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Online Vocational Pedagogy During COVID-19:

An Analysis of Video Lectures by Technical and Vocational Lecturers

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A thesis submitted to the School of Education in fulfilment of the requirement for the degree of

Master of Education

Supervisor: Prof. Wayne Hugo

Abstract

The purpose of this study was to identify and describe the types of knowledge and skills, as well as the pedagogical archetypes displayed by technical and vocational education and training lecturers. This study also investigates the potential impact of these pedagogical practices on the growth and development of expertise. Despite the critical role played by TVET institutions in equipping students with work-ready skills, many TVET lecturers remain inadequately qualified, which likely compromises the quality and effectiveness of their teaching methods (Rabaza, 2021). The shift to emergency remote teaching further challenged the lecturers' abilities, demanding that they adapt their pedagogies to suit the "new model" of teaching. This qualitative case study was framed within the interpretivist paradigm and employed the Legitimation Code Theory (Maton, 2009) and Hugo & Louton's (2020) conceptualisation of vocational pedagogy. Observation of the YouTube videos created in response to the COVID-19 pandemic was used to collect data. The collected data was analysed deductively and inductively.

This study aimed to explore how TVET lecturers employed different pedagogical strategies in online instructional videos and to examine the potential impact of these pedagogies on student learning. The study identified three archetypal vocational pedagogies used in TVET, through which students encounter distinct forms of knowledge, skills, attitudes, and values. The findings indicate that these archetypes have varying impacts on knowledge growth, with one particular archetype shown to progressively integrate different types and structures of knowledge, thereby enabling a shift from novice understanding to work-ready, proficient individuals. These insights offer a crucial framework for professional development initiatives aimed at enhancing the pedagogical effectiveness of TVET lecturers, ultimately improving the quality of teaching despite current qualification challenges.

DECLARATION

Submitted in fulfilment of the requirements for the Masters of Education degree in the School of Education, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

I, Thembeka Madondo, declare that:

1. The research reported in this thesis, except where otherwise indicated, is my original research.
2. This thesis has not been submitted for any degree or examination at any other university.
3. This thesis does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
(a) their words have been re-written and the general information attributed to them has been referenced, or
(b) their exact words have been used, then placed in quotation marks and referenced.
5. This thesis does not contain text, graphics, or tables copied and pasted from the internet unless specifically acknowledged and the source is detailed in the thesis and in the References section.

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Date: 25/06/2025

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Acknowledgement

I would like to acknowledge the love and support I have received from my family. The journey has been long, and I know it has demanded from you as much, if not more, than it has from me. But through it all, your encouragement and belief in me have kept me going. To my mother, Memu, knowing that my girls were safely in your care gave me the peace of mind I needed to focus on my studies. Ngiyabonga, Mnquhe. To my sister T, what haven't you done for me during this process? I can never thank you enough.

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

Technical and vocational education and training (TVET) is a sector that plays a pivotal role in preparing young adults for the workforce. It encompasses all educational processes that result in acquiring new skills and knowledge necessary for gaining employment. Therefore, what occurs within these institutions is crucial not only for the future of the students but also for broader society. The Covid-19 pandemic not only threatened lives but also placed unprecedented demands on TVET lecturers, requiring them to innovate swiftly to ensure the continuation of teaching and learning. This demand was further intensified by the lack of data on effective online and remote teaching practices in the TVET sector. This study examined the range of pedagogies employed by lecturers at TVET colleges across South Africa during this period.

This chapter constructs a contextual map of the TVET sector in South Africa, focusing on the curriculum taught and the challenges presented by the introduction of the National Certificate Vocational curriculum, an alternative to grades 10-12 aimed at equipping students with the skills and knowledge essential for the workplace. It discusses the impact of the Covid-19 pandemic and the resulting lockdown on teaching and learning, both internationally and nationally. The chapter begins by providing a contextual background of the TVET landscape and emergency remote teaching. Thereafter, the research problem, aims, and objectives will be outlined. In conclusion, an overview of the research methodology, theoretical framework, and structural outline will be provided.

1.2 Background to the problem

Since the dawn of democracy in South Africa, the TVET sector has undergone a myriad of changes – from structural, to institutional, to curricular reforms. These changes have been driven by both the need to redress past injustices and to drive the country forward in terms of the economy (Buthelezi, 2018; Boka & Paterson, 2016). The shortage of skills, as well as advancements in technologies, have placed an urgent demand on TVET colleges to produce graduates who possess the necessary skills and who are lifelong learners, able to adjust to the constant changes happening in industry (Buthelezi, 2018).

In 2007, the National Certificate Vocational (NCV) programme was introduced to respond to these demands and to also provide an alternative academic route for those who did not qualify for other forms of tertiary education (Boka & Paterson, 2016; Buthelezi, 2018; Manyua, 2015). In contrast to its predecessor, the National Accredited Technical Diploma (NATED), the NCV is a three-year program offered at the same level as Grades 10 to 12. Whilst NATED is offered in semester blocks, including practical internships, the NCV is assessed annually, foregrounding general knowledge with vocational relevance. Academics and industries have alluded that it is not clear whether the NCV programmes are designed to prepare students for specific jobs or if they lay the foundation for pursuing further study toward a specific occupation (McGrath & Akoojee, 2009). As a result, the program has not managed to attain the very ideals on which it is built, and thus the shortages of skilled artisans persist, as do high unemployment rates (Rogan & Isdale, 2022).

Apart from reluctance on the part of industry to employ NCV graduates, the colleges struggled to produce graduates at the envisioned rate. A large number of students who enrolled for the NCV certificate dropped out before completion. According to a factsheet released by the department of Higher Education and Training, of the 60,000 students registered for the NCV qualification in 2017, only about 10% completed the NCV Level 4 in 2019 (Khuluvhe & Mathibe, 2022). While some students complained of financial constraints, others complained that the subjects were pitched at a level above their comprehension abilities (Nthako, 2020). This is ironic as the program was designed to accommodate those who struggled with the academic requirements of mainstream education.

Students were not the only ones struggling with the new curriculum and its content. Initially, lecturers complained of not being trained sufficiently in the new subjects and subject delivery (Buthelezi, 2018; Manyua, 2015). They also stated difficulties in articulating the policy documents. Whilst in the past lecturers worked mostly with practical subjects and knowledge, the NCV contained more theory than practice and more administrative requirements. Thus, the role of TVET lecturers shifted from that of masters in a master-apprentice relationship to that of lecturers. This was despite the fact that the majority of the TVET lecturers did not possess any pedagogical qualification (Buthelezi, 2018; Sebola, 2022). The DHET has since introduced a suite of qualifications for TVET lecturers, but these are only beginning to be introduced by universities (Manyua, 2015; Blom, 2015a).

Before the introduction of these qualifications, inadequately qualified lecturers had to respond to the increase in student numbers following the introduction of the NCV. In the years 2011/2012 alone, student enrolments increased by over 60% (Buthelezi, 2018; Wedekind & Buthelezi, 2016; Blom, 2015b). The student profile transformed from being largely students with only a Grade 9 qualification to those who had completed their matric successfully and those who failed in matric. Buthelezi (2018) quotes Mokone, who states that lecturers had to learn to deal with "adolescents, rather than young mature, responsible adults" (p. 13). Research also showed that the younger students were less motivated and demanded more guidance than the older students.

These challenges charted new territories for lecturers as they had to find pedagogies that would attend to the majority, if not all, of their challenges. Lecturers had to seek methods of teaching that would appeal to both the young and old but still be able to achieve the intended subject outcomes.

In this context, the arrival of the COVID-19 pandemic compounded these challenges faced by the TVET sector in South Africa. Once again, lecturers had to adjust their teaching methods and strategies to align with the demands placed on them by changing conditions.

1.3 Adaptation to Remote Teaching during COVID-19

Following the pronouncement by the World Health Organization (WHO) of COVID-19 as a pandemic, more than 160 countries implemented a form of lockdown in a bid to curb the spread of the virus (Hoftijzer et al., 2020). These lockdown measures meant that over 1,6 million youth and children were prevented from receiving face-to-face education, as countries resolved to use remote teaching and learning modalities (United Nations, 2020). The World Bank proposed that those working in policy prioritize three policy objectives for the TVET sector; namely: coping with the pandemic and saving the academic year, creating systems that would allow for a smoother return to face-to-face learning when countries started to open, and, finally, learning from the pandemic (Hoftijzer et al., 2020).

Due to its ability to transcend time and space, the use of technologies in education has been proposed as a means of increasing opportunities to access. However, before the outbreak of Covid-19, not many countries were offering TVET remotely. A survey conducted by UNESCO-ILO revealed that less than 30% of the countries that responded offered any form of remote

learning and training before the Covid-19 outbreak (Hoftijzer et al., 2020). However, the numbers increased to over 60% of the countries offering fully remote learning during the lockdown period (Hoftijzer et al., 2020). While the report warns against the interpretation and use of these results due to the representativeness of their respondents, these results do give a glimpse into the impact of COVID-19 on the TVET sector.

As South Africa implemented its lockdown protocol in March of 2020, the Department of Higher Education and Training (DHET) implemented responsive changes and strategies under the banner "#save lives, save the academic year." (Nzimande, 2020a) Over 400,000 students across the 50 TVET colleges were affected by the pandemic as face-to-face classes were discontinued (Nzimande,2020). The Department immediately started engaging with internal and external stakeholders to ensure that remote teaching and learning were implemented (Nzimande, 2020b).

The department proposed different strategies to address the needs of different demographics in South Africa (Nzimande, 2020a, 2020b). To reach those with no internet access, the use of TV and radio to broadcast lessons was suggested, together with the issuing of printed study materials and provision of previous exam papers (Nzimande, 2020d). The use of social media and as well as other communication platforms was encouraged. The Department also engaged with network providers in a bid to create data-free websites for students to be able to access learning materials (Nzimande, 2020a). Colleges were also encouraged to create video lessons for students. These lessons were to be posted on college websites, internet channels like YouTube, and other websites established for continued learning. The department (Department of Higher Education, Training, Science and Innovation, 2021) indicated it was not well equipped for the shift to remote teaching and learning modalities, citing both infrastructure constraints as well as the shortage of adequately trained and resourced staff members. The department (Department of Higher Education and Training, Science and Innovation, 2021) indicated it would not implement online teaching and learning but rather other remote teaching modalities.

As part of this response, over 100 videos from different colleges were posted on the Jelo Creative YouTube channel, but even more were posted on a website that was later taken down when face-to-face classes resumed. These lessons were of lecturers from across the different subjects offered in the TVET sector, covering both the NATED as well as the NCV curriculum. All levels of study were represented, and both theory-based lessons and practical lessons were recorded.

Whilst the Department and colleges responded promptly to the outbreak (Nzimande, 2020b), the effectiveness of these strategies remains unclear. In a country like South Africa where the majority of the TVET students come from poverty-stricken homes, access to technological devices is not always possible (Sikwela et al., 2023). Furthermore, the existence of load shedding and its resultant power shortages negatively impacted the provision of blended learning modalities (Maharaj, 2023), making online videos the better option for the provision of teaching materials as students could access these anytime. It also increased the pressure on lecturers to pack as much content into as few recordings as possible to limit the data costs associated with watching online videos (Aina & Ogegbo, 2022)

With teaching and learning scheduled to continue remotely, there remained a need to restructure the academic year to accommodate assessments and the work experience component of learning. While all students had returned to the different campuses by the end of July, the NATED exams for Business Studies only commenced in September (Nzimande, 2020c). With the Engineering students having written their exams in July, the NCV students were said to be on track for their November examinations. With so many teaching days lost and given the challenges encountered with implementing remote learning, it is unclear how much of the official curriculum was enacted, and how much of the enacted curriculum was learnt by students.

1.4 Problem Statement

Despite the critical role of Technical and Vocational Education and Training (TVET) in equipping students with work-ready skills, many TVET lecturers remain inadequately qualified, which likely compromises the quality and effectiveness of their teaching methods (Rabaza, 2021; Alexander & Mosoabi, 2017). The emergency shift to remote teaching and learning due to the prevalence of COVID-19 further highlighted the need to equip lecturers with digital skills. Although the Department of Higher Education and Training has issued a White Paper on the qualification of TVET lecturers, it fails to include the pedagogical content necessary to guide the development of effective teaching practices, which may lead to inconsistent or insufficient training for TVET educators (Zascerinska, 2022). Consequently, higher education institutions and curriculum developers lack a clear basis for designing programs that build pedagogical capacity in vocational contexts. Although there is a growing body of research on the benefits of vocational pedagogy, limited understanding exists regarding the underlying principles that guide TVET lecturers in their day-to-day teaching and the potential impact of these approaches on

students' knowledge acquisition and skill development. This presents an empirical gap in the development of a vocational pedagogy.

1.5 Significance of this Study in Enhancing TVET Pedagogy

The renewed interest in technical and vocational education has resulted in numerous investigations on how best to improve the quality of teaching and learning. While these studies have focused on the types of pedagogies suitable for teaching technical and vocational subjects, little research has focused on the principles that guide lecturers during decision-making in their lecture rooms or workshops. The purpose of this study was to fill this empirical gap by making explicit the archetypal pedagogies and the underlying semantic principles employed by TVET lecturers during the lockdown period. During this period, TVET lecturers, who are accustomed to delivering lectures on a face-to-face basis (Makgato, 2019), suddenly found themselves adjusting their pedagogies and pre-recording their lessons, with no interaction with their students (Aina & Ogegbo, 2022). While teaching and learning returned to face-to-face modalities after the intense phase of the pandemic, reflecting on these experiences yielded valuable lessons on the semantic drivers of TVET pedagogies.

Since the videos were of lecturers who worked at TVET institutions and were an impromptu response to the pandemic (Aina & Ogegbo, 2022), we can assume that many of the decisions made by lecturers as they worked through the content reflected the decisions they make when lecturing in the presence of students. If this assumption is true, this research previews the types of vocational pedagogies found in South African TVET colleges. Insights from this study about the potential impact of the existing pedagogical archetypes could contribute to the project of conceptualising a specific South African vocational pedagogy.

Furthermore, one of the objectives of TVET globally is to increase access to quality education and training, which can be achieved through increased TVET enrolments. However, Ogur (2023) states that many potential students in developing countries do not have access to TVET programmes due to geographical and financial constraints. By analysing the potential impact of online videos on knowledge growth, this research offers insights into the possibility of using and sharing these videos as a means of expanding access to quality and effective TVET learning. During a time when little is known or understood about online technical and vocational education, this research examines the types of learning experiences that enable students to

acquire the theoretical knowledge that governs practice and also introduces practical knowledge through the use of appropriate methods and pedagogies.

Moreover, one of the challenges faced by the TVET sector internationally is the shortage of teaching materials that are appropriate for online or blended learning and are designed specifically for the TVET sector. Of those videos available online, the majority come from the West. Thus, there is a need for videos designed from an African perspective to be used for teaching in the African context. By identifying the patterns of pedagogy as well as their contribution to knowledge building, this research can contribute to the development of the required instructional videos, using the videos used in this research as a starting point.

1.6 Research Aims and Objectives

This research aimed to identify and describe the pedagogical patterns displayed by TVET lecturers as they emerged from plotting the observed knowledge types, as captured in the online videos created during the pandemic, on a semantic plane.

The research objectives included identifying the types of knowledge taught at South African TVET institutions, the pedagogies employed by TVET lecturers, and the role that these pedagogies play in knowledge building. These can be listed as follows

1. To explore and describe the types of knowledge taught at South African TVET institutions, as evidenced through the online videos observed.
2. To categorise and describe the pedagogical patterns that emerged from the pedagogical choices made by lecturers during the lessons as captured in the vocational pedagogy dashboard (Hugo & Luoton, 2020); and
3. To analyse and examine how the pedagogical patterns enable or hinder knowledge growth using Maton's Legitimation Code Theory (2009)

Three research questions governed this investigation:

1. What kinds of knowledge are taught in the TVET sector?

2. What pedagogical patterns emerge from TVET lecturers' online videos during the pandemic when analysed through the Semantic Code analysis (Maton, 2009)

3. How do these pedagogical patterns impact knowledge building in the TVET sector, in terms of both skill development and the acquisition of underlying scientific principles

1.7 Overview of the Methodology

This research was a qualitative case study, which explored TVET lecturers' pedagogical actions, as observed in the online videos created in response to the Covid-19 pandemic. It was framed within the interpretivist paradigm, using observations as a data collection tool. The videos analysed were taken from a YouTube channel that showcased videos from four colleges, and deductive and inductive data analysis was performed on the data.

1.8 Overview of the Theoretical Framework

This study used Hugo & Louton's (2020) Vocational Pedagogy Dashboard (VPD) to analyse the pedagogies employed by South African TVET lecturers during the COVID-19 pandemic lockdown. To do this, I traced pedagogic decisions from the curriculum through to the teaching methods employed. Since the ultimate aim of education is to ensure that students can apply the knowledge they have acquired to new contexts, I used the semantics codes of Maton's Legitimation Code Theory (Maton, 2014; Maton et al., 2016) to look at the possible impact of these pedagogies in preparing students for work.

1.9 Structure of the Thesis

Chapter 1 Introduction and Background

The first chapter has located this research project in the context of time and space. This chapter began by exploring the contextual background of vocational education and training in South Africa, and how this sector adapted its teaching nature in the wake of the Covid-19 pandemic. The problem statement was discussed in detail and how this study is significant in practice and for theory development was provided.

Chapter 2 Literature Review

This chapter critically reports on the existing body of literature relevant to this study. It is divided into six key themes. The first theme is vocational pedagogy, which is critically examined by reviewing literature on the different conceptions of TVET, the nature of learning associated

with TVET, and the conceptualisation of vocational pedagogy. The second theme builds on the established understanding of vocational pedagogy by focusing on the types of knowledge that are associated with learning in the TVET sector. The third theme serves as a summation of the first and second themes as it seeks to critically review literature on the different dimensions of expertise.

The fourth and fifth themes look at the research that has been undertaken on online learning. The fourth theme explores online learning in TVET and how YouTube has been used as a pedagogical tool in this sector. The first theme delves into research on emergency remote teaching, looking at previous modalities and those that were employed during the Covid-19 pandemic.

The sixth theme is on research conducted using the Legitimation Code Theory (Maton, 2009).

Chapter 3 Theoretical Framework

The third chapter reports on the theoretical underpinning of this study. This study employed two main theories, namely the theory of vocational pedagogy by Lucas et al. (2014) and the Legitimation Code Theory (Maton, 2009). Chapter three describes these theories by describing related theories. The theory of vocational pedagogy is preceded by the learning theories and signature pedagogies. Since this theory was applied to this research through the lenses offered by the vocational pedagogy dashboard, this analytical tool is also described in this chapter.

To make sense of the Legitimation Code Theory, this chapter delves into Bernstein's theory of knowledge discourse. The semantics dimension of LCT is described, focusing on the knowledge structure, codes and profiles.

