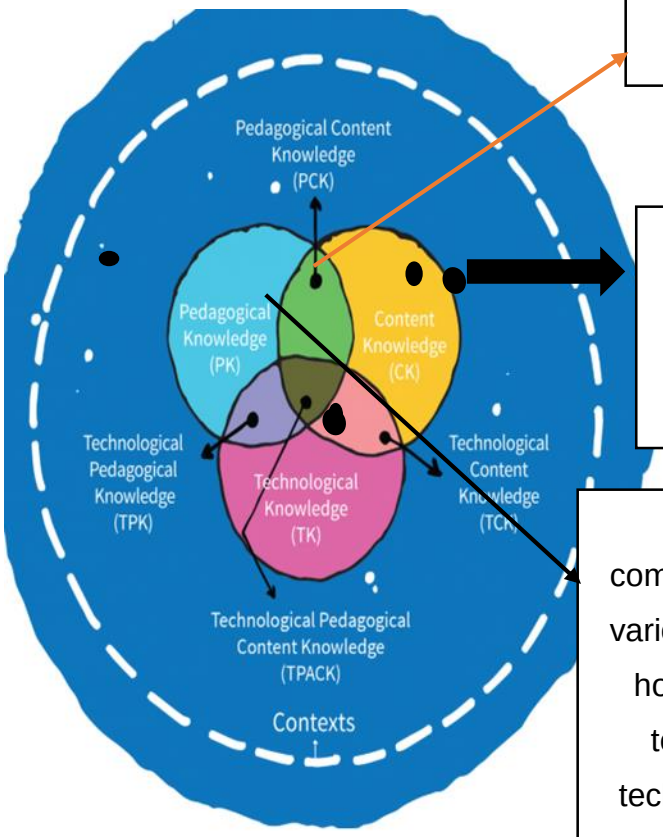
Technological Pedagogical Knowledge (TPK): refers to the knowledge of how various technologies can be used or fused into the teaching process. This type of knowledge enables educators to successfully integrate technology into their pedagogical practices within their respective disciplines or subjects; it is not topic or content specific. This kind of knowledge includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies. To build TPK an educator needs to develop a deeper understanding of the constraints and affordances of technologies and the disciplinary contexts within which they function is needed (Mishra & Koehler, 2009, p.65).

Technological Pedagogical Content Knowledge (TPACK): Technological Pedagogical Content Knowledge. This is the type of knowledge required by educators that; allows them to have an intuitive understanding of the intricate relationship between the three basic components of knowledge (CK, PK, and TK). Through teaching content knowledge using suitable pedagogical methods and technologies. TPACK is only evident in the classroom when a teacher can simultaneously integrate the knowledge of technology, pedagogy, and content in their pedagogical practices.

For this study, the researcher chose to focus on all the domains of knowledge that are found within the TPACK model. This was done to gauge the extent that lecturers are actually integrating technology and also to gauge the various types of knowledge that they are currently blending into pedagogical practices, particularly about how they incorporate technology into their pedagogical practices.

Likewise, the researcher also chose to use the entire TPACK model because it is representative of the highest form of knowledge within the model that a teacher can develop and that demonstrates the full ability to effectively and efficiently integrate technology into teaching and eventually into pedagogical practices. In addition to that, the usage of the entire TPACK model was influenced by the fact that "development of TPACK by teachers is critical to effective teaching with technology" (Koehler & Mishra, 2009, p.60).

The model below of TPACK illustrates the various forms of knowledge that form the foundation of TPACK



The foundational component of TPACK, stems from Shulman's notion of PCK

The black dots represent the seven types of knowledge or the knowledge components that are blended or that are blended or that constitute to this broader knowledge body

TPACK, and is characterized by diverse competencies and all the black dots represent these various competencies. These include understanding how to represent concepts with the assistance of technologies, pedagogical techniques that use technologies in constructive ways to teach content, epistemologies or strengthen old ones (Mishra & Koehler, 2008)

FIGURE 7: TPACK FRAMEWORK

Figure 7 illustrates the various knowledge bases that constitute to the formation of the TPACK framework. The three circles represent the three forms of knowledge namely: Pedagogical Knowledge, Content knowledge and Technological Knowledge and the dot in the middle of the three circles is PCK, which is where those three elements meet. Essentially, the knowledge in the circles forms the basic knowledge babes that form the foundation of TPACK. Outside the three circles are the other four types of knowledge that contribute to the formulation of TPACK. [5]

[5] **Source:** https://www.schoology.com/blog/tpack-framework-explained

2.24. The Technology Readiness Index

The last model that will be discussed is the Technology Readiness Index (TRI). This is a model that was proposed by Parasuraman (2000) and what this model does is that measures what Parasuraman calls an individual's propensity to embrace and use new technologies for accomplishing goals in two spheres of their lives mainly: in their home life and their life at work.

In addition to being a model, it also described it as being a construct which is representative of an individual's overall state of mind of, that comes into existence as a result of a gestalt of mental enablers and inhibitors, that collectively work together to determine an individual's predisposition to the use of new technologies (Parasuraman, 2000).

The **enablers** and **inhibitors** are two main dimensions that determine an individual's readiness. Under those dimensions, there is what are called contributors. These contributors make up the dimensions of technology belief that impact an individual's level of technology readiness. These contributors are optimism, innovativeness, discomfort, and insecurity (Elliot et al., 2008).

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Within the (TRI) model there is a dual relationship that occurs between the main dimensions and the contributing dimensions. This is how this dual relationship is formed: the main dimension of enablers is coupled to the following contributing dimensions: optimism and innovativeness, whilst the dimension of inhibitors is coupled with discomfort and insecurity.

Figure 8 below illustrates the relationship between the main dimensions and the contributing dimensions in the Teacher Readiness Index

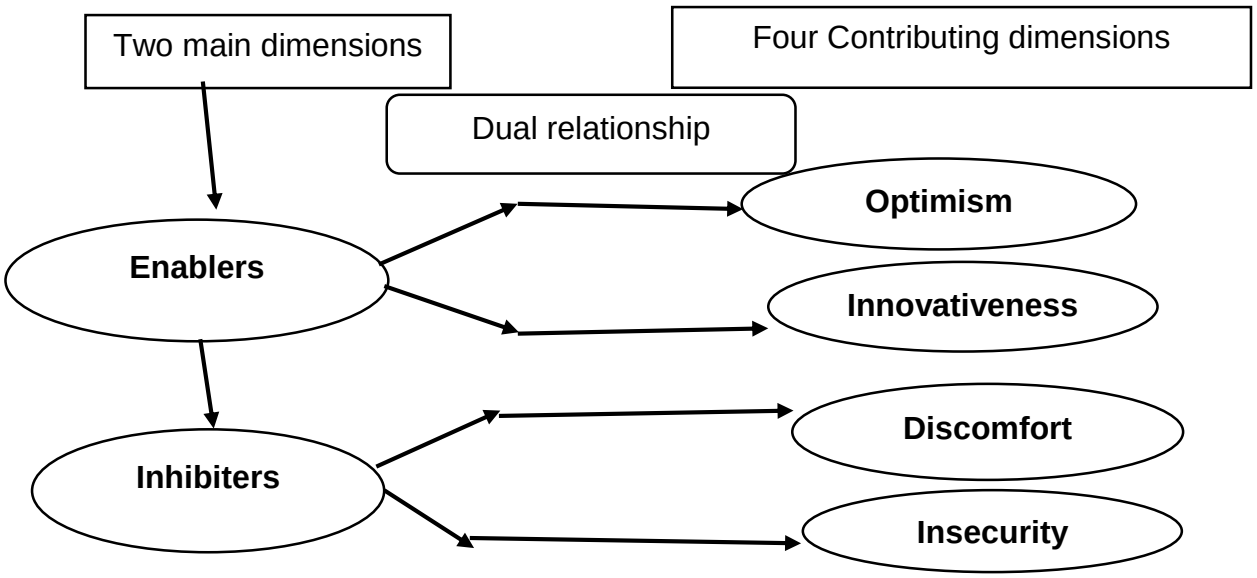


FIGURE 8: TEACHER READINESS INDEX

Optimism can be categorized as the extent to which an individual believes that technology can benefit them in their lives and give them control over their lives. **Innovativeness** can be characterized as an innate curiosity that an individual has about technology. It can be further defined as an instinctive desire to experiment with new technologies that can eventually see an individual becoming a leader who leads their counterparts in terms of experimenting with those technologies within their respective workspaces (Elliot et al., 2008).

Whilst, **Discomfort** can be defined as a feeling that is characterized by a lack of control over technologies and also by the lack of confidence in making the technology work and lastly **Insecurity** can be defined as an individual need for assurance that a technology-based product, service or process will operate dependably and accurately with minor to no challenges (Elliot et al., 2008).

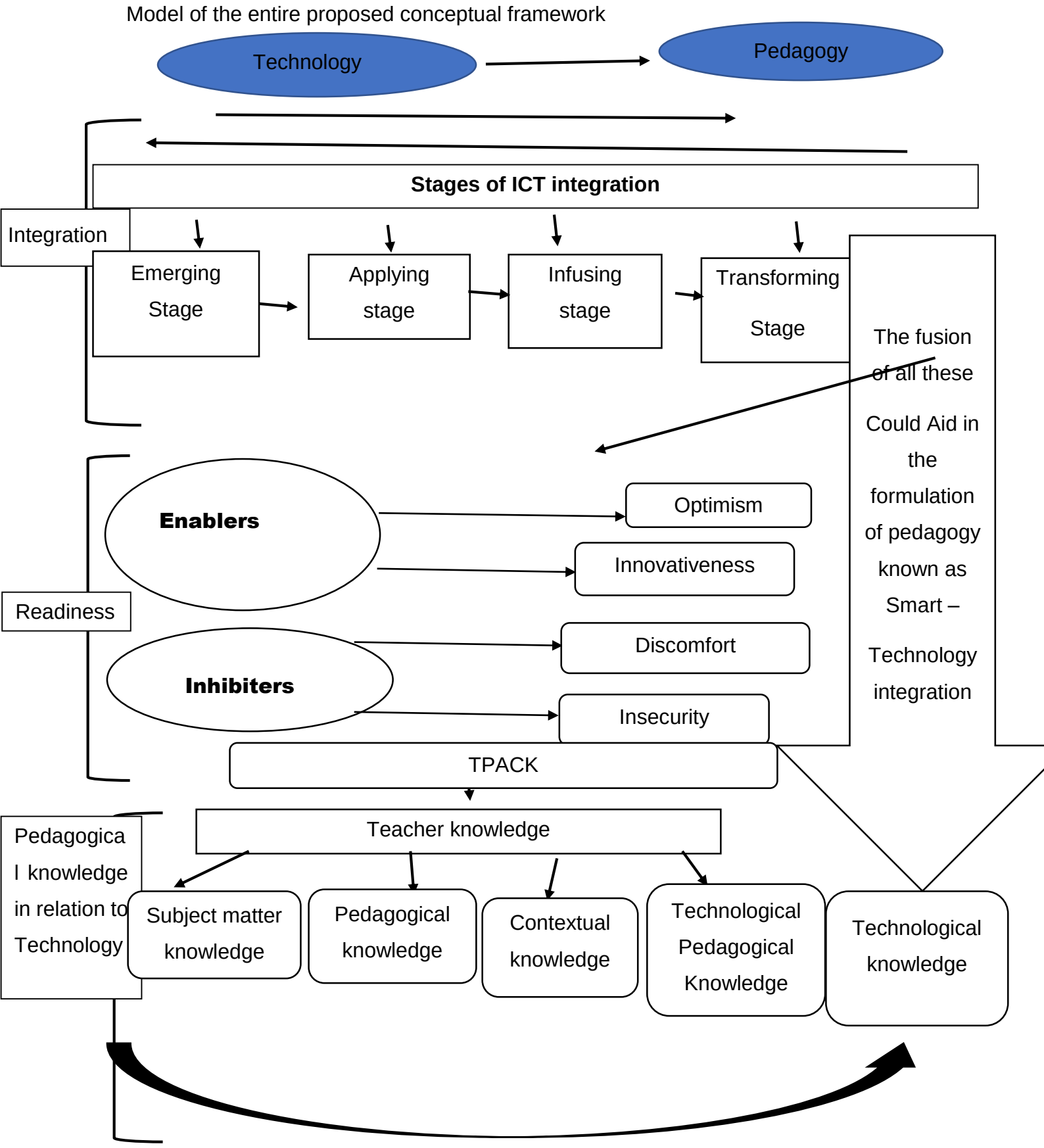


FIGURE 9: CONCEPTUAL FRAMEWORK

The diagram of the conceptual framework above is intended to illustrate the associations between the different theories used in this study and how they can aid in the formulation of a new vocational pedagogy. This new pedagogy will be discussed in more detail in chapter 5 of this study.

The framework above shows the various variables that need to be considered before and when introducing ICTs into Vocational Education before integrating ICTs. The main elements that influence or lead technology integration are technology and pedagogy. Then we need to consider the fact that integration occurs in various stages and that is where the UNESCO integration model comes in. The model supports the formulation of a plan to maneuver through the stages of integration. This helped with establishing, the characteristics that characterized each stage of integration. The UNESCO model gauged our progress, in terms of integration.

Next, the researcher needed to think of the concept of readiness in relation to enablers and inhibitors to ICT integration. Through establishing the factors that enable and inhibit lecturers from integrating ICTs, the researcher could find possible ways to help mitigate the inhibitors and encourage the inhibitors. One possible way of doing that will require the usage of the TPACK model. The TPACK model consists of different types of knowledge that a lecturer needs to have to be able to integrate ICTs or any other form of technology into their pedagogical practices. Starting from subject matter knowledge, which is the most basic form of knowledge, required for a lecturer to integrate ICTs into their practices.

Once, all those forms of knowledge have been considered and accounted for and then the move into ICT integration can then begin. This conceptual framework advocates for a transformation of pedagogy to new pedagogy. A new pedagogy that is foundationally led by the integration of ICTs through the consideration of the different variables and forms of knowledge that needs to be considered.

2.25. Conclusion

This chapter aimed to explore, discuss and to provide a detailed account of all the key rudiments that constituted to this research study. The central rudiments that were discussed were the literature review, the theoretical and conceptual framework. These are crucial rudiments that were used to conceptualize this study. These rudiments all formed part of this chapter and they all assisted with providing an outline that guided how the researcher conducted this study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

The previous chapter of this study focused on engaging with existing pieces of literature that were related to this study. In addition to that, it also focused on building a comprehensive conceptual framework, using a theoretical framework as the basis for that conceptual framework.

This chapter will endeavor to conceptualize the methodology, which was employed in the journey of conducting this study. This will be achieved through exploring the key features of this study starting with the research design, the research methodology, population, and sampling. In this chapter the researcher will also provide a comprehensive discussion on the philosophical underpinnings that guided this study. In addition to that, the researcher will also provide an account of the ethical considerations that the researcher needed to be cognizant of, prior to conducting this study.

3.2. Research Design

This study was structured after the intensive design and it was qualitative in nature. Intensive design is characterized as a type of research that is often associated with qualitative methodologies of data collection. In addition to that, intensive research "Often involves looking at the details of individual cases to develop in-depth descriptions of the fundamental properties that govern the behaviours, relationships, and/or interactions of the participants" (Dillon, 2008, p.8). Although the word intensive is a general term concerning research design, it is most often associated with qualitative methods; and these methods have their corresponding strengths and weaknesses.

One of the biggest advantages that are associated with intensive research designs lies in the fact they encourage researchers to create detailed descriptions of data. In essence, it creates a room that allows researchers to construct what are known as "thick descriptions" (Dillon, 2008p.8).

Furthermore, intensive research utilizes tools like- words, storytelling, interviews, and pictures, artifacts, and many other non-numerical types of data to assist the researcher

to develop a rich understanding of research data. It is through this rich data, that researchers can develop the "thick descriptions" that are cited above.

Fundamentally, thick descriptions integrate the details of social interaction, with the broader cultural patterns, that animate specific actions with meaning thick descriptions. This requires researchers to describe an action such as: briefly contracting one's right eyelid, like a blink, a twitch, or a wink, perhaps deployed conspiratorially, in parody, in rehearsal, or for deception (Dillon, 2008).

Another distinct feature of intensive research is that it enables researchers to study

> "Participants in their setting, allowing them to embrace the complexities that define the subjects, the relationships that are present, and the context in which they exist. Ultimately, intensive research designs provide specific explanations of individualized cases and allow for detailed descriptions of research settings through providing detailed verbal and other non-numerical forms of data" (Dillon, 2008, p3).

Hence, the methodologies (which are often qualitative) are often associated with intensive research. This is because these methods allow researchers to study participants in their settings/ immediate environment and this allows the researcher to embrace the complex dynamics that define the participants (who are the subject/subjects of the study). Ultimately, intensive research designs offer researchers with an opportunity to get specific explanations of individualized cases, experiences and allow for detailed descriptions of research settings through verbal and other non-numerical forms of data that can be collected (Dillon, 2008).

3.3. Research Methodology

For this study, the researcher chose to utilize qualitative methods to collect data. Qualitative methods often involve trying to understand a particular phenomenon, without formulating a preconceived hypothesis. Furthermore

> "Qualitative research normally occurs in the participant's immediate, natural environment. It often requires the researcher to go to the participant's home, school or other immediate environments to collect data. This enables the researcher to develop details about the research they are conducting" (Devlin, 2006, p.53).

Additionally, qualitative methods aim to answer questions about **where what**, **how** or **why** of phenomenon occur. Rather than **how many** or **how much,** which can be answered through the use of quantitative methods (Patton & Cochran, 2002).

One feature that sets qualitative research methodologies apart from quantitative research is the Modus operandi of qualitative research, which is to describe the general characteristics of a population. As opposed to providing detailed individualistic accounts of participants involved in the study. Therefore, qualitative data should produce a wealth of detailed data from a small pool of participants (Hyde, 2000).

Qualitative research strategies are often based on the process of meaning-making and knowledge construction. Which are influenced by constructivist perspectives. These perspectives seek to create meaning of individual experiences, which are socially and historically constructed to develop certain theories or patterns. The data that is collected by a researcher, who uses the qualitative strategy, is mainly focused on the fundamental objective of developing themes- using that data (Creswell, Plano Clark, Gutmann & Hanson, 2003).

Glaser and Strauss (1967) as cited in Hyde (2000) also posit that the findings that are made from qualitative data suggest that a researcher, who embarks on qualitative data collection commences their data collection “with an open mind that is open to the perspectives of the subjects” (Hyde, 2000, p.83).

Moreover, qualitative research uses multiple methods that are both characterized as being interactive and humanistic (Creswell et al., 2018). Generally, qualitative methods also aim to understand the attitudes, as well as the experiences of a particular group of people or of the individuals’ that are involved in a research study. Which was the case with this particular study. The participants for this study were a group of lecturers that teach Automotive and Repair and Maintenance.

This study was characterized by the following methods of qualitative research: observations, which observed lecturers’ behaviours, in terms of how they integrated ICTs into their existing pedagogical practices. Additionally, it employed open-ended, semi-structured interviews, which were also utilized by the researcher to establish lecturers’ beliefs about ICT integration and to investigate the teaching practices that took place in Automotive classrooms. Furthermore, the semi-structured interviews were conducted following the points above. The researcher selected the usage of

qualitative methods because these “methods are approachable means for examining reality” (Thanh & Thanh, 2015, p.26).

The methods used in qualitative studies regularly make use of traditional methods

> “That are based on open-ended observations, interviews, sound, emails and other emerging forms of data collection. In addition to that, qualitative research is essentially interpretive in nature, as it requires the researcher to interpret the data collected. In order to make sense of it. The data analysis part of the data includes the process of developing a description of an individual, their setting for themes or categories and making an interpretation or drawing conclusions” (Creswell, 2018, p.182).

Ritchie, Lewis, Nicholls and Ormston (2013) prescribe that seven common attributes characterize qualitative research these are:

1. The fact that the aims and objectives of qualitative research are directed at, providing an in-depth and interpreted understanding of the social world of participants. By learning more about the sense that participants make of their social circumstances, histories, and perspectives.
2. Qualitative methods make use of what are known as non-standardized methods to generate data. This is sensitive to the social context in which the study takes place.
3. There is not a single way to use these methods. However, they can be easily adapted for each participant, which allows for more flexible ways to explore emergent issues.
4. Data that is collected using these methods is detailed, rich and complex. The analysis stage of research conducted using this method retains a certain level of complexity, and nuance that respects the uniqueness of each participant or case amidst recurring themes.
5. There is a level of openness to the emergent categories and theories at the analysis stage of interpretation of the data.
6. Outputs of data include detailed descriptions of the phenomena that are being researched. This is normally grounded in the perspectives and the accounts of the participant.

7. Qualitative research may have what is known as; a reflexive approach. This is an approach that acknowledges the role the researcher plays in the research proves and recognizes their participant's experiences. This occurs when data is gathered on the field. During this, the researcher encourages their participants to report on these experiences openly and honestly (Ritchie et al., 2013). All these attributes are, to a certain extent evident in this study.

Qualitative methods of data collection were ideal for this particular study. This is in terms of one of the theories that make up the theoretical as well the conceptual framework of this study. The one theory that mainly overarched the researcher's conceptual framework, which is the TPACK framework. According to Voogt et al. (2013) TPACK is determined through a combination of several instruments such as analysis of student products, document analysis, classroom observations, interviews, and surveys. This coincides with two of the instruments and methods, which were used by the researcher to gather data for this study.

3.4. Worldviews or Research Paradigm that Influenced/Underpinned this Study

Essentially, according to Mackenzie and Knipe (2006) by definition "a research paradigm is a worldview a perspective, thinking, school of thought or set of shared beliefs that inform the meaning or interpretation of data Mackenzie and Knipe (2006) as cited in (Kivunja & Kuyini, 2017, p.26). Furthermore, a research paradigm also influences the data collection methods that will be used to collect and analyze the data.

Similarly, Denzin and Lincoln (2000) as cited in Kivunja and Kuyini (2017), describe paradigms as human constructions, which deal with principles that indicate a researcher's perspective/view of the world. This informs how the researcher constructs meanings that are embedded in data.

Consequently, paradigms are significant in a research study; because they provide beliefs and dictate a particular discipline, influence what should be studied, how it should be studied, and how the results of the study should be interpreted (Kivunja & Kuyini, 2017).

This study was shaped and influenced by the Interpretivist paradigm, which is also often referred to as being the constructivist paradigm. This is largely because this paradigm emphasizes an individual and their understanding/ interpretation of

knowledge and the world around them. Additionally, this paradigm also asserts “reality is socially constructed” (Kivunja & Kuyini, 2017p.27).

Hence, it is also often called the ‘constructivist paradigm’. It is also important to note that by implication that means that, in this paradigm: theory does not precede research. But that research precedes theory” (Kivunja & Kuyini, 2017, p.27).

Therefore, the foundation of research within this paradigm is grounded on the data generated by the research, or the data collected from research. It is not based on preconceived ideas or constructs that a researcher might have had prior to conducting the study. After all, “Interpretivist paradigm states that the world is constructed through interactions between individuals, each with their own subjective experiences and perceptions” (Scott, 2013, p.127). That aligns with what Thanh and Thanh (2015) cited in their study, which states that researchers who use this paradigm view the world through the perceptions and experiences of their participants. These experiences are utilized to construct and interpret the researcher's understanding, from the data that they have collected.

It is important to note that within the context of social sciences research, the terms constructivism and Interpretivist are often used interchangeably. Moll (2002) endeavors to explain the various ways in which the word “constructivism” is used differently in Educational research and within Social Science research. He presupposes that humans through tools socially construct everything including reality: language and culture, which in turn shape reality. Thus, the reality is one that exists outside and exists independently of the conventional constructs of it (Moll, 2002). Thanh and Thanh (2015) concur with Moll by stating “Interpretivist view the world through a series of individual eyes and that participants have their interpretations of reality” (Thanh & Thanh, 2015, p.26).

Data within this paradigm is mainly collected through the act of observing human behaviour. For the type of data that the researcher sought to collect, it was essential for the researcher to physically step into the participant’s area of work because, Interpretivist asserts that people’s behavior is influenced by their immediate environment (Willis, Jost & Nilakanta, 2007). That influences the subjective realities that the subjects experience and how they internalize those experiences and realities.

The Interpretivist/ constructivist approach seeks to understand the world and the phenomena that occur in the world, through the eyes of the participants. That is either being studied or part of a research study. It makes use of what is termed "*subjectivist epistemology"*. Meaning that whilst or after collecting data, the researcher makes meaning of their data, through their thinking and cognitive, perceptive processing of data, which is informed by the interactions that they had with their participants (Willis et al., 2007).

Furthermore, interpretivism also posits that: researchers who operate within this paradigm are engaged in a collaborative process that requires them to mingle, converse, interrogate, listen, read, write and record research data (Kivunja & Kuyini, 2017). Which is precisely what the researcher did during the data collection and analysis process.

Various characteristics are associated with research that is influenced by the Interpretivist paradigm. Firstly, most of the research that is underpinned by this worldview normally utilizes qualitative methods to collect data. In addition to that, Marguerite, Dean, and Catharine (2006) as cited in Thanh and Thanh (2015) also state that research that is underpinned by interpretivism has the following characteristics:

It utilizes data collection techniques that involve observations and the interviewing of participants that bring the researcher into close contact with their participants. In addition to that, the researcher is very active and plays a very interactive role in their research and with their participants. This active/ interactive role often requires the researcher to interact with the participants in their immediate social contexts, in which they live or work. This is normally dependent on the type of research that the researcher is conducting.

The hypothesis of the research is formulated after the researcher begins data collection, especially, after the data has been modified and analyzed. In addition to that, the research report that is drafted after the data has been analyzed is normally written in a narrative form.

Interpretivism is often seen as being more subjective as opposed to being objective, as it does not seek answers to researchers' questions in ridged ways. Rather, it allows researchers to explore participant's reality in relation to the researcher's understanding of reality. It also grants the researcher an opportunity to examine the participants and

what they have to say or how they verbalize their experiences, about what the researcher is trying to establish in their particular study. Researchers who utilize interpretivism also believe that understanding of participant's context is a key factor that needs to be considered when interpreting data (Thanh & Thanh, 2015).

Ritchie et al*.,* (2013) also posits that the research process of research studies that follow this particular paradigm is considered to be inductive. This is because the interpretations that emerge from the data collected here are theory-laden. After all, they are mediated by already existing ideas and assumptions that researchers might have before commencing the research process.

Certain implications come with utilizing interpretivism in research. According to Gage (1989), two main implications come with using interpretivism in research. The one implication has a bearing on the researcher and the other is associated with the actual data that was collected and how it was analyzed.

The first implication is that: the data that in research, in the Interpretivist approach should never be influenced or organized around or based on researchers' prior assumptions. The second implication states that; a researcher should also adopt an investigative orientation in their research. This is an orientation that seeks to learn what is going on in particular situations, in the endeavor to get to an understanding of the distinctive orientations of the participants involved in the study (Gage, 1989).

According to Lincoln and Guba (1985), and Morgan (2007), as cited in (Kivunja & Kuyini (2017) eight characteristics are found in research studies that utilize the Interpretivist paradigm. However, for the context of this study, the researcher only chose to utilize four characteristics because those were more relevant for this study. The following diagram below illustrates the characteristics of interpretivism that were utilized and evident in this study.

The following diagram below illustrates the four characteristics of interpretivism that are evident in this study.

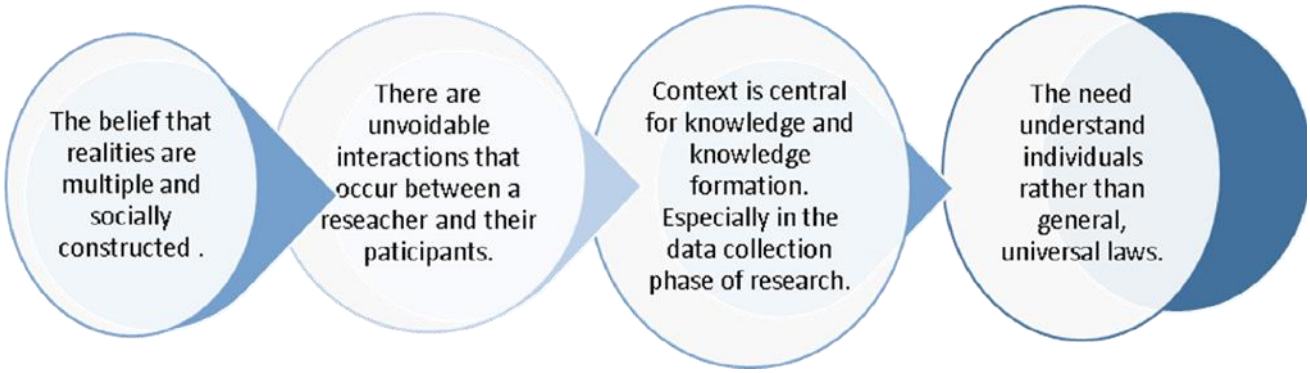


FIGURE 10: ELEMENTS OF INTERPRETIVISM

The diagram above briefly illustrates the different elements of interpretivism that were used in the study. Furthermore, it illustrates how these elements influenced this study.

3.5. Population and Sampling

Population and sampling are two variables that needed to be carefully considered before conducting a research study. However, what is a population and what is a sample? These two terms mean the same thing or that can be used interchangeably, or do they mean two different things?

Essentially a population is defined as “all the organisms that both belong to the same group or species and live in the same geographical area” (Creswell, 2008, pp.29-30). This does seem to be a very generic manner of looking at the concept of a population. However, this definition works just as well in the context of research as it does in the world that exists beyond research.

Additionally, Arikunto as cited in Creswell (2008) also theorizes that a population is what the entire research project is about; he went on to define population as being the “census” of a research study (Creswell, 2008).