Chapter 4 Methodology

Chapter 4 outlines the research methodology employed in this study. It begins by locating this study within the interpretivist paradigm and describes and justifies the use of a qualitative research design. The chapter then describe the case study methodology adopted for this research, elaborating on why the case study methodology was the best option for this study. The rationale for using a case study design leads to the description of the type of case study. Furthermore, the

chapter outlines the research methods used to select, gather data, and analyse the data. The chapter concludes with a discussion on how data is being stored and a discussion on the ethical considerations that were taken before embarking on this research journey,

Chapter 5 Results

Chapter 5 presents the research results. It describes how the TVET lecturers made decisions about how to teach certain topics. These decisions are not limited to the methodological choices but also the practical choices involved in teaching. The chapter begins by presenting the results found when data was analysed using the vocational pedagogy dashboard (Hugo & Louton, 2020). The next half reports on the findings that were observed when the data was analysed using the LCT (Maton, 2009)

Chapter 6 Pedagogic Archetype

Chapter 6 details the pedagogic archetypes that were observed in the lessons. Three themes or archetypes emerged from the data, and chapter 6 introduces all three before delving farther into each archetype. The first type to be reported on is the Progressive Complexity model, the second type is the Conceptual and Linkages model, the last one is the Conceptual Clusters and Linkages model. Each archetype is elaborated on using a detailed description of a lesson that exemplifies this archetype. To conclude this chapter, a detailed description of the semantic structures observed in these videos is given. This description explores the ontological categories and how these can be useful for understanding the pedagogic archetypes. They are also used to explore the potential impact of these archetypes on knowledge transfer as well as the implication for vocational pedagogy.

Chapter 7 Summary and Conclusion

This chapter concludes the thesis by summarising the major findings and implications of this study for vocational pedagogy. An evaluation of the study methodology is presented, and the limitations of this study are outlined. The chapter concludes by suggesting possible future research.

1.10 Conclusion

The first chapter of this thesis provided a background to the TVET sector in South Africa,

highlighting the challenges faced by this sector, specifically the shortage of suitably qualified lecturers. It also discussed the impact of the COVID-19 pandemic on teaching and learning in this sector, resulting in emergency measures for teaching and learning. This chapter stated the research problem and identified the research aims of making explicit the pedagogic patterns revealed by analysing the pedagogies displayed by the lecturers in the online videos. To conclude this chapter, the structural outline of the thesis was stipulated.

The next chapter will provide an in-depth analysis of the literature currently available on vocational pedagogy, knowledge types and their relevance to TVET, online and remote teaching and learning and how this manifests within the TVET sector. An overview of research that has been conducted using the Legitimation Code Theory (Maton, 2009) will also be provided.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The first chapter of this thesis provided a contextual background to this study and explained the aims and objectives, and how the researcher planned to undertake this study. This chapter will review the literature on what is known about teaching and learning in the TVET sector, and teaching and learning using online modalities. This will be expanded on with a focus on the literature about emergency remote teaching in TVET during the COVID-19 pandemic. It will conclude with a review of the literature on the research done using the Legitimation Code Theory (Maton, 2014).

The first part of this chapter will focus on what is known about vocational pedagogy, beginning by exploring what is understood about how work skills and knowledge are learned. Thereafter, the pedagogical approaches to TVET and how they are expected to impact the development of skills and knowledge will be critically analysed.

2.1.1 Defining and Understanding Technical and Vocational Education and Training

UNESCO initially defined TVET as those “aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupants in various sectors of economic and social life" (Mathur, Sharan, Chakraborty & Mullick, 2022; p.2) This definition of TVET highlights the two dimensions of this sector: general education and education directed towards the development of occupational expertise. Winch (2017) uses the German concept of *Bildung* to make explicit the difference between general education and education for work. According to Winch (2017), *Bildung* comprises three types of education: *Ausbildung, Grundbildung,* and *Allgemeinbildung. Grundbildung* refers to basic education, *Allgemeinbildung* refers to education that qualifies one as ‘educated’ according to society, and *Ausbildung* refers to education geared towards specific occupations. Thus, the definition offered by UNESCO can be said to describe *Bildung* in its totality. However, Guile and Unwin (2019) argue that there has been a separation between TVET and the concept of *Ausbildung,* shifting the focus to Grundbildung and Allgemeinbildung. They state that TVET planning and provisioning have focused on the acquisition of skills and have neglected the development of students' ability to

utilise these skills in the workplace.

Moodie (2002) describes vocational education as a form of education geared towards the advancement and the use of specific knowledge and skills. Wheelahan (2015) states that one's ability to use a skill appropriately demands that one possess a range of other skills, knowledge and abilities. Thus, education and training in TVET should be geared toward the development of not only job-specific skills and knowledge but also a wide range of relevant skills and knowledge.

The European Centre for the Development of Vocational Training (CEDFOP, 2020) offers a slightly different definition of TVET, stating that it is "education and training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market" (p. 13). Lucas et al. (2010) posit that education and training are similar but distinct activities undertaken to cause a shift in one's competence. They state that vocational training is usually associated with practical education geared towards the development of one's ability to work with physical materials effectively in the production of certain products or the performance of certain procedures. They state that practical education concerns itself with the ability to act and do, rather than the demonstration of understanding. Vocational education, on the other hand, is about developing an ability to apply technical and theoretical knowledge to task performance. This ability to apply theory to practice not only demonstrates an ability to act but an understanding of why acting or behaving in a particular way is most appropriate in a given context. Thus, they define vocational education as "the provision of materials and teaching that is designed to prepare people to function at a specific level" (Lucas et al., 2010, p. 3). Some forms of vocational education may include vocational training; however, not all forms of vocational training encompass vocational education.

Mortaki (2012) expresses a similar understanding of the difference between vocational education and vocational training, stating that vocational training is a component of vocational education, while vocational education refers to all educational activities directed at equipping one with the knowledge and skills to be able to practice a profession. This indicates that TVET is an educational field that can be conceptualised as two sides of a coin, where one side – training – is geared towards the action, and the other side – education – is geared towards the development of the mind and understanding theory. Hugo & Luoton (2020) quote Carson, who warns about

privileging training over education, stating that TVET should be approached as an educational task and that educating students "demands more than training for the workplace." According to him, at the end of the teaching and learning experience, students should have acquired a corpus of knowledge and the ability to integrate and use that knowledge. These sentiments echo those expressed by Young, Gamble & Human Research Council (2006) who had earlier stated that vocational education should not only focus on practical and specific occupational aspects but, rather, should teach knowledge that is not specifically occupational but relates to the occupations. Mortaki (2012) states that, though TVET attempts to teach both the knowledge and the capability to act, it focuses on the utilisation of knowledge and skills, rather than how this knowledge is acquired and developed.

Commenting on the South African TVET sector, Young notes that this sector has been unable to provide students with adequate exposure and opportunity to allow students to acquire the necessary disciplinary knowledge, without compromising practical knowledge (Young, 2006). Unwin and Guile (2019) argue that the preoccupation with the educational dimension of TVET has rendered the workplace "a servant to TVET rather than its inspiration" (p. 20); such that the skills taught in TVET are decontextualised from the workplace. They posit that the more removed this sector is from the industries, the more ineffective and less useful it becomes.

These definitions of TVET highlight the contentions existing within this education sector; namely, the divide between knowledge in the theoretical and technical sense and the development of the ability to work with one's hands. It foregrounds the 'pull' from the academic side and the 'push' from the industry side that are exerted on this sector. In an article titled 'Identifying Vocational Education and Training', Moodie (2006) states that the lack of a uniform and clear understanding of TVET is one of the reasons those in this sector seem compelled to defend its value and usefulness. Being clear on the relationship between knowledge, skill and their role in the industry, and vice versa, when investigating vocational education, is necessary for advancing this sector (Lucas, et al., 2012).

This section has presented numerous definitions of the concept of TVET. From these definitions, it is clear that there is a shared understanding of what TVET is or should be. It has highlighted the two dimensions that comprise TVET – education and training – and has shown how these have been used to conceptualise TVET. However, both education and training are activities crafted and provided through the education sector and are offered as services for students to

consume. For this study, vocational education is conceptualised as education focused on equipping students with the necessary skills, they require to gain employment and successfully execute their duties. It encompasses practical, hands-on training as well as the teaching of the underlying scientific principles that govern their work. This understanding of TVET is important The next section will explore how vocational learning occurs.

2.1.2 The Nature of Learning in TVET

Both training and education aim to cause a shift in the abilities, knowledge, and skills of the student. This change only occurs when learning takes place. Lucas et al. (2013) define learning as "what learners do, it involves things like tinkering, practising, reading, comparing, imagining and asking questions" (p. 3). In their conceptualisation of vocational pedagogy, Lucas et al. (2012) state that when making decisions about vocational pedagogy, it is important to consider what students need to do to learn the desired skills and knowledge. A similar viewpoint is raised in a report by the Commission on Adult Training and Vocational Learning (CATVL, 2013), which states that to improve teaching and learning in TVET, there is a need for a clear understanding of the different ways in which students learn new skills and develop their competencies across different learning sites. Sarikaya Erdem & Yildirim (2019) conceptualise learning by drawing from a definition by Stasz and Wright (2004), which identifies learning as "activities and experiences that lead to an understanding of and/or skills relevant to a range of work environments" (p. 30). These views position learning as a process in which students gain knowledge and skills.

According to Lucas et al. (2013), vocational learning can be viewed as having two dimensions: practical learning and vocational learning. While some aspects of practical learning may be included in vocational learning, all aspects of practical learning cannot be included in vocational learning. They expand on this concept by defining practical learning as those activities that students partake in, dedicated to the development of practical or physical abilities. In these experiences, students acquire the ability to work with physical materials, create new products or perform a certain task. Learning occurs through the practical application of ideas and knowledge in a practical setting or during problem-solving.

Catts et al. (2011, cited in Sarikaya Erdem & Yildirim, 2019) conceptualised vocational learning as dual-faceted: comprising "learning as the acquisition of vocational knowledge, and … learning as the contextualised (socio-political and cultural) application of the accumulated" (p. 30). In the same vein, Sfard (1998, cited in Broad, n.d.) describes learning firstly, as a personal process of gaining knowledge and skills, and secondly, as an active participation in occupational practices. These descriptions portray learning as both a cognitive and a social process. Broad (n.d.) argues that how lecturers conceive learning has a direct impact on the type of teaching and learning activities they afford their students.

Technical and vocational learning is often said to be situated: occurring through hands-on experience in a real-world setting or in simulated environments (Sarikaya & Yildirim, 2019). Sutcliffe (2012) states that TVET should provide students with learning opportunities that closely resemble the workplace, while giving students activities that will allow them to think critically, engage in reflective judgement and make speculations about the possible outcomes of their actions. These activities should slowly progress, under the guidance of the lecturer, to learning from challenging situations which provide students with the ability to demonstrate 'expert-level' competence. Sarikaya and Yildirim (2019) posit that effective vocational learning should be experiential, incorporating problem-solving and inquiry-based learning. They argue that learning is an active process of knowledge-building and becoming as students negotiate their professional identities.

Researching vocational learning and pedagogy from a Malaysian perspective, Mohaffyaza et al. (2012) propose that understanding students' learning styles is important for designing learning opportunities. By gaining a better understanding of students' learning styles and preferences, educators and instructors are better able to create learning environments using learning materials that will be effective for teaching and learning the desired skills and knowledge. They further propose that vocational students are visual learners and thus learn best by watching demonstrations and practising the desired behaviours and abilities. Faraday et al. (2011) state that students' learning styles should be treated as part of the contextual factors that determine the teaching methods and strategies that the lecturer adopts when teaching TVET subjects.

Chappell (2003) proposes three pathways for TVET learning. Firstly, students can receive direct

instruction, where they are provided with all the necessary skills and knowledge. Secondly, learning can occur through physical engagement, allowing students to acquire skills and abilities through hands-on activities. Thirdly, student can actively construct vocational knowledge by engaging in real work-based experiences within a community of practice or by reflecting on their own performance. Summarising research on TVET teaching and learning, Lucas et al. (2012) propose that TVET learning methods can be categorised into three groups: learning 'by', learning 'through', and learning 'on the fly.' For each category they provide a list of learning methods which they believe would be effective in TVET.

Table 1: Summary of learning methods as proposed by Lucas et al. (2012, pp. 61-67)

1. Learning by		
• Watching • Teaching and helping • Competing • thinking critically and producing knowledge	• Imitating • Real world problem solving • being coached	• Practising (trial & error) • Reflecting • drafting and sketching • listening, transcribing and remembering
2. Learning through		
• Conversations • games	• virtual environments • enquiry	• simulations and role play • feedback
3. Learning on the fly		
• Unplanned learning experiences, arising on the job		

This section has detailed multiple conceptualisations of learning. From this discussion it is clear that learning is a process in which the end goal is the development of expertise. From the discussion, it is clear that there are numerous ways in which students learn; as such, lecturers need to be cognisant of the different learning methods, as well as the teaching methods that are most appropriate for learning the different skills and knowledge that TVET seeks to develop. This necessitates that lecturers possess a clear understanding and a repertoire of teaching strategies to create learning opportunities aligned with the aims and objectives of their qualifications and modules. In this study, teaching methods are used to determine the learning methods using the vocational pedagogy dashboard, which proposes that teaching methods closely align with learning methods. The next section describes and defines vocational pedagogy based on the present understanding found in the literature.

2.1.3 Defining and Understanding Vocational Pedagogy

Numerous contextual factors have been identified as differentiating technical and vocational education from academic education. These have been used to justify the need for a pedagogy that is specific to TVET. These factors include the type of students found in the sector, the sites of learning, the knowledge that is taught, and the links that the sector has with the workplace (Winch, 2018). Experts concur that TVET educators should possess a body of pedagogical skills and knowledge and also have industry expertise (Barnett, 2006; Blom, 2016; Winch, 2019). They should know the content of the subjects that they are teaching and how these relate to the workplace, but they should also be up to date with the practical realities that manifest in the workplace. Young (2006) describes vocational pedagogy as boundary crossing, stating that lecturers have to be able to take knowledge from one dimension and work with it in another dimension. Vocational lecturers are therefore expected to be able to recontextualise workplace knowledge into content knowledge that they can share with their students

In the same vein, Barnett (2006) states that "vocational pedagogy, the content and process of vocational teaching and learning, is influenced on one hand by workplace activities and on the other – though at a considerable remove at lower levels – by disciplinary knowledge" (p.145). In this definition, Barnett recognises the relationship between disciplinary knowledge and knowledge gained from the workplace. However, knowledge acquired from the workplace is positioned as the major player in this relationship. This view is contrary to that put forward by the Commission on Adult Training and Vocational Learning (2013), which states that TVET teaching should be about recontextualizing knowledge from the underpinning sciences with occupation-specific knowledge to suit the different learning contexts. Such debates highlight the role and influence that knowledge plays in designing and understanding vocational pedagogy.

Winch and Newton (2018) describe vocational pedagogy as not just the linking of occupational knowledge with theoretical knowledge but as a means of combining the different forms of knowledge, skills, and behaviours in a process of inducting students into communities of practice while building their professional identities. While this aligns with the schools of thought described earlier, it also posits the end goal as the driving force in the development of vocational pedagogies. However, a focus on preparing students for joining professional bodies is an activity

that almost all higher institutions of learning strive for. Sebola (2022) poses the question of how a person educated in the field of engineering at a university differs from one trained at a TVET college. He quotes Swart (2018, cited in Sebola, 2022), who states that "[u]niversities must enable students to acquire the necessary disciplinary knowledge workplace skills and the right graduate attributes (theory, practice and generic qualities), needed to meet the needs of the industry, business and communities" (p. 52). The attributes described by Swart are similar to those identified by Winch and Newton (2018) in their definition of vocational pedagogy. Similar sentiments are expressed by Williams (2020), who notes that TVET and general education share a common goal – especially, the development of transversal skills. However, the Wolf Reports state that TVET institutions equip students with different skills and a knowledge set than those taught in universities (Sixabayi, 2023).

Debating what vocational education is, Rampersaud (2018, cited in Winch & Newton, 2018) states that "[a]cademic education can be vocational in that it is often practical (experiments in science, field projects in geography), and is often chosen with a specific career goal in mind (medicine or journalism)" (p.6). If this is so, it raises the question whether TVET colleges and universities should share the same, or similar, pedagogy. An e-forum organised by UNESCO debated a similar question and concluded that there are aspects of 'mainstream' education that are shared with TVET but, ultimately, the end goals of the two forms of education differ, with TVET preparing students for specific forms of work while university students are taught broader knowledge that can be applied to very different workspaces (Lucas, 2014). So while universities may offer programs that lead to specific occupations, the majority of their offerings as well as the types of knowledge foregrounded in their subjects, are more theoretical, focused abstract propositions. Whereas TVET subjects are designed with specific occupations in mind, therefore, the knowledge taught in these subjects is selected specifically to enable students to perform their duties.

TVET shares stronger ties with the industry than universities, with some of the education and training occurring in the workplace (Blom, 2016). This link not only affects what is taught but also how it is taught, as industries tend to lean toward the reproduction of the current employee profile rather than preparing for future needs. These links highlight the value of teaching of specific values and attitudes that are shared within certain industries or by specific occupations. In certain countries, the role of industries in the teaching of technical and vocational subjects begins at the curriculum development phase, where industries are actively involved in

determining the technical and vocational outcomes that are stipulated in the policy documents. Blom (2016) goes so far as to say that, in TVET, work is the curriculum. As such, workplace activities are broken down into smaller skills, which are then incorporated into the curriculum as the competencies that students need to achieve. In other countries, TVET is offered in a dual system, where student learning occurs in both schools and designated workplaces (Hartel, 2017; CEDEFOP, 2015). This relationship between industry and school-based TVET providers mandates that vocational pedagogies be approached differently than university pedagogies.

Another point that has been raised in support of a pedagogy that is TVET-centred is the type of students that TVET institutions cater for (Winch & Newton, 2018). Lucas et al. (2012) make mention of students as a contextual factor that needs to be considered when designing a vocational pedagogy, as TVET students may differ not only in age but also in terms of their physical, mental, and social development and, therefore, any pedagogical approach should be responsive to and mindful of these differences. Currently, the student composition in TVET colleges varies considerably in terms of age, gender, and educational experiences (Buthelezi, 2018). This renders TVET institutions different from universities in South Africa which only cater for students with at least a Matric qualification.

Learner-centredness, though conceptualised differently in different contexts, is viewed as one of the best pedagogic approaches to TVET. CEDEFOP (2015) describes it as

> a range of learning theories, teaching methods and teaching cultures which are believed, by various stakeholders, to do one or more of the following: make educational provision more responsive and accessible to learners; align it with the nature of learning processes; link it with the interests, capacities and needs of individual learners; and associate it with the learning outcomes defined in the curricula (p. 17)

From these debates and others relating to TVET, it is clear that the teaching that occurs at TVET institutions requires lecturers to constantly make decisions about knowledge, the type of learning experiences they want, and the intended goal of those learning experiences. As such, Lucas (2014) defines vocational pedagogies as the “science, art and craft of teaching” (p. 2), stating that they are the result of the integration of all the decisions that lecturers make as they teach vocational subjects. Therefore, they state that when designing vocational pedagogies, lecturers should be mindful of their end goal. To assist lecturers in determining the goal, they propose that

vocational subjects can be better understood by grouping them into broad categories based on the medium in which their work is expressed.

Lucas et al. (2014) identify three categories of vocations: namely, those occupations that work with physical materials, such as carpentry; those that work with people, such as childcare; and those that work with symbols, such as accounting sciences. The idea of beginning with the end in mind is echoed by a CEDOF (2105) report that states that vocational pedagogy should be directed towards the formation of a vocational identity. Blom (2016) defines this as the shaping of identity; thus, vocational pedagogy should be mindful of who the students need to become to be successful in their occupations.

Thinking about the end goal also dictates that lecturers need to be specific about the type of skills, knowledge, values, and attitudes they want to impart to their students. Hyman (Winch & Newton, 2018). proposes that one of the most important things in vocational education is the adoption of a pedagogy that is aimed at developing the mind, the heart, and the hands. The CEDOFOP (2015) report specifically names the development of self-regulation as one of the skills that vocational pedagogy should strive towards. This means that a lecturer in vocational education should be intentional about setting up learning experiences in which students get to practise and develop self-management and self-regulation skills. In their conception of vocational pedagogy, Lucas et al. (2014) identify six capabilities which need to be developed in addition to specific occupational skills: routine expertise, functional literacies, resourcefulness, craftsmanship, business-like attitudes, and wider skills such as problem solving, teamwork and resilience. These will be elaborated on later in the theoretical framework. Winch et al. (2013) bring our attention to the term ‘transversal abilities’: activities that require a sense of autonomy and agency on the part of students. He notes that at some point during their working lives, students will be required to either judge their work, plan projects, or communicate aspects of their jobs. These tasks are context-specific and, as such, there is no fixed criterion for how they should be judged. For example, good planning skills cannot be judged by the ability to write a step-by-step action plan, but these need to be executed in a context-specific manner in order to achieve the envisioned goals. The Commission on Adult Vocational Teaching and Learning (CAVTL) posit that assessment should be occupation-specific and derived from those used in the workplace.

The purpose of this section was to define vocational pedagogy and justify the need for a specific

pedagogy tailored for the TVET sector. To achieve this, the most common reasons for vocational pedagogy were presented, positioning the TVET sector as a distinctive academic field, one that is uniquely aligned with the industries. While this section revealed ongoing debate regarding the necessity of a pedagogy specific to the TVET sector, this research supports the call for a vocational pedagogy. For this study, vocational pedagogy is understood as the distinct set of behaviours and actions observable during teaching and learning. These actions and behaviours reflect the decisions made by the lecturer before the lesson, as well as those made continuously during the lesson based on context and student feedback. How these decisions are made will be further elaborated in in Chapter 3 (3.2.3 and 3.3.3). Ultimately, these decisions aim to create learning opportunities for students to acquire and construct new knowledge.

The first part of the chapter has conceptualised TVET as a multidimensional sector of education that is dedicated to the development of knowledge and skills that are needed to gain employment. The goals of this sector were discussed together with the nature of learning that is associated with attaining these educational goals. An understanding of how students learn is necessary for this study, as it analyses the pedagogies employed in the teaching of technical and vocational subjects. The following sections will elaborate on the types of knowledge that TVET seeks to impart.

2.2 Exploring the Types of Knowledge in TVET: Know-What and Know-How

The importance of knowledge in TVET is evidenced in the discussions above. This section elaborates on the different types of knowledge and their relevance for the development of technical and vocational competences. The section begins by discussing typologies for occupations.

2.2.1 Three typologies of occupations

The teaching of skills predates formal education (Guile & Unwin, 2019) and dates back to the earliest transmission of knowledge among humans from parent to child for survival. As skills evolved, resulting in the differentiation of labour, people started investing time into becoming specialists in a specific field of work (Gamble, 2013). They became masters and used their expertise to train others. This gave rise to the master-apprentice model of skills teaching which shapes most of today's technical and vocational education (Gamble, 2013). In this model, young

people learned on the job what the master deemed necessary for them to learn. Students had opportunities to observe and imitate, learning mostly through trial and error. The job of the master trainer was to model, demonstrate, and coach. During training, students learned how to perform specific tasks and the 'tricks of the trade', and were initiated into communities of practice.

Winch (2014) describes those who were taught through apprenticeship as craftworkers and proposes that they had five distinct features. First, craftworkers learn through active experience (Winch et al., 2013). They are first taught individual skills, and as they master these skills, they progress to using these skills together on a project (Winch, 2013b). Arising from active learning, apprentices acquire tacit knowledge, which he describes as areas of practical knowledge that cannot be reduced to verbal descriptions. The possession of tacit knowledge is the second distinct feature of craft workers. The third feature is phronesis: through experience, craftworkers develop good situational judgement (Winch, 2010, 2013b). They know what to do when to do it and how to do it. The fourth feature is moral judgement, craftworkers develop a sense of pride and joy in their work: thus, judgement extends to include how their finished products look as well as the moral judgments associated with them. Furthermore, craftworkers value tradition, their techniques are based on tried and tested methods that have endured the test of time. The fifth and final feature of a craftworker, which is common sense. Everyday decisions and actions performed by craftworkers rely on theories and ideas that have been in existence long enough that they have become accepted as common-sense knowledge. Hugo and Louton (2020) summarises these features as a singled attribute: 'situated understanding'.

Modern-day advocates for on-the-job training propose that it is a better approach to learning than classroom-based learning as students do not have to transfer knowledge from one context to another (Billett, 2001; Papier, 2012). They propose that experts in specific fields do not rely on rules and theories learned from formal schooling to govern their actions but rather they use their intuition gained through practical experience (Dreyfus & Dreyfus, 2004; Aarkrog, 2005). Given this, teaching should focus on what a person can do rather than what a person can avow.

While on-the-job training is said to overcome the barrier between classroom and industry, it may not be sufficient to overcome the transfer barrier between different work context (Broad, n,d). Billett (2016) states that as occupational practices differ across different occupational contexts, students should be adaptable and intentional in their practice with good situational awareness.

Similar sentiments are expressed by Evans et al. (2009), who postulate that all forms of knowledge are entrenched in particular contexts. This is echoed by Winch's (2014) sentiments that students should not just be able to perform specific tasks, but should be able to perform them repeatedl0y across a varied range of appropriate contexts. They should be able, when required, to adapt their task performance based on the situation. According to Broad (2016), while tacit knowledge is important, because it is situated, as it is transferred from one context to the next it loses its value. And since knowledge is fluid and always changing, changes in the workplace lead to the redundancy of such knowledge. And as some skills become obsolete, other skills become necessary and are in demand.

For workers to be able to pivot and adapt to changes in the workplace, Hugo and Louton (2020) states that they need to have a good understanding of the theoretical underpinnings of their practice. This echoes Winch's (2010) sentiments that student assessment should not just focus on practical demonstration. Winch (2010) states that judging students' competence based on a single episode of physical manifestation of know-how is inadequate. Students should possess a type of knowledge called Techne (Winch et al., 2013). They describe techne is the knowledge that equips one with an ability to work with physical objects or to create new things. Students with Techne are not just practical actors but possess a body of knowledge that allows them to clearly articulate their processes. According to Dunne (1993, cited in Winch, 2013) "techne enables the practitioner to plan and control a process; also, to explain and predict the success or otherwise of an intervention" (p. 3).

Classroom-based TVET thus satisfies the need for theoretical learning. Students are taught procedures derived from theory, as well as the theory governing practice (Blom, 2015). Proponents of the cognitive approach to skills acquisition propose that if someone can clearly state how thigs are done and why then they possess the necessary know-how to perform the said tasks (Winch, 2013b). Skills and techniques are reduced to declarative knowledge. One's competence is thus defined as one's ability to use and apply one's cognitive capacity to assess situations and act accordingly (Chappelll, 2003). Winch (2014) describes such workers as executive technicians; they have a repertoire of strategies or methods for how to perform tasks. These methods are based on scientific proof, and all the worker does in the job setting is decide which method is best for the particular aim and goal. They may not always fully understand the theory underpinning their practice; thus, their judgements are based on readily available choices, and they are incapable of drawing inferences or dealing with new situations not provided for.

The view that know-how is equivalent to declarative knowledge fails to account for situations where one knows a way of doing and can articulate it but cannot do what they know needs to be done, which Boenher terms ‘possessing inert knowledge’. In his model of competencies, Boehner describes ability as “the power to perform a certain practical task that involves a high level of cognitive awareness” (2015, cited in Hugo & Louton, 2020). Thus, to claim skills competence based on one’s power to recite procedural steps is insufficient for the workplace.

These debates warrant a deeper discussion on knowledge typologies and their relevance to TVET. The following section elaborates on the different types of knowledge and skill and how they were conceptualised for the purposes of this study.

2.2.2 Know what

Know what describes both the knowledge of propositions as well as systemic knowledge. Winch (2013) proposes that an increase in the number of propositions that one has on a certain subject is the first step towards epistemic ascent. However, we cannot just accept that someone is knowledgeable simply because they can avow certain propositions. Rather, they need to be able to use the knowledge they have acquired and be able to understand and draw inferences from the proposition. For instance, in baking, it is not enough to know that yeast is a biological leavening agent: one needs to understand the effect of adding yeast during the baking process. To successfully make inferences, one needs to understand the kind of relationships that the specific proposition shares with other related propositions. The appreciation of such relationships is also made manifest in one’s ability to justify certain claims. Winch (2013b) states that epistemic ascent pertains to knowledge that includes becoming fluent in the language of the subject.

2.2.3 Knowledge how

Guile and Unwin (2019) describe expertise as ‘the ability to act’. Winch (2013) suggests that for one to act, one needs to know a way to act. Technique, as described by Winch (2010), is a way of doing something: the most basic level of know how. It is only when one has a technique that one can intentionally make use of it to achieve certain tasks. The use of a technique toward the achievement or completion of a certain task constitutes a skill. When one determines how to act, one needs to keep in mind the context in which one is acting. We can only attest that one possesses a skill if one can use the skill in contextually relevant situations to achieve the desired

outcomes. Furthermore, by using normative standards we can evaluate how well someone is in executing certain skills. To say that someone possesses certain skills or know how, they need to be able to explain what they can do, demonstrate their abilities in contextually-relevant situations, and be able to explain how they would achieve the desired outcomes should the situation vary from the current state – or at least why they chose to use a certain technique instead of another.

Another aspect of know how is tacit knowledge, a concept attributed to Polanyi (1967, cited in Broad, 2016). Tacit knowledge is defined as something that one can do but is unable to avow (Broad, 2016). Through practice and repeated exposure to certain activities one can develop skills and dispositions, such that when one encounters situations which require the deployment of such skills and abilities one might not be able to explain or justify their chosen technique because they simply know what to do (Broad, 2016).

2.2.4 Transversal abilities and their role in vocational education

Often referred to as transferrable skills, transversal abilities are those activities that cannot be ascribed to one particular skill. The successful manifestation of these activities is dependent on the context in which they are performed, as well as the achievement of the intended goal (Winch, 2013a; 2013b). They do not describe or name a particular action and are usually sustained over a long period. These abilities include communication, planning, coordinating, evaluation, and controlling.

2.2.5 Development of expertise

Polanyi (1967, cited in Guile & Unwin, 2019) defines epistemic ascent as the progress made by a novice as they transition from the periphery of the communities of practice to the centre as they acquire more knowledge and skills. Authors such as Dreyfus & Dreyfus (2004), Ericsson (cited in Aarkrog, 2020), who have studied the development of expertise, have proposed that this development occurs in a linear progression. Ericsson claims that a specific amount of time dedicated to practice will result in a transition from novice to expert. According to Dreyfus and Dreyfus (2004), the different stages of development are characterised by differences in how one works with knowledge when approaching different tasks. They propose that by the time one becomes an expert, one no longer relies on standard rules and procedures, as one has become more intuitive and just knows what to do.

Winch (2013a) argues that epistemic ascent is not linear but occurs in a layered sense. The initial development of skills and acquisition of basic theoretical knowledge form the base for the development of professional judgement, autonomy, and higher-order skills required by most occupations. Professional judgement is reliant on the individual's ability to make and justify assertions as well as to engage in debates about assertions made by others. This requires that one not only possesses a body of propositional and systemic knowledge, but that one possesses inferential abilities, a form of know-how closely related to know-that. Apart from knowing and being able to apply theoretical knowledge, the development of professional judgment also requires a good understanding of situational knowledge.

To describe the types of knowledge found in the TVET sector or that should be taught in this sector, the second part of chapter 2 has identified and described three typologies of workers and the types of knowledge they possess or require in their workplaces. Furthermore, the section has highlighted that the different types of workers are a product of the type of teaching and learning that the workers have been exposed to, as well as the types of knowledge privileged in their type of work. An understanding of these typologies is necessary for understanding knowledge growth within the TVET sector.

2.3 Dimensions of Expertise and Knowledge Construction

A lecturer's understanding of the different conceptions of the dimensions of occupational knowledge has a significant bearing on their pedagogy. As stated, Lucas et al. (2012) propose that vocational pedagogy begins the moment we are clear about the types of knowledge and skills we want to impart, such that all pedagogical decisions are then based on identifying the best approaches teaching to equip students with adequate theoretical and practical knowledge so that, over time, they may progress from being novices to being experts in their fields.

This development of expertise, according to Winch (2017), is dependent on pedagogical actions that manage the different types of knowledge in a way that responds not only to the needs of the subject but to the student's needs as well. Thus, clarity on the different types of knowledge, their relationship, and the impact of this relationship on the development of expertise is crucial to understanding vocational pedagogy. While the development of practical skills and theoretical knowledge follow different paths, both are, to a certain extent, dependent on each other. For example, the successful employment of a skill – which is a form of know how or practical

knowledge – requires that one possess certain propositional knowledge which is manifested in the execution of such a skill.

As previously stated, to design an effective vocational pedagogy the goals of TVET must be clear, and this includes being clear on the types of knowledge and skills that students need to acquire during teaching and learning. This section has identified the types of knowledge and skills that TVET lecturers may strive to impart to students. The next section focuses on how the envisioned learning can be designed and delivered to students remotely through online teaching, especially online remote teaching.

2.4 Online Learning

Technological developments have resulted in the growth of the remote teaching and learning sector. The TVET sector has not been immune to these changes. This section explores the available literature on teaching and learning in the TVET sector using online modalities.

2.4.1 Exploring Online Learning in TVET

UNESCO has proposed that ICT be integrated into TVET delivery (Latchem, 2017), including the offering of teaching and training opportunities using remote modalities. However, a study conducted during the COVID-19 pandemic indicated that less than 12% of the countries surveyed had used remote teaching before the pandemic (International Labour Organization, 2020). Furthermore, only about 50% had used online teaching before the pandemic.

The slow adoption of distance and online learning methods can be attributed to several factors. One of these is the country's socio-economic status (Armored, 2021). In Bangladesh, Raihan and Han (2013) found that though e-learning aimed to extend learning opportunities to everyone, the reality was that infrastructural and social conditions restricted e-learning provisions to those who were financially privileged. This situation is not unique to Bangladesh. In South Africa, the Minister of Higher Education and Training expressed similar sentiments during the lockdown period.

Apart from socio-economic barriers to students accessing online education, there are also infrastructural issues at play that make establishing online learning environments a challenge. E-learning requires lecturers to have access to hardware, such as computers, and software, such as

Learning Management Systems. In South Africa, like other developing countries, poor infrastructure has been found to be one of the reasons that tertiary institutions have been unable to engage fully with e-learning (Franken, 2020). Despite an instruction from the Department of Higher Education and Training (DHET) to the TVET colleges to use information and communication technology (ICT) in the teaching of TVET subjects and to make Open Distance Learning (ODL) opportunities available to students, in 2022 there were still no signs of a strategic plan being developed to achieve this (Aina & Ogegbo, 2022). In a bid to solve issues of connectivity, the DHET commissioned the South African Broadband Education Networks (SABEN), a non-profit organisation company dedicated to providing high-capacity bandwidth to TVET institutions, to connect the TVET colleges to the South African National Research Network (SANReN), a network group that was commissioned by the South African government roll out high-speed network for educational, scientific and research purposes. By the end of 2020, 320 campuses were reported to have been connected to the network (Nzimande, 2020a). Despite improved bandwidth, most colleges still struggled with other barriers, such as loadshedding, a national blackout of electricity, which disrupts internet connectivity (Hugo et al., 2022).

Teaching using online-based modalities requires that lecturers are adequately trained in how to use both the hardware and software associated with virtual environments. The resistance of lecturers in South Africa to using ODL has been linked to a sense of inadequacy on the part of lecturers. According to a study conducted by Hugo et al., (2022) lecturers who had initially been hesitant to adopt e-learning were more willing to try it after they had been properly introduced to the system and its benefits. Aina and Ogegbo (2022) mention a study by Torres and Giddies (2020) that found that most teachers in South Africa not only lacked access to ICT but that most lacked the necessary computer literacy to engage in virtual environments.

Despite these challenges, digitisation is a reality in many workplaces, including teaching and learning institutions (Douse & Uys, 2019). TVET institutions, as sites responsible for the production of work-ready individuals, are therefore faced with the burden of redefining their programmes and the way these programmes are offered, in line with the technological advancements of our time. Weiss (2015, cited in Hartel, 2017) posits that TVET needs to be structured such that more learning is provided through virtual learning environments.

Due to the wide range of teaching media available for teaching online, e-learning offers

synchronous as well as asynchronous learning opportunities. Virtual classrooms enable lecturers to engage with their students in real time. Chat platforms allow students to engage with each other outside of the scheduled meeting times. Keller (2012), a co-founder of Coursera, a massive open online course provider, states that since students work on their platform from different geographical locations, there is almost always someone working on the same module somewhere else, even if one is working at night. Therefore, if a student posts questions or concerns there is always another peer to respond, even if the lecturer is not available. Such platforms encourage peer teaching and learning, allowing students to not only learn from experts in their chosen field but to also co-construct knowledge with other peers.

Different formulations of e-learning offer students varying levels of control over the pacing, sequencing and selection of their studies (Latchem, 2017). Therefore, careful planning of instructional design is necessary for the effective delivery of online teaching and learning. Providers of e-learning need to provide robust ecosystems that not only support learners academically but offer support at the same level as brick-and-mortar institutions (Hodges et al., 2020).

Platforms such as the German Median community offer trade-specific knowledge and skills training (Hartel, 2017). This platform offers online teaching and learning in the field of graphic arts. Students can take interactive multimedia modules with socially augmented realities. This enables students to access learning content directly from their smartphones or tablets at any time, as augmented realities are connected to social networks. Virtual realities and augmented realities give students opportunities to experiment with real-life problems in controlled and monitored environments and apply the skills and knowledge that they have acquired to practical situations.

The effectiveness of these learning experiences depends on careful instructional planning and design. Hodges et al. (2020) estimate that it can take anything between six and nine months to develop an online course. Unfortunately, the move to remote teaching during the pandemic did not afford institutions the time necessary for the development of robust online ecosystems. Lecturers had to suddenly migrate from offering learning experiences face-to-face to providing instructions through online or other remote modalities.