From the population, in research, we filter down to what is known as the sample. The sample is defined as a part, a portion of the entire population that is selected to become participants or observers in a research study. The sample that was chosen to participate in this study consisted of five Automotive Repair and Maintenance lecturers who teach in the NC (V) stream. These lecturers were from two different TVET Colleges in the Ekurhuleni area.

In research, there are numerous kinds of sampling that one can utilize such as multi-phase sampling, convenience sampling, quota sampling, dimensional sampling, volunteer sampling, and purposive sampling just to mention a few.

This particular study utilized purposive sampling which is also known as judgmental sampling/ convenience sampling. This type of sampling was used in its most generic, purist, basic form. Whereby, the main aim of using this type of sampling was to gain access to knowledgeable people, who had first-hand encounters with the issues that the researcher wanted to research. Additionally, the participant's immediate sphere of contact was important, so in this instance, for this study it was their profession. The crux of purposive sampling is to acquire information from a group of people who are in a position to give that information (Cohen, Manion & Morrison, 2007). This type of sampling was utilized to assist the researcher to select five lecturers who teach Automotive Repair and Maintenance, in TVET Colleges within the Ekurhuleni district.

Purposive sampling involves the process of meticulously selecting individuals, who will become participants in a study based on certain characteristics (which are sought after or deemed as being vital by the researcher conducting the research, because they will be able to relate to the experiences that the researcher seeks or they are more likely to generate data that will be useful for their study). Researchers who use this type of sampling are generally looking to create a sample that will be adequate enough to cater for their data collection. The participants chosen to be part of a purposive research sample are selected based on a set of criteria "they are chosen for a specific purpose" (Cohen et al., 2007, p.115).

The participants that were chosen to participate in this study had to meet the following criterion:

- Firstly, they had to be lecturers who were teaching Automotive Repair and Maintenance.
- Lecturers had to be lecturing in the NC (V) stream/programme.
- Lastly, the lecturers needed to be lecturing in TVET Colleges that are located in the Ekurhuleni region.

3.6. Data Collection Methods

For this research, the researcher employed two data collection techniques, namely: classroom observations and semi-structured interviews. The researcher chose those

two methods mainly because they were more appropriate for the kind of data that the researcher sought to collect. Additionally, these data collection methods assisted the researcher to generate an adequate understanding of the lecturer's lived experiences and their pedagogical practices.

By definition, an interview is viewed as a flexible tool, in the form of a conversation that can be used for data collection, which enables multi-sensory channels to be used. Channels such as verbal, non-verbal, spoken and heard can be used to collect data. In addition to that, the structure and the flow of interviews may be controlled by both the interviewer and the interviewee, while still giving room for spontaneity. Also, during the interview, the interviewer can channel the interview in a manner that will not allow the interviewee/interviewees to provide complete responses about complex and deep issues. In short, the interview is a powerful implement that researchers can use to collect data (Cohen et al., 2007).

Similarly, according to Kavale (1996) as cited in (Cohen et al., 2007) an interview, is a process that affords or creates a platform for an exchange of views between two or more people on a topic of mutual interest. This is central because the basis of human knowledge production is situated in human interaction, which allows knowledge construction between participants.

> Hence "Interviews enable participants – be they interviewers or interviewees or the respondents as they are also known – to discuss their interpretations of the world in which they live, and to express how they regard situations from their point of view. In these senses the interview is not simply concerned with collecting data about life: it is part of life; its human embeddedness is inescapable" (Cohen et al., 2007, p.349).

As mentioned above it is essential to note that an interview is a conversation. However, it is not just a usual informal conversation. In contrast to an informal conversation, it has a specific purpose, and it is often question-based on the questions being asked by the interviewer. The interviewer alone may express ignorance (and not the interviewee), and the responses must be as explicit and often as detailed as possible. The interview is also constructed rather than being a natural occurrence. This renders it different from an everyday conversation. Therefore, the researcher should set up, and abide by, different 'rules of the game' in an interview.

Furthermore, according to Kvale (1996) as cited Cohen et al. (2007) there are 10 key characteristics that make up qualitative research interviews these are: Lifeworld, Meaning, Qualitative, Descriptive, Specificity, Deliberate naiveté, Ambiguity, Sensitivity, Interpersonal relations, and Positive experience.

Semi-structured interviews generally make use of open-ended questions and prompts. Open-ended questions are questions that require unstructured, free responses (Harrell & Bradley, 2009).

Some characteristics and the advantages of semi-structured interviews include and are not limited to the fact that: The exact wording sequence of questions can be controlled, and pre-determined by the interviewer. All respondents are required to answer the very same set of questions, in the very same order.

One of the strengths of open-ended questions lies in the fact that: since respondents are asked and respond to the same set of questions. This increases the compatibility of the responses, during the data analysis stage of the research. The asking of the same questions also helps to ensure that there is reduced interference, bias (from the interviewer) when interviews are being conducted. Moreover, according to Cohen et al., (2007) using open-ended questions “Permits decision-makers to see and review the instrumentation used in the evaluation. It also facilitates organization and analysis of the data” (Cohen et al., 2007, p.288).

Since the open-ended questions and prompts are standardized, it becomes easy for the interviewer to guide or provide direction during the interview without being explicit or obvious about it.

A key weakness that is often associated with the use of open-ended questions is in fact that there is little to no flexibility, in relating the interview to particular individuals on the topics that are addressed during the interview. In addition to “the standardized wording of questions may constrain and limit what is perceived as the “naturalness” and relevance of questions and responses” (Cohen et al., 2007, p.288). To mitigate this weakness, the researcher urged the participants to be as natural, honest and transparent as possible in their responses. As this would have a huge bearing on the quality of the data and the quality of the planning and preparation for Advanced Diploma in TVET.

During the data collection process, the researcher conducted semi-structured interviews with the lecturers first. After concluding that, the researcher moved on to conducting classroom observations. This was a strategic move by the researcher in the endeavour to organize and make sense of the data that was collected during the data collection process. The semi-structured interviews were conducted with the intent of assisting the researcher to interact with the lecturers through a conversation. During the semi-structured interviews, the lecturers told the researcher a bit about themselves, about how they felt about the integration of ICTs into the classroom and their current pedagogical practices in relation to ICT use.

The second technique that the researcher utilized to collect data were classroom observations. The observations were conducted in the endeavour to strengthen or find the patterns of differences and similarities, between the responses that were collected during the semi-structured interviews and the realities that occurred in the classroom.

According to Scott and Morrison (2006) observations can provide details and specific information about the various educational activities, and practices that occur in a classroom. These details would be difficult to determine using other data collection methods. Additionally, observations also enable researchers to sample educational experiences first-hand rather than to depend on what participants say they do. Through using other data collection methods, it often becomes difficult for the researcher to infer cause from effect, the intention from observation and stimulus. All of these tend to be difficult to decipher through mere verbal responses during interviews (Cohen et al., 2007).

Likewise, observations also enable researchers to understand the context of problems, they also force observers to be open-ended and inductive, to see things that might otherwise be unconsciously missed, to discover things that participants might not freely talk about in interview situations, to move beyond perception-based data (e.g. opinions in interviews) and to access personal knowledge. This is because observed incidents are less anticipated and there is a certain level of freshness to this form of data collection, which is often denied or unexploited in other data collection methods. Also, observations seek to catch and encapsulate the dynamic nature of events, to intentionally seek themes, trends, patterns of similarities and differences (Cohen et al., 2007).

Furthermore, observations gave the researcher an opportunity, to get insight into and to perceive certain aspects of phenomena that might otherwise be unconsciously missed and to discover things that participants might not freely divulge in during the semi-structured interviews, to move beyond perception-based data such as opinions from the semi-structured interviews). Observed incidents are less predictable, and there is a certain element of freshness to this form of data collection that is often denied in other data collection methods (Cohen et al., 2007). The researcher conducted all observations during school hours, because the researcher needed to witness how the lecturers were actively using ICTs and other technological devices, in their pedagogical practices, when teaching their students during their lessons.

Furthermore, for the study, two observations were conducted with each lecturer in each TVET College. One observation was conducted in the theory classroom and another was conducted during the practical workshop sessions. This was done to help the researcher gauge the similarities, and differences in ICT integration in these two different contexts. Observations were also conducted, to provide the researcher with an indication of the context where ICT integration was more evident or where it lacked and still required supplementary support.

The observations were conducted to allow the researcher to physically see, experience and be a part of both the teaching and learning experience, which both the students and the lecturers went through in the classroom. This was also done to investigate the extent to which lecturer's pedagogical practices matched the statements that they made during the semi-structured interviews.

3.7. The Setting of the Study

This study was conducted in two different TVET Colleges in the Ekurhuleni region, in the East Rand. The two TVET Colleges were both situated in the same context, in the township, within the Ekurhuleni district. The two TVET Colleges were given pseudonyms: College A and College B, this was done to keep the TVET Colleges unidentified. These Colleges were situated in townships that are densely populated, with high unemployment rates. Below is a more detailed account of the College's demographics.

3.7.1. TVET College A

TVET College A is situated in Ekurhuleni, it had about 1000 students registered in the institution. There were about 240 students that were registered and attended the Automotive Maintenance and Repair course in this college from NQF level 2-4 in the NC (V) stream. This is how the student body was rationed according to the different NQF levels. Firstly, there was 1 lecturer for every group of about 30 students, meaning there about 30 students in each Automotive Repair and Maintenance classroom. The College had:

Two-level 1 Automotive Repair and Maintenance classes

Two-level 2 Automotive Repair and Maintenance classes

Two-level 3 Automotive Repair and Maintenance classes

Two-level 4 Automotive Repair and Maintenance classes

For the subject Automotive Repair and Maintenance, the students attended two sessions, in two different venues. One venue, which was a classroom, was utilized for the teaching of the theoretical component of Automotive Repair and Maintenance whilst the workshop was utilized for practical workshop sessions. The theory classrooms were equipped with one whiteboard, whiteboard markers and a few models that lecturers used for demonstrations and a cupboard for the students' textbooks and a projection screen.

However, the College did not have a projector for the lecturers to use with the screen. For the practical component of Automotive, the students went to the workshop. The workshop at the College was equipped with various technologies/equipment from spanners, engines, carburetors from various models and makes of vehicles, diagnostic machines, and an old television set were all found in the workshop. In terms of the diagnostic machine, there is one model in the workshop model of the diagnostic machine that the researcher found in the workshop, it is important to note that this diagnostic machine was an old model. However, when the researcher engaged with the lecturers they alerted the researcher to the fact that College A, was waiting to receive new equipment and technologies from one of their sponsors.

3.7.2. TVET College B

This TVET College was situated about 10 kilometers away from College A and had 1 200 students registered in the College across different trades including boilermakers, as well as students who were studying Electrical and Mechanical engineering and Primary Health. This college had three Automotive Repair and Maintenance lecturers and each lecturer was allocated 3 classes in the NC (V) stream. The school had a total of 9 Automotive classes and each class consisted of about 30 students, so currently the school had about 270 students (from level 1-4) students who study Automotive Repair and Maintenance.

In this College this is how learning time is split: students are allocated time/ hours for Automotive Repair and Maintenance. So, what happened in this College is that students would go to the theory classroom for a week. In those sessions, the lecturers would cover the content theoretically and students would engage with the theory abstractly. This would happen prior to going to the workshop to apply the knowledge that they learned in the workshop. Students proceed to spend the next week in the workshops completing their practical tasks in the workshop. This was not fixed practice though; it would change based on the complexity of the content that the lecturers were teaching.

In terms of resources and ICTs, the school was not adequately equipped with ICTs, especially, in the theory classroom. The theory classes are fitted with a white-board and projection screen. Moreover, this TVET College did not have projectors fitted into any of the classrooms. There was one projector available for use, in the entire College. Which was a challenge for the lecturers because, if one lecturer is using the projector, obviously the other lecturers cannot use it. Then there was one model of an engine in the theory classroom, which the lecturers predominantly used for the demonstrations in the classroom. The College has a fully equipped workshop fitted with a diagnostic machine, pressure testing machines, engines, and carburetors.

3.8 Participants' Profiles

A tally of five lecturers were utilized as participants for this study, two of those lecturers were from College A and the other three were from College B.

3.8.1. Lecturer A

Lecturer A is a male lecturer at College A. He is a post level 1 lecturer who also acts as Facilitator in the College. He lectures all streams of Automotive in College A, which are NQF streams/ levels 2-4. In addition to that, he teaches both theory, as well as the practical workshop sessions. In terms of age, he falls between the ages of 25- 35-year category. He was the youngest participant in this study. In terms of qualifications, he has a Technical Diploma in Mechanical Engineering, which he obtained in 2016. That is also his highest qualification. He is a registered artisan, specializing in Automotive Repair and Maintenance. He is very passionate about Automotive Repair and Maintenance; he is very up to date with all the latest trends in Automotive.

Furthermore, he is registered with SACE (South African Council for Educators). Overall, he has three years of teaching experience in Automotive which he gained at the College that he is currently teaching at, which is college A. In addition to that, he also has 6 years of industry-based work experience and he has never completed any form of computer literacy course, nor has he attended any computer/ technology or ICT related training course. He asserts that all he knows about computers is self-taught, with the assistance of YouTube.

3.8.2. Lecturer B

Lecturer B is also a lecturer at College A and he is a male. He is also a post level 1 lecturer in College A. He lectures levels 3 and 4 of Automotive in College A. His age range falls between the ages of 35- 45-year range. In terms of qualifications, he has a National Diploma, which he obtained in 2009, that is his highest qualification. He is a registered artisan, and his trade is Automotive Repair and Maintenance. He also teaches both the theoretical and practical elements of Automotive.

In addition to that, he is also registered with SACE (South African Council for Educators). Overall, he has seven years of teaching experience in Automotive which he gained from two institutions, which are firstly the College that he is used to work for (College E) and College that he is currently teaching at. He worked at his previous (College E) for 4 years, before joining College A, where he has been teaching Automotive for 3 years. In addition to that, he also has 2 years of industry-based work experience and he has never completed any form of computer literacy course nor has he attended computer/ technology or ICT related training or course.

3.8.3. Lecturer C

Lecturer C is a lecturer at College B and he is also a male. He is a post level 1 lecturer, and he lectures all levels of Automotive in College A. His age range falls between the ages of 45- 45 years. In terms of qualifications, he has an N6 certificate in Mechanical Engineering, that he obtained in 2008 and he is a registered artisan, and his trade is also Automotive.

In addition to that, he is registered with SACE (South African Council for Educators). Overall, he has 10 years of teaching experience in teaching Automotive. He has been teaching Automotive at the College that he is currently in for 6 years now. However, that is not the only experience he has. He also has 4 years of experience of teaching Automotive from the previous College that he taught at before coming to College B. In addition to that, he also has an astonishing 12 years of work-based experience.

Lecture C like the rest of his counterparts has never completed any form of computer literacy course. Nor has he ever attended computer/ technology or ICT related training.

3.8.4. Lecturer D

Lecture D is a male and he is a lecturer at College B. He is also a post level 1 lecturer and His age range falls between the ages of 35- 45-year category. In terms of qualifications, he has a Technical Diploma, which he obtained in 2014. However, as opposed to his counterparts who specialized in trade and wrote a trade test, he did not write the trade test. Therefore, he is not a qualified artisan or tradesman. He possesses a Technical Diploma, in which he specialized in General Diesel and Motor mechanics, for teaching purposes. He has an aggregate of 4 years of teaching experience, this experience pertains to Automotive. He has been teaching at his current College for 4 months and he has 4 years of experience of teaching Automotive from the College he worked at previously. In addition to that, he also has six years' work-based experience; he used to work as a Mechanic, before becoming a lecturer. He is registered with SACE and has never completed any form of computer literacy course nor has he attended any computer/ technology or ICT training or related course.

3.8.5. Lecturer E

Lecturer E is a male and he is a lecturer at College B. He is a post level 1 lecturer, and His age range falls between the ages of 55- 65-year category. He was the eldest participant in this study. He possesses a Technical diploma in Automotive, which he

obtained in 2005. He also is a qualified artisan specializing in Automotive and he also possesses a BA Honours degree, which is his highest qualification.

In addition to that, he has a total of 13 years of teaching experience in Automotive. 8 of those years of experience were gained from a College that he previously worked for. The other five years of experience were gained at the college that he currently works at. In addition to that, he also has five years of industry-based work experience. He has also never completed any basic computer/ICT training or course.

3.9. Data Analysis

After the data collection process was completed, the researcher commenced with data analysis. Data analysis is one of the most crucial aspects of the research process. In quantitative research, data analysis tends to be significantly rich and detailed. Additionally, qualitative data analysis "generally involves the processes of organizing, accounting and explaining the data" (Cohen, Manion & Morrison, 2007, p.493).

The researcher utilized two different methods for data collection. Hence, the data analysis also took place in two phases. The two sets of data were analyzed separately. The researcher started by analyzing the semi-structured interviews. Once all the interviews were conducted with the participants, the researcher listened to the interviews (quite a few times) and transcribed them onto a word document and backed them up on Google drive. Once, the transcriptions were completed the researcher conducted a two-way check. This process involved reading through the transcriptions thoroughly (whilst listening to the interviews) to ensure that the transcriptions were accurately aligned to what the lecturers said during the semi-structured interviews. To check if the written transcripts correlated with what was articulated in the recordings.

Once the transcriptions were completed, the researcher developed themes. The themes emerged from the codes, which emerged from the data that was collected. Thematic analysis was employed to analyze the data. The thematic approach to data analysis is an approach that seeks to look across all data that has been collected and identifies all the common issues that recur from that set of raw data. Thematic analysis also identifies the main themes that summarize all the views that have been collected by a researcher. This method is commonly used to analyze descriptive qualitative research studies (Patton & Cochran, 2002).

The themes that emerged in this study were from various aspects of the research, like the instruments that were used to conduct this study. To a certain extent, they were also predetermined. The themes were primarily shaped by the nature of the research questions, which the researcher asked the lecturers during the semi-structured interviews and from the observation schedules that were used for the observations. These instruments assisted the researcher to generate patterns of similarities and differences in this study. The coding process was also utilized to analyze the data. The coding process involved:

3.9.1. Reading and Annotating Transcripts

This was the most basic, foundational stage of the data analysis. During this process, the researcher merely made preliminary observations of the raw data. This process was vital in assisting the researcher to develop a feel for the raw data that was collected.

3.9.2. Identifying Codes in the Raw Data

During this step, the researcher focused on reading the data in detail, and on identifying all the codes that were present in the data. The one question that was guiding the researcher on this quest to make sense of the raw data and to extract information from that data was “what is going on here?” The researcher also highlighted the transcriptions using different colours according to the various codes that the researcher had created. In addition to that, the researcher also wrote notes on the margins of the responses and identified the themes that emerged from lectures responses.

3.9.3 Coding the Raw Data

In this step, the researcher applied the codes to the whole set of transcriptions (the data) that were collected, and all the codes were written in the form of notes on the margins of the data.

3.9.4. Developing Themes for the Raw Data

After identifying and gathering the codes, the researcher began the process of developing a coding scheme. Furthermore, this coding scheme was utilized to formulate a list of themes. These codes and themes were applied and utilized by the researcher to analyze the data.

3.9.5. Cutting and Pasting Data and Narrative Analysis

Once the coding was completed, the researcher used the cut and paste method to group the data into piles, according to codes and themes. Patton and Cochran (2002) suggest that this is the point where researchers take data extracts from their original contexts (the interview, observation or focus group transcript) and put them together with other examples of data on the same topic to start looking for patterns across the data (Patton & Cochran, 2002).

For the researcher to be able to cut and paste for this study, a word processor was used, which was in this case, a word document. That was an efficient method of assisting the researcher to keep track of the cutting and pasting. The codes, patterns, themes, categories, and relationships that emerged from the codes and themes formed the basis of the findings of this study. Those findings will be discussed in the next chapter of this study.

Graphical representation of the process the researcher used for the data analysis

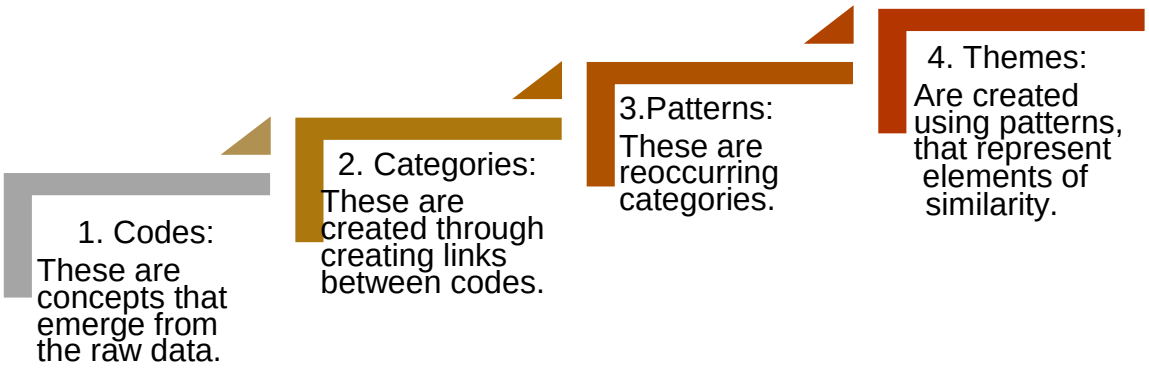


FIGURE 11: DATA ANALYSIS PROCESS

Figure 11 above is just a graphical representation of the data analysis process that the researcher utilized during the data analysis phase of this study. It simply depicts the main aspects that the researcher used and had to be cognizant of, during the data analysis stage of this study.

3.10. Ethical Considerations

The consideration of ethical issues is central to the development of any sound study. It entails building an argument that is cogent and perceivable, this demonstrates that the researcher has what is deemed as exquisite sensitivity (Marshall & Rossman, 2011).

Therefore, it was essential for the researcher to apply with the Wits Ethics Committee and for the researcher to get granted clearance to conduct this study before, collecting data and conducting this study. In addition to that, the researcher also had to be granted permission to conduct this study. This permission had to be granted by all the Campus managers from the various TVET Colleges that were selected to participate in this study. Once again this had to be done prior to conducting the data collection process of this study.

Patton and Cochran (2002) stipulate that everyone who participates in a research study should freely consent to participate in a research study, without being coerced or unfairly pressured into doing so. This requires participants to be enlightened about what participation entails. In addition to that, participants need to be affirmed that declining from participation will not affect or compromise them in any way.

Hence, the researcher conducted a meeting with all participants, before the data collection process. During the meeting, the researcher got the opportunity to explain the study to the participants. The participants were also given information sheets – which explained the purpose of this study to them in writing. Additionally, the participants were also required to sign a consent form prior to participating in this study. Please see Appendix A on (page 192) of the study, which contains the Ethics clearance form that the researcher was given before commencing with the data collection by the Wits Ethics committee. Please also see Appendix B (Pages 193-194), which contains the information letters that were given to the school managers

3.11. Confidentiality

The protection of participant's identities is a vital formality that needs to be heeded to when conducting research. That is why it is vital to protect the identities of all participants that partake in any research study (Patton & Cochran, 2002). Therefore, for this study, the researcher decided to assign pseudonyms to all participants that were part of this study. This was done to ensure that their identities were protected, and also to ensure that people who engage with this research paper will not be able to identify any of the participants that were part of the study.

In addition to that, throughout the data collection process, during the observations and particularly during the semi-interviews, participants were not required to identify themselves or to disclose any of their personal details, except for the information that

was required for the demographics section of this study. Besides that, participants were not required to divulge in any information that would make them identifiable. Participants had to share basic information such as work experience and qualifications during the semi-structured interviews. The mentioning of information such as names or any other piece of information that could make it possible to identify participants was discouraged. This was a measure that was taken to ensure that the participant's true identities remain anonymous.

3.12. Conclusion

This chapter focused on providing a semi-detailed account of the research design and methodology that was utilized to execute this study. Furthermore, it focused on documenting the worldview/theoretical underpinnings that influenced the study, the various data collection methods, participant's profiles, the data analysis process and the ethical considerations that the researcher needed to be cognizant of in the journey of conducting this study.

CHAPTER 4: DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1. Introduction

The previous chapter of this study focused on presenting the research methodology that was utilized to execute this study. In addition to that, the chapter also focused on providing a detailed account of the methodology that was used to conduct the study. The focal points of the chapter were; the conceptual and theoretical framework, the worldviews that underpinned the study and the ethical considerations that needed that the researcher needed to heed to in the journey of conducting this study.

In this chapter of the study, the researcher will endeavor to explore the journey that was taken to analyze data that was collected during the data collection phase of the study. This will be mainly achieved through highlighting the key themes that emerged from the data, which was collected during the data collection phase of the study (these themes emerged from the semi-structured interviews). This chapter of the study will also provide the reader with the results that emerged from the classroom observations that were conducted by the researcher.

Data analysis is one of the most crucial aspects of the research process. In quantitative research, data analysis data tends to be significantly rich and detailed. In addition to that, qualitative data analysis “generally involves the processes of organizing, accounting and explaining the data” (Cohen et al., p.493).

As mentioned previously in chapter 3, the data analysis of the data for this study mainly consisted of two of the following processes: the coding and generating of themes. Those two processes formed part of what is broadly known as as-the thematic approach to data analysis. According to Cohen et al., (2007) coding is a process of disassembling and reassembling data. The process of fragmenting data into lines, paragraphs or sections categorizes the process of disassembling. The process of rearranging the data then follows this process. This process of rearranging data through codes is done in the endeavor to generate new understandings that will enable researchers to identify patterns of similarities and differences across several different cases.

In addition to that, they also posit that there are three types of approaches that researchers can use in their attempts to code data. These are open coding, axial coding, and selective coding. For this study, the researcher chose to use a blend of

open and axial coding. Open coding involves “the exploration as well as the process of identifying units for meaning feelings, actions, and events” (Cohen et al., 2007, p.493). Whilst in axial coding “codes are explored, and the interrelationships are examined, and the codes and categories are compared to an existing theory.”

Firstly, the researcher used the open coding to help identify the sentiments, feelings that lecturers had about ICT integration, about how they are integrating ICTs into their pedagogical practices, in the semi-structured interviews and also to make meaning of events; which were in this case the classroom observations that the researcher conducted with the lecturers. Additionally, axial coding was utilized to assist the researcher establish the interrelationships between the data from both the semi-structured interviews and the observations.

The second technique that was utilized by the researcher entailed the process of organizing the analysis using the research question. This is considered to be an extremely effective mode to systematically categorize data. As it makes it easy to unify the relevant data for the exact issue of concern, and it preserves the coherence of the materials (Cohen et al., 2007).

Individuals facilitated the third technique that was utilized by the researcher through the process of organizing of data. With this technique, the total responses of a single participant were presented, and analysis was done on an individualistic level. The researcher did this with each participant in the research individualistically as cited by (Cohen et al., 2007).

Additionally, some of the themes that the researcher generated/ created were based on frequency and patterns of similarities that were gathered in the raw data. This was accomplished through identifying similar responses, and responses that appeared frequently through the analysis of respondent’s responses. However, it is important to note that some of the themes that emerged from the data were also predetermined by; the researcher’s main research question, as well as the research sub-questions, that this study was based on.

Lastly, according to Braun and Clarke (2006) “Thematic analysis is a method of identifying, analyzing and reporting themes within a set of data. It minimally organizes

and describes a set of data in rich detail" (Braun and Clarke, 2006, p.6). That quote adequately elucidates how the researcher analyzed the data that was collected for this study.

4.2. General Themes That Emerged from the Raw Data

The themes that are written below were gathered from the semi-structured interviews that the researcher conducted during the data collection process. The themes were generated through the process of gathering and grouping lecturers' responses from the semi-structured interviews.

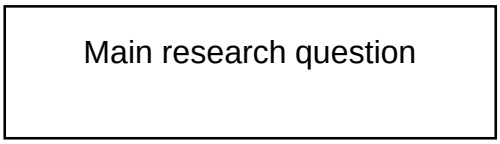
The themes were generated from the patterns of similarity, based on the frequency of responses. All responses that were similar or that were reoccurring were collected and grouped together. As previously stated, some of the themes were predetermined by the research question and sub research questions that this study sought to answer. The themes that emerged from the data were also related to the three main variables that were evident in the study.

Main Research Question

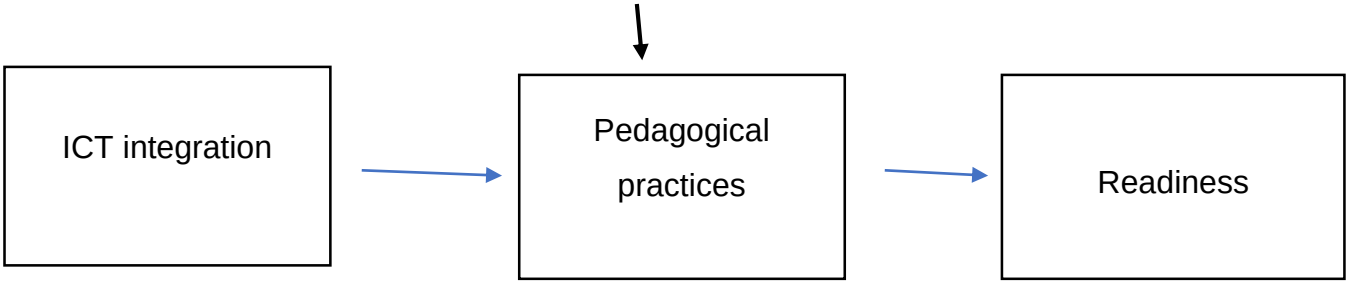
The main research question of the study was phrased in the following manner:

How ready are TVET College lecturers from Ekurhuleni in integrating ICTs into their pedagogical practices, in Automotive Repair and Maintenance classrooms?

4.3. Variables That Were Considered in the Study:



These variables were derived from the main research question:



Key sub research questions

1. What type of ICTs do lecturers have access in their respective TVET Colleges?
2. What are lecturers' understandings of various roles that ICTs have in the TVET College system?
3. How are lecturers blending ICTs into their pedagogical practices? (This was in relation to the practical and theoretical aspects of Automotive and repair).
4. What factors that influence lecturer's pedagogical practices when they integrate ICTs into their lessons?

FIGURE 12: VARIABLES PRESENT IN THE STUDY

Figure 12 depicts a flow diagram that briefly outlines the variables that the researcher needed to be mindful of during the data analysis process of this study. Based on the figure it is evident that the research question had a significant bearing on the other variables that emerged in the study, this in conjunction with the sub-research questions, had a significant impact on how the analysis was conducted.

This part of the analysis is dedicated to discussing the first instrument that the researcher utilized to collect data-which were the semi-structured interviews. Therefore, it will mainly discuss data that was gathered from the semi-structured interviews that the researcher conducted with the lecturers that teach Automotive Repair and Maintenance, in the TVET Colleges that took part in the study.

4.4. Themes that Emerged from the Thematic Analysis of the Semi-Structured Interviews

- Key qualities that make a great Automotive lecturer (***T1)***
- Lecturers Technological Knowledge/ competencies (***T2)***
- Lecturers Pedagogical practices ***(T3)***
- ICT Integration ***(T4)***
- Challenges to integration in the Automotive classroom ***(T5)***
- The ICT integration process in the TVET space and what the process would entail ***(T6)***
- Access to resources/ ICTs ***(T7)***
- Lecturers beliefs about ICTs and ICT integration ***(T8)***
- Lecturer's Technological Content Knowledge and its impact in the classroom and on ICT integration ***(T9)***
- The state of ICT readiness in TVET colleges ***(T10)***
- Lecturer's views on the new impending teacher qualification for Vocational Education. Information for the Wits Program (Advanced Diploma in Technical and Vocational Teaching) is an overarching theme that emerges when important elements from all the other themes are combined ***(T11)***

4.5. Sub Research Questions and their Relation to Themes that Emerged from the Data

The table below illustrates the relationships between the researcher's sub-research questions and the themes that emerged from the data. If you observe the themes (above carefully), it is notable that not all the themes were directly linked to the sub research questions that were asked in this study. Hence, the researcher created those other themes mentioned above from the lecturers reoccurring responses from the semi-structured interviews. These themes were not directly related to any of the research questions. The table below shows the relationships between the sub-research questions and the themes, which emerged from the data.

Table 1: Relationships between the sub-research questions and the themes

Research question (*RQ*):	**Theme/s (*T*)**
What type of ICTs do lecturers have access to in their TVET Colleges?	This question fell under one theme: Access to resources/ICTs. ***(T8)***
What are lecturers' understandings of various roles that ICTs have in the TVET College system?	This question fell under one theme: Lecturers beliefs about ICTs and ICTs integration ***(T9***)
How are lecturers in TVET Colleges currently blending ICTs into their pedagogical practices? (This was concerning the practical and theoretical aspects of teaching Automotive and repair).	This question fell under two themes: Lecturers Pedagogical practices ***(T3)*** **And** Lecturers Technological Competencies ***(T2)***
What factors influence the pedagogical practices that lecturers take on when they integrate ICTs into their lessons?	This question fell under two themes Access to resources/ICTs ***(T8)*** **And** Lecturers Technological Competencies ***(T2)***
How do lecturers integrate ICTs into their lessons?	Lecturers Technological Knowledge /competencies ***(T2)***

	Lecturers Pedagogical practices (***T3)*** Access to resources/ICTs (***T8)*** Lecturers beliefs about ICTs and ICTs integration ***(T9***) Lecturer's Technological Content Knowledge and its impact in the classroom and ICT integration. ***(T10)*** Lecturers Technological Knowledge ***(T11)***

TABLE 1: RELATIONSHIPS BETWEEN THE SUB-RESEARCH QUESTIONS AND THE THEMES

4.6. In-depth Discussion of the Themes

(T1) Key qualities that make a great Automotive Repair and Maintenance lecturer

To get data that would feed into this theme, the following question was posed to lecturers during the semi-structured interviews:

What qualities make a good Automotive Repair and Maintenance lecturer?

The main purpose of this question was to establish lecturer's perceptions of themselves in terms of their identity as professionals, concerning their profession. This question was asked with the intention of giving the researcher insight into what lecturers regarded to be the key qualities that make a good Automotive Repair and Maintenance lecturer.

One of the key factors that lecturers need to be aware of that will enable them to be good teachers, lies in them being able to identify the key qualities that a good Automotive and Repair and Maintenance lecturer should possess. This question would idealistically be grouped with the theme: Lecturer beliefs. However, the researcher chose to create a separate theme titled: *"Lecturer beliefs"* and that theme is focused

on exploring lecturer's beliefs about ICTs and ICT integration. Using the lens of lecturer's pedagogical practices to assist the researcher to get an understanding of those beliefs. Therefore, this question was created to establish the more pedagogical aspect of "*lecturer beliefs"* about ICT usage in their classrooms.

Through the interviews that the researcher conducted with the lecturers, it became evident that all the lecturers shared the same/similar sentiments. When it comes to the qualities that they thought an Automotive Repair and Maintenance lecturer should possess. In order, for them to be able to effectively teach Automotive Repair and Maintenance.

Lecturers majorly agreed on three key qualities that a lecturer that teaches Automotive should have. Firstly, all lecturers cited content knowledge (which relates to both the teaching of the theoretical as well as the practical components of Automotive). This knowledge is also inclusive of knowledge about how technology is used in Automotive. Secondly, the lecturers also insisted that they should be specialists in Automotive. The table below cites lecturer's responses to this question and theme.

Table 2: Lecturer's responses

(T1) Key qualities required by an Automotive Repair and Maintenance lecturer.	<u>Lecturers: A, B, C, and D.E.</u> <u>Lecturer A</u> "An Automotive lecturer should be a Subject specialist. He or she must have knowledge about Automotive. This is inclusive of theoretical knowledge, knowledge of specialized technology used in Automotive and practical knowledge that would allow the lecturers to conduct workshop sessions." "The lecturer should also be able to link theory and practical because if you teach them you need to teach them the theory then show them how it is done practically so that the students can understand more what is happening practically." "A lecturer must also have a passion for this subject."

	Lecturer B “You need to like and enjoy what you do or else it will be difficult to teach Automotive. But also, it is important to know what you are teaching, and how to teach it. It is especially important to know how to conduct and facilitate the practical’s in the workshop. Anyone can teach theory. But it takes an expert to be able to handle the students in the workshop, for practical.”
	Lecturer D “The lecturer must have a thorough understanding of all the content. So, they teach the theory and practical. A lecturer also needs patience to teach the subject because students do find it difficult to understand Automotive, particularly in the beginning stages of teaching the subject.”
	Lecturer E “The lecturer must be computer literate and they must also be advanced in their knowledge and ability to use the computer and they must know the subject matter that they are going to teach.” “Also, you must have background knowledge of practical. You must know the practical or how to conduct the practical with your students because theory is there, you can read theory and come and teach in the class. But, you also need to be able to do the practical, let us say for example you are teaching your students about diagnosing. You must also have the background knowledge for the practical. So, you can show your students how to diagnose, during their practical and also so that you will be able to answer their questions and assist them when they have challenges during the practical”

TABLE 2: LECTURER’S RESPONSES

Interestingly, the lecturers' responses were all very similar. All five lecturers cited knowledge of the subject as being a fundamental character trait that counted as a quality, which makes a good Automotive Repair and Maintenance lecturer. The researcher found this to be interesting because the question was extremely open-ended. The researcher did not provide any prompts for the responses, yet all the lectures had this common thread in all their responses. There was also another pattern of resemblance in the responses which was demonstrated by the lecturers talking about lecturers having to be "*specialists in the subject"* this sentiment was reflected in most lecturers' responses.

(T2) Lecturers technological competencies

This theme is linked to two of the researcher's research questions, which were phrased in the following manner:

- What are lecturers' understandings of various roles that ICTs have in the TVET College system?
- How are lecturers in TVET Colleges currently blending ICTs into their pedagogical practices? (This was concerning the practical and theatrical aspects of Automotive and repair).

This theme was also linked to one of the questions that the researcher asked the lecturers, during the semi-structured interviews. This theme is an important theme that emerged from the data. This theme is important because it gave the researcher insight into how lecturers perceive their technological competencies. This is in general, and concerning their existing pedagogical practices. Which the researcher believed had an immense bearing on how lecturers integrate ICTs into their pedagogical practices. This particular theme also provided the researcher with an understanding of lecturers' perceptions of ICTs.

During the semi-structured interviews, lecturers were asked to provide the researcher with their understanding of ICTs. Lecturers were also asked to discuss how they integrate ICTs into their pedagogical practices. Lastly, lecturers were also expected to provide examples of how they are integrating ICTs into their lessons. This was done in the endeavor to assist the researcher to gauge whether lecturer's understood what ICTs are, and also to give the researcher insight into how lecturers feel they are integrating ICTs into their current pedagogical practices.

One of the questions lecturers were asked required them to rate or describe their Technological competencies. Through that question, lecturers were able to provide the researcher with various insights into how they view and rate their technological competencies or abilities to use technology.

In general, most of the lecturers, 3 out of the 5 lecturers, indicated that they felt they were highly competent with ICT usage and this was based on various reasons, which ranged from-

> Lecturer A *"I am able to successfully use the diagnostic machine, which is a basic form of technology used in Automotive. If you can use that you can use any other piece of technology."*
>
> Lecturer B ***"****I am highly competent because I am able to use a computer and the diagnostic machine and the other tools in the workshop on my own. In a number I would rate myself ten out of ten."*
>
> Lecturer C *"I am very competent especially with using the computer. I can use the Internet for doing research, on my own. I use Google a lot and I also use YouTube to help me find videos to help me better my understanding and also to find videos for my learners"*
>
> Lecturer D ***"****I am somewhat competent. I know the basics, but I think when using ICTs with these students you need to be advanced because they are also advanced. That is why I am not always confident with using ICTs in front of these students. I know my content very well but I am scared to use ICTs in front of the students just in case I make mistakes. I do not want my mistakes using ICTs to take away from what I am teaching my students during a lesson. The students should always remember the content and not that "sir made so many mistakes during the lesson." Already we are struggling with making sure that we cover content in the syllabus within the stipulated time frames."*
>
> Lecturer F: *"I am not very competent, I can use the computer to type and capture marks but even then, I am very slow. You know when I was doing my training years ago we did not have computers. So, we were not trained to use them, and we also did not have all this difficult and strange digital technology, that we have in the world now. We just had chalk and the chalkboard. I am very*

comfortable with writing on the chalkboard. If I must use these new technologies to teach, it would be difficult for me to teach."

The lecturer's key determiner of lecturer's technological competencies seemed to be indicated or determined by their ability to utilize a specialized piece of ICT or technology that is peculiar to Automotive: the diagnostic machine. Which is according to the researcher's interpretation, a fair indicator even though that indicator does not encompass other ICTs or accurately depict all ICTs, the researcher believed that it is a step in the right direction. Here the lecturers were focused more at the technological aspects of their competencies and juxtaposing them with a specific type of technology that they seem to regard as a key, basic technology that could potentially lead to the ability to use other forms of technology.

The other two lecturers revealed that they felt they were not competent and that they required more training to become more competent. Lecturers went to the extent of giving the following responses:

Lecturer D *"I think that I am not highly competent, I'm still getting there. I think I need some training."*

Lecturer E *"I am not too good, but I am not bad because I think I have the basic knowledge that I use when I use technology in the workshop, but I think I still need training, so I can become better, with these ICTs."*

To indicate how they felt that they had a deficit in terms of their technological knowledge.

Equally, when lecturers were asked about the competencies, they thought they required enabling them to integrate ICT into their lessons. Astoundingly all the lecturers cited "computer skills" as a basic prerequisite skill that is required to be able to use specialized technologies. Lecturer B even cited that *"a lecturer should have basic computer skills because if they do not know how to use the computer, they won't be able to diagnose the car."*

Interestingly, the lecturers discussed computer skills concerning two levels. Three out of the five lecturers spoke about basic skills and computer literacy whilst the other two other lectures spoke about advanced computer skills which *"could be used to operate the various forms of technology that are peculiar to Automotive"* (Lecturer A). All

lecturers seemed to view computer skills as being part of the set of skills required to; enable lecturers to integrate ICTs into their pedagogical practices.

In addition to that, one lecturer (Lecturer C) also mentioned *"IT" (Information Technology) "should also be a prerequisite competency that lecturers needed to have going forth into the fourth industrial revolution."*

(T3) Lecturers Pedagogical practices

This theme sought to describe and explore how lecturers are currently integrating ICTs into their existing pedagogical practices. This theme was formulated through the grouping of one of the researcher's sub- research questions with some of the questions that were asked during the semi-structured interviews. One of the questions that the lecturers were asked that were linked to this theme, required lecturers to describe and to provide the researcher with an indication or a description of the methods and resources/ICTs that lecturers use to teach Automotive. The following emerged from the lecturer's responses. From a general level, lecturers seemed to be focused on using traditional methodologies.

All the lecturers seemed to be guided by the same logic in terms of how they employed and utilized their resources, ICTs, and methodologies, which are termed as "methods" in this study. In addition to that, lecturers also utilized the same traditional methods to assist them with conveying knowledge about Automotive to their students. Traditional Methodologies consist of what is commonly known as "Talk and Chalk". Which is the teaching that makes use of the textbooks as well as teacher/lecturer -centered talking of content at students, with the usage of little to no visual aids. Lecturers also indicated that they predominantly utilized "textbooks" and "demonstrations." The lecturers seem to use the textbook (hardcopy) to assist them to provide learners with theoretical knowledge/ concepts. Then they utilized the demonstrations to give the learners *"*see the theoretical knowledge in motion" or "so that the learners can see the theory they learned being applied." (Lecturer D).

Furthermore, one of the five lecturers that were interviewed (Lecturer C) admitted to utilizing simulations. However, this was not at the current College that the lecturer is in. This was from previous experience, which the lecturer had at a different TVET institution that the lecturer worked at. The lecturer did, however, cite that he utilized a

“projector (Sometimes) when teaching theory at the TVET College that he is currently teaching at.”

However, his usage of the projector was limited, as it was dependent on the availability of the projector because there was only one projector available for the entire campus to share. Hence, it was not a common pedagogical practice. Another commonality that was evident across all the lecturers’ responses was in the fact that: all the lecturers professed to utilize multiple methodologies in the efforts to teach and make the teaching of Automotive fun, in the Automotive classroom. The quotes below serve as evidence to back up the Statements and findings that were stated above.

Lecturer A

> *“I try to be versatile with my teaching methods. When I teach, I use the textbook, we are all expected to use it and it has all the content. I have a few models that are related to the content that we teach, and I use them for demonstrations. Then, I also use my cellphone to make lessons more interesting. I use WhatsApp, we have a group there and I post materials and videos for my students there. This is mostly for the theory, to assist the students with theory. In the workshop, we have a television, but it is not working anymore. But I used to use it to show students videos of the activities that they will do in the workshop before they actually do the practical themselves.”*

Lecturer B

> *“Honestly, most of the time for the theory I use the textbook, it has all the information. I normally read through the content and then make notes on the board. Then sometimes if we have a model, I will use it to explain. For the practical, the students go into the workshop and they do practical with the tools, equipment, and technology. But before the students start with the practical I normally demonstrate, what they are expected to do, then I let them complete their practical tasks.”*

Lecturer C

> *“For this question, I will give you an example just to give you an indication of the different teaching methods that I use. I just need you to remember that the methods that we use to teach theory are very different from the ones that we use to teach practical. So, for example, I am teaching my students about: the*

parts of an engine. What would happen is that: I first go to the theory class, because that is where I teach the students concepts before they go to the workshop. In the theory class, I read information from the textbook, I write notes on the board and I also draw a lot of illustrations on the board to help strengthen my explanations, of the different parts that make up an engine."

Then I also like to have discussions with my students, during the last twenty minutes. During these discussions, I ask the students questions about the content and they ask me questions and I clarify the things that the learners did not understand. Then during the practical, I take the students to the workshop. Then I show them the real engine and the parts then I dismantle the engine and then I assemble it again. When that is done the students are put into groups of 4 or 5 and they dismantle and assemble the engines on their own. I normally use the equipment that is available in the workshop."

Lecturer D

"When I teach my students, I want them to understand the theory as well as its applications in the theory class before they go to the workshop. This is why I use many methods when I am teaching. If I am teaching my students about the gearbox, I need my students to understand. I start by explaining what a gearbox is in a theoretical way. Most of the terminology is written for the students on the board and the students copy it down into their notebooks. Then, I also do some role play with the students I get them to stand in front of the classroom and to pretend to be the different parts that are found in a gearbox that interact with each other, by doing this I am getting the learners to see the applications of the gearbox and the parts within it using their peers, I am putting the students and placing them in the workshop (well their minds there) whilst they are still doing theory. Then when they are done, they go into the workshop. I normally get them to do the practical from the theory. If I can see the students are struggling, then I will demonstrate."

Lecturer E

"I try to use many methods. But due to constraints, I mainly use the textbook and I read the information from it and I ask the learners to summarize their understanding using their own words in their

workbooks. I also use demonstrations, if the equipment for the topic that I am teaching is available in the workshop, and if it is portable, I bring it for demonstrations in class. If I have access to models for that concept, I bring the models to class and I show them to the learners. In the workshop, I believe that learners should learn from their mistakes and each other whilst I guide them. So, I do not do a lot of teaching but a lot of reinforcement there. I normally use the equipment that is available in the workshop and students get to interact with those."

The other question that was asked during the semi-structured interview required lecturers to list the main factors that affect the types of ICTs, which they utilize/integrate into their respective lessons.

For that question, lecturers revealed that their ICT usage/integration was influenced by mainly two factors namely: the topic and content that they were going to teach their students. Whilst on the other hand (Lecturer B) also indicated that his ICT usage was based on the ICTs that he had at his disposal in both his classroom and in the workshop. He stated, *"The technology that I am using is influenced by the available resources. If I do not have enough resources then integration will be affected, I will not be able to integrate technology." Which is a valid argument because, essentially, lecturers cannot be expected to use technologies that they do not have access to in their classrooms".*

(T4) ICT Integration

The main question that led to the formation of this theme was a question that asked lecturers to share their views about ICT integration in the Automotive Repair and Maintenance classroom. The question asked lectures: if they thought ICT integration was necessary for the teaching of Automotive?

Interestingly, all the lecturer's responses were unanimous on this. They all stated that ICTs were indeed necessary for teaching Automotive. The lecturers also provided the researcher with similar reasons that were just phrased differently. But on a general level, they all stated, **"**some of the fault findings in a motor vehicle, especially with the new hybrid vehicles, need computers. Additionally, it also needs the lecturer to know the computer to be able to identify faults and diagnose the faults and to this, you need a computer which is technology, you must have the computer and the manuals."

Lecturer A said: *"Yes, ICTs are needed to teach Automotive Repair and Maintenance. The industry is moving and incorporating more technology that we need to teach our students about."*

(T5) Challenges to integration in the Automotive classroom

This theme endeavored to give the researcher insight into the various challenges that lecturers face in their attempts to integrate ICTs in their lessons. Furthermore, it sought to provide the researcher with insight into the various factors, which hinder lecturers from integrating ICTs into their pedagogical practices when teaching Automotive. All the lecturers were able to provide the researcher with comprehensive responses, that we're able to paint a picture of the current state of affairs, which hinders lecturers from utilizing ICTs in their pedagogical practices.

Lecturers mentioned the following challenges: firstly, access to internet/ Wi-Fi. This was a major challenge that was mentioned in all the TVET Colleges. Lecturers feel that if ICT integration is to become a reality, they need to have access to the most basic necessity in ICT, which is: The Internet. Lecturers expressed that "the internet was not available for academic purposes. In all of the TVET Colleges that the researcher went to, Internet access was mainly limited or reserved for the administration staff or for the communal computers that lecturers had access to in the staffroom.

Lecturers also mentioned issues of costs "especially in the township and rural areas because, *Internet access is expensive and with the class inequalities, and the difference that exists within South Africa"* (Lecturer A). Lecturers also expressed that without assistance and commitment from the government, it would make it impossible for institutions from these two economic classes/ backgrounds to have access to the internet/ Wi-Fi. However, this limitation does not apply to all ICTs, as not all ICTs require the usage of Wi-Fi for functionality.

In addition to that lecturers also noted: that there is a lack of technological resources in the classrooms as well as the lack of up-to-date technology in the workshops." Lecturers also expressed their disappointment in the fact that "they still had access to old models of mechanical vehicles (which are the old versions of motor vehicles that are becoming obsolete) as opposed to hybrid electronic ones (which are the latest versions that students will encounter once they leave the TVET sector."

Likewise, lecturers also mentioned the fact that they had not received new technological equipment for their workshops. They were frustrated at the fact that they were still: using engines with carburetors and fuel injection whilst the motor industry is currently moving to electric, pure electric and hybrid cars.

One lecturer (Lecturer C) even stated that

> *"I cannot teach learners about the electric, hybrid cars, because the College just doesn't have access to the technology that would make it possible. It breaks my heart to have to teach these learners about old engines because, when they leave for industry, they will not have all the relevant knowledge."*

Through the response specified above, it becomes evident that lecturers experience various challenges with ICT integration. On a very general note, the lack of adequate ICT resources seemed to be a common denominator. Amongst that were other factors such as: the lack of correlation between the curriculum, what is currently happening in society (in terms of technological advancements) with the types of technology that is being provided for lecturers and students in the workshop and the changing trends in industry.

One lecturer (Lecturer B) even bought two vital factors these factors are at the forefront of the interviews. "*The first factor which is a major problem in South Africa, which is a factor that the researcher had overlooked was that of crime rate in South Africa .The lecturer mentioned that "it is very risky to bring these new age, expensive technologies into institutions in the township because they are more likely to get stolen. Especially, because we are working with motor vehicles and the various parts of motor vehicles in Automotive."*

Another lecturer cited that he had a self- confidence issue related to using technology. He stated *"not having enough confidence in his personal ability to use technology in front of his students was a huge challenge because that essentially hindered him from integrating ICTs in his lessons."*

Through the lecturer's responses, it became evident that most factors that hinder lecturers from being able to integrate ICTs, fully into their pedagogical practices are mostly factors that are external to the lectures. These are factors that are beyond the lecturers' jurisdiction. Therefore, it makes it extremely difficult for the lecturers to be able to change or mitigate these challenges on their own.

(T6) The ICT integration process in the TVET Space and what the process would entail

This theme emerged through a question that sought to unearth, the lecturer's perspectives of what they thought the ICT integration process would entail.

When lecturers gave responses to this specific question. They strived to provide the researcher with detailed accounts of what the ICT integration process would ideally entail. The lecturer's responses all concurred in terms of one element. Which is "training" with some lecturers alluding to this element implicitly, whilst some of them explicitly mentioned it in their responses. In addition to that, the lecturers also cited the purchasing of equipment, and the preparation of the physical infrastructure in their respective Colleges as being, two other processes that would feature in the ICT integration process. Here is a sample of two of the responses that reinforce what the researcher cited above:

Lecturer E

"Firstly, the lecturers would be taken for training so that they know or learn how to use the technology. Especially for their area of teaching, specialization- for me, it would be Automotive. This would assist lecturers to be able to integrate ICTs in their subjects for purposes of teaching and learning with technology. Thereafter, the lecturers would have to get tested to see if they have learned how to integrate technology into their teaching. From there, maybe the lecturers can now go and implement what they learned in their classrooms. It would also be helpful to have ICT support staff on-site to assist lecturers, throughout the beginning stages of integration."

Lecturer A

"Firstly, the procurement office must come to the party, I don't know maybe they can bring them to the school so that they can get an understanding of the technological needs that TVET Colleges have. Also, management must come to the party and ask us about what we need to be able to integrate technology into our classrooms and then they must also buy the equipment/ICTs and then train us to use those ICTs. So, we can integrate them into our teaching."

Lecturer A also spoke about the process of *"purchasing equipment." Which is a significant process that needs to be thoroughly considered in the integration process.*

Through the interactions the researcher had with the lecturers it became evident that to be able to integrate ICTs into their pedagogical process, the ICTs that lecturers need to integrate need to be made available to them, so that they can actualize ICT integration.

Lecturer B also stated

"Firstly, the infrastructure in the TVET institutions needs to be updated, to facilitate the integration. We cannot talk about ICT integration if we do not have doors or computers for the staff and students in our institutions at the moment. We need to fix our institutions. Also, we need to ensure that we beef up our security. From then we can train lecturers then bring the ICTs into the ICTs into our Colleges."

(T7) Access to resource/ICTs

During the semi-structured interviews, the lecturers were asked to list the ICTs that they have access to. Additionally, they were provided with a list of ICTs, and they had to discuss their level of access to, that particular technology based on a scale. The scale based on three categories was: Free access, limited access, and no access. Bar graphs that graphically illustrate these responses will be provided below.

The lecturer's responses during the semi-structured interviews illustrated that all lecturers did not have any access to the following ICTs: Learning Management Systems, Interactive boards/ Smart boards, Virtual reality. For the presentation of the results of access, the researcher utilized bar graphs to graphically represent the lecturer's responses.

The bar graphs below are graphical representations of the ICTs that lectures have no access to in their respective TVET Colleges.

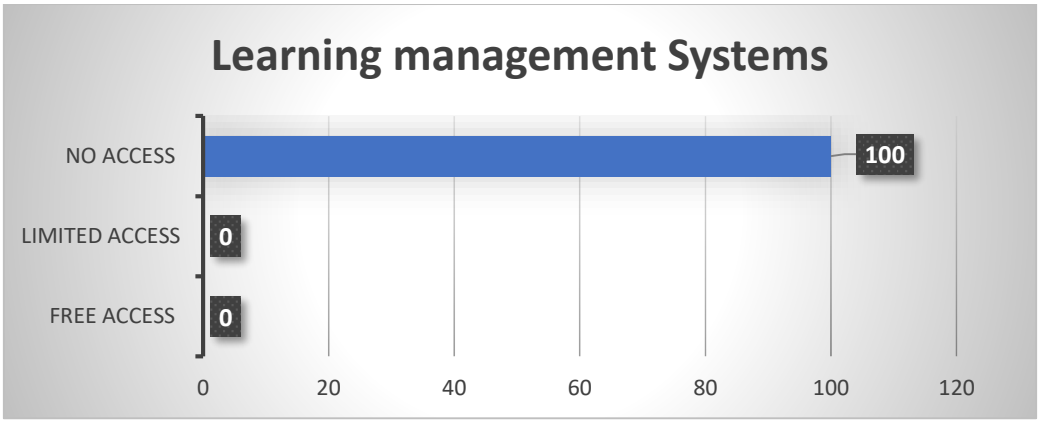


FIGURE 13: LEARNING MANAGEMENT SYSTEMS

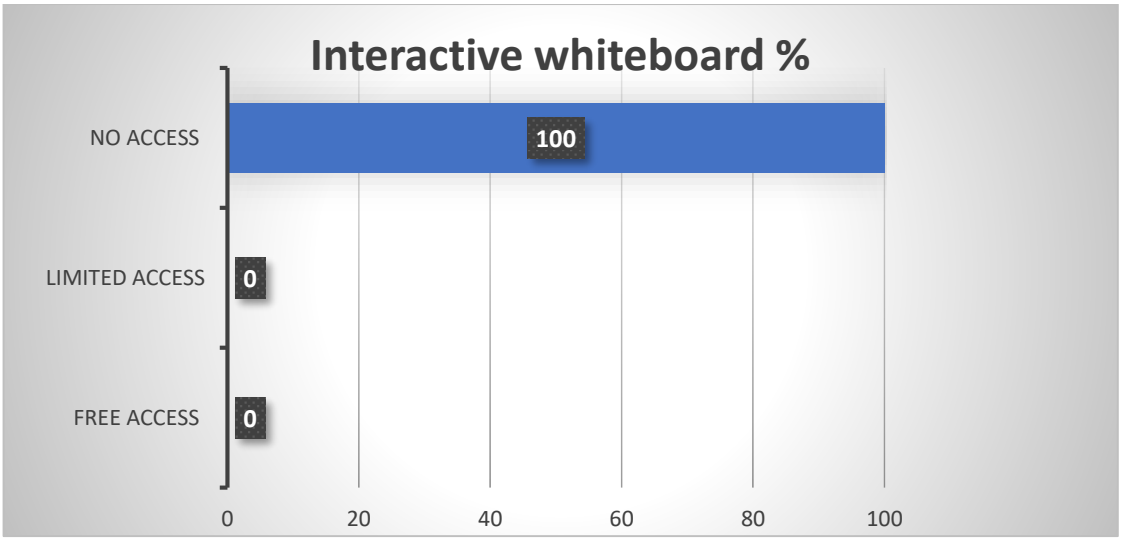


FIGURE 14: INTERACTIVE WHITEBOARD

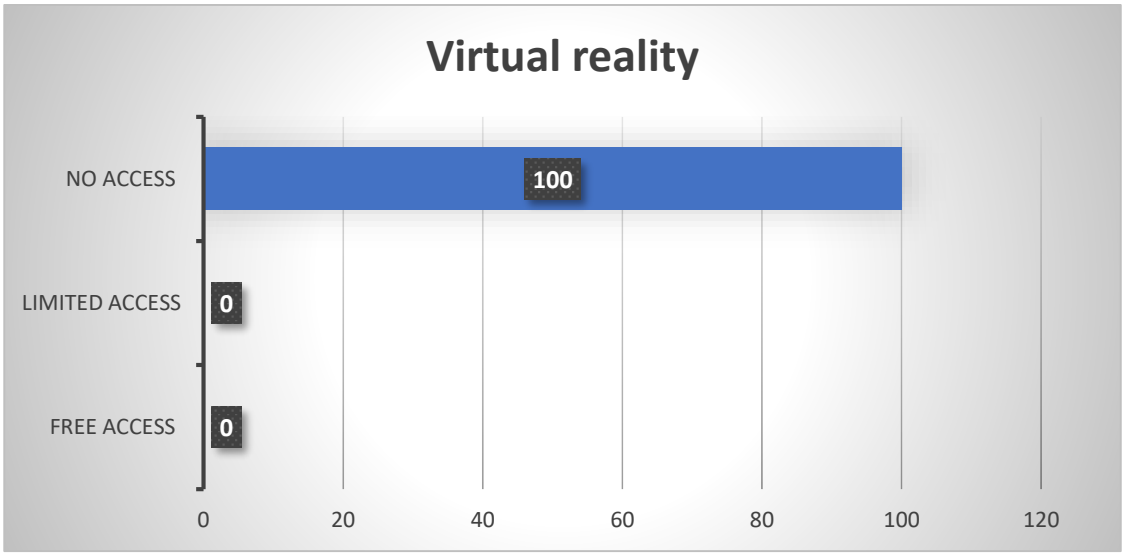


FIGURE 15: VIRTUAL REALITY

Through their response's lecturers indicated that; they have free access to the following ICTs which will be illustrated by the bar graphs that will be placed below.