This section has highlighted that despite global recommendations for integrating ICT into TVET, many countries, especially those with socio-economic and infrastructural challenges such as

South Africa, have struggled to adopt online teaching and incorporate ICT into the TVET sphere effectively. What has also been evidenced is that effective online TVET delivery requires well-designed virtual ecosystems, adequate lecturer training, and time for proper instructional planning, which was lacking in emergency responses. Describing the current state of online learning in TVET creates a contextual base for thinking about and talking about teaching and learning during the pandemic.

2.5 Emergency Remote Teaching (ERT) During Crises

The effectiveness of online learning is largely dependent on careful instructional and programme design. The adoption of remote learning modalities in response to the COVID-19 pandemic was a rapid reaction to the closure of TVET colleges to mitigate the spread of the virus. Lecturers across the world had to quickly adapt their approaches to content delivery from face-to-face modalities to approaches that could be delivered remotely, quickly and to as many students as possible. Remote learning modalities became a panacea, as governments encouraged educators at all levels to make use of digital technologies to ensure that learning continued during the crisis. Due to the speed at which educators had to adapt to the new methods of teaching, the majority were ill-prepared for the demands of these new modalities. Research documents that most educators felt inadequately prepared, and that they did not receive adequate support from their superiors (Aina & Ogegbo, 2022; Masina & Mawonedzo, 2022). Adequate support and support structures are some of the requirements.

Traditionally, online learning programmes go through an extensive development process, educators are then trained to use the programmes and are given support by established ICT professionals if and when the need arises. Moore and Hodges (2023) argue that teaching and learning that took place using the Internet during the COVID-19 pandemic should not be referred to as online learning, because it didn’t follow this process; rather, it should be called ‘emergency remote teaching’. A term pioneered by Hodges et al. (2020), ERT refers to the temporary measures taken to maintain teaching and learning created in response to a crisis. Content created for face-to-face teaching is repackaged and delivered remotely via print media or e-learning.

In crises, education systems are usually compromised, and educational institutions may look to remote learning modalities to ensure continued teaching. While the term emergency remote teaching only became official in 2020 to distinguish it from online learning, in the past

educational institutions have had to respond to crises such as wars, environmental crisis such as earthquakes and floods, disease epidemics such as N1H1, and even social unrest (Cauchemez et al., 2009; Stern et al., 2009; Barbour et al., 2020). The COVID-19 pandemic is said to have had the greatest recorded effect, affecting over 1 billion students worldwide (Pokhrel & Chhetri, 2021). Initially, national governments set up task force teams to evaluate the readiness of their educational sectors to provide remote teaching. These teams developed ERT measures relevant to their countries' conditions. The World Bank suggested that these strategies be developed with three objectives in mind. First, ERT policies should be aimed at limiting learning losses as well as managing the continuation of teaching and learning. Second, they should create programmes and schedules for recovery when schools reopen. Finally, they should serve as learning experiences, so that institutions will be better prepared for similar positions in the future.

Countries across the globe responded differently to the demands imposed by the virus. While some countries opted to keep their educational institutions open (Lindblad et al., 2021), most countries implemented either fully remote learning or blended remote learning with a limited amount of face-to-face engagement. The South African government imposed a strict lockdown, forcing the education sector to resort to fully remote teaching strategies. The initial lockdown was scheduled to last 21 days, with the possibility of extension depending on the infection rate. The Department of Higher Education and Training planned for two possible trajectories: the phased-out return to physical classrooms as well the possibility of an extended period of remote teaching. According to the minister of higher education, science and innovation, the first cohort of TVET students returned to campuses on the 10th of June 2020, while the last group returned on the 26th of August, 2020 (Nzimanande, 2020). This highlights the temporality of the situation and, also, the uncertainty and constant change that are associated with ERT.

Issues relating to access are frequently encountered with ERT, for both printed media as well as digital or online learning. In South Africa, institutions took advantage of all the modalities offered by remote learning, ranging from printed teaching materials to TV and radio broadcasts, to synchronous as well as asynchronous online learning. In an article detailing the numerous approaches adopted by lecturers during the lockdown nationwide, Anthony Jnr and Noel (Anthony Jnr & Noel, 2021) note that in some cases lecturers requested students to join a course through massive open online courses. Upon completion of this course, students were granted credits towards their learning course. Drawing from a list of free educational platforms provided by UNESCO, lecturers employed the use of channels such as YouTube and Khan Academy.

While some lecturers relied on readily available materials, others created their own custom materials such as recorded video lessons.

In South Africa, the Department of Higher Education and Training, Science and Innovation responded to the demands of the pandemic by creating a remote teaching plan centred mostly on textbook-based learning and the provision of previous assessment papers, as it estimated that only about 60% of the students would be able to access online learning opportunities, even though some were offered over zero-rated websites. As part of its online ERT strategy, the Department made available e-guides and support through its National Open Learning System (NOLS) platform (PMG, 2020). TVET colleges were mandated to provide video lectures to supplement the study guides. Lecturers from different colleges were recorded delivering lecturers in both classrooms and workshops. These videos were posted on several platforms, including YouTube (Nzimande, 2020b).

Pre-recorded videos offer students asynchronous learning opportunities. Lecturers have control over the content, sequencing and pacing while creating the video. They also control the use of teaching materials, enabling them to incorporate more visually engaging materials (Lim et al., 2022). Pre-recorded videos offer students numerous benefits including access to individualised support from lecturers through contact made via email or other learning support forums. In the TVET videos posted on YouTube, most lecturers provided students with their email addresses, encouraging them to make contact should they need help. The platform itself, through its comment prompt, makes it possible for students to engage with each other.

In summary, this section has described how, before the advent of technology, the education sector responded to crises to sustain teaching and learning despite the circumstances. It further clarified how technology has opened more opportunities for remote teaching and learning, however, these avenues are not devoid of challenges. A specific description of how South Africa responded to the demands placed on the education sector by the prevalence of COVID-19 was provided. This clarifies the context in which the analysed videos were recorded.

2.5.1 YouTube as a pedagogic tool in TVET

There is a corpus of research on the use of YouTube as a pedagogical tool, which explores the types and characteristics of YouTube videos (Arkenback, 2023), and students' perceptions of YouTube videos for academic purposes (Koc & Yucel, 2022). However, research on the

effectiveness of these videos is scarce. The available literature indicates that YouTube has been used in the teaching of medical subjects, language skills, cooking, and other technical and vocational subjects.

While there is a shortage of data on the effectiveness of using YouTube videos, recent studies indicate that the incorporation of YouTube into teaching could be beneficial to students as they are learner-centred, allowing learners to study independently at their own pace (Aboc, 2024; Arkenback, 2023). Sagbas and Koc (2021) found that students valued using YouTube videos as they could watch them repeatedly. Odongo et al. (2017) found that engineering students reported that YouTube complemented what they learned in the classroom, and helped them to understand better how to perform machine operations, and to operate computers programs and use certain software. They underscored the value of YouTube in teaching and learning as it supports students with low literacy skills.

Studying the use of YouTube videos in the training of retail students, Arkenback (2023) found that there are three types of instructional videos available on YouTube: tutorial videos, skills training videos, and blended learning videos offered by training institutions. He posits that the features of YouTube align with the policies of TVET institutions in Australia as they promote collaborative learning. Similar sentiments are expressed in Odongo et al., (2017), who state that YouTube creates a platform where students and lecturers can “discover and share educational content” (p. 111) relevant to their course.

Arkenback (2023) found that the teaching methods that were prevalent in YouTube videos included role play, persuasion, giving instruction, and modelling of the desired actions, attitudes, and values. This encouraged students to learn by observing a model approach and allowed them to take notes when instructions were given or follow the directions given in the videos. Curran et al., (2020) indicate that in the teaching of medical skills YouTube videos allows students to be exposed to a broad range of context, which supports their clinical experience as it allows them to observe a procedure performed in different ways, something that is not always possible with in-person clinical rounds.

Although there are numerous perceived benefits to using YouTube for teaching technical and vocational subjects, there are also some challenges associated with it. While YouTube is easily accessible anywhere and anytime, access is dependent on the availability of network connectivity

and the availability of other supporting elements such as electricity and finances for data. Furthermore, as anyone can post on the platform, it is not possible to verify the accuracy and trustworthiness of the videos shared (Akakpo & Akakpo, 2024). Thus, when students use videos that have not been vetted by their lecturers or institutions, there is a possibility the information will be incorrect.

In this review of the literature, most of the research conducted on the use of instructional videos for skills development was undertaken within the medical sphere, and I could not locate any research undertaken in South Africa. Odongo et al. (2017) posit that there is a shortage of instructional videos produced in Africa, as most of them are produced in the West. Despite the lack of evidence that TVET lecturers in the South African context had incorporated YouTube videos as part of their pedagogical toolkit prior to the Covid-19 pandemic, the pandemic resulted in the dissemination of YouTube instructional videos across the different TVET colleges.

This review of the literature on the use of YouTube revealed that the use of YouTube videos to teach technical and vocational subjects did not begin as a response to the pedagogical demands of the COVID-19 pandemic. The teaching methods observed in the previously existing corpus of videos resemble those observed in lecture rooms, and there is an indication that these videos add value to the teaching and learning of vocational subjects.

The next section discusses the emergency remote teaching modalities that TVET lecturers drew upon during these unparalleled times.

2.6 Legitimation Code Theory (LCT) in Vocational Education

Debates in the TVET sector have largely centred around knowledge: the types of knowledge, the best pedagogies for teaching different types of knowledge, and even the best sites for acquiring different types of knowledge. However, little attention has been given to the relationships between the different types of knowledge (Maton, 2013). Overlooking these relationships may have a negative impact on the preparation of students for the world of work, because there is a risk that the different knowledge types will be engaged as separate and unrelated entities, or students may fail to link knowledge learned from the different learning sites. This segmented learning may result in situations similar to those discussed by Winch (2013b), where one might be able to explain how to perform a task and might even be able to demonstrate the task in a

controlled environment but will not be able to do so in other contexts. Lecturers in the TVET sphere are therefore burdened with the task of reconciling the knowledge related to specific repetitive tasks with general occupational goals to prepare their students to be able to enter their occupations as individuals capable of contributing to discussion and debate around the development of the occupation (Locke & Maton, 2019, Winch, 2013a). Maton (2013) proposes that the challenges of fragmented knowledge can be overcome by using Legitimation Code Theory to plan and shape pedagogical practices.

2.6.1 Semantic Dimensions: Analysing Knowledge and Pedagogy

Legitimation Code Theory is a socio-realist-based framework that can be used to analyse and shape practice in any pedagogic instance. Social realism views knowledge as socially constructed (Maton, 2014). Accordingly, research aligned with this paradigm seeks to explore the underlying principles of knowledge and how these change in different contexts over time as well as the effects of these changes (Maton, 2014). LCT offers numerous dimensions for analysing and shaping practice, one of which is semantic coding. Semantic coding allows one to study the extent to which knowledge is dependent on its context (semantic gravity) as well as the degree to which meaning is imbued by a word, sentence, phrase or paragraph (semantic density). Semantic gravity and semantic density exist in different degrees, and may vary between weak and strong strengths. As pedagogical episodes unfold, the different patterns formed by the variations in semantic gravity and semantic gravity affects knowledge growth and accumulation. In the TVET sphere, studying knowledge using semantic codes allows us to investigate not only the underlying knowledge principles but also the relationship between theory and practice.

Numerous studies have been conducted across different educational sectors that look at the teaching of different subjects using either semantics gravity and semantics density, or both. A study by Jackson (2016) on South African English teachers highlighted the value of using LCT in research, as she indicated that using LCT allowed her to uncover differences between lessons with similar classification and framing profiles. Her study revealed two approaches to knowledge. One approach seemed to take students through varying degrees of semantic density and semantic gravity. Hugo (2015) details how movement from low to high, or high to low, semantic gravity and semantic density can be achieved through condensation and abstraction, which allow students to construct knowledge from everyday contexts as well as from experts. Abstraction and condensation will be discussed in depth in Chapter 3.

Maintaining a constant level of semantic gravity and semantic density, whether high or low, deprives students of gaining access to worthwhile knowledge, as low-flatlines only equip students with context-dependent knowledge that they cannot use in novel situations. Whereas high-flatlines present students with abstract knowledge that is beyond their comprehension level Investigating the effect of the strength of semantic gravity in problem-based teaching, Hassan (2020) found that most of his students struggled with applying learnt concepts to their work environment as the teaching programme was based on a medical case study although the students were not studying medicine (thus, high semantic gravity). Similarly, Georgiou et al. (2014) found students were unable to respond to a context-based scenario after they were taught abstract concepts in their physics lessons, suggesting that students need to be exposed to a certain degree of context-dependent knowledge before learning abstract concepts. Both studies illuminate the dangers of either limiting pedagogical approaches to context-based experiences or teaching of abstract ideas with no relevance to context. In both instances, students are excluded from constructing the powerful knowledge that is required for knowledge accumulation and knowledge transfer.

Research using LCT has also revealed instances where knowledge is separated into numerous chunks, which are unpacked individually without any links being made (Maton, 2013). Investigating the teaching practices of law lecturers, Clarence (2017) reported that one lecturer identified a gap between what students were saying in the classroom and what they wrote during assessments. Clarence alludes that this knowledge gap can be attributed to the lecturer's teaching style which resembles broken escalators. Describing the lecturer's pedagogy, Clarence (2014) states that lecturer introduced and explained legal terms and immediately moved on to the next term, giving students the idea that these concepts or practices can be learned "as a list or a chunk of content to be memorised" (p.127)

There are many more studies that have engaged with Legitimation Code Theory, all of which point to the same conclusion- fragmented teaching that presents new knowledge to students without integrating it with prior knowledge impedes the accumulation of knowledge (Maton, 2013). Such teaching practices lead to segmented learning, where new skills and knowledge are learned as separate ideas, rather than in a progressive or accumulative manner. Some practitioners have applied these findings practically in their workspaces. Hassan (2020) attempted to create a learning experience that would take students from context-based, problem-based learning to deriving general rules applicable across a wide variety of contexts. In this

study, Hassan used a medical model for problem-based learning to train 10 teaching development programme alumni. The study failed to create a wave-like patterned lesson appropriate for the students as it was contextualised for the medical field. This highlights another value that Legitimation Code Theory brings to the study of knowledge because research in education is often context-dependent and cannot be fairly compared or applied across different situations. The use of a translation device in Legitimation Code Theory allows for the establishment of a standard evaluation tool or set of criteria that can be applied in different contexts.

Blackie (2014) used Legitimation Code Theory to structure chemistry lessons. Based on the view that chemistry is an abstract subject, Blackie set out to showcase how chemistry teachers could present these abstract concepts using specific or context-bound examples to help students better understand the concepts. Blackie describes the methods used to strengthen and weaken semantic gravity and semantic density, and also describes how applying the principles of Legitimation Code Theory allowed him to pace and sequence his teaching differently, enabling better learning and understanding amongst his students.

The last part of the literature review has detailed numerous research projects that have used the Legitimation Code Theory (Maton, 2009) to analyse pedagogy and knowledge building. By examining how this framework has been applied in analysing knowledge growth, the review provides insight into its relevance for understanding vocational pedagogies. These studies also offer methodological and analytical guidance while positioning the current research within an established body of scholarly work.

2.7 Gaps in Research

While numerous research endeavours stemmed during the pandemic, many were focused on the experiences of both lecturers and students, gathering their views and opinions and documenting the challenges they experienced. Others investigated systematic structures, looking at access and the infrastructural factors that either enabled or hindered teaching and learning during this period or reviewed available methods of remote teaching and learning and how institutions employed ICT to facilitate teaching during this period. There is a shortage of data on how pedagogies were adapted during this period or studies that focused on the effectiveness of these emergent pedagogies on learn. This research fills this gap in the literature by analysing the pedagogies of

TVET lecturers during the pandemic, as they were captured in online videos.

This review has also highlighted the scarcity of literature on the effectiveness of vocational pedagogies with a specific focus on knowledge growth and epistemic ascent. Available literature on vocational pedagogy reports on studies that focused on either a specific subject or occupations.

2.8 Chapter Summary

This chapter has explored the concept of vocational pedagogy. It discussed what is technical and vocational about TVET that mandates a unique pedagogical approach, different from that used in general education. Vocational pedagogy can be defined as the sum total of the choices made by TVET lecturers to provide students with the learning opportunities that they require to gain working competence. This chapter discussed the most effective ways in which vocational skills and knowledge are learnt. As this study focused on the pedagogies employed by TVET lecturers as part of the emergency remote teaching response to the 2020 COVID-19 pandemic, this chapter also explored literature on online teaching and learning and the emergency remote teaching models that were adopted by the TVET sector locally and internationally. included literature on the use of YouTube videos in the teaching of TVET subjects, which highlighted that YouTube videos can serve as an effective pedagogical tool, yielding affordances that otherwise cannot be attained using traditional teaching tools. This chapter concluded by exploring research on TVET and other educational settings using the Legitimation Code Theory (Maton, 2009). The following chapter will describe the theoretical framework that was adopted to frame this study.

CHAPTER 3: THEORETICAL FRAMEWORK

3.1 Introduction

The previous chapter detailed the research that has been undertaken in the field of vocational pedagogy, remote learning. and knowledge building using Legitimation Code Theory (Maton, 2009) as a governing principle. This chapter will explore how the vocational pedagogy dashboard (Hugo & Louton, 2020) and the semantics dimension of Legitimation Code Theory (Maton, 2013) were used as an explanatory and analytic framework. The need for a robust and explicit vocational pedagogy cannot be overstated, and describing and making explicit the current practices establish a platform on which the development of such a pedagogy can be used. The analytical tools used as the theoretical framework are underpinned by Lucas et al. theory of vocational pedagogy (Lucas et al., 2012) and Maton's (2009) legitimation code theory, respectively. This chapter describes the theories that have contributed to the development of the theory of vocational pedagogy (Lucas et al., 2012) and the Legitimation Code Theory (Maton, 2009) and how these theories impacted the current study.

3.2 Vocational Pedagogy

This section discusses the learning theories associated with TVET and the concept of signature pedagogies (Shulman, 2005) and their relevance to the theory of vocational pedagogy (Lucas et al., 2012). This is followed by a discussion of Hugo & Louton (2020) conceptualisation of vocational pedagogy as expressed in the vocational pedagogy dashboard.

3.2.1 Learning Theories and their Relevance to Technical Vocational Education and Training

Learning theories use what is known about the nature of learning to influence the type of educational activities and pedagogies that are designed and prescribed. While numerous theories have been proposed for teaching in the TVET sector, three theories seem to have had the most significant impact, namely: behavioural, cognitive and constructivist theory.

Behavioural theories advocate for practical hands-on learning, proposing that students learn from performing tasks in the presence of someone who can offer guidance and correction. Students learn in situ. Chappell (2003) identifies instructional cues, demonstrations, practice,

reinforcement, and feedback as pedagogic cornerstones when working with behavioural theory. According to Lum (2004), capabilities are developed and reinforced as students are constantly allowed to practice. Sharing similar sentiments, Billett (2016) notes that students acquire new skills and abilities when exposed to novel experiences. Gamble (2001) states that in such teaching spaces, there is no clear separation of “thought and action”, as craft knowledge is difficult to teach through explicit instructions. Ryle claims that it's not just the exposure to these activities repeatedly that results in learning but rather students learn and develop expertise by making informed decisions in both new and old situations (1945, cited in Winch, 2009).