The bar graphs below will give a graphical representation of the ICTs that lectures have free access to in their respective TVET Colleges.

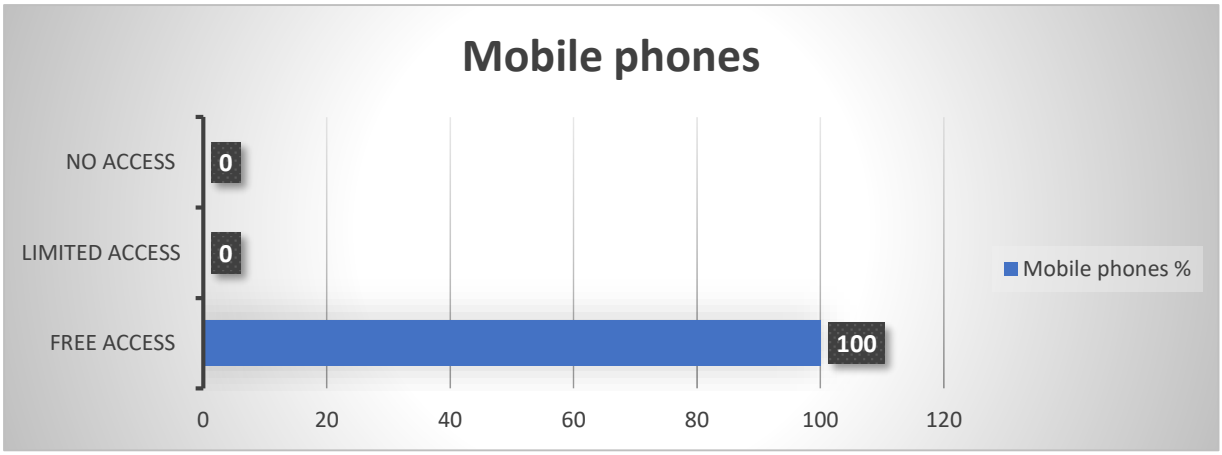


FIGURE 16: MOBILE PHONES

This graph merely illustrates how all lecturers have access to mobile phones.

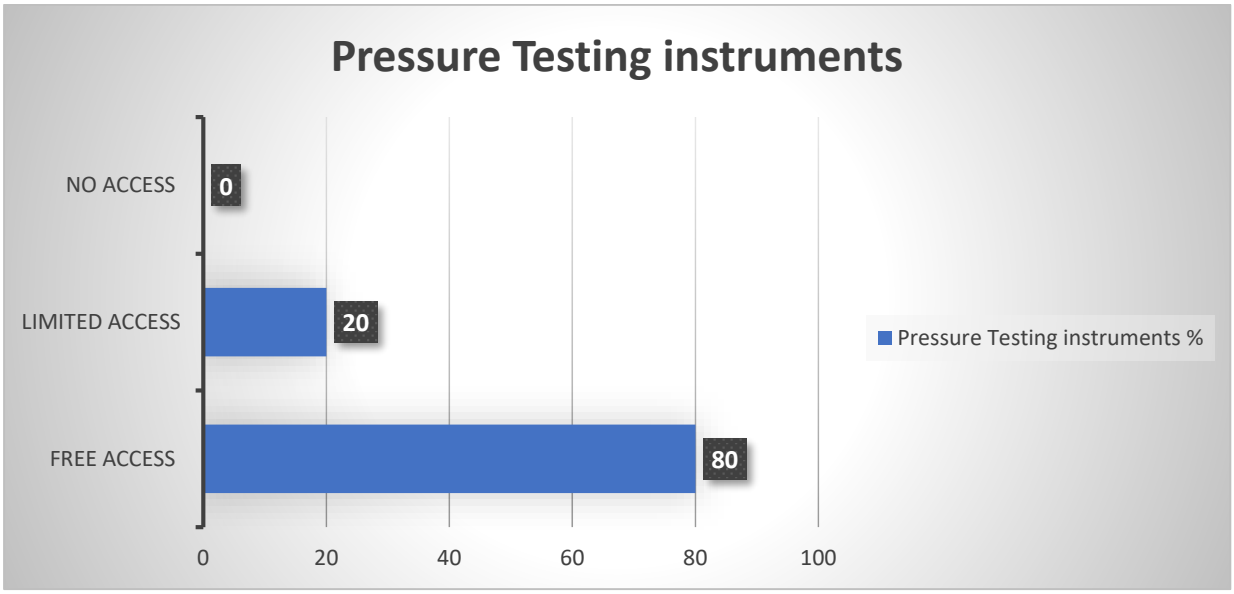


FIGURE 17: PRESSURE TESTING INSTRUMENTS

Pressure testing instruments are an essential piece of technology that is a requirement that all Automotive Repair and Maintenance workshops need to have. Therefore, in terms of pressure testing instruments during the interview, four (80%) of the lectures revealed that they had had free access to pressure testing instruments. Whilst one lecturer said he had limited access to pressure testing instruments.

Conversely, lecturers also revealed that they have free access to the following ICTs: Mobile cellphones (which are the educator's own devices) diagnostic scan tools which

are vital for diagnosing faults in Automotive were mentioned, as being available in the all the workshops. In terms of computers/laptops disclosed that he has had access to those devices. However, in most instances, these devices belonged to the institutions the lecturers were working for.

The bar graphs below are a graphical representation of the ICTs, that lectures have free access to in their respective TVET Colleges.

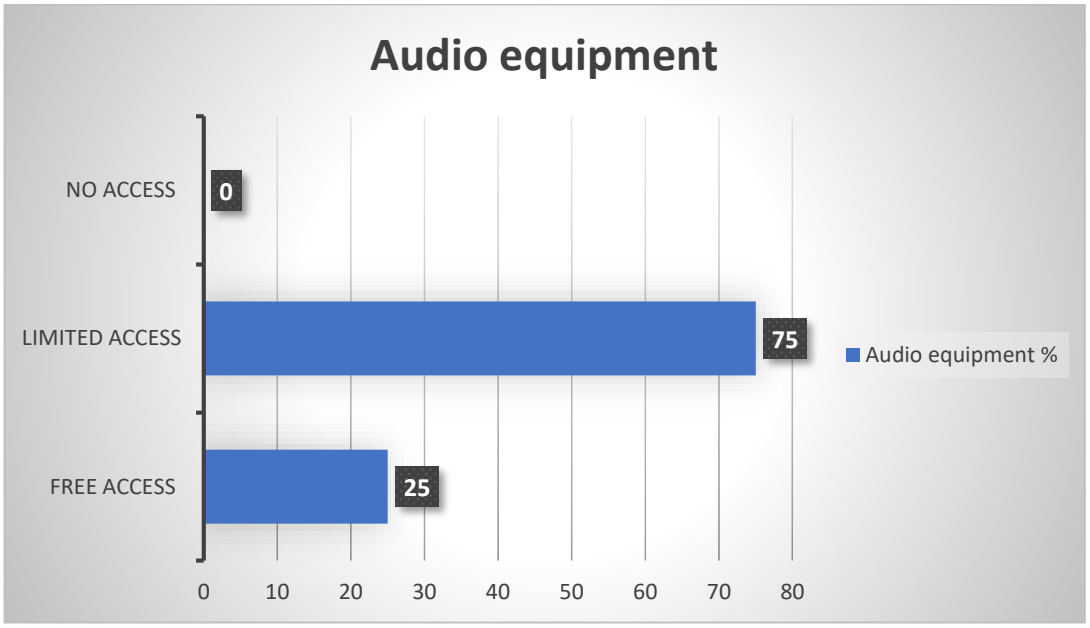


Figure 18: AUDIO EQUIPMENT

When lecturers were asked if they had access to audio equipment 75% of them said that they had limited access to Audio equipment.

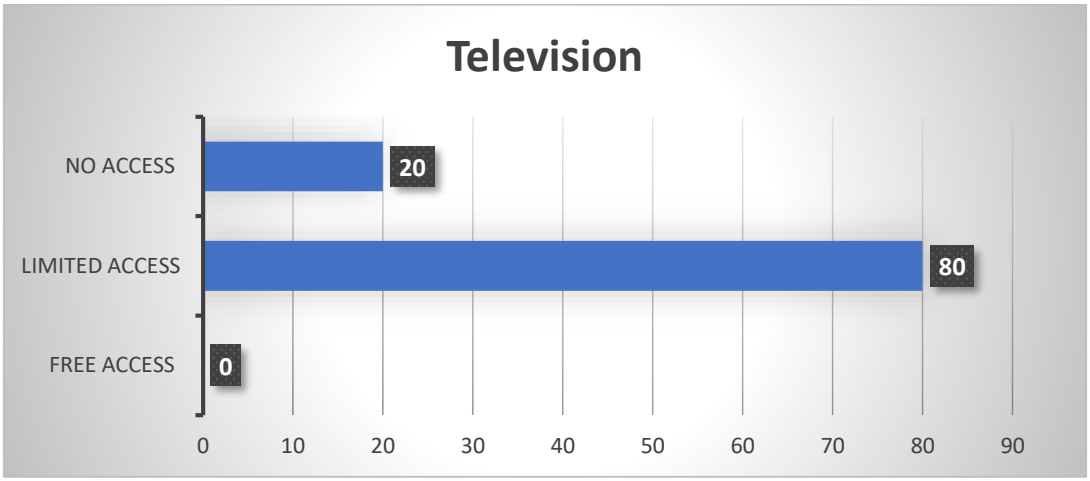


FIGURE 19: TELEVISION

This bar graph illustrates that 80% of the respondents that the researcher interviewed indicated that they have limited access to television sets. However, one lecturer

(Lecturer A) revealed that he used to have a television set in his workshop that he used to show his students videos, before practical's a couple of years ago. Unfortunately, the television no longer works. This lecturer constituted the 20% that had free access to television sets.

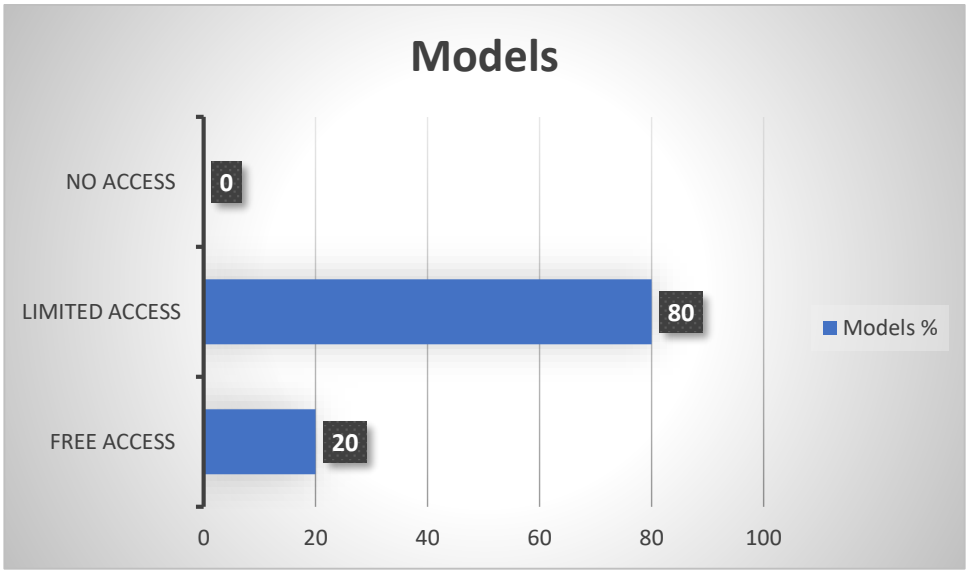


FIGURE 20: MODELS

Additionally, during the interviews 80% of the lecturers, which is representative of four of the five lecturers stated that they have access even though it is limited access to models, that they can potentially use to show students concepts. These models were utilized within the theory classrooms in the TVET Colleges; the researcher witnessed the lecturers using them during the classroom observations as well. In most instances, the lecturers had access to one model in the theory classroom that they could use for a demonstration when explaining particular aspects of the theory. One of the lecturers (Lecture D) stated *"on the theory side we need to have more models if I can put it that way. Remember that when we teach, we need to have models; we need to have those models in class besides the workshop. So, we can show the students whilst teaching theory..."*

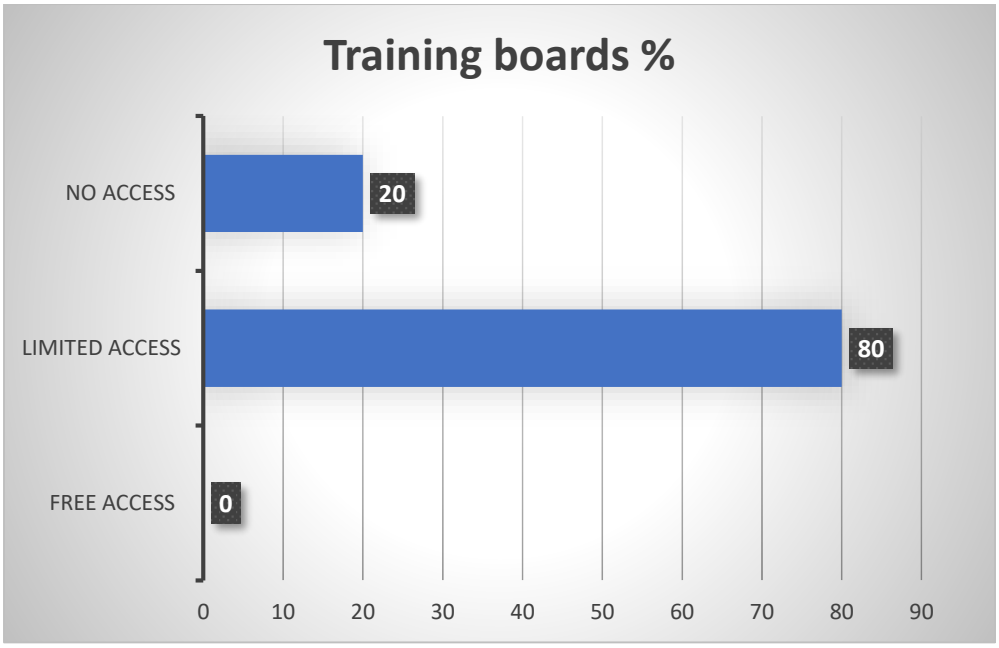


FIGURE 21: TRAINING BOARDS

The bar graph exemplifies how most of the lecturers (80%) which is four out of the five lecturers said that they have limited access to training boards. Whilst one who constituted to the 20% said that they have no access to any training boards.

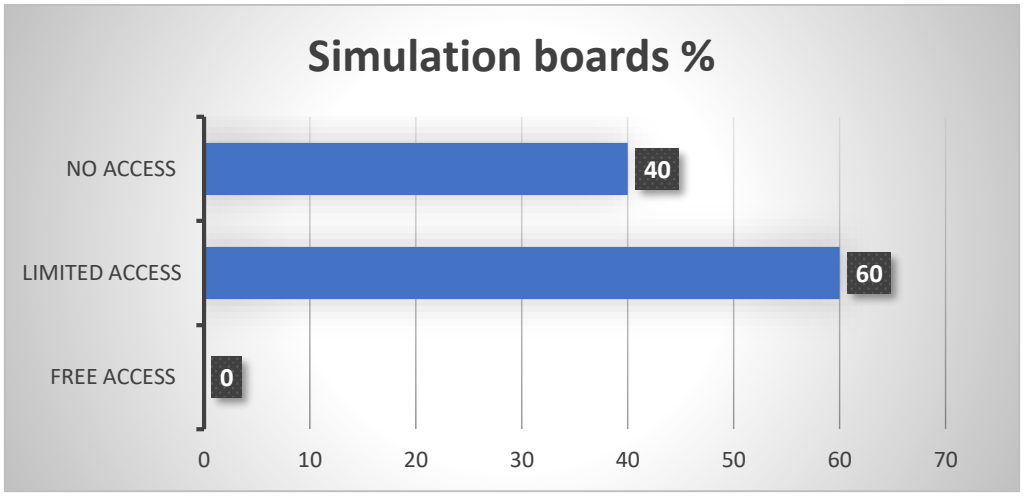


FIGURE 22: SIMULATION BOARDS

When asked about access to simulation boards 40% said that they have no access to simulation boards. Whilst a confounding 60% said they have limited access to simulation boards which is a huge problem because that still means that a majority of College lecturers do not have free/ unlimited access to simulation boards.

Now from beholding from these bar graphs that are presented above by the researcher, it becomes evident that lecturers have limited access to some of the most

basic and crucial ICTs, that that could make teaching Automotive more fun, insightful, less abstract and more practical.

(T8) Lecturers Beliefs about ICTs and ICT Integration

This theme emerged from a series of questions that sought to give the researcher insight into lecturer's beliefs about technology and ICT integration in TVET Colleges.

The first question that the researcher asked lecturers was whether they felt that integrating ICTs into teaching was necessary? All lecturers agreed that integrating ICTs into teaching was a necessary move, which needed to be made urgently in order to keep Automotive relevant.

They all seemed to be very optimistic about the prospect of teaching all Automotive content using technology. Lecturers seemed to also have some knowledge about some of the affordances that ICTs could potentially bring into the Automotive Repair and Maintenance classroom. All the lecturers provided various reasons to substantiate their views. Lecturers used phrases like "fun, efficient, necessary and makes learning interesting and easy" to describe how they felt about the usage of technology would impact the teaching of Automotive.

Lecturer B gave a very thought-provoking response that alluded to the fact that Automotive is in itself a technology which required a technology to be used to teach it. The lecturer said, *"There is no way you can teach Automotive without technology by just talking. Technology makes teaching easier and more practical."*

Lecturer E even went to the extent of saying: *"It is very necessary to use technology when teaching Automotive. Without technology, there is no Automotive and technology is helpful when teaching. It will also make life easier for both the lecturer and student and it will make it easier for the student to grasp the knowledge and understand the content."* Which also spoke to the practicality element of teaching Automotive.

Lecturer D even cited technology usage in Automotive as being a "need" which further emphasized the importance of introducing and infusing technology into lecturers' pedagogical practices.

In addition to that question, lecturers were given the following prompt, that they needed to fill in to further illustrate their beliefs about using ICTs to teach Automotive: this is

how the prompt was phrased: Teaching Automotive Repair and Maintenance without ICTs is…

Lecturers used words such as: ***"****not okay, very bad, not good and disastrous." to describe what it is like to teach Automotive Repair and Maintenance without the usage of any form of ICT.*

The last question that constituted to this theme asked lecturers to describe what they thought was more important or came first when conceptualizing and teaching a lesson. Lecturers had to choose between two key elements that are required to enable a lecturer to teach Automotive Repair and Maintenance between the Technology and the Content. A majority of the lecturers (three, out of the five) to be precise stated that the content comes first before the technology. Whilst only two of the lecturers' said that Technology came first.

In summary, the lecturers who stated that technology were important because it helps the educator to make the content more practical for the learners. Additionally

> (Lecturer B) also stated "if you focus too much on giving the learners content without using technology to help them, they might not be able to understand and apply the content that they were taught. Which is a huge problem for a subject like Automotive, where students are not only expected to understand theoretical concepts. But they are also expected to be able to apply the knowledge in the workshop."

Whilst the lecturers who said content is important they also highlighted the importance of content by stating that *"content is the basic knowledge that an Automotive lecturer needs to have to be able to successfully and efficiently teach Automotive."* Furthermore, the lecturers emphasized that technology or having access to technology in the classroom did not guarantee that learning and teaching are taking place in a classroom. They stated that the presence of ICT did not necessarily lead to teaching and learning.

Lecturer C even stated that *"matter how much technology a lecturer has on their possession it would be impossible to teach and transfer the knowledge if it is not there. That is why I say that the content comes first".* The lecturers, who had a shared similar view, basically implied that ICTs were mere tools that can be utilized to help learners

understand and apply the content that they have been taught “a means to an end” as opposed to being “an end in them.”

(T9) Lecturers Technological Content Knowledge and its impact in the classroom and on ICT integration

The main question that led to the formulation of that theme was the following question:

What are lecturers’ understandings of various roles that ICTs have or can have in the TVET College system?

There are nuances of this theme in the other themes that have been discussed already. However, the main aim with this question was to establish whether lecturers who tech Automotive Repair and Maintenance were aware of the various roles that ICTs can play in the TVET sector. The lecturers seem to have an understanding of the roles that ICTs can have in the classroom. They all seemed to agree on the fact that ICTs can be sources of information. Lecturer A said, *“ICTs can help to make learning better, more fun, relatable and fun.”*

Lecturer B *“ICTs can make learning more real for the students. I can use simulation and videos for example to show the learners content and for a change, they won’t have to imagine, because they will be able to see visually, without having to imagine or taking them to the workshop.”*

Lecturer C stated that

> *“Sometimes the students do not understand my explanations of concepts when I explain them. These students are so addicted to music videos and technology. So, I think that ICTs, depending on which one you choose to use can also help with explaining concepts. Sometimes students understand other people more than us their lecturers. ICTs can also help to be the mediator between me (the lecturer), the content being taught and the student.”*
>
> Through these responses, it becomes evident that lecturers do have an idea of roles that ICTs can play within their classrooms. Additionally, the lecturers’ responses also display that they are aware of the importance of ICTs in the process of teaching and learning.

(T10) The state of ICT Readiness in TVET Colleges

This particular theme sought to explore the lecturer's perceptions about the concept of readiness. Additionally, it also sought to assist the lecturers to think about the concept of; Readiness concerning the respective TVET Colleges, which the lecturers worked at. Through this theme, the researcher wanted to gain an understanding of whether lecturers are ready to fully integrate all forms of ICTs into their school curriculum and most importantly into their pedagogical practices.

This was based on factors such as: the infrastructure and teacher readiness in terms of various factors that either encourage or hinder ICT integration. This consisted of factors such as; skills, knowledge and lecturer's ability to use and integrate ICTs into their pedagogical practices and eventually into their lessons on a general level. It is vital to note that the integration both the researcher and the respondents were referring to was in relation to both the practical as well as the theoretical aspects of teaching Automotive.

There seemed to be a consensus in the lecturers' responses about the question of readiness. This was in regard to the fact that there are certain elements, that need to be considered and changed before the Colleges can completely be ready to integrate all forms of ICTs. However, the lecturers were split in their responses with some lecturers saying they are ready. Whilst others said their Colleges were not ready to integrate ICTs.

One lecturer (Lecturer E) stated that he felt that his College was not yet ready to fully integrate ICTs into his pedagogical practices. He stated that he felt that *"all the lecturers needed to receive training prior to being expected to integrate ICTs into their pedagogical practices."* Another lecturer (Lecturer A) stated that he also felt that ***"**his college was not ready because the infrastructure was not fully prepared for the lecturers to be able to integrate ICTs."* Furthermore**,** he utilized the workshop as a classical example to illustrate his point. He stated that "the workshop would have to be expanded to fit more students. Ideally. In his opinion, he would like to see 50 students being able to fit into the workshop, which is not necessarily the case at the moment."

> He also alluded to the *"fact that theory classrooms should be fitted with projectors and smart boards, which would assist with simulations. The*

simulations would be the visual aid that would help the students before they go to provide so that students can acquire the appropriate skill sets in the correct level of study. So, for example, ideally, the students who are studying level 2 of Automotive need to be exposed more to hand skills and basic skills, whilst level 3 and 4 students need to focus on engine overhauls."

In an ideal world for this lecturer, it would be better if new-age digital technologies could be used alongside hand tools/ technologies. Making these more accessible to students according to the skill sets that; they need to be taught in each level of study. Would assist students to acquire the necessary skill sets that they required to master in each year of study.

Furthermore, this lecturer suggested that it would be great if the lecturers had access to laptops, not personal but laptops that are exclusively for work particularly within the theory classroom. This would make it possible for lecturers to show their students: PowerPoint presentations, videos, and simulations whilst they are explaining the theory. This would ensure that students are provided with a visual representation of what he is explaining theoretically in class. Which is a practice that is not happening currently in the classroom.

Similarly-Lecturer B stated that he thought, ***"****His colleagues were ready for the ICT integration process."* However, he also noted ***"****lecturers just need more training to guide them through the integration process."* In addition to that, he also mentioned *"the infrastructure within Colleges needed to be upgraded to facilitate the physical aspect of ICT integration in the classroom."* Another point that (Lecturer A) *emphasized was the fact that the training that is given to be given to the lecturers, should be relevant to how they are expected to integrate ICTs, within Automotive and other technical subjects.*

Another lecturer (Lecturer B) stated that he thought his colleagues are indeed ready for ICT integration. Unfortunately, his statement wasn't based on any tangible evidence- it was exclusively based on the assumption that the lecturer had which was "that all lecturers are good with using ICTs, especially with the ICTs that are peculiar to their areas/ trades of specialization."

(T11) Lecturer's views on the new impending teacher qualifications for vocational education

One of the key factors that would ultimately determine whether WITS University offers the new vocational education qualification (the Advanced Diploma TVT) lies, in the lecturer's views about the qualification. One key determiner that would determine Wits would offer this qualification, lies in the fact that the target audience, which are the lecturers need to show interest in being a part of the program, as it would be pointless to offer lecturers a qualification that, they would not necessarily be interested in pursuing.

Interestingly, all the lecturers agreed on the fact that the formal qualifications TVET lecturer courses were an essential breakthrough that most lecturers in the TVET space had been longing for. Furthermore, lecturers expressed that; this qualification would be the first of its kind in vocational education, and principally in teacher training education within this sector.

Four out of the five lecturers agreed on the fact they felt that these qualifications were necessary. This is based on the fact currently there isn't qualification within Higher Education, which is especially devoted to equipping TVET lecturers with all the necessary knowledge and skills. That would make it possible for them to be able to teach their vocational subjects efficiently and effectively using ICTs.

One of the lecturers (Lecturer B) expressed the fact that he was excited about this qualification as it would give him an opportunity to be more than just an artisan, it would give him a chance to become a lecturer with a recognized Degree that would make him a fully-fledged lecturer in the academic space who has more than a mere trade test.

Another lecturer (Lecturer D) expressed the fact that these new qualifications could lead lecturers into other vocational careers like Automotive Engineering. One lecturer expressed the fact he did not want to remain an artisan for *"I do not want to remain an artisan forever; I would like to become an engineer."* In addition to that, (Lecturer B) also mentioned the fact that he perceived that in this new age and the near future teaching students Automotive would require a qualified Engineer, who understands both the electronic and the mechanical components of motor vehicles. *"Which is one*

of the biggest problems the TVET College is currently facing in the education system, particularly within the TVET sector".

Lecturer E even hinted that this kind of qualification would create opportunities for growth in Vocational Education. Which could potentially lead to more research and even the commencement and cultivation of some form of formal academic culture within the TVET space. This would create the need for research, which would eventually lead to the development and formation of Doctors and Professors in Vocational Education.

On the contrary, one lecturer articulated that he was not interested in the new vocational qualifications, due to the fact he already had an Honours degree. In his opinion, this qualification would be a *"downgrade"* from his current qualification. This was contrary to the researchers' views because the lecturer has a Bachelor of Arts (BA) Honours degree. However, this degree is not remotely related to Vocational Education in any capacity, in this degree the lecturer did not specialize in a vocational trade or subject.

4.7. Discussion and Presentation of Observations that were conducted at TVET Colleges

The discussion that is presented here is from the data that was collected from the observations that the researcher conducted in the various Colleges that partook in the study. Automotive lessons are conducted using both the theoretical and practical approach/ methodology. Hence, the observations also needed to be conducted during both the theory and practical workshop sessions of Automotive Repair and Maintenance.

The lecturer's pedagogical practices differed with each of these aspects of Automotive since each of these elements are peculiar and require a different set of pedagogical practices.

For this part of the analysis the researcher utilized, the TPACK theoretical framework to assist with rating and identifying lecturers' level of competencies, to measure the types of knowledge that Automotive lecturers have mastered and also to identify the types of knowledge that educators lack within the TPACK framework.

The TPACK framework is a framework that extensively outlines different types of knowledge that an educator/ lecturer needs to master to be able to have what is called: Technological Pedagogical Content Knowledge, which is broadly known as TPACK. One requirement that lecturers need to fulfill to be deemed as having TPACK is that: they need to have mastered all the seven forms of teacher knowledge.

These forms of knowledge are characterized by different traits or attributes that are utilized to measure the extent to which a lecturer has mastered a certain type of knowledge. The different kinds of knowledge that need to be mastered by lecturers which consist of: Subject matter /Content Knowledge, Technological Knowledge, Pedagogical Knowledge, Technological Pedagogical Knowledge, Technological Content Knowledge, Pedagogical Content Knowledge and Technological Pedagogical and lastly, Content Knowledge.

This section will commence with a discussion of the observations. It is important to note that information in this portion of the discussion is presented in graphs. Two keys are utilized to represent the main forms of pedagogy that are employed in the TVET system. The keys are explained below:

Key: = Workshop observations

= Theory observations

The figures below represent the findings from the classroom observations. These findings were compiled in accordance with the observation schedule that the researcher had complied. This schedule focused on observing a set number of criteria across all knowledge areas that make up the TPACK model. This criterion that was assessed is denoted by the (C) on the graphs and in the discussions underneath each figure. In each graph (T) was used to denote the findings for the observations that occurred in the theory classroom/sessions. Whilst (W) denotes the observations that were conducted during the practical workshop sessions.

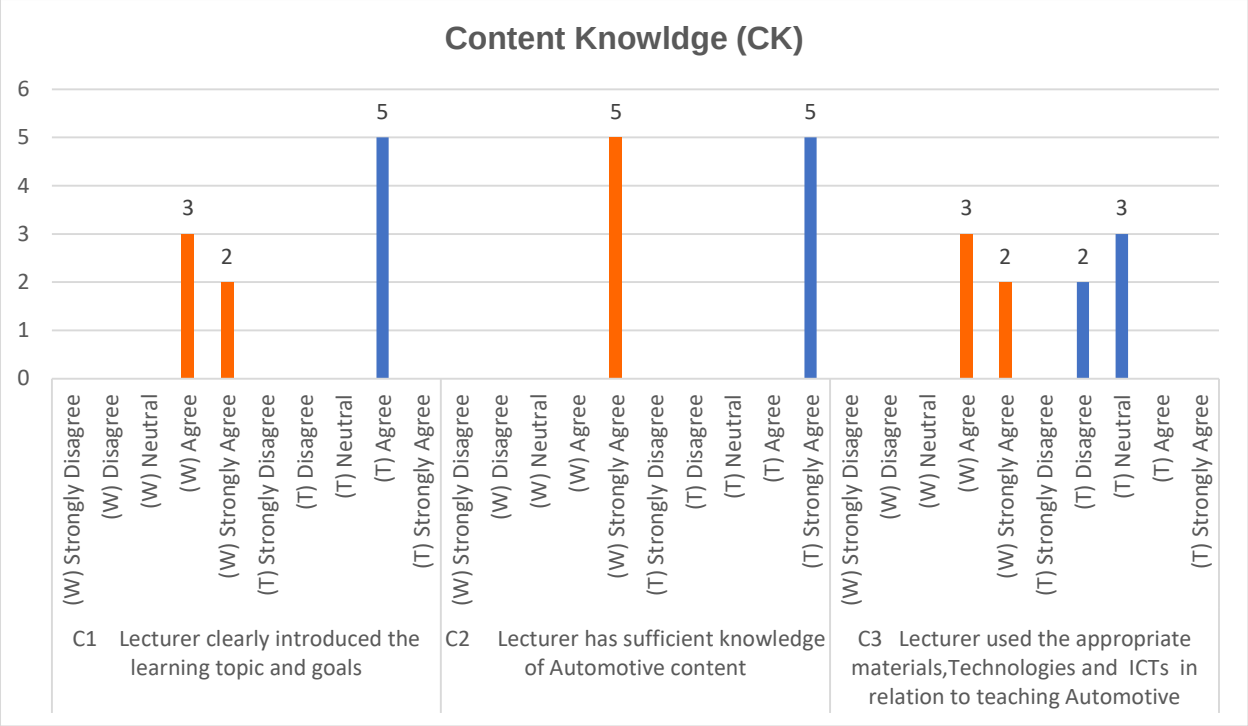


FIGURE 23: REPRESENTATION OF LECTURERS CONTENT KNOWLEDGE

Figure 23 depicts the observations the researcher made of the lecturer's Content Knowledge (CK) based on a set of criteria that was observed, during both theory and workshop sessions of the observations. Through evaluating the figure, it is evident that lecturers have mastered Content Knowledge. Firstly, the researcher rated the lecturers between the range of *"agree"* and *"strongly agree"* categories, for all three sets of criteria, that were observed in both theory and workshop sessions.

Generally, during the researcher's observations, one thing that stood out for the researcher was in the fact that: the researcher could not fault all the lecturers in terms of their Content Knowledge. The lecturers' content knowledge was more than adequate and matched the task at hand. Judging by the positive responses observed from the students during the teaching and learning process, and how the lecturers responded to students' questions during the lesson, it was quite evident that lecturers have sound knowledge of the content that they are teaching.

Under (C1), for Content Knowledge the researcher sought to observe whether lecturers were introducing learning topics to their students. 2 of the lecturers observed explicitly introduced the topic and the outcomes to their students; hence they were rated under the *"strongly agree"* category whilst the other 3 also introduced their

students to the objectives and outcomes. However, their explanations were not as explicit as the other two lecturers. Hence, they were rated under the *"agree"* category. For the workshop sessions, interestingly, all 5 lecturers were rated under the *"agree"* category for the theory aspect. The researcher observed that all lecturers did explain the learning topics and goals to their students. However, they would not really focus on explaining the key skills that they want students to master during their sessions and after the completion of the sessions.

(C2) sought to understand the depth of the lecturers actual Content Knowledge. All 5 lecturers were rated under the *"strongly agree"* category. All the lecturers were very knowledgeable individuals; they were specialists in Automotive Repair and Maintenance. They knew their content very well and as a result of that, they were also able to give quick, informative responses to their students' questions during their lessons. That was evident in both the theory as well as the workshop sessions. Additionally, the researcher was also impressed by how lecturers used Automotive related jargon/ terminology during the various lessons class to teach concepts to their students.

The third set of criteria (C3) sought to make connections between the selections of technology, ICTs and content being taught. For the workshop sessions, the researcher rated 3 lecturers under the *"agree"* category whilst the other 2 were rated under *"strongly agree"* category. This was based on the fact that the researcher did indeed observe that lecturers were making meaningful connections between the content and the practical activities. The only key distinction between the two categories was in the fact that the lecturers who were rated under the *"agree"* category were utilizing tools and the technologies that are dated; the biggest example was the carburetors. However, the lecturers were able to use them to help them to enhance learners' understanding and application of knowledge that they were teaching.

Whilst for the theory aspect, 2 lecturers were rated under the *"disagree"* category. This was mainly because these lecturers did not make use of any technological devices at all during the execution of their theoretical lessons. These lecturers were explaining the concepts to their students without the assistance of visual aids. They were merely talking students through the theory. The researcher noted that students were often confused and very passive during these lessons whilst the other 3 lecturers that were

rated under the *"neutral"* category attempted to use models and training boards to assist them with explaining theoretical concepts. Even though these resources were limited, the lecturers were using them creatively to teach concepts, which the researcher found to be interesting. it was also stimulating for the students, and sparked some engagement in these lessons, which was great to see.

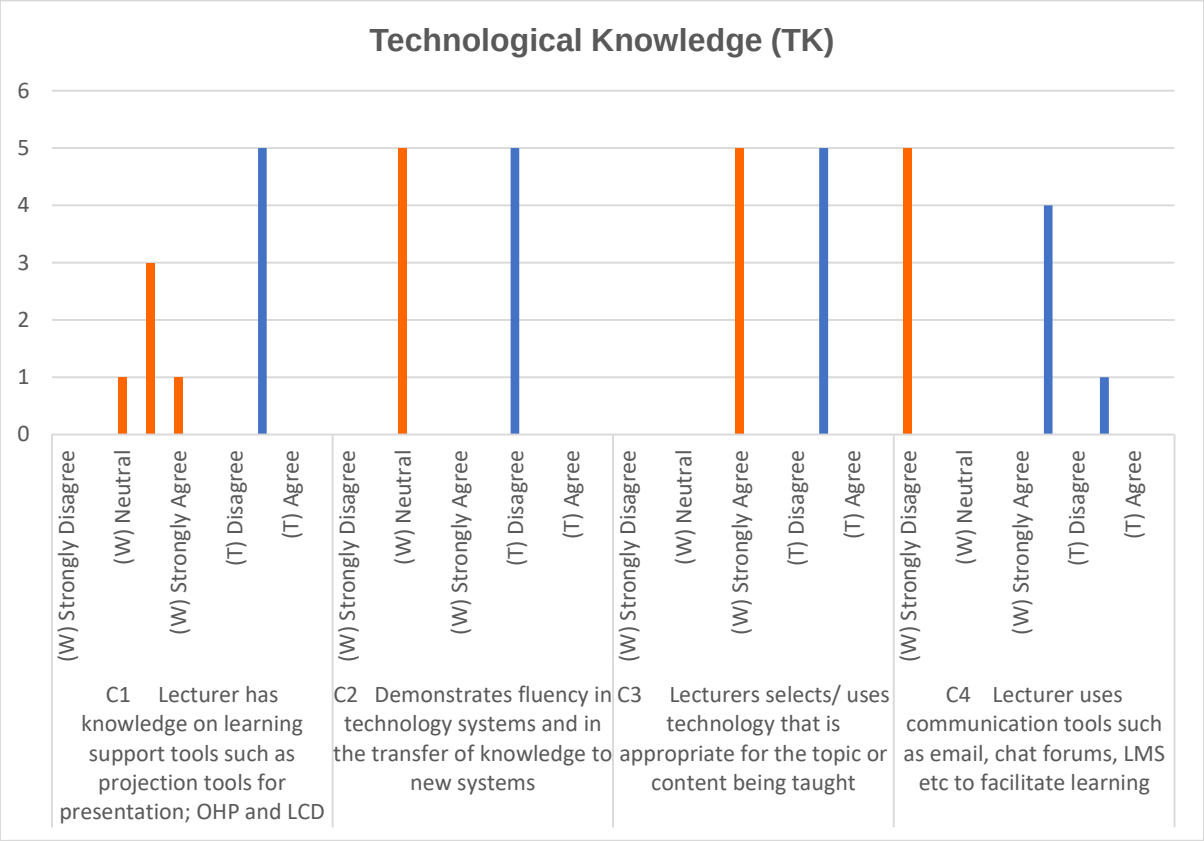


FIGURE 24: REPRESENTATION OF LECTURERS TECHNOLOGICAL KNOWLEDGE

Figure 24 exemplifies the level of complexity that was encountered by the researcher in the endeavor to observe and analyze lecturers Technological Knowledge (TK). For TK the researcher observed four sets of criteria, which was slightly more complicated when compared to the other forms of knowledge. (C1) which measured the lecturer's ability to utilize learning support tools during sessions. For the theory sessions the researcher rated all 5 lecturers on the *"disagree"* category for the theory sessions. This was due to the fact that none of the lecturers actually used and learning support materials such as: Over Head Projectors (OHDs). That could be mainly attributed to the fact that the lecturers did not have access to any of these supporting materials in their classrooms. Therefore, the researcher could not gauge nor accurately deduce whether the lecturers could or could not use those materials. Hence, the researcher

rated the lecturers under that particular category. In terms of the workshop sessions, 3 lectures were rated under the *"agree"* category; these lecturers were effectively using technologies and tools during their sessions for demonstrations.

The 1 lecturer that was rated under the *"strongly agree"* category used the tools to also demonstrate the practical tasks that students were expected to complete prior to actually giving the students the practical. This lecturer also made students complete small enabling tasks to help build their confidence on using tools and technology prior to giving the students a task to complete in the workshop. Lastly, 1 lecturer was rated under the *"neutral"* category. This was based on the fact that, though the tools and technology were available in the workshop the lecturer was not really utilizing them effectively to engage the students on the content. The lecturer used them to just give practical tasks to students. Through reading the graph, it becomes quite clear that lecturers' Technological Knowledge for this criterion is unevenly distributed through three main categories within the scale. This was particularly obvious in the workshop sessions.

For (C2) which sought to understand when the lecturers were using technology to transfer knowledge and to create new knowledge systems. All 5 lecturers were rated under the *"neutral"* category for the workshop sessions. This was based on the fact that the lecturers were utilizing tools and technologies that they had access to in their workshop sessions, yet they were not necessarily used to create new learning experiences. All 5 lecturers were also rated under the *"disagree"* category for the theory sessions. This rating was mainly influenced by the fact that none of the lecturers were actually seen actively utilizing these tools to create new knowledge systems, this could be mainly attributed to the fact that these tools and technologies are not available in the actual classrooms. Therefore, it was difficult to measure lecturer's ability to utilize these to create new knowledge systems and learning experiences.

For (C3) which sought to understand and make connections between the technologies used during the sessions and the content that was taught. For the theory sessions all 5 lecturers were rated under the *"neutral"* category. This was mainly attributed to the fact that the lecturers did not always utilize technology during these sessions. Lecturers used technologies that were at their disposal in most instances they had access to one model in their classroom which was of the gear system or the valves in

a car and that wasn't always appropriate for usage for all the content that the lecturers were teaching. Furthermore, the lack of appropriate technology contributed to the rating that the lecturers received. For the workshop sessions all 5 lecturers were rated under the *"strongly agree"* category, mainly because they utilized the appropriate technologies for the content they were teaching.

(C4) pursued to examine whether lecturers were utilizing communication tools and Learning Management Systems (LMS') in the facilitation of learning and teaching. For both theory and the workshop sessions most, lecturers were rated under the "*strongly disagree"* category. This was based on the fact that lecturers did not utilize LMS' and communication tools in the execution of any of those sessions. The lecturers did not have access to these, which made the integration of these tools impossible. However, the researcher did note one lecturer, who attempted to use cellphones in his lesson. This lecturer allowed students to record his theory sessions. In addition to that, he also had a WhatsApp group for his Automotive classes, and he was the one lecturer that was rated neutral for his theory classes.

Overall, throughout the researcher's observations, it was evident that: it was slightly more difficult to judge and rate lecturers on this form of knowledge. However, the researcher could infer that some lecturers have more Technological Knowledge than their counterparts. Some lecturers were not able to exhibit and effectively use that knowledge to their lessons. Particularly, in the theory classrooms, due to the fact lecturers did not have access to all the necessary ICTs that would permit them to do so. Hence, for the theory sessions the lecturers were mostly rated under the *"strongly disagree"* category. The researcher observed that lectures were using mainly verbal explanations to explain concepts to students.

Therefore, the lectures could not demonstrate fluency in technology systems. Out of all the knowledge bases that were observed during classroom observations Technological Knowledge was undeniably one of the areas of knowledge within the TPACK framework that lecturers require the most support in. Especially when it comes to the theory classrooms, because within these classrooms the researcher observed minimum to no ICT usage or integration. Teachers were mostly using whiteboards to write and draw illustrations, in some instances, they used models to assist them to

explain concepts in their lessons in the attempt to teach students content and was the only technology usage that was observed by the researcher.

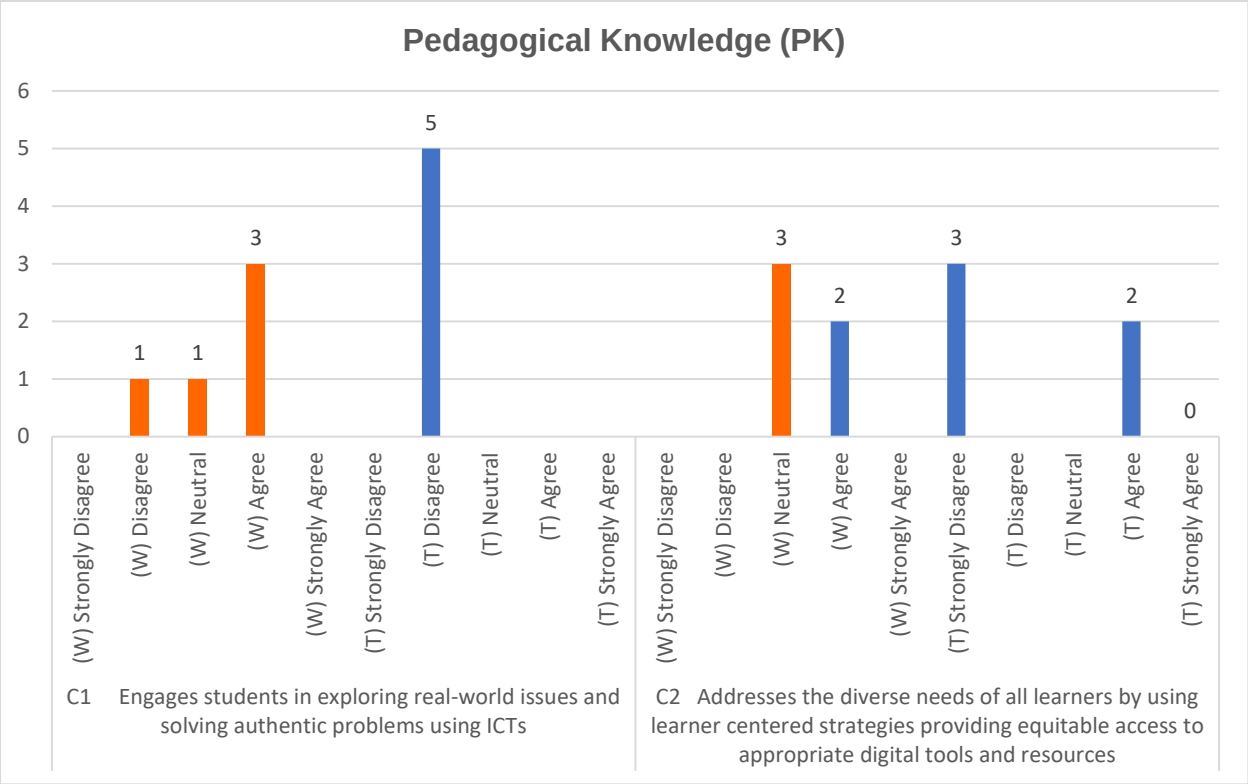


FIGURE 25: REPRESENTATION OF LECTURERS PEDAGOGICAL KNOWLEDGE

(C1) endeavored to measure whether lecturers were utilizing ICTs to explore real-world issues and to solve authentic problems. For that criterion within the workshop sessions 1 lecturer was rated under the *"disagree"* category, this lecturer did not actively engage with his students on the content in relation to the activity they were doing. The lecturer merely provided the students with the instructions to the practical activity students were required to complete. He did not actively engage the students with the technologies used in the workshop even though the students were using them to solve authentic problems. Another lecturer was rated under the *"neutral"* category based on the fact that the lecturer utilized an ICT that is peculiar to Automotive, the diagnostic machine for fault finding. However, the machine that the lecturer utilized was dated, hence he was rated under that category.

3 lecturers were rated under the *"agree"* category this is because these lecturers engaged with technologies. These lecturers also performed demonstrations using the technology and utilized that to assist students to see and assimilate usage of the technologies before going into performing the practical in their groups. In addition to

that, the researcher also noted that the technologies that were utilized by these lecturers were also dated, but better because they were from the late 1900s.

(C2) measured whether lecturers were using learner-centered pedagogies to address their students' academic needs. For the workshop sessions, 3 lecturers were rated under the *"neutral"* category. Lecturers had more access to technologies in the workshops; they tried to include more authentic problems in the class and attempted to address some of the students' academic needs. The pedagogy that was used in the workshops was more practical and less theoretical. These lecturers were not utilizing student-centered pedagogies; they resorted to reading and explaining the workshop tasks to their students and then dismissing the students to complete the task on their own. The other 2 lecturers that were rated under the *"agree"* category attempted to be more hands on, they would explain the task to the students. After completing that they would do a mini enabling task.

They would model tasks with the students and then let the students go off into groups to execute the practical task. These lecturers used more student-centered approaches when teaching their students. Whilst, for the theory sessions 2 lecturers were rated under the *"agree"* category. These lecturers attempted to bring models into their lessons; they used visual aids to assist them explaining the content. In instance the visual aids they had at their disposal were not relevant. So, they resorted to drawing illustrations on the board. The only problem with the models that the lecturers were using was that there was not a model available within the classroom, for every topic that was taught.

Generically, the examples that the lecturers utilized in the workshop sessions were better, because the lecturers and students were using technologies to help students solve authentic problems. This was attributed to the fact they had access to authentic tools to assist with solving those problems.

The other 3 lecturers were rated under the *"strongly disagree"* category. These lecturers mostly focused on using lecturer-centered pedagogies in their delivery of content. Lecturers were seen talking knowledge at students, with minimal to no interaction with their students. That mainly characterized the lecturer's pedagogical practices; students were merely sitting absorbing the knowledge, with some writing notes in their workbooks. Furthermore, lecturers were seen explaining concrete

concepts to students using theory, in an extremely abstract manner. The researcher could see that in most cases, the students were either confused or getting frustrated during the lessons.

Furthermore, the researcher did not witness these lecturers using various teaching strategies, to try and meet students' needs in the theory classroom. The lecturers struggled to relate and explore world issues and solving authentic problems using ICTs particularly, in the theory aspect. Lecturers did attempt to bring in real-life examples into the theory aspect of the lessons. However, the examples used did not always resonate with the students because they were very abstract.

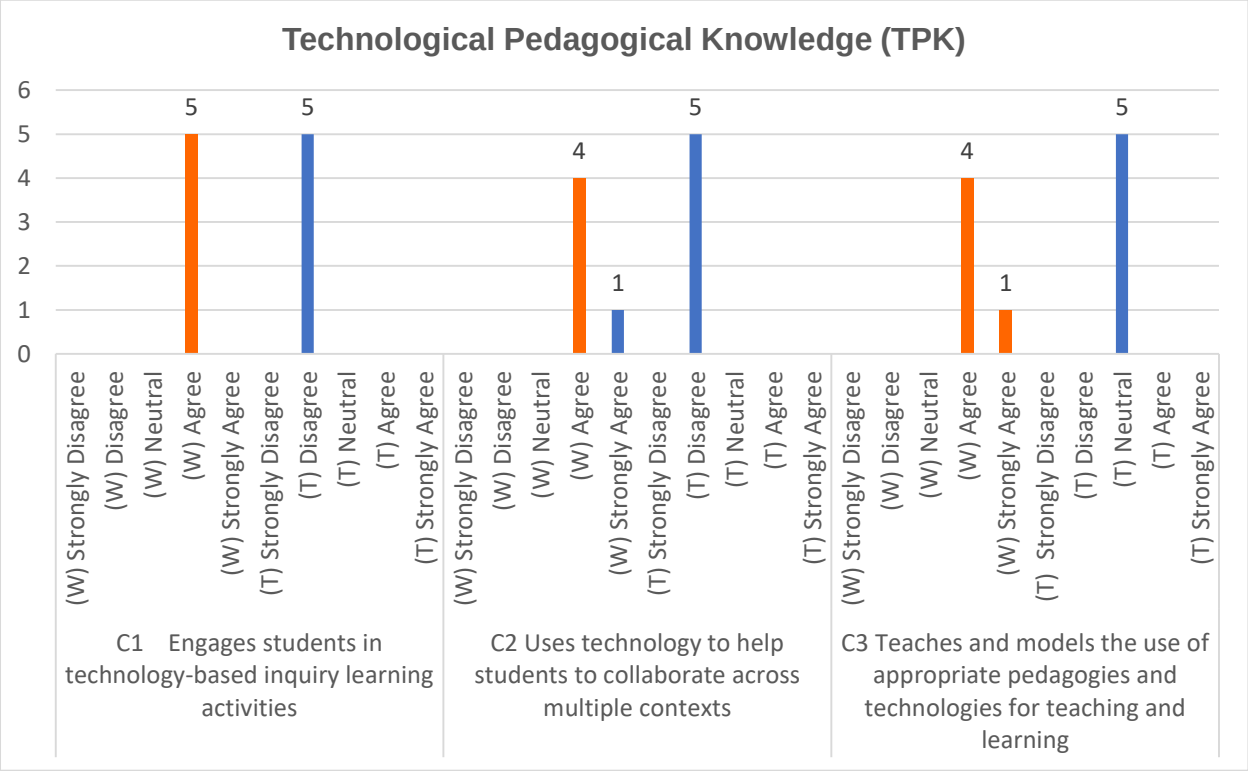


FIGURE 26: REPRESENTATION OF LECTURERS TECHNOLOGICAL PEDAGOGICAL KNOWLEDGE

Firstly, through glancing through this graph it becomes evident that lecturers (TPK) was vastly evident within the practical classroom during the workshop sessions, when contrasted to the theory classroom.

(C1) which endeavored to measure the extent to which the lecturers were engaging students in technology-based inquiry learning activities. For the theory sessions all 5 lecturers were rated under the *"disagree"* category. This was mainly attributed to that fact that the lecturers were not actively engaging their students during these sessions.

Since there was minimal (in some classrooms) and no technology most the students could not be engaged in technology-based inquiry learning activities.

For the workshop sessions all 5 lecturers were rated under the *"agree"* category. This was due to the fact that the lecturers were able to engage with their students more. They were also using more enquiry-based teaching, which required the students to complete practical learning activities that were technology-enquiry based. Both the lectures and the students were able to use the technology of the trade, which cuts across the classroom and industry. Lastly, the lecturers had more access to specialized technologies that were more appropriate usage for the purposes of teaching and learning in the workshop sessions. Even though the integration was not at its best, it was reasonably good and evident in the practical sessions. Based on that the lecturers can be said to possess a certain TPK, even though it is not extensive, it was evident for the researcher in the observations.

Then for (C2) which sought to understand whether lecturers were using technology to help students to collaborate across multiple contexts. For the workshop sessions 4 lecturers were rated under the *"agree"* category and 1 lecturer was rated under the *"strongly agree"* category. This is due to the fact that the lecturer used the technologies that they had to make meaningful connections between the content, and they taught in the theory classroom, the workshop sessions how that fits in real life. All 5 lecturers were rated under the *"disagree"* category for theory sessions, mainly because even though some lecturers were trying to integrate ICTs in the form of models, it was more to assist the students make sense of the information and not necessarily for the purpose of assisting them to collaborate across multiple contexts.

With the last set of criteria (C3) the researcher sought to measure whether the lecturers were modeling the use of appropriate pedagogies and technologies for the teaching and learning in their lessons. For the workshop sessions 4 lecturers were rated under the *"agree"* category, 1 under *"strongly agree"* category. The one characteristic that essentially set the two categories was that the lecturer one lecturer exhibited more creativity in how they utilized technologies and also the lecturer utilized more teaching strategies to capture his students and make sure that they were actively engaged through the teaching and learning process.

For the theory sessions all five lecturers were rated under the *"neutral"* category because though the researcher witnessed limitations in terms of access to technological resources. The researcher noted that the lecturers were attempting to model appropriate pedagogies with limited technologies that they had access to. This was mostly achieved through the attempted demonstrations.

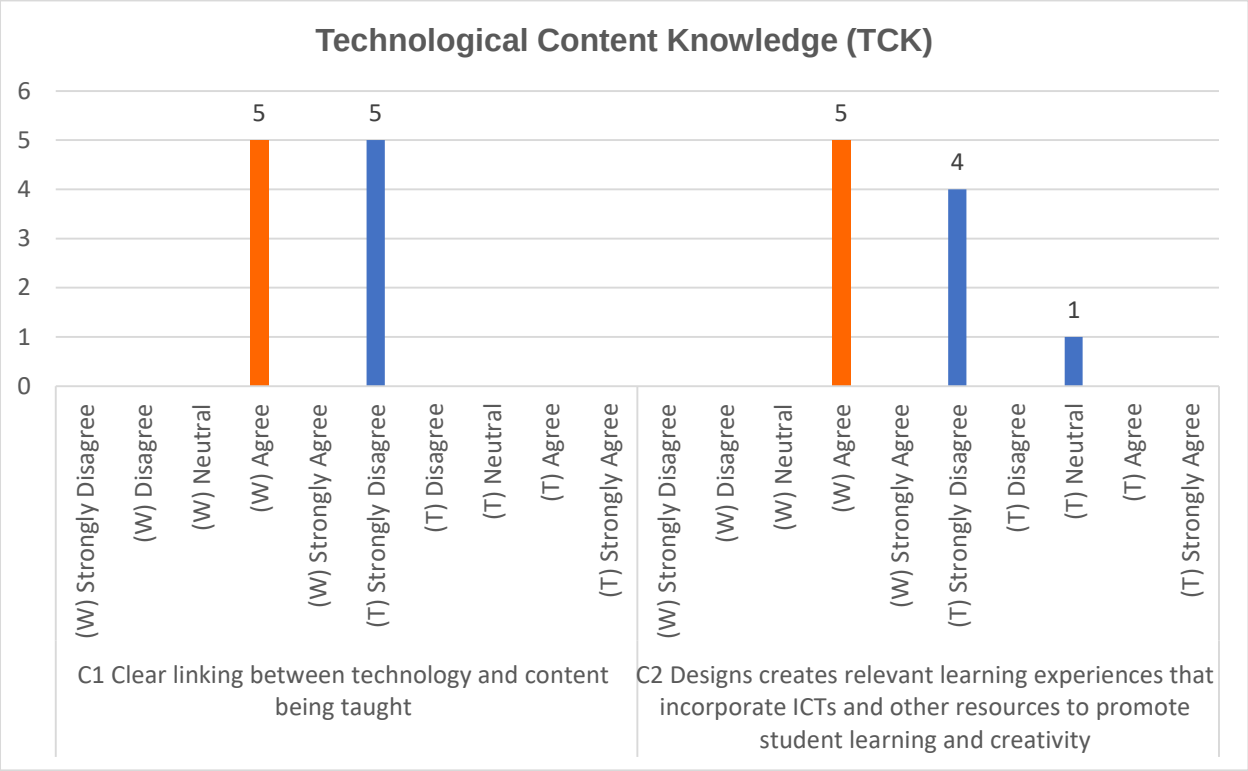


FIGURE 27: REPRESENTATION OF LECTURERS TECHNOLOGICAL CONTENT KNOWLEDGE

For TCK two sets of criteria were evaluated during the observations. The first criteria (C1) evaluated the linking of technology and theory in the lessons. The linkage of technology was in specific reference to ICTs. In the content/ theory sessions the usage of ICTs was not evident. Therefore, the researcher rated all 5 lecturers under the *"strongly disagree"* category, owing to the fact that technology integration was not evident in those theory sessions. The link between the technologies was more apparent in the workshop sessions. Since, students were engaged in practical application of knowledge and all the tasks that they engage in, blend well into the criteria in terms of the criteria of designing learning experiences. Hence, the researcher rated the majority of the lecturers between the *"agree"* to *"strongly agree"* categories.