Cognitive theorists claim that students learn how to act by learning certain propositions about how to act. Therefore, learning is the accumulation of declarative knowledge that students can draw on during task performance. Expertise is defined as one’s ability to apply their theoretical knowledge to perform specific tasks (Lum, 2004). Learning is thus the growth in declarative knowledge that one possesses: the more rules and procedures one knows and can declare, the better able one is assumed to be (Lum, 2004). Thus, teaching involves lecturing, with students taking notes, responding to lecturer questions and proposing the best possible solutions to problems (Chappelll, 2003). The underlying presumption is that action can be reduced to propositions and if students can describe how to perform certain acts, then they can perform those acts (Winch, 2009). Furthermore, learning is described as a mental activity rather than the training of the body; however, when someone has successfully learned, they can apply what they have learned physically. Thus learning, while intellectual, can be assessed both through performance and through the avowal of proposition (Hager, 2012).

Both these theories have been criticised for viewing students as passive participants, where learning is something that happens to them (Chappelll, 2003).

In contrast, constructivism states that students construct knowledge as they interact with meaningful experiences; thus, learning is self-directed (Cedefop – European Centre for the Development of Vocational Training, 2015). This shifts the lecturer's role from didactic to that of a facilitator in the learning experience: instead of telling students what is, lecturers construct experiences and help students to make meaning of these experiences. Teaching methods that centre around problem-solving are proposed as the best methods as students can draw on all their experiences.

Lecturers' beliefs about how best students learn influence the types of teaching strategies they employ. However, Shulman (2005) theorises that in the teaching of vocational subjects, pedagogical decisions are based on the vocation for which the student is being trained. Shulman (2005) posits a theory of 'signature' pedagogies.

3.2.2 Signature Pedagogies

Blom (2016) argues that TVET colleges are sites for the creation of "occupational identities," thus producing the type of workers that are already in existence in a particular occupation or trade. According to Shulman (2005), this reproduction is a result of a certain type of pedagogy, employed in the training of novices by an expert, which is specifically aimed at teaching the novice about the important aspects of their jobs. Shulman (2005) calls this a 'signature' pedagogy, stating that through this form of teaching novices are taught how to act, perform, and think as required in their profession, with different profession emphasising different dimensions (Shulman, 2005). It is easy to identify these pedagogies as they differ from profession to profession, but also because they share similar features across professions. Signature pedagogies are similar in that they are pervasive and routine in nature to create certain habits thus making day-to-day engagements simple (Shulman, 2005). They also require students to physically perform their duties as required in their professions, thus facilitating active learning.

Signature pedagogies have a surface structure, a deep structure, and an implicit structure (Shulman, 2005). The surface structure refers to the physical acts of teaching the methodologies chosen by the lecturer as the most appropriate. The deep structure refers to established or generally accepted modes of transmitting certain types of knowledge to students. These are assumed to be the best methods of teaching students how to think and act like professionals in their field. The implicit structure refers to the beliefs about professional attitudes and values (Shulman, 2005).

Both the learning theories and signature pedagogies derive their relevance to this study from their relevance to the theory of vocational pedagogy (Lucas, 2014; Lucas et al., 2012). Both these theories conceptualise knowledge types against pedagogical actions, as such by looking at the pedagogical decisions, we can infer the types of knowledge foregrounded by the lecturers. While learning theories reveal the knowledge types, signature pedagogies reveal how and why there may be differences in how the knowledge is taught across the faculties.

While learning theories and signature pedagogies offer a broad understanding of the relationship between knowledge types and pedagogical actions, Lucas et al. (2012) theory on vocational pedagogy offers a more focused view, relating the knowledge types to not only the teaching methods but to the end goal or objectives of vocational education and training. It also categories subjects within the TVET sector into groups making it easier to analyse and compare how different types of knowledge are taught. Thus, the theory of vocational pedagogy enhances our understanding of the types of knowledge taught in TVET sector. But it also enhances our understanding of the pedagogic patterns that emerge from the decision made by TVET lecturers by offering a decision-making tool.

3.2.3 Theory of Vocational Pedagogy by Lucas et al. (2014)

The theory of vocational pedagogy is a theoretical framework developed by Lucas et al. (2014) to facilitate the process of designing a vocational pedagogy. This theoretical framework is beneficial for analysing and making sense of the pedagogical actions of TVET lecturers. In this theory, vocational pedagogy is conceptualised as a series of decision-making processes, which ensue when the goals of TVET have been clearly defined (Lucas, 2014; Lucas et al., 2012). They posit that TVET is geared towards the attainment of six broad outcomes, while simultaneously equipping the students with the competencies required for work.

*3.2.3.1 **Technical Vocational Education and Training Outcomes***

Lucas et al. (2012) contends that TVET should not focus on the teaching of skills and work-specific competencies only, but that it should incorporate a range of other capabilities which are necessary for the world of work. They propose six capabilities that TVET should strive to attain. The best vocational pedagogies ensure that all the outcomes are achieved, with the correct emphasis, as they apply to the specific occupation.

a) Routine expertise

   Routine expertise refers to day-to-day activities that are skilful in nature, learned through practice, and are necessary for the execution of work duties (Lucas, 2014). These include everyday procedures that entail working with materials, tools, or symbols. The teaching of skills usually involves explaining, demonstrating, and giving students opportunities to

practise, which is accompanied by guidance and feedback (Lucas et al., 2012).

b) Resourcefulness

Resourcefulness is the ability to apply learned skills and knowledge to novel situations to bring about desired outcomes. Students should be encouraged to use their knowledge in contexts which are not closely resembling the contexts in which they are taught (Lucas, 2014). Even if the knowledge and skills necessary in the moment are not usually employed by the students in the completion of daily tasks, students should be able to retrieve and manipulate them to solve problems as they arise (Lucas et al., 2012). Resourcefulness can be taught through the provision of a wide range of contexts for practice, affording students opportunities to problem solve, engage in simulation activities and role -playing (Lucas et al., 2012).

c) Craftsmanship

Craftmanship is about “the pleasure, pride, and patience involved in doing a good job” (Lucas, 2014, p. 11). Lecturers need to model excellence, encourage students to pursue excellence, and actively coach them in the process.

d) Functional literacies

Functional literacies cluster together the literacy skills of literacy, numeracy, and ICT as well as general communication and comprehension skills required in the workplace. While these are generally acquired before the end of grade 9, older students benefit from repeated, guided practice (Lucas et al., 2012) .

e) Business-like attitudes

While not all vocational occupations are for profit, students need to be trained to conduct themselves in efficient ways. These attitudes need to be demonstrated and modelled for students (Lucas, 2014; Lucas et al., 2012).

f) Wider skills for growth

Wider skills for growth include skills such as problem-solving, ability to work in a team, resilience and entrepreneurship skills (Lucas et al., 2012). Clear goals are just one aspect

underpinning vocational pedagogy as theorised by Lucas et al., (2012). They propose that an understanding of signature pedagogies is important for vocational pedagogy design. They state that the best way to develop a pedagogy that can serve the specific needs of the TVET sector is to begin with the end in mind: that is, to conceive the different occupations taught in TVET based on the nature of work for each occupation.

*3.2.3.2 **Nature of TVET subjects***

They posit that TVET subjects can be categorised into three categories based "on the medium through which work is expressed"(Lucas et al., 2014, p. 11). The identified mediums are people, physical materials, and symbols. 'People' subjects prepare students for working within the service sector. These occupations involve working and interacting with others to a great extent. Examples include jobs in the hospitality and retail industry, childcare, and counselling. Subjects in the 'physical materials' group are geared towards occupations that involve working with physical materials such as plumbing, carpentry, and fitting and turning. Subjects in the 'symbols' group prepare students for working with numbers, coding, words, and graphic design. Examples include journalism, games development, and accountancy. Lucas et al. (2012) propose that these categories work similarly to signature pedagogies and provide us with a theoretical underpinning for determining the best learning methods for each category. Based on the nature of the subject, we can infer the best ways for preparing students for the specific occupations they are training for. All occupations entail working with all three mediums, but they do so to varying degrees. As such, lecturers should ensure that all categories are catered for. They argue that the best vocational pedagogy links the vocational outcomes, the nature of the subject, and the learning methods.

*3.2.3.3 **Relationship between the nature of the TVET subject, TVET outcomes, and learning method***

Lucas et al. (2014) hypothesises that there are learning methods that are better suited for achieving each of the TVET outcomes and that TVET lecturers need to consider a plethora of teaching methods in order to select one that is suitable for the vocational outcomes and the nature of the subject that they are teaching. They propose that learning in TVET occurs using several methods that can be organised into three broad modes, namely: learning *on*, learning *through*, and learning *by* (Lucas et al., 2014). These categories are presented in Table 1.

They propose that lecturers can employ any of these methods for any of the TVET outcomes but good vocational pedagogic design occurs when the chosen methods align with both the vocational outcome and the nature of the subject (Lucas et al., 2012). Based on this, Lucas et al. (2012) suggests the best learning methods for each TVET outcome and each subject nature. For the TVET outcomes, they propose that functional literacy, craftsmanship, business-like attitudes, and wider skills for growth do not have specific learning methods, but any method chosen should be specific to the intended occupation. The table below summarises the methods for the other three outcomes.

Table 2: Learning methods associated with routine expertise and resourcefulness (Lucas et al., 2014, p 87)

Routine expertise	**Resourcefulness**
Methods include watching, imitating, practising, conversations, feedback, and virtual environments	Methods should be vocation-specific feedback, simulations and role play, enquiry, real-world problem solving

The following table summarises the learning methods proposed based on the nature of the subjects.

Table 3 The nature of the TVET subjects and their corresponding learning methods (Lucas et al., 2014, p. 86)

People	**Symbols**	**Physical materials**
watching, imitating, virtual environments, simulations and role-playing	games, virtual environments	watching, imitating, teaching others, drafting and sketching, being coached

While decisions about the most appropriate methods should be centred on this theoretical conception, contextual factors should also be foregrounded. TVET institutions vary based on the types of students being taught, available resources, and the actual teaching site – which can be the workshop or the lecturer rooms. These factors are conceptualised as the last group of factors that lecturers need to consider when making decisions about vocational pedagogy (Lucas et al., 2014). To assist in this decision-making process, they developed a ten-point decision-making dashboard, shown in Figure 1.

Figure 1 Ten-point decision-making toolkit (Lucas et al., 2014, p.109)

For each decision, the choices lie on a continuum and are useful for designing the everyday actions of lecturers. While vocational pedagogy theory (Lucas, 2014) provides an extensive framework for developing a vocational pedagogy, Mokoena (2017) raises a concern that this framework fails to consider the role of knowledge and the relationship between the different types of knowledge.

3.2.4 Hugo and Louton's Vocational Pedagogy Dashboard

Hugo and Louton's (2020) vocational pedagogy dashboard draws on Lucas et al. (2014) and builds on Hugo's earlier work on educational analysis (Hugo, 2013). According to Hugo and Louton (2020), vocational pedagogy can be conceived as a four-step decision-making process, with each step consisting of a set of variables that are combined to create a unique teaching and learning experience geared towards the attainment of working competence.

According to Hugo and Louton (2020), vocational pedagogy begins with the lecturer making decisions about the aims and objectives of TVET. TVET is directed at attaining the goals of three main stakeholders, namely: the students, the industry, and society. While students seek job security and dignified, meaningful and fulfilling work, industry seeks innovative workers who

can get the job done and possess leadership skills. Society seeks transformation, and a workforce that can provide solutions to societal problems.

The next step in the decision-making process is to identify the contextual factors that challenge or enable the enactment of certain teaching methods. This means considering factors that may relate to students, lecturers, industry, colleges, and society. Lecturers need to consider things like students' ages, experiences and abilities, resource availability at the college level and other factors, and how these enable or hinder certain pedagogical experiences.

Hugo and Louton (2020) proposes that the third step in designing a vocational pedagogy is to decide what to teach: the curriculum. The curriculum is conceived as a two-dimensional concept entailing the official curriculum and curriculum management choices (Hugo & Louton, 2020). The official curriculum stipulates the aims and goals relating to student competencies – specifically, the skills, knowledge, attitudes, and values (Hugo & Louton, 2020). These decisions are remote to the lecturers, in that the lecturer has no control over what is stipulated; however, the lecturers need to decide how best to manage the curriculum to ensure that the official curriculum is enacted. Hugo (2014) draws on his conceptualisation of curriculum variables to list six choices lecturers must make regarding curriculum management. These are:

- Content selection
- Connection between topics
- Connection between courses
- Sequencing of learning
- Pacing
- Assessments

The current research focused on pacing, sequencing and selection as these had a direct impact on how the lessons unfolded.

Selection: Open vs Solid Selection

Solid selection means working with only pre-determined concepts: the lecturer sticks to what they have selected for the duration of the lesson (Hugo & Louton, 2020). Open selection considers the context, and the lecturers may introduce other related concepts which come up during the lesson. Even though the lecturer had not prepared to cover those concepts, during the

lesson the lecturer may choose to divergent and include those topics or concepts into the lesson, because they seem relevant and necessary to convey the chosen topic.

Sequencing: Open vs Solid Sequencing

When sequencing is open, the lecturer allows for the ordering of classroom activities to be determined by the students and other contextual factors. In cases of solid sequencing, the lecturer predetermines the ordering of tasks: everything is done in a set sequence with a clear beginning and end (Hugo & Louton, 2020).

Pacing: Open vs Solid Pacing

Pacing has to do with how much time is dedicated to the teaching of a specific topic. An open state means that the lecturers choose to move at the pace of their context, whereas a solid state indicates rigid timeframes: when the allocated time is finished, the lecturer moves on to the next task (Hugo & Louton, 2020).

In his theorisation of educational analysis, Hugo (2014) describes two other states that can be used to describe pacing. While he did not include these concepts in the theorisation of the vocational pedagogy dashboard (Hugo & Louton, 2020), they were significant for this study due to the time constraints that lecturers were facing during the pandemic. The two concepts are complexity and content amount. Content amount refers to the number of topics covered within the broader objectives, whereas complexity refers to the intricate links between ideas or steps when problem-solving. Hugo (2014) states that complexity is based on the relationship that concepts have with previously taught concepts, and the more related they are the heavier, or the more complex, the lesson is. Lecturers can thus work to cover as many concepts as possible as quickly as possible or work through them very slowly, making little progress. On the other hand, the lecturer may choose to cover fewer concepts and, instead of introducing new ideas, build up the complexity of one idea. Thus, ideas are repeated but with each repetition there is something new or something a little different. Thus, it seems like lecturers are moving at a slower pace relative to the one who tries to cover many different concepts as quickly as possible.

When the lecturer has made decisions about how best to manage the curriculum, the next step is for them to determine their teaching approach. Teachers need to be clear about their views on teaching, learning and knowledge, and how they believe learning occurs (Hugo & Louton, 2020).

In this step, lecturers respond to three questions about their views on three ideas, namely, their views on knowledge, their role as lecturers and the role of their students.

- knowledge: Is knowledge to be transferred to learners or is knowledge constructed through learning experiences?
- Role of lecturers: Do they view themselves as an authority figure, the main sources of knowledge, or do they view themselves as facilitators in the process of knowledge building?
- Role of students: Are students passive consumers of knowledge or are they active agents in the learning process?

According to the vocational pedagogy dashboard, in the next step of designing a vocational pedagogy, the lecturers need to make choices about their teaching methods (Hugo & Louton, 2020). While Lucas et al. (2014) conceptualised that an effective vocational pedagogy employs specific learning methods based on their ability to achieve the desired TVET outcomes and their applicability to the nature of the subject, the vocational pedagogy dashboard aligns these learning methods to the most appropriate teaching methods. The table below links the learning methods to teaching methods.

Table 4 Learning methods matched with the proposed teaching method (Hugo & Louton, 2020)

Learning methods	**Teaching methods**
Imitating Watching	Demonstrating
Generalizing Practising	Coaching
Listening	Lecturing
Participating	Instructing
Problem-solving	Facilitating
Exploring	Advising

Hugo and Louton (2020) proposes that, in the final step, the lecturers make decisions about the practical aspects of their teaching. Decisions need to be made about

- Means of knowing: Will the lesson be a theoretical lesson or a practical lesson?
- Prior knowledge: Will the lecturer engage previously learnt concepts or will the lesson

only focus on the new concepts?

- Nature of tasks: Will the tasks be real-world activities or not?
- Visibility of the process: How visible are the learning tasks?
- Use of space: Where will the lesson take place; will it be a lecture room or a workshop?
- Approach to task: Weill learning consists of individual tasks or tasks that can be done in groups?

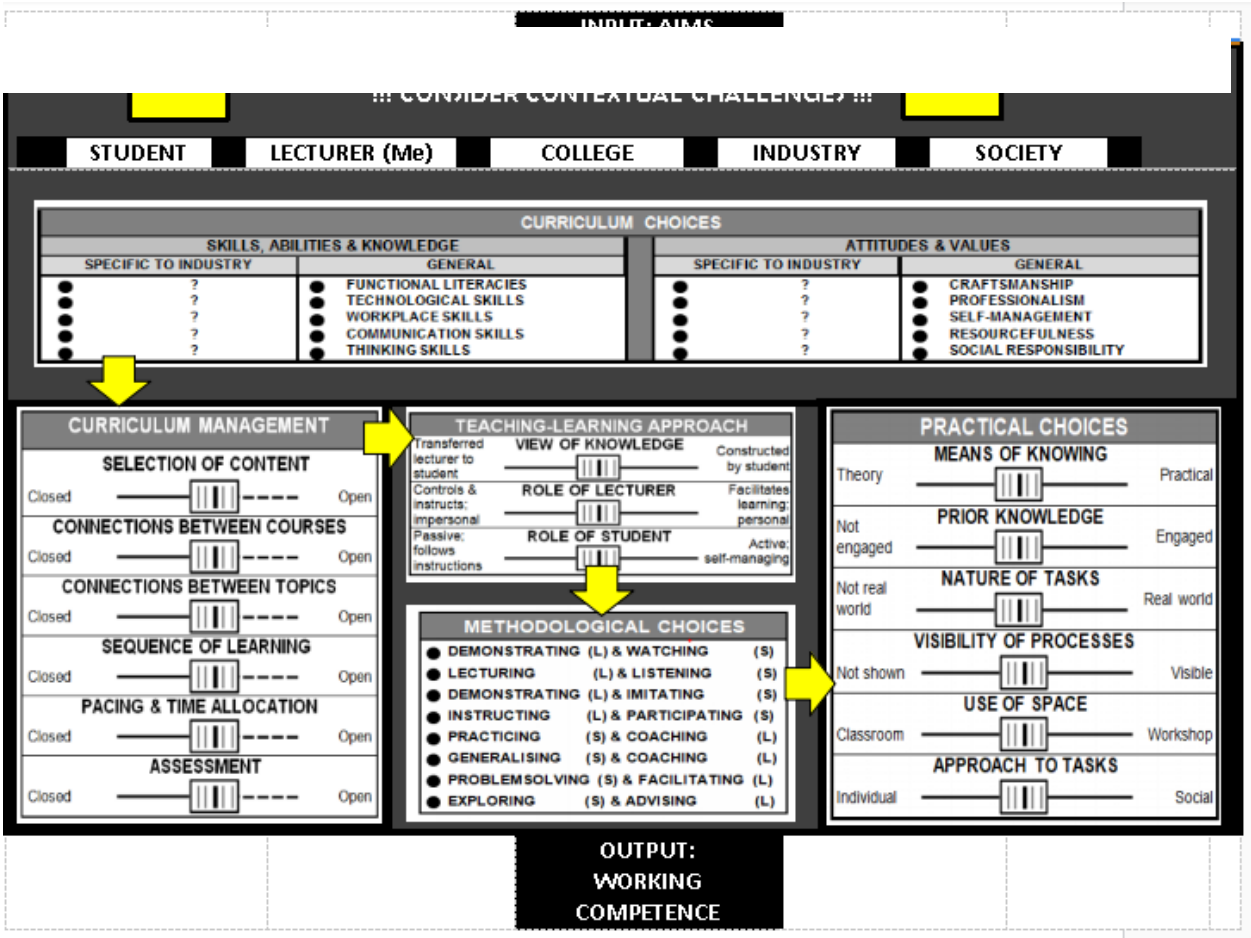

Figure 2 shows the dashboard that demonstrates the step-by-step process of designing a vocational pedagogy (Hugo & Louton, 2020).

3.3 Legitimation Code Theory

To respond to the second and third question regarding the pedagogic patterns and their potential impact on knowledge growth, we relied Legitimation Code Theory (Maton, 2009). LCT is a socio-realist framework for analysing social practices. The framework has been used in

numerous studies to analyse the pedagogic practices of educators in disciplines as diverse as law (Clarence, 2013), music and science (Blackie, 2014; Georgiou et al., 2014). The framework offers five analytic dimensions; however, for this research, only the semantics dimension was applied. Based on Bernstein's (1999) knowledge structures, the framework posits that knowledge is an object worth studying. It understands knowledge to result from the choices made by the educator that can lead either to the growth of the student's knowledge or to the exclusion of the student from gaining valuable knowledge, by either teaching the knowledge in a way that is too abstract for students to comprehend or too context-specific for students to be able to apply the knowledge beyond the context in which it was acquired. Semantics frame social practices as semantic structures, with semantic gravity (SG) and semantic density (SD) as the organising principles (Maton, 2014).

3.3.1 Bernstein's Theory of Knowledge Discourse and Knowledge Structures

In his theory of the sociology of knowledge, Bernstein (1999) proposes that there are two distinct types of knowledge discourse: horizontal and vertical. These discourses differ from each other in terms of their knowledge forms, how they are socially constructed, and how they are epistemically structured (Bernstein, 1999; Hordern, 2017). Horizontal knowledge takes the form of everyday language; it is specific and context dependent. Vertical knowledge is more abstract and presents in the form of specialised language. Bernstein states that horizontal knowledge is useful within the context in which it is produced, whereas vertical knowledge can be used to draw inferences that make it possible to use it in different context (Bernstein, 1999). Hordern (2017) describes organisational procedures and workplace-specific knowledge as forms of horizontal discourse. In contrast, vertical knowledge is systemic and explicit, containing propositions and elements of procedural inferential know-how (Hordern, 2017).

Bernstein (1999) theorises that vertical knowledge is underpinned by hierarchical and segmental knowledge structures. Segmental knowledge structures organise knowledge into "a series of specialised languages with specialised modes of interrogation and criteria for the construction and circulation of text" (Bernstein, 1999, p. 161). Unlike knowledge structures in horizontal discourse, segmental knowledge structures are not context-dependent; rather, they are connected through meaning – like subjects in the humanities. Knowledge is thus not derived from shared norms, but from "symbolic structures of explicit knowledge" (Bernstein, 1999, p. 161). Hierarchical knowledge structures differ from segmental knowledge structures in that they

organise knowledge in a manner driven toward creating “general propositions and theories” through the integration of lower-order forms of knowledge (Bernstein,1999, 162).

While Bernstein’s theory is not directly used in this study, an understanding of it is necessary to comprehend and apply the LCT (Maton, 2009). Maton (2009) extends on Bernstein’s conceptualisation of knowledge discourse and knowledge structures through his Legitimation Code Theory (Maton, 2009). Maton (2009) proposes that discourse can be understood as a practice in which different propositions compete for legitimacy, and these can be analysed “in terms of their underlying structuring principles or legitimation codes.” (2009, p. 45). Knowledge codes, or semantic codes, view the claim to legitimacy from the viewpoint of the possession of skills, procedures, and specific principles (2009).

3.3.2 Defining Semantic Gravity

Semantic gravity describes the extent to which concepts are dependent on its context to make sense or their degree of context dependence. When meaning can only be construed in the context in which it is being taught, semantic gravity is said to be strong (SG+). Hugo (2015) gives an example using street mathematics, where a boy selling goods on the street knows how to calculate the total price for three items but struggles to use the principles of multiplication outside of the selling environment: if he is selling watermelon for R 27 each, for example, he knows how to calculate that 5 watermelon will cost R135; but if you ask him what 5 x 27 is, he will not be able to answer. Thus, his calculation method is dependent on the context of selling watermelon. In contrast, when meaning-making is not dependent on the context, semantic gravity is said to be weaker (SG-). For example, the teaching and learning of the multiplication table can be said to be weak in terms of gravity strength.

3.3.3 Defining Semantic Density

Just as semantic gravity strength is not absolute, but can range from weak to strong, semantic density (SD) can also present as weak (SD-) or strong (SD+) along a continuum. Semantic density describes the degree to which meaning are condensed within a term, concept, phrase or practice (Maton & Doran, 2017a). When semantic density is weaker (SD-), concepts have fewer meanings associated with it, while stronger semantic density (SD+) denotes that more meaning is embedded in the practice. Maton (2014) provides an example of weaker and stronger semantic density by speaking of a hypothetical ‘Gwiffly’. When the Gwiffly is introduced and its

characteristics are described, the concept of a Gwiffly is weak in semantic density. However, when other types of Gwifflies are introduced and their difference and similarities are discussed, semantic density is stronger (SD+). By locating the Gwiffly within a larger classification system, the semantic density of the term is strengthened. Hugo (2015) uses an example of cilia to differentiate between weak and strong semantic density strength. In this example, stronger semantic density strength is achieved by breaking down the cilia into its parts. These two examples describe two ways in which condensation of meaning can be achieved to strengthen semantic density.

Maton and Doran also describe semantic density in terms of relationships between meanings, stating that by increasing the number of conceptual relations established, semantic density is increased (Maton & Doran, 2017b)

3.3.4 Critical Analysis of Semantic Strengths and Semantic Codes

The strength of semantic gravity and semantic density not only exist on a continuum, but they are not static. As a lecturer progresses through a lesson, introducing new concepts or engaging students to apply what they have been taught, the strengths of both may vary between weak and strong. For example, a lesson may begin by introducing a general rule applicable across different contexts, e.g., Area = length X breadth – a pedagogical choice that has weak semantic gravity – but then use an example to demonstrate how this rule can be applied – strengthening the semantic gravity.

Usually, the strengthening or weakening of semantics gravity and density work in indirect proportion, meaning that the strengthening of one is usually accompanied by the weakening of the other. In mathematics, for example, teaching of the area rule has relatively weak semantic gravity and strong semantic density, this may vary from context to context, as the rule is an abstract concept that requires that students have a foundational knowledge of shapes and multiplication.

Each pattern formed as a result of the weakening and strengthening of the semantics codes has a specific effect on knowledge building and impact on students' ability to apply the new knowledge to other contexts. In the Disciplinarity, Knowledge, and Schooling project (DISKS) studies, Maton (2014) speaks of the challenge of high-stakes writing. The DISK studies were conducted in Australia using Legitimation Code Theory (Maton, 2009) and systemic functional

linguistics to analyse knowledge growth in secondary schools. Maton (2013) reports that teacher pedagogies serve as a link between the academic knowledge that students need to acquire, what he terms “high stakes reading” and the assessments that students need to undergo to demonstrate that they have acquired the said knowledge, what he terms high stakes writing (p.13). Both the academic knowledge to be learned and the knowledge which students need to reproduce for assessments are abstract and decontextualised, thus are characterised by weaker semantic gravity strength and stronger semantic density strength in comparison to the semantic strengths found in classroom practices. The role of the teacher is to create teaching and learning experiences that will bridge the gap between high-stakes reading and high-stakes writing, by recontextualising high-stakes reading by gradually strengthening semantic gravity and weakening semantic density strength. He argues that some pedagogical practices are more effective in preparing students for high-stakes writing than others. He also distinguishes between cumulative learning and segmental learning, arguing that knowledge practices that are characterised by strong semantic gravity may lead to segmented learning, hindering the transfer of knowledge from one context to the other (Maton, 2009).

One of the challenges facing TVET students is linking what they have learned in the workshop or workplace to what they have learned or are learning in the classroom, and vice versa. According to Maton’s (2009) Legitimation Code Theory, the enactment of different semantic profiles by engaging in different pedagogic practices could address this problem by linking the types of knowledge and the learning sites by weakening and strengthening semantic gravity and semantic density; students can also be taught to make these links themselves by learning to identify the semantic patterns in practice. This could also strengthen students’ ability to transferring knowledge across different work environments – the importance of which is stressed by Billett (2016).

3.3.5 Describing the Semantic Profiles

Maton states that all forms of practice are characterised by semantics codes (2012, cited in Blackie, 2014; Maton, 2014), but that they differ in strength, resulting in different semantic profiles. Profiles demonstrate the changes in semantic gravity and semantic density strengths during practice, over time. Four semantic profiles have been identified in practice: a semantic wave, a high-flatline, a low-flatline, and a downward escalator (Maton, 2014; 2020).

These are represented in Figure 4. Line A represents a high-flatline profile, where a lesson is characterised by strong semantic gravity and weak semantic density and thus remains at an abstract level, with no reference to context or other means of simplifying or explaining the lesson concepts. Line B represents a low-flatline profile, where semantic gravity is weak and semantic density is strong. The lesson is strongly context-bound, and meaning cannot be applied to instances beyond the given context. Again, semantic density remains the same throughout the lesson, with very little condensation of meaning that sometimes it seems non-existent. Neither of these profiles are conducive to knowledge building or useful for students who want to be able to apply their learned knowledge to new contexts.

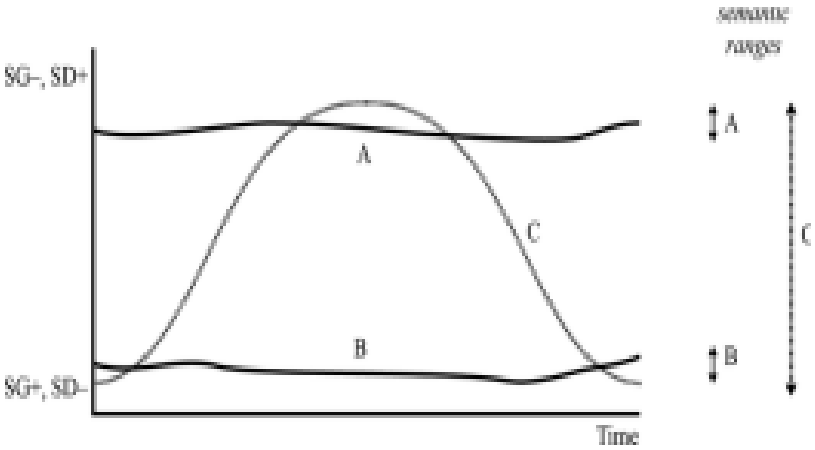

Figure 3 Semantic profiles (Maton, 2014)

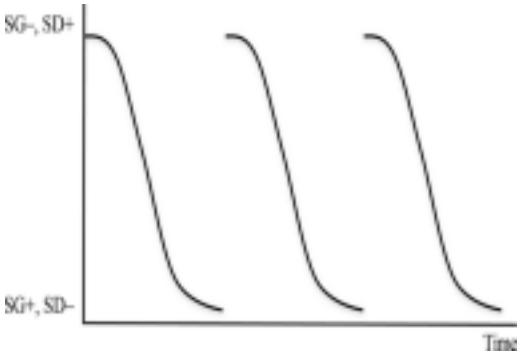

Figure 4 Downward escalator semantic profile (Maton, 2014)

The broken escalator profile is illustrated in Figure 5. In this profile, the lecturer does a lot of

explaining– simplifying abstract concepts and giving practical examples – but does not reintegrate the concepts or establish the relationships between them. By the end of the lesson, the student has learned different concepts but does not understand how they work together or how to apply them in new environments.

The high-flatline, low-flatline and broken escalator profiles do not promote epistemic ascent. The optimal profile to foster epistemic ascent is the semantic wave profile, represented by line C in Figure 3. Following this profile, the lecturer begins the lesson with weak semantic gravity and strong semantic density, followed by the simplification of concepts, which strengthens semantic gravity and weakens semantic density. The breaking down of abstract concepts into simpler ideas is followed by reintegration of these concepts into a larger schema, which may require students to apply the learned concepts to new contexts. This wave is usually followed by subsequent waves, where concepts are simplified into general and context specific ideas and are later reintegrated to form more abstract understanding.

Figure 6 demonstrates how the waves build up over time, bridging the gap between high-stakes reading and high-stakes writing (refer to section 3.3.4). Teaching and learning in the TVET sector functions to bridge the gap between the prescribed knowledge aims and objectives and the industry knowledge and skills requirements. The lecturers' responsibility is to create teaching and learning experiences that will enable the students to develop higher order skill through mastery of the basic skills (refer to section on 2.3.5 on the development of expertise and epistemic ascent). The small waves represent classroom activities, that need to "…provide a point of entry for novices" (Maton, 2013, p. 15) preparing students for the world of work by equipping them with the necessary skills and knowledge. During these activities, lecturers recontextualise the prescribed skills and knowledge using the available resources for teaching purposes. However, the execution of skill and the application of knowledge differ between the TVET institutions and the workplaces. In the workplaces student need to not only demonstrate an ability to perform certain task, but they are expected to integrate different skills and knowledge in order to plan, execute, control, assess and sometime communicate their projects. Winch (2020) states that TVET programmes should teach students how to make professional judgements and be able to communicate act appropriately to achieve the intended results. His statement below on how students are taught how to make judgements clearly articulates how

TVET teaching traverses the gap between academic knowledge and skill and working competences.

> "Part of teaching will involve an explanation of what is involved in professional decision-making, part will involve making such decisions (probably in controlled conditions) and part will involve justifying the various elements of the decision." (p. 2)

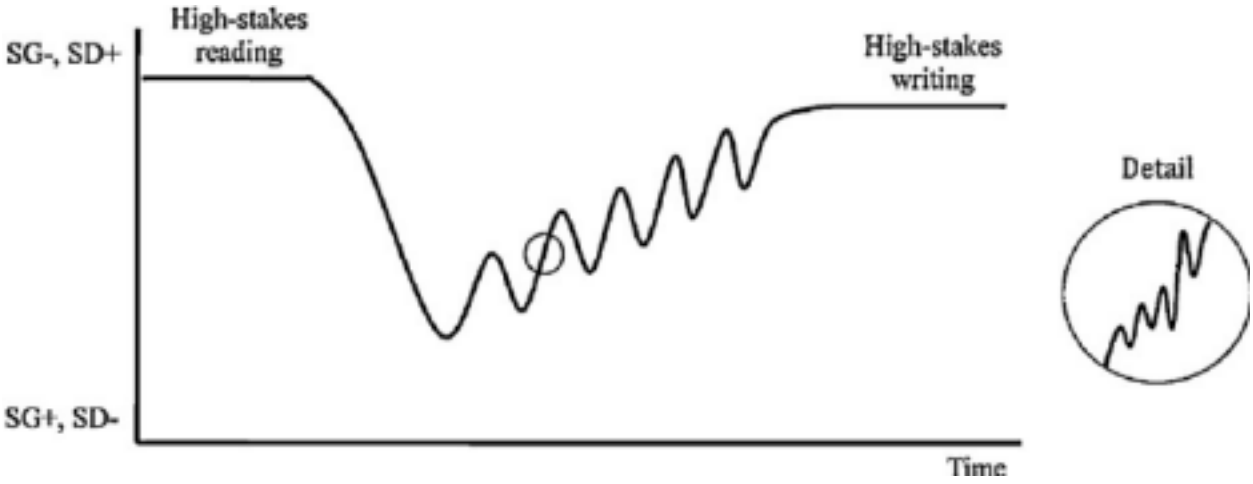

Figure 5 An example of a semantic wave profile enacted over time (Maton, 2013)

3.3.6 The Semantic Plane and its Relevance to Vocational Education

All types of knowledge are undergirded by the organising semantic principles of density and gravity. These have implications for how knowledge is taught, learned, and framed during a pedagogic instance. While semantic profiles map the movements between weaker and stronger semantic strength, they offer a very simplistic view of the relationship between semantic density and semantic gravity. Maton (2016) cautions against assuming that all types of knowledge practices are structured in this way, offering a way of identifying the different underlying principles by plotting them on a Cartesian plane. By using a Cartesian plane, we can see all possible combinations – what Bourdieu calls 'the space of possibles' (Bourdieu, 1993, cited in Maton, 2016). Figure 6 illustrates the four possible relationships can exist between semantic gravity and density, where both gravity and density can also be weak or strong at the same time (SG+/SD+; SG-/SD-). The bottom right-hand quadrant represents what Maton (2016) calls the 'worldly code', representing pedagogical approaches in which knowledge is very complex but

highly contextualised (SG+/ SD+). The bottom left quadrant, ‘prosaic code’, describes pedagogical approaches in which knowledge is highly contextualised and involves no technical language (SG+/ SD-).

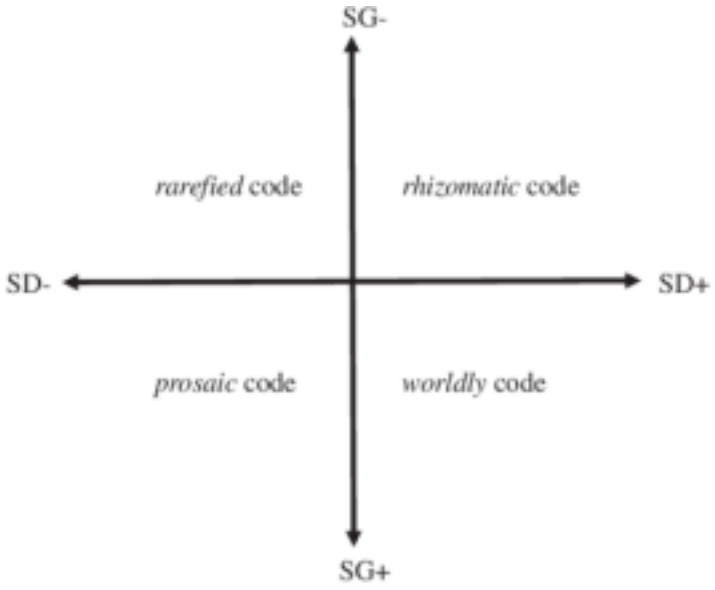

Figure 6 Semantic plane (Maton et al., 2016)

To assume that contextually-bound knowledge is never technical would overlook the possibility of contextually-bound knowledge which is principled, such as the knowledge structures in vocational subjects (Gamble, 2001). For example, in the teaching of motor mechanics, fixing broken components in a car requires that a student is familiar with the different systems in which the component is located, and also the relationships that the part has with other parts in the system (Hugo & Mokoena, 2023). Thus, when students work with physical materials, they require an understanding of the science underlying how they work or knowledge of the properties of the materials.