The graph above illustrates that lecturers lack or have not yet mastered using TCK in the theoretical aspect of their lessons. Judging by the total tally for the theoretical component of TCK it becomes evident that lecturers who teach Automotive lack it more the theory classroom. The researcher did not note any links between technologies and the content being taught, because there was not much technology for all five lecturers to integrate into their theoretical lessons as opposed to the practical side. Surprisingly, lecturers exhibited more TCK during the workshop element of Automotive. That is where it is more evident, hence all lecturers were rated under the *"agree"* category for this type of knowledge.

That is due to the fact that, the researcher saw how practical the lecturer's pedagogical practices evolved, during the practical workshop sessions. Lecturers were also able to link the content that they were teaching to the learners, to the tools and technology, which they were teaching with. Through that lecturers were able to promote student learning. During the workshop sessions the students had more of a voice, there were more interactions, they did lots of activities that required them to interact and work in groups, they asked more questions that are related to the content they were taught. Which was not the case with the theory classroom.

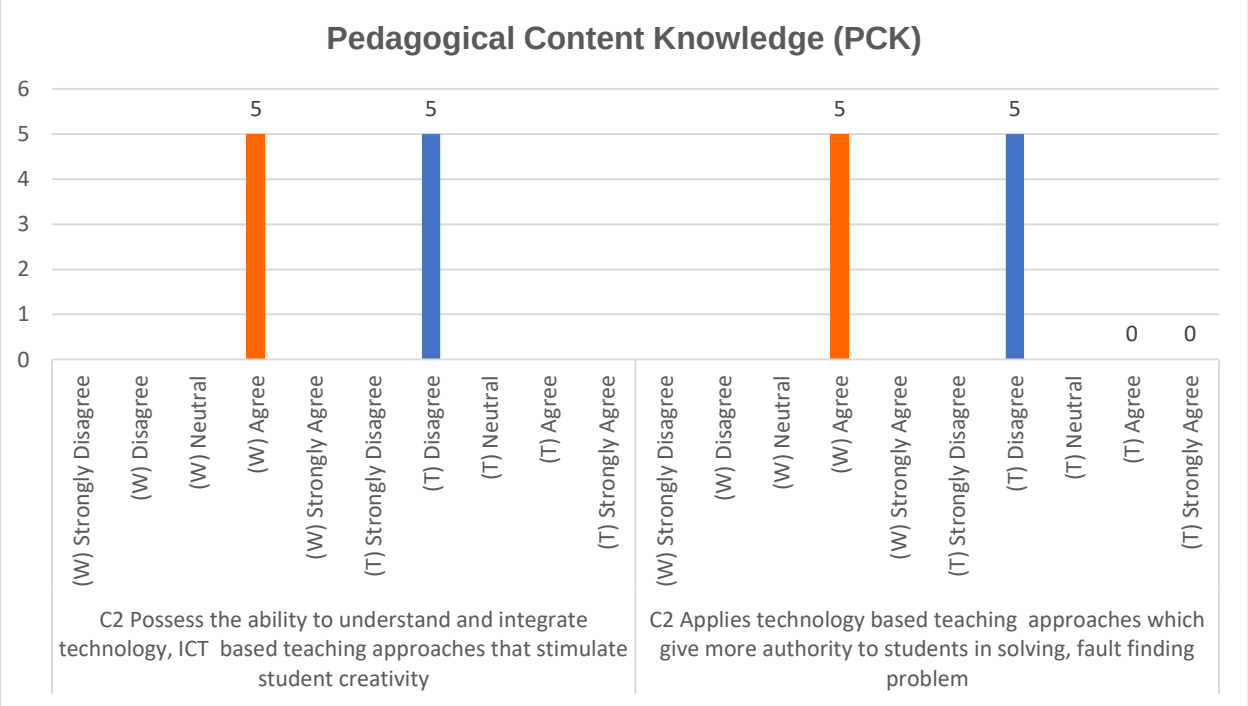


FIGURE 28: REPRESENTATION OF LECTURERS PEDAGOGICAL CONTENT KNOWLEDGE

In the context of this study (PCK) mainly focused on evaluating two sets of criteria in relation to how lecturers were integrating ICTs into their existing teaching practices. The first criteria (C1) assessed lecturer's ability to integrate teaching approaches that stimulate student creativity. All 5 lecturers were rated under the "*disagree"* category for the theory sessions, mainly because there was minimal evidence of lecturers integrating technology or ICTs for the sheer purpose of sparking student creativity. For the workshop sessions all 5 lecturers were rated under the *"agree"* category. This was mainly due to the fact that lecturers were utilizing technologies; some elements of creativity were evident. However, it was also restricted, mainly by the nature of the activities and the learning objectives that were prescribed for these particular sessions.

The graph above also demonstrates that lecturers have some insight about this type of knowledge, particularly within the context of the workshop sessions. Yet, lecturers still require support to assist them to hone this type of knowledge in order for them to be able to successfully integrate these technologies in their teaching approaches in the theory classroom. During the observations the researcher noted that the lecturers employed more lecturer-centered methods, to teach their students theory in Automotive. That is a key hindrance to lecturer's ICT readiness and integration.

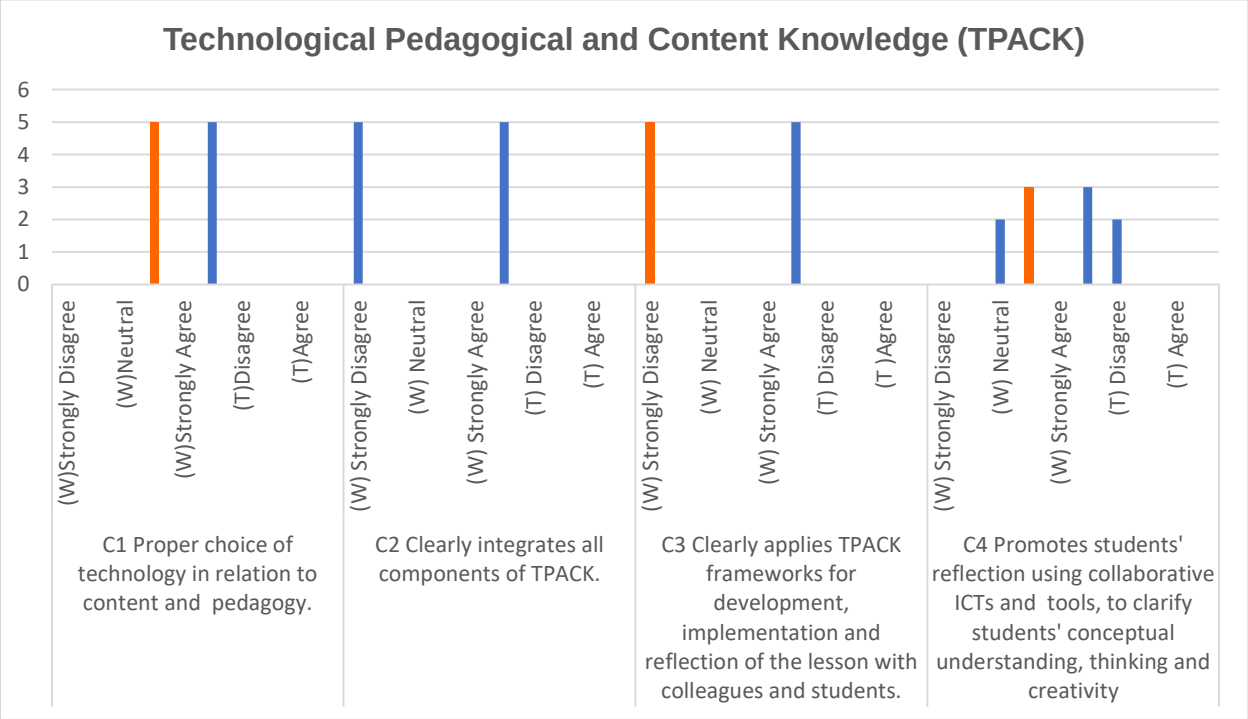


FIGURE 29: REPRESENTATION OF LECTURERS TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE

When we speak about integration and readiness TPACK is the ultimate form of knowledge that lecturers need to demonstrate in order to be able to effectively integrate ICTs into their lessons. TPACK is foundationally representative the highest set of Knowledge and skills, that lecturers need to master and use in their lessons. When a lecturer can successfully display this form of knowledge we can deduce, that the lecturer is ready to fully integrate ICTs into their pedagogical practices.

(C1) which measured the connections between technology, pedagogy and content for the workshop sessions all 5 lecturers were rated under the *"agree"* category this was mainly because the researcher noted a definite link between the content, technologies and pedagogies that were utilized by lecturers. Even though in some of the instances the technologies and tools were dated, which was obviously beyond the lecturer's control. Whilst for the theory all 5 lecturers were scored under the *"strongly disagree"* category mainly due to a point that has been bought up the researcher quite a few times in this paper, which is lack of access to the relevant ICTs in the theory classrooms.

C2 measured if lecturers were integrating all components of TPACK into their lessons. For the workshop sessions 4 lecturers were rated under the *"disagree"* category. These lecturers were exhibiting some of the knowledge bases and not all whilst the 1 lecturer that was rated under the *"neutral"* category also exhibited some of the knowledge bases. However, he exhibited more flexibility and creativity in his lessons when compared to his counterparts.

For the theory all 5 lecturers were rated under the *"strongly disagree"* category mainly because in order for lecturers to be able to integrate TPACK successfully they need to have mastered all the knowledge bases prior to this. Through reading the previous graphs it becomes evident that the lecturers were already experiencing challenges with the other knowledge bases. Therefore, it is not possible for the researcher to say that the lecturers have mastered TPACK. The main contributing factor to this was in that the lecturers barely had access to technologies in their theory classrooms. That also contributed to their inability to have mastered TPACK.

(C3) which measured if lecturers were utilizing technologies for development, implementation and reflection in their lessons. For both workshop and theoretical sessions all 5 lecturers were rated under the "strongly disagree" category. This is

attributed to the fact that lecturers did not have access to ICTs that would make development and reflection in their lessons impossible.

(C4) sought to measure lecturer's ability to promote students' reflection using collaborative ICTs and tools, to clarify students' conceptual understanding, thinking and creativity. For the workshop sessions 2 lecturers were rated under the *"neutral"* category, mainly because they were seen using the ICTs and technologies to merely assist the students with their conceptual understanding of concepts that they were taught in the theory classroom. In addition to that, lecturers also attempted to assist students to make links between those concepts and the practical activities that students were expected to complete in the workshop. The other 3 lecturers were rated under the *"agree"* category, this was mainly due to the fact that these lecturers also were also utilizing the ICTs to assist students to reflect on their knowledge in addition to just using them to assist students build their conceptual knowledge.

Whilst, for the theory sessions 3 lecturers were rated under the *"strongly disagree"* category mainly because these lecturers did not use any ICTs or tools during the execution of their theory lesson. Which was because as mentioned afore, because these lecturers did not have access to these ICTs. Then 2 lecturers were rated under the *"disagree"* category. These 2 lecturers also did not have access to ICTs in their theory classroom. However, what distinguished them from the other lecturers was the fact that they were more creative with their pedagogies, which they used, in the endeavor to assist their students develop conceptual knowledge.

Through analyzing figure 29 above one can easily assert that most respondents that took part in this study were not ready to fully integrate ICTs into their existing pedagogical practices. Especially, when teaching theory and that is where a majority of the discrepancies occurred in terms of ICT integration. Whilst, lecturers really attempted to integrate ICTs, the integration was more evident in the workshop sessions and that is a key finding that emerged from the data and in the figure above.

Furthermore, according to the criteria used to observe the lecturers, it become evident that most of the lecturers TPACK still needs to be improved. The main problem that relates to TPACK lies in the fact that, for a lecturer to have successfully reached TPACK they need to have mastered all forms of knowledge that form TPACK. This is because TPACK is an amalgamation of the all the other forms of knowledge.

Therefore, the researcher posits that the other forms of knowledge within this framework act as a foundational knowledge base that lecturers need to cultivate, prior to being able to use TPACK.

Based on the information displayed on figure 29 it becomes apparent that the lecturers that participated in this study have not yet mastered TPACK. However, they do have some or have mastered some of the various forms of knowledge that are foundational to the formulation of TPACK.

This is a summary of how they have mastered some of the knowledge bases required within TPACK.

The lecturers have Subject/ Content Knowledge; they know their content very well. This was thoroughly demonstrated in their teaching. They are able to utilize the correct terminology when teaching, interacting with their students. In addition to that, they are also able to use the correct materials (the ones they have at their disposal when they teach, which is highly commendable).

In terms TK, PCK and TPK: the lecturers do display these forms of knowledge to a certain extent. But, this was limited in their pedagogical practices in the workshop sessions. However, it was often not mirrored in their pedagogical practices during the theory lessons/sessions.

Generally, in terms of PK it emerged that: lecturers also need support to improve on their PK to enable them to engage students in exploring real-world issues and solving authentic problems using ICTs, especially in the theory classroom whilst the use of ICTs was evident but limited in the workshop. The lecturers were often seen making use of very lecturer-centered pedagogies when teaching knowledge. Improving the lecturer's PK would enable them to use more student-centered teaching strategies to teach their students.

TPACK: overall the lecturers have not yet mastered TPACK. However, certain elements of it are present in their pedagogical practices. For instance, when lecturers were choosing technology to use in their lessons and relating that to the content. This was also more apparent in the practical workshop sessions; a major contributing factor to that would be that technology usage is mandatory in the workshop sessions for both

lecturers and their students; this is stipulated in the curriculum for Automotive. However, the same cannot be said about the theory classrooms and sessions.

4.8. Limitations of the Study

According to Simon and Goes (2013) limitations are matters and incidences that ascend in a study, that are beyond the researcher's control. These are often a result of conscious inclusionary and inclusionary decisions made by the research, during the development of a research study.

There are two main limitations that the researcher was able to generate from this study. The first limitation was the limitation of time; during the data collecting process the researcher experienced major setbacks in terms of time. The researcher wanted to spend more time collecting more in-depth data, specifically during the classroom/workshop observations. This would have intensified the "thickness" of the descriptions that were provided in this study. Additionally, it would have assisted with checking consistency and inconsistencies in the lecturer's pedagogical practices. Through spending more time observing lecturers the researcher would have gotten more in-depth information about lecturer's pedagogical practices.

Furthermore, the researcher experienced difficulty in getting lecturers to consent to participate in this study. That was a huge challenge, because other participants would agree to take part the study and cancel at the last minute, which was a setback because the researcher was working with a very limited number of TVET Colleges especially, ones that offer Automotive Repair and Maintenance in Ekurhuleni, which is the area where the sample for this study was from.

In addition to that, the researcher also experienced time constraints, the academic calendar that TVET Colleges use is very different to the academic calendar used at the University of the Witwatersrand. Therefore, there were numerous clashes between the researcher's schedule and the TVET College's schedule. Furthermore, the researcher wanted to conduct a pilot study prior to conducting the actual study, but due to time constraints that did not happen. The pilot would have really assisted the researcher with triangulation for the purposes of validating this study.

The researcher could have utilized the data from the pilot to compare with the actual study and, also to do cross checking. This cross checking would have assisted with identifying patterns of similarity and difference. The pilot could have also assisted the researcher to identify the challenges that the researcher would encounter. Through conducting the pilot, the researcher would have been able to come up with solutions that would have assisted the researcher to mitigate, some of the challenges that the researcher faced during data collection process prior to the actual data collection process.

4.9. Conclusion

The main aim of this chapter was to assist the researcher give a semi-detailed account of the various steps that were undertaken in the data analysis process. This was all done in the endeavor to assist the reader to get a sense of what emerged from research data that was collected by the researcher. In addition to that, the researcher also endeavored to provide the results that emerged from the data analysis from both the semi-structured interviews and the classroom observation through, the usage of graphic representations and graphical organizers such as graphs that represented the observations that were made by the researcher.

CHAPTER 5: SUMMARY DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The main purpose of this chapter is to discuss the key findings that emerged from the data that was gathered and analyzed (in Chapter 4) of this study. The discussion of these findings is also in light of the relationships between some of the arguments that were apparent and discussed in the literature review and in the theoretical and conceptual framework that the researcher used for this study. In addition to that, the researcher will also endeavour to discuss some recommendations, that could be used to mitigate some of the key findings, challenges that arose from the findings. With that, the researcher will outline some ideas for future research and provide some concluding remarks to round up this study.

5.2. Key Findings from Semi-Structured Interviews

According to Trinidad (2006) the integration of Technology in education comes in a two-fold process. This process is preceded by the creation of an ICT integration policy. Which is then succeeded by the creation of ICT integration framework/s. This is because the mere creation of a policy is not sufficient enough to initiate the ICT integration process mainly, because an integration policy only mandates the use of ICT in education (Trinidad, 2006). Whilst ICT frameworks describe the characteristics of effective learning and quality pedagogy. Furthermore, ICT frameworks make ICT Integration a tangible process. This is achieved through outlining the various stages of advancement, which educators need to go through as they attempt to integrate ICTs into their pedagogical practices in the bid to working towards quality ICT pedagogical integration in the sphere of education (Trinidad, 2006).

The statements written above illustrate the importance of the creation of both the ICT integration policy/policies and ICT integration framework/ frameworks. In the process of conceptualizing this study, the researcher embarked a rigorous journey of engaging with literature and trying to make sense of the current, trends and pedagogical practices that occur in classrooms in TVET Colleges. The first document that the researcher sought after was an ICT integration policy for Higher Education. In addition

to that, the researcher strived to find a section that spoke about ICT integration within the context of TVET Colleges. Through this process, the researcher realized that one of the biggest challenges that TVET Colleges face, which is a key hindrance for ICT readiness and integration for institutions of higher learning. Specifically, in TVET Colleges lies in the fact that there isn't a policy document that has been drafted, that is solely devoted to mandating ICT integration in the sphere of Higher Education, which provides clear directives and guidance to various stakeholders (and specifically to lecturers) on how the process of ICT integration should occur within these institutions.

Unlike, with Basic Education which has the E-white paper: which is a document that outlines and guides the execution of ICT integration with the intention of introducing (E-Learning) within Basic Education. The only policy document that provides directives within the context of Higher Education is The White paper for Higher Education. One of the biggest challenges with that particular policy document is in the fact that it does not speak principally about ICT integration, even at its most basic level. This document also does not provide directives on how lecturers in TVET Colleges should utilize ICTs. Nor does it stipulate how technology should be utilized to teach students within TVET Colleges the specialized, technical, vocational skills and knowledge that they will require when they exit the TVET College system and enter the workplace. This is a finding that concurred with one of the findings that Cross and Adam (2007) cited in their study.

As a result of the lack of policy, comes the lack of investment, lack of financial support and the lack of upgrading currently existing infrastructure especially, the technological infrastructure within the TVET space. That becomes a major hindrance in the process of integration because lecturers cannot be expected to utilize technologies that they do not have access to, in their lessons. All respondents that were part of this study expressed the fact that they are interested in utilizing ICTs in their lessons. However, they also highlighted they had limited and in most instances no access to these ICTs.

Additionally, through interacting with the lecturers the researcher realized that lecturers are attempting to integrate ICTs into their lessons. However, this was very surface-level integration, which was mainly evident in the workshop sessions, and not necessarily in the theory classroom sessions. This finding is a major concern for the

researcher. Since, the theory that students are taught in the theory classroom is meant to introduce them to concepts prior to them getting to apply the knowledge in the workshop. The observations and semi-structured interviews that the researcher made in terms of integration revealed that: lecturers are mainly using specialized technology in the workshop sessions, in the attempt to get students to formulate a practical understanding of the theoretical concepts that they were taught. Furthermore, the researcher also noted that ICTs such as interactive whiteboards, virtual reality, simulators and training-boards are not being utilized in TVET Colleges.

Another finding that was initially cited as a challenge in the literature review which stated that: TVET Colleges lack an element of efficient ICTs use “because even if programs are offered in this sector of education use technology. Often modern technologies are not utilized to upgrade both facilities and the academic programs that are being offered” (UNESCO, 2011, p.17).

Which was indeed evident in the TVET Colleges that the researcher went to. Essentially, all the Colleges have access to antique technologies such as carburetors, which are no longer utilized in the new hybrid models of motor vehicles that are being currently produced in the Motor industry. In addition to that, the lecturers also have access- to dated models of cars in their workshops. Now in saying that they are using dated technologies, it is important to note that the researcher is not implying that the TVET system should completely phase out the usage of these technologies when teaching students. As these dated technologies can be used to teach students fundamental knowledge about Automotive Repair and Maintenance. However, the researcher is advocating for students to be taught using more modern technology. As that would be more relevant, to what is happening in the industry that students will enter in the future, or after they complete their qualifications.

Additionally, that move of bringing in new current technologies could assist to possibly sync or narrow the gaps between the technology and education and trends that occur in first-world economies and the vocational education sector.

Furthermore, the respondents that took part in this study also revealed that they feel that technology can also be used to complement the process of instruction in the Automotive classroom- which occurs when technology is utilized to supplement the process of instruction.

The key emphasis here is in light of the fact that lecturers believe that ICTs could be used to provide students with new, exciting unique learning experiences. The lecturers also suggested that ICTs can be used to provide students with various avenues that they can utilize to internalize knowledge, in a manner that makes it easy for them to understand concepts. Furthermore, the lecturers also believe that the use of ICTs and other forms of technology within the classroom could allow students to practice skills taught and extend learning. Lecturers suggested that this could be accomplished by using specific software applications and other specialized technologies that are specifically associated with Automotive Maintenance and Repair.

The statement above coincides (to a certain degree) with what Yalcin et al. (2011) said about technology when they proposed that technology could support students' learning process. They also stated that technology could also assist students to build their understanding of content taught during the lesson and increase their academic success. Which can eventually contribute to student motivation, cooperation in the classroom and improve their creativity and students' problem-solving skills. This is particularly true for the practical workshop sessions that are conducted in Automotive Repair and Maintenance. During these sessions' students are required to utilize the theoretical knowledge to make meaning and assimilate this knowledge and apply it in the practical classroom/ workshop and put it into action to solve a real-life problem. A typical example of this in the Automotive Repair and Maintenance curriculum would be that the researcher observed is faultfinding.

If we look at ICT integration concerning, or from the lens of education and training. This is in particular reference to lecturers' educational backgrounds and training. It is acceptable for the researcher to infer that the lecturers' educational backgrounds have a huge bearing on their ability/abilities to integrate technology into their classroom practices. During the interviews, some lecturers disclosed that they felt their technology competencies were relatively low or that they felt that they lacked certain technological competencies. Which is understandable because the types of technologies that are being used are slightly and, in most cases, more advanced than those that the lecturers were exposed to in the education system in their era. That coupled with the lack of access to appropriate ICTs, new-age tools and other technologies, that can be used in both the theoretical and workshop sessions is a

formula for disaster, within this sector. It is in fact a major hindrance to ICT integration in the sector.

ICT usage/ integration in South Africa and particularly in education is a relatively new practice in education. It was formally introduced through initiatives such as; the E-*Schools Network* in 1993, *Gauteng Online* and The *Khanya project* (Isaacs, 2007 pp.10-12). When the researcher tried to trace the usage of technology using one key aspect that impacts ICT integration is the lecturer's background, specifically the lecturer's educational backgrounds. The researcher realized that: when most of the lecturers who are currently working in TVET Colleges, trained or studied for their trades. They did this during a period when very minimal technology was used. Or the technology that lecturers were exposed to, is technology that was mainly used within the practical components or subjects or they were specializing in that was related to their respective trades. That is why lecturers were more inclined and accustomed to using certain technological devices that are associated with Automotive. They were only accustomed to using the technological tools that are prescribed in their field of specialization or trade.

In addition to that, during the semi-structured interviews when the lecturers were asked if they had ever completed any formal computer literacy or ICT skills training. All of them expressed the fact that they have never completed any formal computer literacy or ICT skills training. Which is a major problem, because if lecturers are to integrate ICTs into their teaching, they should be provided with avenues that will enable them, to acquire the knowledge and skills that they will require to make ICT integration possible. This is irrespective of the fact that some lecturers already have some ICT knowledge. Whilst some lecturers will take initiative and go and teach themselves to use technological devices. Training, preparing or equipping the lecturers is an integral aspect of ICT integration. This is a suggestion that was also previously made by Koehler et al., (2007) who also stated that teacher preparation is an essential characteristic of technology integration. Essentially, lecturer training would also form part of these preparations. However, it is also important to note that whilst lecturers should receive training the type of training should not be generic. It should be training that will equip lecturers with the skills and knowledge that they need to have in order for them to be able to successfully integrate ICTs into their specific subject/trade.

Furthermore, the lecturers never studied education or possess a degree in education or have a qualification that is remotely related to the field of education. Meaning that they do not necessarily have two of the most important, basic knowledge bases, that are crucial and that also set the teaching profession, apart from other professions as stated by Shulman. Which are PCK and Pedagogical reasoning, which can only be transferred to lecturers through qualifications that are devoted to education. This is not the lecturer's fault though. This is mostly because there isn't a degree or professional teaching qualification, in institutions of Higher Education that specifically cater for, lecturers or educators, who are interested in venturing into Vocational Education. In Addition to that, institutions of Higher Education also do not have programmes that are dedicated to the task of upskilling in-service lecturers in TVET within the South African context. Which is a problem if lecturers are expected to teach using 21st century pedagogies and technologies.

Additionally, lecturers were not introduced, trained or taught to incorporate digital technologies or ICTs into their pedagogical practices. Especially, in the theory classrooms and that was evident in the observations that were conducted by the researcher. Furthermore, the researcher also noted that lecturers could successfully integrate technologies that were peculiar to their trade: Automotive into the pedagogical practices. However, this was only evident during the practical workshop sessions. This is mainly attributed to the fact that the lecturers were already exposed to these technologies whilst they were studying towards the various diplomas for their trades. Another contributing factor to that phenomena is that lecturers are accustomed to using these technologies because these technologies form part of the mandatory component of the TVET curriculum, which are the practical workshop sessions, that all lecturers need to conduct with their students.

Hence, they were able to adapt, use and integrate these ICTs into their pedagogical practices during the practical sessions. Whilst that was not the case for the theory classroom. It would be unreasonable to expect lecturers to have the essential knowledge, capacity and skills required, to enable them to integrate ICTs into their pedagogical practices. If the lecturers are not trained or equipped with the necessary knowledge or skills that they are required to have to enable them to able to do this successfully and efficiently. Therefore, lecturers would have to be trained to integrate ICTs in the context of the Automotive Repair and Maintenance theory classroom. With

the changes that are occurring in industry, the same training would also have to be given to lecturers to upskill them for the workshop sessions as well.

In addition to that, another key finding that emerged from the researcher's findings was a finding that did indeed validated one hypothesis that the researcher had about lecturers in TVET Colleges. This was about lecturer's passion for the subject Automotive Repair and Maintenance. One thing that was apparent during the researcher's interactions with the lecturers was their zeal for the subject Automotive Repair and Maintenance. The TVET College lecturers who were participants in this study were very passionate about Automotive.

In addition to that, the researcher perceived that the lecturers have in-depth content knowledge about Automotive. Through the researcher's interactions with the lecturers, it was quite evident that they were conversant when it comes to content about Automotive which was remarkable. The lectures possessed what Shulman (1987) calls curriculum knowledge; which is defined as the tools of the trade, which lay down the foundation for the curriculum, in programs. This is also a type of knowledge that assists lecturers to determine the kind of curriculum material that ought to be used to teach a subject. This kind of knowledge is also called Content Knowledge in the TPACK model.

5.3. Key Findings from the Observation Schedules

On the observation schedule when lecturers' knowledge was evaluated in graphs using the TPACK model. It emerged from the knowledge bases that make up the TPACK framework. That the lecturer's content/ subject matter knowledge is the highest form of knowledge that the lecturers possess within the TPACK model.

However, on the contrary, the lecturers lack two crucial rudiments that are essential for the teaching that also set teaching/lecturing apart from other professions. These elements will be discussed in more detail in the next paragraph. One of the rudiments that lectures require is a set of knowledge and the other is a skill base that forms a special type of reasoning that lecturers need to have to be able to transfer knowledge successfully.

According to Shulman (1987) as cited in Brant (2006) the first rudiment is a form of knowledge that is broadly known as PCK (Pedagogical Content Knowledge). Which is a form of knowledge that is characterised as being a by-product of the process of

blending: sound subject knowledge, with an understanding of pedagogy, the knowledge that is crafted by educators for fitness of purpose. Additionally, PCK gestates teacher expert knowledge. Furthermore, he also states that it is an amalgamation of various proficiencies that an educator needs to have, which is constructed from knowledge of learners' environmental contexts, knowledge of students and knowledge of pedagogy and subject matter (Brant, 2006). Therefore, PCK is a form of knowledge that is needed to separate a Motor Mechanic from an Automotive Repair and Maintenance lecturer.

Lecturers are integrating various elements of ICTs into their pedagogical practices. However, this is occurring at different levels. This integration is mostly evident in the practical element of Automotive Repair and Maintenance, which are also called workshop sessions of their lessons. These are lessons, which take place in the workshops where both students and lecturers have access and get to interact with machines, technology that is specialized and peculiar to Automotive.

However, with theoretical sessions, there is limited, and in most instances no integration of technology. The only technological tools that are being used in some lessons are the models. This lack of usage is largely attributed to the fact that; the lecturers do not have access to ICTs that make it possible to teach theory using technology. That further demonstrates that there is indeed "slowness" as cited Hayes in Saud (2011). This is a "slowness" in terms of investment, taking actionable steps that will lead to more being done about making the infrastructure and various ICTs required by the lecturers available because, the integration of these ICTs in both the theory and practical sessions is essentially what will lead to the formulation of a new pedagogy in Vocational Education. This is a pedagogy that is centered on the intense usage of ICTs in TVET Colleges. Lecturers are undeniably still struggling to incorporate new-age digital technologies into their traditional, conventional pedagogical practices, particularly in the theory classroom.

One of the key challenges that face Vocational Education in terms of lecturer qualifications lies in the fact that most lecturers who are teaching students in Automotive in TVET Colleges do not have formal qualifications that are related to the field of Education. Nor have they completed a qualification in Vocational Education. Moreover, most of the lecturers did not complete a teaching qualification. The lecturers

have either written the trade test, or they have a qualification such as a (National Diploma/Diploma) related to the trade that they specialized in. Which was coupled with the trade test. That is essentially a problem because the qualifications that the lecturers currently possess have key knowledge gaps, which need to be addressed. These knowledge gaps can be addressed through a qualification that is dedicated to the TVET sector hence, the deficiencies in lecturers PCK and the TPACK. Within the TPACK framework and these are fundamental elements that enable lecturers to teach and to incorporate ICTs into their pedagogical practices.

In addition to that, the researcher also noted that the skills and knowledge that the lecturers have is slowly becoming irrelevant. The skills and knowledge are not matching to all or most of the technological developments that are occurring in the motor industry. With that being said, it is vital to note that the researcher is not discrediting the lecturer's knowledge. But the researcher is merely creating awareness about a key area of knowledge that also needs to be addressed in the endeavor to get lecturers who teach Automotive to integrate ICTs into their pedagogical practices. This is also a vital factor that needs to be considered in the Vocational Education qualification that the University of the Witwatersrand will be offering in 2021.

Most lecturers who are currently working in the TVET system are artisans, who have a substantial amount of knowledge about the Motor industry, and they can relate that knowledge, using their past experiences as a foundational base for teaching Automotive Repair and Maintenance. In addition to that, they have limited knowledge of ICTs and electronics in relation to motor vehicles. Which puts them at a deficit in terms of knowledge when it comes to knowledge about new developments such as new hybrid vehicles. For lecturers to be able to teach students about these cars in Automotive they need to more electrical knowledge as opposed to mechanical knowledge, which is not current.

On a general note, the lecturers are excited about the prospect of a TVET focused qualification. They feel that the new vocational qualification that Wits intends to offer in 2021 is necessary. Especially, when it comes to ICT integration. Lecturers hope that this qualification will be structured in a manner that will help to equip them with the necessary skills and knowledge that will enable them to integrate various forms of technology / ICTs into their current pedagogical practices when teaching Automotive

Repair and Maintenance. Furthermore, lecturers expressed that they hope that the programme will place a huge emphasis on the concept of *"teaching TVET for the future* through *the use of ICTs and other forms of modern digital technologies"* (Lecturer B).

Another finding that the researcher made is that a major bearing on ICT readiness and integration at a foundational level is non-existent, which is the issue/ challenge of access to ICTs. This is a key factor that influenced, the extent to which lecturers could integrate ICTs into their pedagogical practices. Without access to the necessary ICTs, it is unreasonable to expect lecturers to be able to even begin with the process of integration.

The following findings were made concerning the researcher's research questions.

In terms of the main research question which asked:

How ready are TVET College lecturers from Ekurhuleni in integrating ICTs into their pedagogical practices, in Automotive Repair and Maintenance classrooms?

The main finding that emerged that answers question is that:

Lecturers are attempting to use or incorporate ICTs in their pedagogical practices particularly, in the workshop sessions. However, they are not yet ready fully to integrate these ICTs into all their pedagogical practices. There is still so much that needs to be done in terms of preparing the infrastructure and preparing the lecturers for this ICT integration. If this integration is to take place a lot of support needs to be offered to the lecturers.

The lecturers also need to be equipped with all the necessary skills and knowledge that they will need to be able to integrate ICTs into their pedagogical practices effectively, in Automotive and in all subjects within the TVET curriculum. In addition to that, the ICTs that lecturers need should be made available for the lecturers, so that they can use them to kick-start the ICT integration. Using the TRI index the following findings emerged.

In terms of **enablers, the following findings were made.**

Previously in the literature review, the researcher stated two key components of enablers within TRI, which are: optimism and innovativeness. **Optimism** can be

categorized as the extent to which an individual believes that technology can benefit them in their lives and give them control over their lives (Elliot et al., 2008).

One key enabler that would enable the ICT integration that emerged for this study is that: lecturers are generally very optimistic about the integration of ICTs into their pedagogical practices. This was mainly reflected in the lecturer's responses to the questions, during the semi-structured interviews that were linked to the theme of teacher beliefs. Through that theme, lecturers expressed the fact that they thought that it is impossible to teach Automotive without technology. They also felt that it was essential to incorporate ICTs into the teaching Automotive. Moreover, lecturers were aware of the importance of integrating modern, digital, ICTs into the process of teaching both the theoretical sessions and the workshop sessions, which is another enabler that would impact the ICT integration process in TVET Colleges.

The second dimension of the TRI is **innovativeness.** because "even if programs are offered in this sector of education use technology. Often modern technologies are not utilized to upgrade both facilities and the academic programs that are being offered" (UNESCO, 2011, p.17). Generally, lecturers expressed that they want to use and to be exposed to the more modern, digital technologies that were being used or introduced in Automotive. They mentioned that getting accustomed with the technology would enable them to be more relevant, in terms of the direction that education is taking when it comes to ICT usage. Additionally, lecturers also expressed that it would also to assist them to gain knowledge and confidence, which they need in order to assist their students to become more equipped for the technological advancements that are currently occurring within the motor industry.

As stated previously, innovativeness is characterized as being an innate curiosity that an individual has about technology. It can be further defined as an instinctive desire to learn about and experiment with new technologies (Elliot et al., 2008). Generally, this was evident during the semi-structured interviews, where all lecturers expressed that they were intrigued by the idea of learning how to use various ICTs and using them to teach their students. The researcher also noted that one lecturer (Lecturer A) who was the youngest participant in the study possessed this characteristic more than his counterparts. He had knowledge and numerous wonderful ideas of next steps that could be utilized to kick start and encourage the usage of ICTs, in Automotive

Maintenance and Repair, to teach students content about the new hybrid and electric cars that are being introduced in the industry into the curriculum.

The dimensions of **discomfort and insecurity Discomfort:** Discomfort can be defined as a feeling, anxiety that workers/professionals might have or experience with regards to the integration of technology into their spheres of work. This is characterized by fear and lack of confidence in their ability to integrate and make technology an integral part of their workplace practices/ culture. It can be further be defined as the fear of not having the necessary knowledge and skills that will enable workers/professionals to control the various technologies that are utilized or to be utilized in their respective work environments. **Insecurity** can be defined as an individual's need for assurance that a technology-based product, service or process will operate dependably and accurately with minor to no challenges (Elliot et al., 2008).

Those two elements were mainly exemplified by the lecturer's competencies. During the interviews, some of the lecturers

expressed that they felt that they lack confidence or that they were not confident in their abilities to effectively use technology in their lessons especially, in front of their students. That was a significant point of discomfort for some of the lecturers. Which arches as both a discomfort and insecurity. Furthermore, the lecturers suggested that training on ICT integration would help assist them to become more competent and confident in their abilities to use ICTs. In addition to that, the lecturers expressed concerns about not knowing how they are expected to incorporate these ICTs in Automotive, for both the theory and workshop sessions of Automotive Repair and Maintenance.

What type of ICTs do lecturers have access to in their TVET Colleges?

The response to this question was dependent on the teaching context that the lecturer was in. This question focused on establishing readiness by using the lens of access to achieve that. The access was in relation to both the practical and theoretical elements/sessions of Automotive. The following findings were made: In the theory classrooms, lecturers only have access to basic forms of technology, such as models which are normally one handheld model that they can use to enhance their explanations. Lecturers also have access to mobile phones and laptops from the

institutions they were working for. Whilst some had access to personal laptops and for some, it is communal computers that were available in the staffroom/ computer lab. Besides what was mentioned the lecturers had no access to ICTs. The situation is better in the workshop.

All lecturers have access to technologies that are peculiar to Automotive such as engines, carburetors, diagnostic machines and pressure testing scanners. Even though some of these technologies are dated in all the TVET Colleges, the lecturers have access to them, and they are doing their best to incorporate these technologies effectively. This usage could be attributed to the fact that this aspect of the lessons makes the use of technologies compulsory, to assist students to grasp the more physical aspect of the knowledge that students are taught. Which is essentially what distinguished these sessions from the theory sessions.

What are lecturers' understandings of the various roles that ICTs have in the TVET College system?

This question is linked to a question that was asked during the semi-structured interviews. This was a question that aimed at assisting the researcher to establish an understanding of the lecturer's beliefs about technology and ICT integration/usage in the Automotive Repair and Maintenance classroom. In addition to that, this question was asked with the intention of assisting the researcher to gain insight into lecturer's understandings of the various roles that ICTs can play in the context of TVET Colleges. Lecturers expressed that: they know that ICTs can be used to assist student's ability to grasp the content and that ICTs can help them to present content in various ways that would captivate students. They also believe that ICTs can make students feel that they have more control over their studies, because they can help them to be more hands-on and do their research on content that they are taught. Lastly, they also knew that ICTs could be used to plan and perform other administrative duties. The following were the lecturer's beliefs about ICT integration: lecturers view the integration of ICTs as being a necessary process that could help cultivate certain skills that students will need for fault finding that will make learning more efficient and more fun.

Some lecturers also believe that ICTs can act as substitutes that can be utilized to "substitute" for lecturers in the event of them being absent due to illness or other commitments. "*You know that sometimes as lecturers we do get sick or sometimes,*

we have meetings with other stakeholders. Instead of just being absent ICTs can help us to continue with our lessons even if we are not in the classroom. We can use the ICTs to either record or post instructions for our students, so they can continue working even if we are not there." (Lecturer A). Additionally, lecturers view ICTs as instruments that can be used to make it easier for students to grasp content and make teaching more fun for students. Lecturers are aware of the fact that students need to be more engaged and stimulated during teaching and learning during both theory and practical sessions. They believe that ICTs can assist with that.

How are lecturers in TVET Colleges currently blending ICT or ICTs into their pedagogical practices?

Overall, the researcher observed that lecturers are attempting to integrate ICTs into their pedagogical practices when teaching Automotive Repair and Maintenance. However, this is limited to the resources that they have access to in their respective TVET Colleges. The researcher established that was minimal to no integration in the theory classroom. In the theory classroom, the lecturers mainly used the textbooks and whiteboards, and where possible depending on the availability they integrated a model for demonstrations. However, this was dependent on the topic being taught. The situation was better in the practical workshop sessions, where lecturers were utilizing technologies such as engines, diagnostic machines and other forms of technology in their lessons. This is a finding that emerged in both the semi-structured interviews and the interviews.

What factors influence the pedagogical practices that lecturers take on when they integrate ICTs into their lessons?

Lecturers disclosed that they were influenced by the content (the nature of the content), as well as the skill sets that they were going to teach or transfer to their students. They also cited the availability of technologies/resources as being another factor that impacts their pedagogical practices. Essentially, lecturers cannot be expected to teach with technological resources that they do not have access to. Lecturers also cited knowledge/confidence in ICT usage as being a factor, because if a lecturer is not confident in their ability to use a specific ICT. They will be reluctant to utilize that ICT in class, in front of their students. That is another finding that emerged from the semi-structured interviews that the researcher conducted with the lecturers.

TVET Colleges ICT integration in relation to UNESCO's stages of integration

In reference to UNESCO'S stages of integration model and based on the researcher's interactions with the lecturers in their working environments, through the observations and semi-structured interviews, which were conducted by the researcher. The researcher inferred that the lecturers in the TVET Colleges that were involved in the study are currently in limbo, between the emerging and the application stages and of ICT integration. However, the predominant stage is the emerging stage. With slight nuances of the application stages that were also evident.

The main reason why the researcher inferred that is because, lecturers are predominantly in the emerging stages is based on the fact that: lecturers are beginning to develop an understanding of the numerous contributions and affordances that ICTs can have on the learning and teaching process. They are also aware of the importance of ICT integration and also advocate for ICT integration, which is essentially what characterizes the emerging stage of ICT integration. In addition to that, Strydom et al. (2005) also posit that educators who are functioning within this phase of integration can be seen consciously integrating ICTs into their pedagogical practices. Now the main emphasis in this level is foundationally on the usage or introduction of ICTs into the process of teaching and learning. This is regardless of content and context. Now, this was also evident in the observations that the researcher conducted concerning the lecturer's pedagogical practices. Even though this was more evident in the context of the practical workshop sessions.

Lecturers who are within this phase of integration are also seen exploring the possibilities and the possible consequences that come with using ICTs in the classroom additionally, because the lecturers who are in this stage are still in the foundational, infancy stage of integration. They are very still heavily reliant, grounded and rooted in the traditional, more teacher-centered methods of teaching. This was evident during observations, especially in the theory classroom and in some instances even in the workshop sessions. That coincided with the chief characteristics of the emerging stage of integration as cited by Strydom et al. (2005). However, though the lecturers are in the emerging stage it is important to note that they have not gotten to a point where they have completed this phase of integration. Mainly because they still

need access to the actual ICTs and infrastructure that ensure that they complete this stage of integration.

The researcher also mentioned the application stage as the second stage that the lecturers were in terms of integration (well nuances of this stage are present in how lecturers were attempting to integrate ICTs into their pedagogical practices). This stage of ICT integration is characterized by the intentional integration of ICTs into the curriculum. Which was evident in the TVET Colleges that the researcher went to, although, this was mainly evident during the practical work workshop sessions. Even though the integration was compulsory, because of the nature of the content that the students were being taught, the researcher cannot negate this form of integration, because integration was still evident.

In terms of the uses between representational and generative uses of technology. Through engaging and observing the lecturers the researcher was able to gauge that the lecturers were mainly using the technologies for Representational use. The lecturers were using the technologies merely for the purpose of representing information. This type of Knowledge denotes the symbolic representation of knowledge. In this view, knowledge is viewed as something that "is absolute, definable and re-presentable." (Strydom et al., 2005, p.74). That quote accurately depicts how lecturers are using the technologies that they have at their disposal.

5.4. General Response to the Main Research Question

Readiness is a construct, which refers to people's propensity to embrace and use new technologies for accomplishing goals in their home life and at work (Parasuraman, 2000). The construct can be viewed as an overall state of mind resulting from a gestalt of mental and physical enablers and inhibitors that collectively determine an individual's propensity to experiment and use new technologies (Summak et al., 2010). Throughout this study, the researcher endeavoured to respond to this question using the various elements that are present in this study. From the problem statement, research questions, the literature review, methodology, and data analysis to respond to this question.

Overall, the lecturers that participated in this study are not yet fully ready to integrate ICTs into their pedagogical practices and the curriculum used in the TVET system. ICT integration is a delicate, layered and intricate process. It is a process that goes

beyond the process of just merely purchasing ICTs and having them visible in classrooms.

Earle (2002) as cited in Wang (2008) posits that a simple combination of content and ICTs does not make the process of integration flow naturally. Hence, there must be planning that foregrounds the process of ICT integration. This process of planning helps to ensure that the correct ICT tools are aligned to the learning objectives that students need to meet in their units of study.

However, it is important to note that this needs to be aligned with the contexts in which these ICTs need to be used in, which also needs to be aligned with the learning and teaching resources, learning environments in which these ICTs are to be used in. Which must be further aligned with scaffolding strategies that will foster student-centered learning. Furthermore, Wang (2008) also suggests that for effective integration to take place three key components need to be taken into consideration. Those three key components are pedagogy, technology and social interaction.

The statement written above illustrates that alignment is also a key component of integration. As alignment acts as a thread that binds various elements together to ensure that integration is a reality.

Based on that and through the other findings made in the study, it is evident that lecturers that work in the TVET Colleges that the researcher went to are not yet ready to fully integrate ICTs into their pedagogical practices. They are still using traditional pedagogies when teaching their students, particularly in the theory classroom. Even though lecturers are trying, and slight nuances of the integration are present it is not enough. There is still so much that needs to be done to facilitate the process of integration, to ensure that the lecturers can fully integrate ICTs into the curriculum and their pedagogical practices.

Furthermore, in terms of the various elements that contribute to readiness in terms of strategic readiness the following findings were made. In terms of strategic readiness “is achieved by developing a comprehensive master plan for the integration of ICTs into TVET. This plan should include the vision, mission, values, objectives, strategies, timeframe and the evaluation scheme for ICT initiatives. It should also outline the budget to cover costs related to hardware and software, connectivity, maintenance and staff training. The plan should clearly delineate the purposes of ICT-mediated

learning with respect to current practices. It should be widely disseminated amongst all key stakeholders" (Kotsik et al., 2009, p.1880). Due to the lack of a detailed, structured policy document, that is centred around the integration of ICTs in pedagogy in TVET. The researcher was able to infer that the TVET Colleges that the researcher went to are not strategically ready for ICT integration.

whilst, Pedagogical readiness focuses on the alignment between ICTs and current teaching and learning practices. To be pedagogically ready, TVET institutions must ensure that their usage of ICTs is compatible with their current philosophy of learning and teaching. Additionally, they have to explore opportunities for including ICTs in TVET, the technological proficiency requirements for teachers and students, ensure that ICTs will meet learners' educational needs, and ensure that instructors are competent to facilitate ICT-mediated learning (Kotsik et al., 2009). Elements of Pedagogical readiness were evident in the TVET Colleges that the researcher went to. Particularly in the workshops where various ICTs and tools that are used in Automotive were seen by the researcher and those were aligned to the content being taught. However, the researcher noted that there is still plenty of room for improvement. Especially in ensuring that the content, ICTs and pedagogy align with the developments in the Motor industry.

Whilst organizational readiness focuses on teachers' involvement in integrating ICTs into TVET. Organizational readiness also assists with establishing whether the necessary action steps have been taken to ensure that TVET lecturers possess the necessary ICT competencies. These actions include conducting needs assessments to determine the ICT comfort level of teachers, establishing minimum training standards, developing training plans and establishing appropriate mechanisms to monitor training and improve results. Whilst technical readiness addresses issues related to infrastructural requirements for ICT integration (Kotsik et al., 2009).

For Organizational readiness, through the researcher's interactions with the lecturers, it was evident that lecturers are willing to ensure that they can achieve organizational readiness. However, they have not been given the opportunities to do that. Lecturers provided the interviewer wonderful ideas on action steps that would need to be taken to ensure that ICT integration takes place in TVET. In addition to that, they also had knowledge on some of the key issues and challenges that they encounter in TVET,

especially when it comes to pedagogy, curriculum and the integration of ICTs, which could be used to achieve organizational readiness.

in Terms of Technical readiness, from the interviews and from the observations the following findings were made; there is a level of technical readiness in the TVET Colleges that the researcher went to. The readiness is more evident in the workshop sessions, where more technology usage is more evident. Even though some of the technology is dated, the technology is there. However, more needs to be done in the theory classroom where minimal technology usage was seen by the researcher. Generally, there is still so much that needs to be done to ensure that technical readiness is a reality in the TVET space

The following next steps need to be taken to facilitate the ICT integration process:

- The drafting of an ICT policy that focuses on ICT integration in Higher Education. This is a policy that should provide directives that specifically cater for the academic needs of the TVET sector.
- The provision of the necessary ICT tools, technologies that lecturers need to be able to make integration possible for both the theoretical and the practical components of the TVET curriculum.
- Generally, more work and investments need to be made to ensure that strategic, pedagogical, organizational readiness and Technical readiness happens in the TVET sector.

  More of these next steps will be discussed in more detail in the recommendation section of this paper.

5.5. Recommendations

Based on the findings that are mentioned above, the researcher would like to propose a few, well three main recommendations to be precise. These recommendations could potentially be utilized to assist to curb, mitigate the main challenges that lecturers who work in TVET Colleges face in their endeavors to integrate ICTs into their existing pedagogical practices.

The first recommendation calls upon the Department of Higher Education and Training (DHET) and other key stakeholders who are involved in the TVET sector, to come up

with a new term that could be used to denote what are known as ICTs, within the TVET space. The researcher proposes that the term: Smart Technology/Technologies be adopted and adapted for this purpose. More details will be provided in the discussion that will follow under the subheading: **Terminology: From ICTs to Smart Technology/ technologies.** In addition to that, the researcher advocates for a paradigm shift within TVET. This shift is in particular reference to the lecturer's pedagogical practices. This shift would see lecturers using more new age digital Smart Technologies in their pedagogical practices to teach both theory and practical elements of Automotive. Lastly, the researcher created a model (the Smart Technology initiation model for TVET). This is a model that can be utilized to help to initiate and execute the process of ICT integration within the TVET sector. More details on the outlined recommendations will be provided in the next section of this discussion. The first recommendation calls for:

Terminology refinement: Move from ICT/ ICTs to Smart Technology/ Technologies in the TVET sector.

In most of the literature that the researcher engaged in preparation for this study, the researcher realized that a lot of the research papers/ literature utilized the term ICT/ ICTs (Information Communication Technologies) to denote technology. Especially, when discussing technology usage in relation to pedagogy in education.

For recommendation purposes in this study, the researcher would like to suggest that DHET and TVET Colleges utilize the term: Smart Technology/ Technologies to denote Technology instead of ICTs in institutions of higher learning, specifically in TVET education. The following discussion will aim to elaborate more on why the researcher proposed the utilization of the term Smart Technology/ Technologies, as opposed to ICTs when speaking about technology and technology usage in Vocational Education.

Generally, in South Africa, we have what are termed Information Communication Technologies, which are also broadly known as ICTs. By definition ICT is a term, which can also be viewed as an educational collective noun, that is used to encapsulate a vast number of technological tools and resources that are used to communicate, create, retrieve, store, distribute and manage information (Tinio, 2003).

Now that definition is very imprecise in terms of the lenses that are used to define the term ICT, it also tends to be very limited, as it mainly focuses on the physical aspects,

properties of technology as well as some of the attributes that these technological devices technologies possess.

Bearing in mind, that technologies or technological devices have a twofold manifestation, there is the physical aspect, hardware and the elements of the technology or technological devices, which we can touch with our physical hands and see with our eyes. Then there is the element that we cannot really touch, but we normally see that is called the output. The output is connected to what we call the software.

Similarly, there is a second definition of ICTs where ICTs can be defined as a combination of networks, hardware and software, as well as the means of communication, collaboration and engagement that enable the processing, management and exchange of data, information and knowledge.

The Department of Higher Education and Training (DHET) in conjunction with Umalusi, (which are both institutions associated with education in South Africa) speak about ICT as being a study they refer to it as being the; study of ICT.

Now the study of ICT is the study of the various interrelated physical and non-physical technologies used for the capturing of data. Furthermore, this study is interested in processing that data into useful information and the management, presentation and dissemination thereof. It also includes the activities that deal with the solution of problems through logical and computational thinking; it incorporates the study of the integrated components of a computer system (hardware and software) and the practical techniques for their efficient use and application to solve everyday problems. The solutions to problems are designed, managed and processed via end-user applications, software development tools (including visual programming tools) and communicated using appropriate ICTs (DHET, 2013).

Common examples of ICTs that are utilized within the context of the classroom in South Africa include Smart-boards, Interactive white Boards that are also known as (IWBs), projectors, computers, laptops and simulations.

The subject ICT incorporates the study of the integrated components of a computer system (hardware and software) and the practical techniques for their efficient use and application to solve everyday problems. These solutions to problems are designed,

managed and processed via end-user applications; software development tools (including visual programming tools) and communicated using appropriate ICTs.

ICTs are more than just these new digital technologies; they include older technologies such as telephone, radio and television, which are pieces of technology that have been extensively used, in the past as instructional tools in teaching as well as open and distance learning. Though print remains the cheapest, most accessible and therefore most dominant delivery mechanism in both developed and developing countries. The use of computers and the Internet is still in its infancy stages of usage in developing countries. This is mainly attributed to limited infrastructure, lack of availability of these technological devices and also because educators or lecturers are not yet able to successfully fuse technology into their pedagogical practices.

Now given the definitions of ICT stated above, it becomes evident where the researcher's issues come in, concerning using the general term ICT. If you carefully read through the definitions above of ICT you will notice a specific pattern. Most of the definitions tend to focus on one technological tool and that is the computer. The foundation of ICTs or ICT usage seems to be directly linked to a computer.

Technology is another term that the researcher used extensively in this study. The researcher used it to denote any form of instrument that can be used in the attempt to get a message across to a group of people. According to Pittendrigh (1988) technology can be defined as a tool, or as a set of tools or techniques that can be used to execute a set of plans. “It is also a body of knowledge and the means of which a man seeks to master, control or manipulate his environment” (Pittendrigh, 1988, p.15). Which goes to indicate that technology can be anything, any tool that can be used to manipulate the current state of any environment, which will, in this case, be the classroom that lecturers are teaching their students in.

Moreover, Stevens and Andrew (2006) also assert that technology consists of humankind mastering creative usage of knowledge and fusing that with skills that are special, products, processes and approaches to better control their environment. The technology comprises *inter alia,* the utilization of artifacts and processes through which labour and productivity are supplemented.

The researcher is aware of the fact that the term Smart Technology is already currently being used, in spaces where technology is mentioned. However, it conventionally used

to connote what are known as Self-Monitoring Analysis and Reporting Technology/Technologies[6], which is not the case in this study. Therefore, the researcher suggests that this term be adopted and adapted for usage in Higher Education. This term can be used as an equivalent of the term ICT/ ICTs. But this would be for the context of Higher Education. Furthermore, the researcher posits that this term can be utilized in all spheres of Vocational Education and especially in TVET Colleges. The manner in which the researcher proposes the term Smart Technology be utilized will be thoroughly discussed and contextualized below.

Firstly, the suggested move from the usage of the term ICTs to Smart Technology is based on the terminological gaps that the researcher discovered to be existent with the usage of the term ICT/ ICTs in Vocational Education. It is also a strategic move that would assist with creating boundaries, differentiation between technology use in primary and high schools (Basic Education) and technology use in Higher Education and particularly within the TVET sector which should be essentially different to the other institutions in Higher Education sector. This is mainly because the educational goals in these institutions are significantly different, from traditional institutions. Therefore, even the very terminologies used to denote technology in these instructions should be different.

From the researcher's observations and through interacting with academic literature it becomes quite apparent that the term ICT Within the context of education is often utilized in discussions about technology use or integration in the primary and high school setting, which the researcher found to be befitting, because of the basic manner in which ICTs are contextualized in these basic levels of education.

However, when it comes to institutions of Higher Education and especially in the case of TVET Colleges, because of the specialized, technical knowledge that they are equipping their students with. Also, because they are essentially preparing students with skills that they will need to enter the "world of work". The researcher found it to be unjust to use the generic term of ICTs within this context. Especially, when referring to technologies used in this context, in particular relation to specialized technological tools that are peculiar to certain subjects that are taught within this context.

[6] https://www.techopedia.com/definition/4537/self-monitoring-analysis-and-reporting-technology-smart

As a result of that, the researcher finds it would be more appropriate to use the term Smart Technology instead of ICT. This term would serve as a synonym for the term that is being currently used to denote technology use within the education space, which are currently termed ICT/ ICTs. However, this term would act as a synonym that is not exclusively related and limited to computer-based programs or technologies. It is a broader term that can be used as an umbrella term, which will encapsulate the use of all types and forms of technology that are found and utilized within Vocational Education. Which includes but is not limited to machines, tools, equipment and all technological devices used in TVET. This term also refers to software, hardware and new-age digital technology that can be utilized in the classroom, or that can be integrated into educational institutions for various reasons even the technologies that are normally used for administrative purposes, as well as for the purposes of teaching and learning. These technologies that can be incorporated be by lecturers into their pedagogical practices with the aim of:

- Improving student's ability to interact and grasp content.
- Creating new learning experiences for students (this is for both the practical and the theoretical components of knowledge in the TVET college system).
- Creating communities of best practice amongst lecturers. Whereby, lecturers can share resources, any other useful pieces of information related to their subjects of specialization and trades with their colleagues.
- Creating communities of knowledge amongst students who are studying or teaching a specific subject or towards a specific trade. These communities could be a platform where students share resources, study tips and offer peer tutoring.
- Creating a new pedagogy for teaching any subject or trade within vocational education and especially in TVET Colleges. This new pedagogy would be a pedagogy that would be underpinned by the usage of various technologies.

The term Smart Technologies also includes all the technologies that are specialized, dedicated or related to a specific vocational subject or trade. Which includes but is not limited to the following examples:

- Virtual reality
- Simulators/ simulations

- Classroom robots
- Diagnostic machines
- Computer-based modeling
- Computers, laptop and tablets
- Interactive White Boards/ Smartboards
- Projectors
- And all other tools and technologies that can be used to teach or enhance the teaching of vocational subjects in TVET Colleges.

In addition to that, the researcher would also like to recommend the creation of a comprehensive policy, which will outline how ICTs should be utilized in Higher Education. This policy should address and outline ICT integration in TVET.