There is also the possibility of a semantic profile characterised by weak gravity and weak density (SG-/ SD-), represented by the top left-hand quadrant of the semantic plane in Figure 6. In this ‘rarefied code’, knowledge is general and not bound to a context; it is also very simple knowledge that can be relayed in common, everyday language.

3.3.7 Translation Device

Maton (2014) explains that semantic codes are not neat boxes within which practices are classified. Since they are not prescriptive, they can be enacted across a range of different practices by creating a translation device. The translation device contextualises the semantic codes by defining the forms they can take in a particular social field (Maton & Chen, 2016). It serves as an external language of description to eliminate misunderstanding about what the concepts in the data. The device is generated with consideration for the data available, enabling the enactment of theory and unambiguous data analysis (Maton & Chen, 2016).

The translation device has considerable value for this study. The TVET sector offers education and training for different types of trades and occupations. While Lucas et al.'s vocational pedagogy groups them into the categories based on the vocation that the subject primarily focuses on (people, symbols, or materials) this does not provide a framework that enables the analysis of practices within a particular category to determine the types of practices that exist and the potential effect that they have on knowledge building and knowledge transfer. While most studies have focused on a single, specific subject, this research analysed the practices of lecturers across different faculties, subjects, levels of study and teaching venues. This was facilitated by the use of the translation device.

3.4 Chapter Summary

This chapter has detailed the theories that informed this study. This included theories that underpinned the understanding of vocational pedagogy – theories associated with TVET, signature pedagogies (Shulman, 2005), Lucas et al.'s (2012) theory of vocational pedagogy, and Hugo and Louton (2020) vocational pedagogy dashboard – and theories that underpinned the understanding of knowledge types and structures and knowledge– which included Bernstein's (1999) sociology of knowledge and Maton's (2009) Legitimation Code Theory.

The next chapter describes the methodological approach used in this research.

CHAPTER 4: METHODOLOGY

4.1 Introduction

The previous chapter detailed the lenses through which this research was approached. By making clear the theoretical framework underpinning this research, the chapter defined how the data was analysed and interpreted. This chapter elaborates on the theoretical paradigm that framed the research process. It describes the case study as a research methodology and explains why this methodology was chosen for this research. A description of the case follows, with details of the data sampling procedures used to create the data set. The chapter describes how data was analysed inductively and deductively. The chapter concludes with a discussion of the ethical considerations.

4.2 Interpretivist Paradigm

According to Bertram and Christiansen (2014), a research paradigm is a "particular worldview that defines, for the researcher, what is acceptable to research and how this should be researched" (p. 22). This definition concurs with that of Cohen et al. (2007) who state that by adopting a specific paradigm one conforms to a certain way of searching for knowledge and agrees to a certain view of what counts as knowledge, what problems are worthy of being researched, and how these can be researched. The current study was framed within the interpretivism paradigm. In so doing, I accepted the view that reality is subject to the context in which is occurring, and that people make sense of their reality based on their lived experiences (Bertram & Christiansen, 2020). My role as a researcher was to describe and explain in detail the lecturers' actions to make them visible to learn and teach from them. By identifying the processes and the contextual factors that enable these actions, the research contributes to the body knowledge of vocational pedagogy, which is vastly under-researched.

4.3 Qualitative Research Design

To achieve the intended purposes of this research, a qualitative approach was adopted. Qualitative research methods allow the researcher to observe and report on human behaviours as they transpire in the natural setting without the researcher intruding into the lives of the participants (Cohen et al., 2007; Flick, 2009; Flick et al., 2004; Hancock et al., 2007). According

to Creswell (2014), four characteristics define qualitative research, namely: they are undertaken in the natural context, there is the active involvement of the researcher in data collection and analysis, researchers usually employ multiple collection tools and lastly the use of both inductive and deductive reasoning in the process of data analysis. This study embodied three of these characteristics: namely, the role of the researcher, the naturalistic setting, and data analysis methods. I, as the researcher, collected and analysed the data using both inductive and deductive reasoning. The fact that my phenomenon existed on the internet meant that I, as the researcher, had no contact with the participants and therefore had no impact on how things unfolded. The lectures recorded were recorded at the TVET institutions, where the lecturers teach.

4.4 Case Study Methodology

This study employed the case study as the methodological design for collecting and processing data. This research methodology was chosen as it made it possible to analyse and generate rich details about the pedagogies employed by the lecturers who recorded teaching videos during the Covid-19 pandemic.

The sections below detail how specific dimensions of the case study design were beneficial for the purposes of this research.

4.4.1 Rationale for Selecting a Case Study Methodology

According to Yin (2009), there are three conditions to consider when choosing a research design, namely: the question being asked, the role that the researcher will play, and the temporality of the phenomenon being investigated.

Research question. The first condition refers to the question of inquiry. The current study explored the following question as the main research question:

> What basic patterns of pedagogy do TVET lecturers display in the video recorded during the COVID-19 lockdown?

To allow for a better understanding of this question, the following questions were formulated:

a) What kinds of knowledge are taught in the TVET sector?
b) What kinds of pedagogical patterns are displayed by the TVET lecturers in online

videos made during the pandemic?

c) How do these pedagogical patterns impact knowledge building in the TVET sector?

These questions were designed to solicit answers that would describe the teaching practices, identify underlying knowledge structures and detail the interactions between the lecturer and the available resources, as well as the students. Furthermore, it required that links be found between actions and outcomes. Therefore, the methodology used needed to offer such insights, and the case study methodology seemed the most appropriate. Mesec (1998, cited in Starman, 2013) defines a case study as "a description and analysis of an individual matter or case … with the purpose to identify variables, structures, forms and orders of interaction between the participants in the situation" (p. 31). Flyvbjerg (2011) goes further to suggest that a case study is the best option for analysing how certain actions result in certain outcomes, enabling cause-effect predictions. One of the objectives of this study was to determine the potential impact of the lecturers' chosen pedagogies on the development of skills and expertise. Therefore, a case study was chosen.

Role of the researcher. The second condition, according to Yin (1981; 1987; 2009), speaks to the researcher's involvement during the research process. This condition pertains to the researchers' epistemological and ontological orientation. My role as a researcher in this project was to observe, analyse and report on what I had seen. My research design had to reflect my belief that there is something that can be learned from the lecturers currently in the TVET sector and that this research could shine a light on this. According to Hancock et al. (2007), case studies are versatile in their philosophical orientation. As an educator, I have undergone numerous professional developments aimed at improving our pedagogies, most of which were based on research findings gathered from research endeavours which emanated from the viewpoint that teachers were the problem. For this research, I believed that to attend to pedagogical issues within the TVET sector, we had to look within the sector to find the answer. During the research process, my role was to collect the data, transcribe and analyse it.

Temporality of the case. The last condition questions the temporality of the phenomenon under investigation. Yin (2009) defines a case study as "[a]n empirical inquiry that: [1] investigates a contemporary phenomenon within its real-life context; especially when [2] the boundary between the phenomenon and the context is not clearly evident."

The temporality of this case study is crucial, as it investigates a contemporary phenomenon within its real-life context, as defined by Yin (2009). This research focuses specifically on pedagogical patterns displayed by South African TVET lecturers during the initial phase of the COVID-19 national lockdown between March and May 2020. After the reporting of several cases of COVID-19 infection, South Africa went into a full lockdown on the 30th of March 2020, meaning that teaching and learning across all education institutions came to a halt and movement within the country was restricted (Mkhize, 2020). The prevalence of the COVID-19 pandemic in April 2020 led to a national lockdown in South Africa, during which TVET teaching and learning migrated from face-to-face methods to remote teaching modalities (Papier, 2021). The easing of lockdown restrictions began in May. It was during these times of uncertainty that these videos were produced.

The videos analysed in this study were not the only videos or teaching materials produced during this period, as other institutions shared their videos directly with students or posted them on their institutional YouTube accounts. This research was confined to the videos posted on the Jelo Creatives channel.

Before the lockdown, each subject was offered to students for four hours each week, and these four hours consisted of both theory and practical aspects of each subject (Chinengundu, 2021). Papier (2021) states that TVET lecturers and TVET institutions were unprepared for this shift despite existing policies that mandated the integration of technologies into TVET. As such, TVET institutions and TVET lecturers adopted emergency remote teaching modalities to ensure that teaching and learning continued during this period. The videos analysed in this research were produced by TVET lecturers from different TVET colleges so that their students could use them as learning resources.

Considering the questions raised in the research, the temporality of the emergency remote teaching and learning during the lockdown period, and the distance between me, the researcher, and the phenomenon being studied, the case study methodology provided the best methodological approach.

4.4.2 Intrinsic Case Study Design

There are different types of case studies available to researchers based on the objectives of their study. For this study, a single intrinsic case study design was adopted. Intrinsic case studies are

used when the researcher is interested in uncovering details about a particular case (Hancock et al., 2007). According to Stake (1995), a case study is said to be intrinsic if the researcher has chosen the case because of the specific aspects of the case that are of interest to the researcher. . According to Harrison et. al. (2017), a case can be anything of interest to the researcher – it could be comprised of individuals, organisations, phenomena, events, or processes. Merriam (1998) defines a case as a system bounded by time and space. Therefore, the case does not necessarily represent a specific group. The focus of this study was on the DHET's response to the COVID-19 pandemic, resulting in the migration to distance teaching and learning, a teaching modality that was only a number of the TVET colleges had explored (Franken, 2020)

4.4.3 Selection of the Case

In an attempt to curb the spread of COVID-19, the government of South Africa initiated a nationwide lockdown. This resulted in the immediate cancellation of all forms of contact teaching and learning. In response to this, the DHET requested that all institutions of higher education and training explore other means of teaching to save lives as well as the academic year. Blad Nzimande, Minister of Higher Education and Training, requested that all tertiary institutions "develop alternative mechanisms for teaching and learning utilising technology to support alternative teaching methodologies" (Nzimande, 2020b).

The Department collaborated with the TVET colleges in the implementation of online teaching programs (Nzimande, 2020). Videos of lecturers conducting their respective lessons were recorded and posted for student access on websites run by the DHET and the individual colleges, as well as other public domains, including YouTube.

My interest was in the pedagogical tools employed by lecturers during this unprecedented period. I chose the corpus of teaching videos available on YouTube as the case to use in exploring this phenomenon. Online teaching was an initiative planned to assist students during the lockdown period. According to DHET, all TVET students had returned to campuses by the 27th of July 2020 to resume teaching and learning, which had ceased at the end of March 2020. In total, 255 videos were available on this YouTube channel. The specific videos used for this project were recorded in joint partnership between the uMgungundlovu, Nkangala, Orbit, Ehlanzeni and Gert Sibande TVET colleges. Of the 225 videos, 29 videos were excluded as they were of programs

only offered at the skills development centres based at the campuses. The videos varied from each other on several variables; therefore, care was taken to arrive at a representative description of the case. According to Cohen et al. (2020), using a representative sample offers researchers an opportunity to acquire greater depth of knowledge about the case through the selection of multiple units to offer maximum variation. The videos used for analysis were specifically chosen to cover the wide range of subjects taught, the academic levels covered, and the modes of teaching employed. Sixteen videos were chosen, of which five of these videos were part of a series of videos by the same lecturer. The other videos in the series were analysed too, to get an understanding of how knowledge practices unfolded over a prolonged period of time.

4.5 Data collection

This section describes the data sampling technique used in this study and the rationale for choosing this technique.

4.5.1 Data Sampling

4.5.1.1 ***Purposive sampling method***

The sample chosen for this study was determined using purposive sampling. Purposive sampling is described by Bertram and Christiansen (2020) as a method that allows the researcher to specify a criterion for the selection of research data. Creswell (2013) further states that the sample is chosen specifically to "inform an understanding of the research problem and central phenomenon in the study" (p. 125). The selection of a case for a case study depends largely on the purpose of the study. It extends beyond the selection of the phenomenon or condition to be studied to the selection of data sources, people, settings, and other social processes for inclusion that represent the phenomenon. Therefore, the researcher needs to purposely choose units for inclusion that will offer valuable insight into the topic of study. The TVET sector is a heterogeneous sector including education and training; therefore, to develop an understanding of this sector, a heterogeneous sample was used. The selection of the videos to be included as data sources was done by myself alone as well as in consultation with a peer group. The process included watching the videos by myself and occasionally meeting virtually with the group to discuss the videos. The first observation we made was that the videos covered lessons from both the NATED and NCV curriculum, as well as the different levels of study, ranging from NCV

level 2 to level 4 and N4 to N6. We further ascertained that the videos were for different subjects and covered different topics. I used this information to create my case.

4.5.1.2 ***Selection Criteria and Process***

The first step towards achieving representativeness was classifying the videos into subjects, or what we called, broadly, ‘faculties. Here we arrived at 4 broad groupings that we classified as business studies, engineering, general, and utility studies. The business studies group consisted of all business, economics, accounting, and related subjects. The engineering group was made up of civil, mechanical, and chemical engineering studies. Utility subjects were work-based subjects that did not fall into either business or engineering; these included retail-based subjects, agricultural, hospitality and tourism, and other related subjects. The general group consisted of mathematics, life orientation, and English, which are basic subjects that all students registered for NCV need to take.

As we were classifying the videos into faculties, we observed that some lessons were practical while others were theoretical; some contained both theoretical and practical components. Some of the videos were explicitly labelled as theoretical or practical, whilst others were not labelled but were practical in nature. The next step involved distinguishing between the practical and theoretical lessons. We also used the curriculum programs and levels of study to classify the videos.

Using this process, a list was compiled of all the videos indicating the faculty, the nature of the lesson, the curriculum program, and the level of study. I then selected videos for my data set using the following criteria:

- include videos from the different faculties (engineering, business, utility, and fundamentals)
- include both theoretical and practical lessons
- include lessons from both NATED and NCV programs
- include lessons from different levels of study.

One of the pedagogical decisions made by teachers relates to how knowledge is sequenced, and since the focus of the study was on the pedagogical actions of lecturers, knowledge sequencing could not be excluded. In an attempt to evaluate how the lecturers progressed from one level to

the next within the same subjects and topics, and how this affected their pedagogies, I tried to find videos on lectures presented by the same lecturers from different levels. Unfortunately, these were not available, what I was able to find were videos in which the lecturer taught the same topic over multiple videos within the same level. In the end, the total data set consisted of 24 primary videos, of which 5 videos were part of a set which were analysed to gain a better understanding of knowledge sequencing and progression.

4.5.2 Description of the Case

According to Lucas (2015), one way of looking at technical and vocational subjects is to focus "on the medium through which work is expressed" (p. 5). He identifies three media: vocations that are centred around *people* (for example, childcare); vocations that work with *symbols* (words, numbers, images), such as accounting; and, lastly, vocations that work with *materials* – such as plumbing. These categories are not mutually exclusive, and occupations can be expressed through one or more mediums.

I classified each lesson based on the subject itself, rather than the intended vocation. I grouped the lessons into four categories, namely: business studies, utilities, fundamentals, and engineering subjects. Most of the subjects in the business studies group were dedicated to vocations emphasising the medium of symbols, but with some emphasis of the medium of people. The utilities subjects drew on the media of both materials and people. The engineering subjects focused on work using materials but with some emphasis on symbols. A description of the lessons in each group follows.

Utilities. Of the 5 utilities videos, one was practical, two were theoretical, and two were mixed. The lessons were on 5 different subjects, from both the NCV and NATED curriculum. Two of the lessons were designed to be used in sequence. The lessons were recorded in different contexts: one was recorded in a workshop, another in the lecturer's office, and the remaining three in a lecture room. The table below shows the composition of the utilities group.

Table 5 A list of the videos that make up the utilities group and their characteristics

Lesson	Subject	Programme	Level	Theory/ Practical
Video 1	Public Administration	Nated	N6	Theory

Video 2	Jewellery design and manufacture	Nated	N4	Practical
Video 3	Office data processing	NCV	L2	T/P
Video 4	Food preparation	NCV	L3	Theory
Video 5	Advanced plant production	NCV	L4	T/P

Fundamentals. This group included two English lessons and two mathematics lessons. The fundamental lessons were all theory-based. Apart from one English video which is a stand-alone lesson, the other two Math videos and English video each belonged to their respective collection of videos, conducted by their respective lecturers. There were no lessons from this faculty from the NATED program.

Table 6 A list of the videos that make up fundamentals group and their characteristics

Lesson	**Subject**	**Programme**	**Level**	**Theory/ Practical**
Video 6	Mathematics	NCV	L3	Theory
Video 7	Mathematics	NCV	L4	Theory
Video 8	English (cartoons, comic strips and pictures)	NCV	L4	Theory
Video 9	English (Job Finding)	NCV	L4	Theory

Engineering. Of the six videos from the engineering faculty, two were from civil engineering, mechanical engineering, and industrial engineering. Two videos were from the NATED program. These videos were part 1 of two and one theory-based and recorded in a lecture venue. The other video was recorded in a factory workshop and was both theory and practical-based. Of the four videos from the NCV program, three were from L2 and one covered work from L2 through to L4. The latter video was part of 5 videos which covered the relevant concepts sequentially across all levels. This lesson moved between theory and practical and was recorded in a lecture room. From the videos analysed, two videos each belonged to their respective collection of videos by their respective lecturers. These lessons were recorded in a workshop.

Table 7 A list of the videos that make up the engineering group and their characteristics

Lesson	Subject	Programme	Level	Theory/ Practical
Video 11	Pneumatics and electrical control	Nated		T/P
Video 12	Plumbing theory	Nated	N1	Theory
Video 13	Fitting and turning	NCV	L2	T/P
Video 14	Engineering Fabrication	NCV	L2	Practical
Video 15	Carpentry and roof work	NCV	L2	Theory
Video 16	Electronic controls and Digital electronics	NCV	L2-L4	T/P

Business studies. Eight videos from business studies were analysed: three from the NATED program and five from the NCV program. The lessons covered different topics: accounting, finance, human relations, and business management/administration.