Furthermore, the researcher would also like to recommend:

- The Improvement/ renovation of the infrastructure such as labs, workshops, security installations for the expensive technological equipment in the TVET Colleges.
- The Procurement of the necessary equipment and ICTs that are appropriate for TVET College education and training.
- The training of academic staff (lecturers) on the latest technological developments that are occurring in their trades. Lecturers should also be empowered and upskilled through regular professional development seminars, such as those locally organized within the TVET College as well as those arranged between TVET Colleges, as a forum for professional sharing and growth in the field. Such collaboration would also empower individual lecturers; create communities of practice, whilst addressing the issue of lack of confidence by some TVET lecturers, which issue was raised by some lecturers during the interview. This upskilling should also be offered through special, TVET dedicated academic qualifications that will assist lecturers to obtain TVET related qualifications.
- The TVET sector and other stakeholders in education (in Universities) should also collaborate and start designing undergraduate qualifications in education that will enable students to specialize in vocational subjects and prepare them to teach vocational subjects or venture into the TVET sector.

Lastly, the researcher advocates for the implementation of new pedagogy within TVET education. This new pedagogy is a pedagogy that is foundationally based on the integration of what the researcher calls Smart Technologies. This new pedagogy is a move away from traditional pedagogies that place much emphasis on the lecturer and making them the key overseer of all the academic activities that happen in a classroom and places more emphasis on the student, and the contributions that they can make to the academic activities that occur in the classroom.

Furthermore, this pedagogy is one that encourages lecturers to use more technology to engage with their students more, to also help their students engage with content and embark on the journey of meaning making. This pedagogy adopts a more student-centered approach to teaching and learning. This is all in the bid to foster more interaction between students and their counterparts, amongst students and their lecturers. In addition to that, this would be done with the intention of assisting students to explore, research and embark on some inquiry-based learning.

5.6. Proposed Model of how Smart Technology Integration Should Occur within TVET Colleges

Figure 30 below is what the researcher labeled: The Smart Technology initiation model for TVET. This model seeks to outline 6 crucial steps that need to be taken into consideration when executing the process of what the researcher calls: Smart Technology integration. It also outlines what the Smart Technology integration process would entail if it is to be executed successfully in TVET Colleges.

The Smart Technology initiation model for TVET.

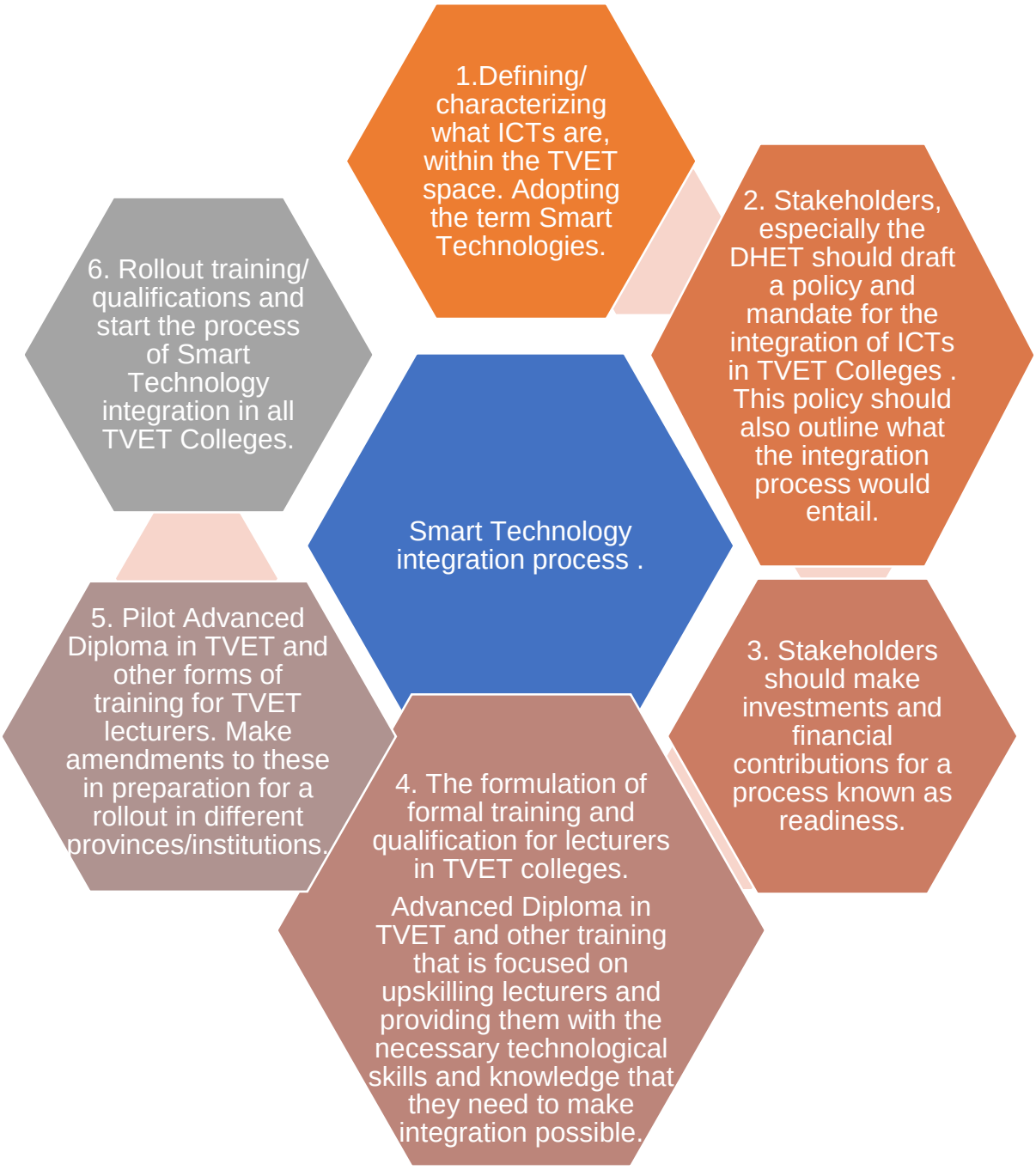


FIGURE 30: THE SMART TECHNOLOGY INITIATION MODEL FOR TVET

This figure is a graphical depiction of the Smart technology initiation model for TVET (that was created by the researcher). it contains the individual steps and explanations of what would happen in each step of initiation.

This part of the discussion will endeavor to provide a more detailed account of the steps to successful Smart Technology integration that were outlined previously in figure 30.

Step 1: **Define what Technologies are within the TVET space.**

As already stated previously, there is a general understanding that is associated with the usage of the term ICT/ICTs within Basic Education. This term is often used to denote various technologies and gadgets that allow the transferal, presentation and sharing information (Latchem, 2017).

However, this is not the case in Vocational Education within the context of TVET. The point of utilizing technologies in TVET goes beyond that is primarily for the function of enabling individuals and communities to find, analyse, transfer, and present information, knowledge, skills, ideas, and experiences (Latchem, 2017, p.28).

So primarily what needs to occur within this stage would be for key stakeholders such as; the DHET and lecturers, to come together and reach a consensus on a definition of what would be a generally acceptable way to define, and denote technology usage in Higher Education. Specifically, within the context TVET sector. In this case, as previously stated the researcher posits the term Smart Technology in institutions of higher learning and specifically within TVET Colleges. Since TVET Colleges offer a technical skill and knowledge base to their students. It becomes imperative for TVET Colleges to provide a definition of ICTs that is more appropriate/ relevant for their context and for the type of specialized knowledge, skills and education that Vocational Education offers its students.

Step 2: **Get stakeholders, particularly the DHET to draft a policy and mandate that will lead the process of Smart Technology integration within institutions of higher learning, especially within TVET Colleges. This should be followed by the process of drafting Smart Technology integration frameworks that will be more suited for the needs of the TVET sector.**

Trinidad (2006) posits that the integration of Technology in education comes in a twofold process. With the first step of the process being the drafting of a policy document. The policy document normally comprised detailed plans of action that pertain to the integration process. Additionally, an integration policy only mandates the

use of technology in education. However, the drafting of a policy is not sufficient and that is why the second step in integration becomes crucial. The second step is the development of technology integration frameworks.

These are frameworks that can be utilized to initiate and guide the execution of the integration process (Trinidad, 2006). Furthermore, integration frameworks also seek to describe the characteristics of effective learning and quality pedagogy as they relate Smart Technology integration, in terms of the stages of integration. Integration frameworks also outline the various stages of advancement that educators go through as they endeavor to integrate Smart Technology into their pedagogical practices in the bid to working towards quality Smart Technology pedagogical integration.

Consequently, this step of the integration model becomes one of the most crucial steps that need to be executed carefully, as it acts as the backbone of the entire Smart Technology integration process. During this step, it would be crucial for stakeholders to draft a comprehensive policy, using existing technology integration frameworks, adapting them and using them in a manner that will cater for the TVET sector. Or alternatively, through the process of drafting a new policy that could be used to provide directives on technology integration in the TVET sector. The creation of a policy and integration framework/frameworks would create action steps that will set out the parameters that TVET Colleges require, and that they need to be made aware of in their attempts to integrate Smart Technologies into their pedagogical practices. Essentially, without a policy in place, we cannot expect to see full ICT, or what the researcher calls Smart Technology integration within TVET education. Instead, we will continue to see the fruits of indirect, minimal, subconscious integration of Smart Technology within this sphere of education.

For example, in TVET there is a practical element in the TVET curriculum that requires the usage of tools, equipment and technologies. The integration policy and frameworks drafted need to provide directives that will foster deliberate, creative technology integration that will encourage alignment between the content, pedagogy and the technology/technologies.

Step three: **Stakeholders should make investments and financial contributions to a process known as readiness**.

Idealistically, during this step of the integration process stakeholders especially stakeholders such as the DHET would have to invest money into the readiness stage of the integration process. They would invest money and time to ensure that they provide their lecturers with all the necessary skills and knowledge (into creating training programs and formal qualifications, which will be discussed in the next step) that they will require to be able to ensure that they can use Smart Technologies on a personal capacity and eventually also able to integrate them into their pedagogical practices when teaching Automotive both: theoretical and the practical aspects of Automotive.

In addition to providing skills, stakeholders would also have to invest in infrastructure that would ensure that both theory classrooms and practical workshops are well equipped with all the necessary Smart Technologies. This would ensure that Smart Technology integration is a reality in TVET Colleges.

Also, the infrastructure that is bought into TVET Colleges should be relevant to the technological needs of the workplace and to the knowledge and skill sets that these institutions are trying to teach and cultivate in their students. This should be in line with what is happening in the industry. Since, each industry has different technological needs, especially within the practical elements it will be vital for each course/subject to formulate a contribution on how they want to see this integration manifest in their respective subjects. As one size fits all approach to integration will not work in this particular context. So, the necessary models, training boards, and all other forms of technologies that would need to be purchased would be influenced by the curriculum in Automotive since this study is mainly focused on Automotive.

5.7. Recommendations for Further/Future Research

There are two key areas of research that the researcher would recommend for future research. Both areas are linked to two aspects that the researcher has already mentioned in this study. The first area would be connected to the pilot that the researcher mentioned in the Smart Technology initiation model. This pilot would assist with measuring the effectiveness of the Vocational Education qualification that will be offered by the University of the Witwatersrand in 2021. Part of this pilot would include offering this Advanced Diploma in TVT to a sample of lecturers before launching the actual qualification. This would assist with gauging the effectiveness of the

qualification and with identifying gaps prior to launching the qualification. These would be specifically knowledge and gaps that within the curriculum that will be offered in this Diploma.

Another key area of research that could be explored would be around the construction of a technology integration policy and framework/ frameworks documents for the TVET sector. The formulation of those two documents is imperative and needs to be led by research, which would lead to the formulation of these documents. The formulation of these two documents would assist in ensuring that lecturers are provided with proper guidelines for technology integration, which specifically caters for the needs of the TVET sector.

5.8. Conclusion

The TVET sector is central in the South African education system. This sector is primarily responsible for producing a mid-skilled, knowledgeable labour force. Additionally, it aims to produce a knowledgeable and highly skilled population that will be able to efficiently contribute to the social, economic development and growth of South Africa. This mid-skilled labour force is a key driving force of our economy and possesses what are known as “scarce skills.” The TVET sector is in charge of ensuring that they produce this labour force. Therefore, TVET Colleges must ensure that they offer quality educational programs that will provide and equip their students with what is deemed as “relevant knowledge” and “real-world working skills” that are required by both the public and private job sectors (DHET, 2013).

Through conducting this study, the researcher was able to unearth some of the key challenges that plague the TVET sector. The TVET sector is embarking on the journey towards making itself attractive institutions of Higher Education for students. Additionally, it also seeks to increase the number of students enrolled in these institutions by 2030. With that in mind it is important to note that there is still so much transformation that is required to ensure that, this goal is reached by 2030. One of the biggest forms of transformation that need to take place in this sector is embedded in ensuring that this sector provides quality education. Through conducting this study, the researcher was able to establish that the usage and integration of technology/ ICTs is a major challenge in the TVET sector. This challenge needs to be attended with urgency, as the knowledge and ability to use ICTs forms a part of the fundamental

skills of the 21st century, which students are expected to have when they leave institutions of learning and enter industry. If the qualifications that TVET Colleges offer students are to remain relevant, stakeholders in these institutions need to ensure that they integrate more technology into their programmes, subjects and courses. That technology integration would assist with creating alignment between what is being taught in the classroom, with what is being done in the industry.

Part of maintaining the relevance of TVET lies in ensuring that TVET Colleges are strengthened, academically. An essential part of that strengthening the TVET sector lies in ensuring that lecturers, who are in charge of executing the academic activities in TVET Colleges are equipped with the various knowledge and skills that will allow them to remain relevant. Part of those skills that lecturers are required to have is the ability to integrate ICTs into their teaching practices. Findings in this study have confirmed that there is indeed a need for lecturers to integrate ICTs into their pedagogical practices, as the era that we are living in requires it. Through the findings that were made in this study the researcher was able to establish the fact that, is minimal to no ICT integration in the theory classes.

A major contributing factor to this lies in the fact that the necessary infrastructure that lecturers need to achieve this integration is not yet available in TVET Colleges. The lack of integration in the theory classroom is problematic because, the theory sessions are where the foundational knowledge base of Automotive is fostered in students, prior to letting the students go into the workshop. Technology integration is more evident in the workshop sessions, even though some of the technologies and tools that lecturers have access to are outdated; lecturers are attempting to use them effectively. One of the key contributing factors that contribute to this is embedded in the curriculum. As technology integration is mandatory in the practical workshop sessions in Automotive and in all subjects across the TVET curriculum.

However, intentional, rigorous integration of technology is essential for both the theoretical and the practical workshop aspects of TVET and this needs to be attended to. As it would assist with ensuring that qualifications that are offered in TVET remain relevant for the industry. The qualification that the University of the Witwatersrand will offer is definitely a breakthrough in Vocational Education. However, for the qualification to be effective, it needs to cater to the skill and knowledge needs and

gaps that lecturers have mentioned in this study. Particularly, when it comes to ICT integration. A key course in the Advanced Diploma that could assist with equipping the lecturers with the skills and knowledge that is necessary for ICT integration would be the Automotive methodology course.

However, for this course to be relevant, it would need to ensure that it takes on a subject-specific approach to technology integration. Meaning that this Methodology course should aim to equip lecturers with the knowledge and skills that will enable them to successfully integrate technology into the teaching of their Automotive lessons. Therefore, the Automotive Methodology course would have to be rigorous to ensure that it is able to equip lecturers with the relevant knowledge and skills required to integrate ICTs into both the theoretical and practical sessions of Automotive. This would also have to be in the context of each subject offered in the TVET curriculum when technology integration becomes a part of every subject in the TVET curriculum. As a generic “one size fits all” approach to technology integration would not be beneficial for all the subjects in the TVET sector. Since, each subject has its own conventions, the ICT integration would also be a bit different in every subject.

In addition to this qualification other investments still need to be made to ensure that the infrastructure that the lecturers will need to integrate technologies are made available. As it would be futile to upskill lecturers with the necessary skills and knowledge on ICT integration and yet not provide them with the physical infrastructure that would make this integration possible. However, before the qualification is offered the researcher suggests that creation of the ICT policy and establishment of ICT integration frameworks should be done first. As this will be the genesis that kick starts the entire ICT integration process in the TVET sector. The TVET sector is faced with a lot of challenges when it comes to ICT Integration. However, the researcher firmly believes that merging the recommendations stipulated above, with the Advanced Diploma in TVT will lead to the manifestation of the transformation that the TVET sector desires to see.

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ANNEXURES

Annexure 1

The table below illustrates the various resources/ ICTs that lecturers have access to in their various TVET colleges based on a scale.

Keys to reading the tables below

(W) = Practical workshop sessions

(T)= Theory sessions

Content Knowledge (CK)		
Criterion	**Degree**	**Score**
(C1) Lecturer clearly introduced the learning topic and goals	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	3
	(W) Strongly Agree	2
	(T) Strongly Disagree	0
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	5
	(T) Strongly Agree	0
(C2) Lecturer has sufficient knowledge of Automotive content	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	0
	(W) Strongly Agree	5
	(T) Strongly Disagree	0
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	5
(C3)	(W) Strongly Disagree	0
	(W) Disagree	0

Lecturer used the appropriate materials in relation to teaching Automotive	(W) Neutral	0
	(W) Agree	3
	(W) Strongly Agree	2
	(T) Strongly Disagree	0
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	5
	(T) Strongly Agree	0

Technological Knowledge (TK)		
Criterion observed	**Degree**	**Score**
(C1) Lecturer has knowledge on learning support tools such as projection tools for presentation; OHP and LCD	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	1
	(W) Agree	3
	(W) Strongly Agree	1
	(T) Strongly Disagree	0
	(T) Disagree	0
	(T) Neutral	5
	(T) Agree	0
	(T) Strongly Agree	0
(C2) Demonstrates fluency in technology systems and in the transfer of knowledge to new systems	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	5
	(W) Agree	0
	(W) Strongly Agree	0
	(T) Strongly Disagree	0
	(T) Disagree	5
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0
(C3) Lecturers selects/ uses technology that is appropriate for the topic or content being taught	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	0
	(W) Strongly Agree	5
	(T) Strongly Disagree	0

	(T) Disagree	0
	(T) Neutral	5
	(T) Agree	0
	(T) Strongly Agree	0
(C4) Lecturer uses communication tools such as email, chat forums, LMS etc. to facilitate learning	(W) Strongly Disagree	5
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	0
	(W) Strongly Agree	0
	(T) Strongly Disagree	5
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0

Pedagogical Knowledge (PK)		
Criterion observed	**Degree**	**Score**
(C1) Engages students in exploring real-world issues and solving authentic problems using ICTs	(W) Strongly Disagree	0
	(W) Disagree	1
	(W) Neutral	1
	(W) Agree	3
	(W) Strongly Agree	0
	(T) Strongly Disagree	0
	(T) Disagree	5
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0
(C2) Addresses the diverse needs of all learners by using learner-centred strategies providing equitable access to appropriate digital tools and resources	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	3
	(W) Agree	2
	(W) Strongly Agree	0
	(T) Strongly Disagree	5
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0

Technological Pedagogical Knowledge (TPK)		
Criterion observed	**Degree**	**Score**
(C1) Engages students in technology-based inquiry learning activities	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	5
	(W) Strongly Agree	0
	(T) Strongly Disagree	0
	(T) Disagree	5
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0
(C2) Uses technology to help students to collaborate across multiple contexts	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	4
	(W) Strongly Agree	1
	(T) Strongly Disagree	0
	(T) Disagree	5
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0
(C3) Teaches and models the use of appropriate pedagogies and technologies for teaching and learning	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	4
	(W) Strongly Agree	1
	(T) Strongly Disagree	0
	(T) Disagree	0
	(T) Neutral	5
	(T) Agree	0
	(T) Strongly Agree	0

Technological Content Knowledge (TCK)		
Criterion observed	**Degree**	**Score**
(C1) Clear linking between technology and content being taught	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	5
	(W) Strongly Agree	0
	(T) Strongly Disagree	5
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0
(C2) Designs creates relevant learning experiences that incorporate ICTs and other resources to promote student learning and creativity	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	5
	(W) Strongly Agree	0
	(T) Strongly Disagree	4
	(T) Disagree	0
	(T) Neutral	1
	(T) Agree	0
	(T) Strongly Agree	0

Pedagogical Content Knowledge (PCK)		
Criterion observed	**Degree**	**Score**
(C1) Possess the ability to understand and integrate teaching approaches that stimulate student creativity	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	5
	(W) Strongly Agree	0
	(T) Strongly Disagree	0
	(T) Disagree	5
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0

(C2) Applies teaching approaches which give more authority to students in solving, fault finding problem	(W) Strongly Disagree	0
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	5
	(W) Strongly Agree	0
	(T) Strongly Disagree	0
	(T) Disagree	5
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0

Technological Pedagogical and Content Knowledge (TPCK)		
Criterion observed	**Degree**	**Score**
(C1) Proper choice of technology in relation to content pedagogy	(W)Strongly Disagree	0
	(W)Disagree	0
	(W)Neutral	1
	(W)Agree	3
	(W)Strongly Agree	1
	(T)Strongly Disagree	5
	(T)Disagree	0
	(T)Neutral	0
	(T)Agree	0
	(T)Strongly Agree	0
(C2) Clearly integrates all components of TPACK	(W) Strongly Disagree	5
	(W) Disagree	0
	(W) Neutral	0
	(W) Agree	0
	(W) Strongly Agree	0
	(T) Strongly Disagree	5
	(T) Disagree	0
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0
(C3) Clearly applies TPACK frameworks for	(W) Strongly Disagree	5
	(W) Disagree	0
	(W) Neutral	0

development, implementation and reflection of the lesson with colleagues and students	(W) Agree	0
	(W) Strongly Agree	0
	(T) Strongly Disagree	5
	(T) Disagree	0
	(T) Neutral	0
	(T)Agree	0
	(T) Strongly Agree	0
(C4) Promotes students' reflection using collaborative ICTs and tools, to clarify students' conceptual understanding, thinking and creativity	(W) Strongly Disagree	
	(W) Disagree	0
	(W) Neutral	2
	(W) Agree	3
	(W) Strongly Agree	0
	(T) Strongly Disagree	3
	(T) Disagree	2
	(T) Neutral	0
	(T) Agree	0
	(T) Strongly Agree	0

Appendices

Appendix A: Ethics clearance letter

Wits School of Education

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

27 St Andrews Road, Parktown, Johannesburg, 2193 • Private Bag 3, Wits 2050, South Africa
Tel: +27 11 717-3221 • Fax: +27 11 717-3009 • E-mail: enquiries@educ.wits.ac.za • Website: www.wits.ac.za

03 July 2018

Student Number: 577689

Protocol Number: 2018ECE024M

Dear Thabile Lindi Mangele

Application for Ethics Clearance: Master of Education

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate, has considered your application for ethics clearance for your proposal entitled:

The integration of Smart Technology in Technical Vocational (TVET) Collages in Johannesburg towards a new pedagogy in vocational education.

The committee recently met and I am pleased to inform you that **clearance was granted**. Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely,

M Mabetha

Wits School of Education
011 717-3416

cc Supervisor – Dr. Vasidevan Naiker

Appendix B: Information Letter for Campus Principal

LETTER TO THE CAMPUS PRINCIPAL, CEO, SGB Chair, etc.

Date: June 2018

Dear:

My name is Thabile Manqele, I am a Masters student in the School of Education at the University of the Witwatersrand.

I am doing research on**: The integration of Information and Communication Technologies in Technical Vocational Education and Training towards a new pedagogy in Vocational Education.**

I would like to invite your school to participate in my research study.

The data collected during this research project will help the University of Witwatersrand identify skill gaps and that they need to mitigate in the B.Ed. degree in TVET and in the Advanced Diploma in TVET new qualifications.

My research involves Observing and interviewing lecturers who work in TVET Colleges (in Johannesburg, who teach automotive). Observations will be conducted with participants, using an observation sheet and semi- structured interviews will also be conducted with lectures. This will be done in the endeavor to understand how lecturers (who are currently teaching automotive) are currently integrating ICTs and other forms of Smart Technology into their pedagogical practices. This will be done in order to help them identify other possible gaps that exist in their pedagogical practices. Hopefully through this research, lecturers will be encouraged to upskill themselves at Wits University through the new Vocational teaching programs that will offered in 2019.

The reason why I have chosen your college is because; your campus is one of eight TVET Colleges (in Johannesburg) that are recognized for their outstanding

teaching of automotive as a course. Therefore, it would be wonderful to see how you are integrating ICTs and other form of ICTs into teaching this course.

Please note that the research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission to participate in the research, at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

The names of the research participants and identity of the school will be kept confidential at all times and in all academic writing about the study. Your individual privacy will be maintained in all published and written data resulting from the study.

All research data will be destroyed between 3-5 years after completion of the project.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,

Tmangele

Thabile Mangele
Dawn Park, Boksburg
Thabilethee@gmail.com
081 2090 173

Appendix C: Information Letter for Students

INFORMATION SHEET FOR STUDENTS

Dear Student: DATE: June 2018

My name is Thabile Manqele and I am a Masters student in the School of Education at the University of the Witwatersrand.

I am doing research on: **The integration of Information and Communication Technologies in Technical Vocational Education and Training towards a new pedagogy in Vocational Education.**

I would like to invite your school to participate in my research study.

My investigation involves the observation of some of your lectures or workshop sessions in the automotive classroom. This will be done to help me understand how your lecturers are using/ integrating ICTs and other forms of Smart Technologies into the automotive lessons. During the observation, sessions I will be part of your (sitting at the back of the lecture room for about 45 minutes) during this will just observe your lecturers to see how they are using ICTs and other forms of Smart Technology to teach you automotive.

Remember, this is not a test, it is not for marks and it is voluntary, which means that you don't have to do it. Also, if you decide halfway through that you prefer to stop, this is completely your choice and will not affect you negatively in any way.

I will not be using your own name but I will make one up so no one can identify you. All information about you will be kept confidential in all my writing about the study. Also, all collected information will be stored safely and destroyed between 3-5 years after I have completed my project.

I look forward to working with you!

Please feel free to contact me if you have any questions.

Thank you,

Tmangele

Thabile Mangele

Dawn Park, Boksburg

Thabilethee@gmail.com

081 2090 173

Appendix D: Student Consent Form

Student consent Form

Please fill in the reply slip below if you agree to participate in my study called:

The integration of Information and Communication Technologies in Technical Vocational Education and Training towards a new pedagogy in Vocational Education

My name is: _____optional_____

Permission to observe you in class

I agree to be observed in class. YES/NO

Informed Consent

I understand that:

- My name and information will be kept confidential and safe and that my name and the name of my school will not be revealed.
- I do not have to answer every question and can withdraw from the study at any time.
- I can ask not to be audiotaped, photographed and/or videotape
- All the data collected during this study will be destroyed within 3-5 years after completion of my project.

Sign_____

Date_____

Appendix E: Information Sheet for Lecturers

INFORMATION SHEET FOR LECTUERES

Dear: DATE: June 2018

My name is Thabile Manqele, I am a Masters student in the School of Education at the University of the Witwatersrand.

I am doing research on: **The integration of Information and Communication Technologies in Technical Vocational Education and Training towards a new pedagogy in Vocational Education**

I would like to invite your school to participate in my research study.

The data collected during this research project will help the University of Witwatersrand identify skill gaps and that they need to mitigate in the B.Ed. degree in TVET and in the Advanced Diploma in TVET.

My research involves Observing and interviewing lecturers who work in TVET Collages (in Johannesburg, who teach automotive). Observations will be conducted with participants, using an observation sheet and semi- structured interviews will also be conducted with lectures. This will be done in the endeavor to understand how lecturers (who are currently teaching automotive) are currently integrating ICTs and other forms of Smart Technology into their pedagogical practices. This will be done in order to help them identify other possible gaps that exist in their pedagogical practices. Hopefully through this research, lecturers will be encouraged to upskill themselves at Wits University through the new Vocational teaching programs that will offered in 2019.

The reason why I have chosen your college is because; your campus is one of eight TVET Colleges (in Johannesburg) that are recognized for their outstanding teaching of automotive as a course. Therefore, it would be wonderful to see how you are integrating ICTs and other form of ICTs into teaching this course.

Please note that the research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission to participate in the research, at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

The names of the research participants and identity of the school will be kept confidential at all times and in all academic writing about the study. Your individual privacy will be maintained in all published and written data resulting from the study.

All research data will be destroyed between 3-5 years after completion of the project.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,

Tmangele

Thabile Mangele

Dawn Park, Boksburg

Thabilethee@gmail.com

081 2090 173

Appendix F: Lecturer Consent Form

Lecturer Consent Form

Please fill in and return the reply slip below indicating your willingness to be a participant in my voluntary research project called: **The integration of Information and Communication Technologies in Technical Vocational Education and Training towards a new pedagogy in Vocational Education.**

I, _____ give my consent for the following:

Permission to observe you in class

I agree to be observed in class. YES/NO

Permission to be audiotaped

I agree to be audiotaped during the interview or observation lesson YES/NO

I know that the audiotapes will be used for this project only YES/NO

Permission to be interviewed

I would like to be interviewed for this study. YES/NO

I know that I can stop the interview at any time and don't have to

Answer all the questions asked. YES/NO

Informed Consent

I understand that:

- My name and information will be kept confidential and safe and that my name and the name of my school will not be revealed.
- I do not have to answer every question and can withdraw from the study at any time.
- I can ask not to be audiotaped, photographed and/or videotape
- All the data collected during this study will be destroyed within 3-5 years after completion of my project.

Sign_____
Date_____