Table 8 A list of the videos making up the business studies group and their characteristics

Lesson	Subject	Programme	Level	Theory/ Practical
Video 17	Applied Accounting	NCV	L4	Practical
Video 18	Applied Accounting	NCV	L2	Practical
Video 19	New Venture Creation/ Office Administration	NCV	L2	Theory
Video 20	Entrepreneurship and business management	NATED	N4	Theory
Video 21	Labour relations	NATED	N6	Theory
Video 22	Financial management	NCV	L3	Theory
Video 23	Applied Accounting	NCV	L3	Theory
Video 24	Income Tax	NATED	N6	Theory

4.5.3 Data Collection Technique

The data used in this research was collected using indirect observation methods. Indirect

observation is defined as “remote observation, relying on others or recording of past events in the form of documentation, video recordings, and so on” (Ciesielska et al., 2018, p. 42). This study observed the pedagogies of TVET lecturers as recorded in teaching videos posted on YouTube in response to the COVID-19 pandemic. YouTube can be used as an archive for storing and sharing data, containing a large corpus of “naturally occurring” material that could be used as data in qualitative research (Laurier, 2014). This research collected videos from this platform that were recordings of South African TVET lectures providing academic support to students during the pandemic.

Indirect observation was chosen for this research because it afforded me, as a researcher, access to pedagogic episodes that I did not have direct access to (Ciesielska et al., 2018). Since the actions of the lecturers were being observed on video recording, I was able to view them repeatedly and describe the actions accurately and in detail (Halimaa, 2001).

Video recordings capture “real-time sequences and behaviours in a clear chronology” (Cohen et al., 2007). They thus provide valuable data for analysing practices within their context, capturing not only the verbal data but also the non-spoken details. This allowed me to analyse how lecturers managed their lessons, used their resources, and demonstrated certain behaviours and dispositions.

4.6 Data Analysis

The following section details how deductive and inductive data analysis was applied to this project and how data was prepared and organised and how it was interpreted using the semantics code from Legitimation Code Theory (Maton, 2009), the theory of vocational pedagogy (Lucas, 2012) and the vocational pedagogy dashboard (Hugo & Louton, 2020).

According to Merriam and Tisdell (2015), data analysis is a process used to derive meaning from the data collected. It involves drawing on what was said and what was observed, using these together to arrive at an interpretation of the process or phenomenon. Flick (2009) states that

> data analysis in qualitative research consists of preparing and organizing the data (i.e., text data as in transcripts, or image data as in photographs) for analysis; then reducing the data into themes through a process of coding and condensing the codes; and finally representing the data in figures, tables, or a discussion (p183).

Creswell and Poth (2018) state that these steps are not sequential but, rather, should be performed concurrently with data collection and report writing to avoid dealing with large amounts of data. Due to the emergent nature of qualitative research, they advocate for deductive and inductive reasoning to be used in data analysis.

4.6.1 Deductive Analysis

Deductive data analysis was conducted using the vocational pedagogy dashboard (Hugo & Louton, 2020) and the Legitimation Code Theory (Maton, 2009), focusing on the semantic codes. To analyse the data, I followed several steps. The first step was to organise the data by transcribing the videos. The transcriptions were organised according to faculties, the allocation of subjects into faculties was based on the groupings that were agreed upon in our peer focus groups. Following this, I familiarised myself with the content by reading the texts and watching the videos simultaneously, adding any extra notes I felt were necessary. The next step was to record the data from each video on the vocational pedagogy dashboard. The notes and the dashboard recordings were shared with the group in our meetings and discussed under the supervision of our supervisor. Thereafter, I compared the dashboards within faculties and across them, making necessary summaries to draw conclusions and decide on the most appropriate examples to use.

4.6.1.1 Application of Hugo & Louton's Vocational Pedagogy Dashboard

To analyse the pedagogies observed in the online videos, the vocational pedagogy dashboard (Hugo & Louton, 2020) was used. Lucas (2014) defines vocational pedagogy as the "sum total of the many decisions made by vocational teachers as they teach, adjusting their approaches to meet the needs of learners and to match the context in which they find themselves" (p. 2). The vocational pedagogy dashboard (Hugo & Louton, 2020) maps the process through which TVET lecturers make decisions, making explicit the variables that TVET lecturers need to consider at each phase of decision-making. The vocational pedagogy dashboard (Hugo & Louton, 2020) identifies five phases for decision-making, which are arranged in chronological order, beginning

with decisions concerning the curriculum.

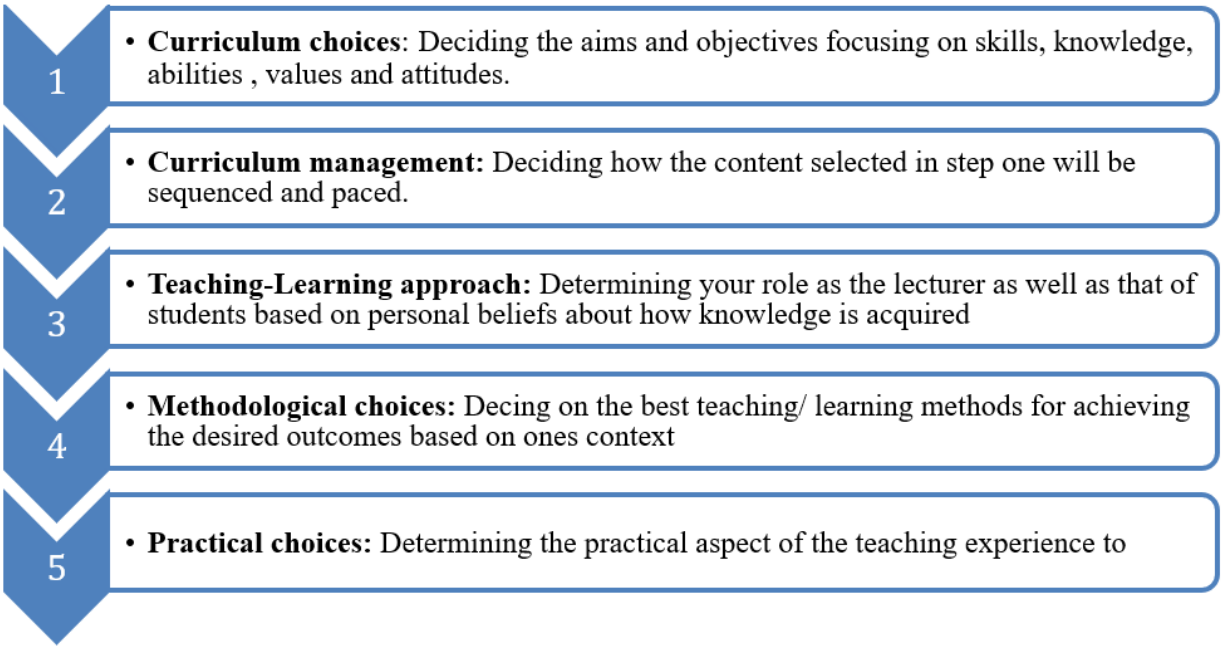

Figure 7 A flow chart adapted from the Vocational pedagogy dashboard (Hugo & Louton, 2020), showing five decision-making phases.

The vocational pedagogy dashboard analysis (Hugo & Louton, 2020) began with me breaking down the dashboard into 5 separate sections. For each section I wrote down a summary of what I observed in the video being analysed. I then watched the video the second time to affirm my notes. I then used the transcripts to record the observations on to my modified dashboard. A detailed description of how this was done for each section is given below.

Category 1 Curriculum Choices

The vocational pedagogy dashboard (Hugo &Louton, 2020) allows us to identity the types of knowledge and skills that each lesson embodies. Usually these derived from the aims and objectives as stipulated in the curriculum, and in most cases the lecturer explicitly state them at the beginning of each lesson. But sometimes they can be observed in the lecturers' actions. For the section on curriculum choices, I dived the dashboard into 4 columns, in the first column I indicated with an X if the skill, knowledge and/or ability was observed in the video. To ensure consistency in my analysis, the second column indicated the sub-categories, whilst the third one described the type of data that falls within this category. The last column served as a place for

noting down the examples that found in the video being analysed.

Table 9 Adapted dashboard for recording data on the skills, abilities and knowledge being taught in the lesson (Hugo & Luoton, 2020)

	Sub-category	Description	Example from the video
	Category 1a: Skills, abilities, knowledge		
	Specific skills, abilities and knowledge	Usually listed as objectives or outcomes, usually specific to a certain job	
	Functional literacies	Literacy (reading/ writing) and numeracy skills	
	Technological skills	Knowledge of basic technologies (e.g., use of computers)	
	General work skills	Skills to be able to function in a work environment	
	Thinking skills	Different ways of thinking, as advocated by Bloom	

Category 2: Curriculum management

As previously stated in section 3. 2. 4, curriculum management refers to the decisions made by lecturers and the education department around what is to be taught, the order in which the selected concepts are to be taught, and the speed through which the concepts are to be taught. The NCV curriculum is predetermined by the government, which explicitly states what needs to be taught, when it should be taught and how much is to be spent on each topic. However, the planned curriculum is not always the enacted curriculum. Lecturers as classroom managers have the final authority on what is taught, how it is taught and how much of the teaching time is dedicated to each concept.

In this study the dashboard was used to analyse the enacted curriculum, looking at how the managed the content that they were teaching. To record the data, I divided the dashboard into 4 columns. The first column was used to indicate the level of student involvement in the selection, sequencing and pacing of the content. Student involvement was expressed using two possibility

states namely open (O) and closed (C). The second column described the type of data to be recorded for each sub category, while the was to be used for noting down the curriculum logic which framed the lecturer's practices. The fourth column was to be used for noting down examples for the video to support the indicated logic.

Table 10 Adapted dashboard for analysing and recording curriculum management choices (Hugo & Louton, 2020)

	Sub-category	Description	Curriculum logic	Example from the video
	Category 3: Content selection, sequencing and pacing			
O/C	Selection	What is to be taught, and who determines it?		
O/C	Sequencing	In what order are concepts to be taught, who determines it		
O/C	Pacing	At what speed, does it take into consideration students' responses to the process		

Category 3: Teaching and learning approach

Teaching is a process where the lecturer creates experiences for students to engage in activities that will result in students acquiring new knowledge, applying what they know or testing the truthfulness of what they have learnt or acquired. Therefore, teaching and learning activities are chosen in line with the lecturer's views of what counts as knowledge and how this knowledge is acquired, the role that both the lecturer and the students play in the knowledge and skills acquisition process. Using the vocational pedagogy dashboard (Hugo & Luoton, 2020) enabled the identification of the lecturers' views on these three concepts by describing two possible choices for each subcategory. To record the data for this section a third column was added to the dashboard, to indicate choice made by the lecturer.

Table 11 Table for recording teaching and learning approach choices that lecturers made based on their views on knowledge, and the roles that lecturers and students play (Hugo & Louton, 2020)

Sub-category	Description	Lecturer's choice
Category 3: Views on knowledge, the role of the lecturer and the role of students		
View of knowledge	Is knowledge constructed or transferred	
Role of lecturer	Is the teacher a source of knowledge or a mediator in the	

	learning process	
Role of students	Are the students empty cups that need filling, or active agents in the learning process?	

Category 4: Methodological choices

The final step in the analysis entailed analysing classroom practices, or the teaching methods chosen by the lecturers. The vocational pedagogy dashboard (Hugo & Louton, 2020) maps out the possible teaching methods against their associated learning methods. To record this data the dashboard was adapted so that it had 4 columns, in column one I indicated with an X if the teaching method was observed. Column two simply listed the possible teaching method and it associated learning method. Column three contained the description of each teaching and learning method. Column four was used to record specific instances observed in the data.

Table 12 A table for analysing and recording the teaching methods used by the lecturers (Hugo & Louton, 2020)

	Sub-category	Description	Examples from the video
Category 4: Teaching methods and their associated learning methods			
	Demonstrating/ watching (DW)	The lecturer performs the action/ explains, and students learn by watching	
	Lecturing/Listening (LL)	The lecturer explains concepts or actions students listen to and learn	
	Instructing/ participating (IP)	Students act while the lecturer guides the students	
	Generalizing/ coaching (GC)	Using learnt knowledge to apply to other contexts	
	Problem solving/ coaching (PC)	Students look for solutions teacher gives advice but does not give direct instructions	

Category 5: Practical choices

Practical choices, or the choices that the lecturers make about the specific teaching activities that

they enact for the students, complement the methodological choices they made. As previously noted in Chapter 3 (3.2.4), practical choices are offered on a continuum, however they are not binary. Therefore, activities may fall anywhere along the continuum. To record the observed data, the dashboard was adapted to create 4 columns. The first column identified the sub-categories in this phase, the second column offered a description of the data to be recorded in this category. The third column listed the two possible choices, while the fourth column was used for recording examples from data that indicate the choice identified in column three.

Table 13 A table for analysing and recording the practical choices that lecturers made about the teaching activities they enacted to facilitate teaching and learning (Hugo & Louton, 2020)

Sub-category	Description	Choice	Example from the video
Category 5: Means of knowing, prior knowledge, visibility of the processes, nature of tasks and use of space			
Means of knowing	Are students learning theoretically or practically engaged in constructing knowledge?	Practice/ Theory	
Prior knowledge	Is knowledge linked to previously learnt concepts/ or is it taught in isolation?	Engaged/	
Visibility of processes	Are students able to view and experience the whole process or activity, or are they only exposed to certain areas	High/ Low	
Nature of tasks	Are the activities authentic, real-world experiences or simulations of the workplaces	Authentic/ Contrived	
Use of spaces	Are the lessons taking place in a workshop, simulation room classroom etc	Workshop/ Classroom	

4.6.1.2 Application of Maton's Legitimation Code Theory

To further explore the lecturers' teaching practices, I relied on Maton's (2014) Legitimation

Code Theory, specifically the semantics dimension. According to Maton (2014), LCT is a framework that makes it possible to analyse practices in different fields to identify the underlying organising principles. By making these principles visible, Maton (2009) proposes that we can see how they enable or constrain knowledge building. The semantic dimension comprises two key concepts, namely: semantic density (SD) and semantic gravity (SG). Semantic gravity looks at how context-dependent knowledge is or, simply, how much the information relies on its context to make sense. Semantic density looks at how much information is contained within a concept or a phrase. Both parameters can range across a continuum of strong to weak, where weak SG indicates that knowledge is not context specific while strong SG signals knowledge that is fully dependent on its context to make sense. Similarly, weak SD indicates that there exist weak relations between concepts, while stronger SD signals the interconnectedness of the concepts being taught.

The LCT framework is a generic framework that should be adapted when applied in different contexts since the concepts manifest differently in different circumstances. In this study, I created a translation device specific to my research purpose. A translation device is defined as an "external language to describe how [concepts] are realised within any specific study" (Maton & Chen, 2016, p. 31). Simply put, the device is a tool that states explicitly what counts as context in terms of semantic gravity and what counts as complex when referring to semantic density. While the two parameters take on unique meanings in a specific study, they must still align with the values indicated in the literature. Accordingly, the process of creating the device was both inductive and deductive, looking to and from both the data and theory.

I began by immersing myself in the work of others who have used Maton's (2009) Legitimation Code Theory as a guiding framework. I also watched numerous recorded seminars about Legitimation Code Theory, where researchers demonstrated how they had employed the dimensions of the theory in studies across different fields. This gave me a basic understanding of how to apply the framework to my study. I then used some of their translation devices to do my initial analyses of data. While this helped paint a picture of the data I was working with, it was not sufficient to fully articulate what was happening in these lessons. Again, my peer group was very instrumental as we debated our initial understandings and definitions of concepts, as well as how these concepts manifested in the context of our research. Thereafter, using the concepts described and guidance from my supervisor, I developed a translation device stipulating the different levels of semantic gravity strengths, semantic density strengths, as well as

epistemological density strengths.

4.6.2 Inductive Analysis: Thematic Analysis

According to Thomas (2006), inductive analysis refer to “approaches that primarily use detailed reading of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher.” (p. 238). This means that the researcher does not rely on pre-existing theories to make sense of the data, but rather allows the data to speak to them and create its own story. This approach to analysis is commonly used in the analysis of qualitative data, especially in instances where the phenomenology being investigated is new. Past research into vocational pedagogy has centred on face-to-face teaching, using dichotomies of knowledge as guiding principles. The theories derived from these served as an entry point into this investigation, but using them as the only organising framework would have led to knowledge blindness as they would have missed critical aspects of online teaching.

There are numerous methods available to researchers who are employing this form of analysis in their endeavours. After reading about them, I chose to use thematic analysis. According to Braun and Clarke (2013), thematic analysis is an approach to data analysis that looks for patterns or themes within the data, describing these patterns as well as identifying the meaning and implications of these patterns. This emphasises the need for elaboration of the themes, which should, on their own, indicate what is to be expected from the data (Mohamed, 2012). To arrive at these themes, researchers need to use appropriate methods that are justifiable based on the research topic and that should be clearly explained to ensure validity and trustworthiness.

In this research, I followed the steps proposed by Miles and Huberman (1994, cited by Mohamed, 2012). This model proposes three steps, namely: data reduction, data display, and data drawing and conclusions. While the steps are distinct, they are not exclusive and should not be separated but rather used to complement each other.

Data Reduction. According to Mohammed (2012, p.44), this step describes the process of “selecting, simplifying and transforming the data.” After transcribing the data, I read the transcription numerous times and, on occasions, I read through the transcription at the same time as watching the videos to observe the actions of teachers as they spoke. Mohammed (2012) suggests that engaging with the data thoroughly before its analysis offers two benefits, i.e. it prevents drawing imprudent deductions from the data and also ensures that you see clearly what

is happening in the data to see links between ideas. To begin the analysis, I read through the transcript, highlighting points that I felt were relevant to my study questions. Next, I divided the lessons into distinct phases, beginning with the basic phases (lesson introduction, content, and conclusion).

Data display. Researchers need to organize and present data in a way that makes it easy to analyse the data without dealing with unnecessary information. I chose to use lesson summaries as a method of data display. In these summaries, I briefly explained each phase of the lesson as well as how the themes and codes manifested during the lesson. I also focused on the sequential appearance of these codes in the lesson.

Data drawing and conclusion. The final step in the Miles and Huberman model (1994, cited in Mohamed, 2012) is the stage at which inferences are made from the data. To achieve this, I grouped lessons that shared the same themes and codes. This allowed me to compare and contrast elements within the lessons. It also made it possible to establish conceptual relations.

4.7 Management and Storing of Data

The videos analysed for this research are currently stored and available online through the Jelo Creatives channel on YouTube. During the research, a list of the available videos was created in Excel. This list stated the subject, lecturer, faculty, year and whether the video was practical or theoretical, or if it was from the NATED or NCV curriculum. On this list, links to the videos were provided.

4.8 Ethical Considerations

According to Flick et al. (2004), research ethics cluster together all ethical principles and rules that impact and govern the relationship between the researcher and the research participants. These rules ensure that research participants are treated in an ethical manner, which protects their privacy and causes no harm. The current research collected and analysed data that was already existing and freely available to the public on YouTube. Rosenberg (2010, cited in Cohen et.al., 2018) states that public data is any data that is freely available to everyone over the Internet. Such data is not intrusive and does not require that contact be made with the source of the data. As such, it is not subject to the same ethical considerations that apply to a research project with human participants. The current research analysed the pedagogical actions of the lecturers,

intending to describe them rather than understand the reasoning behind the actions. For this reason, in my ethics application to the university ethics council, I requested that the research be deemed as not involving human subjects. This application was approved, and a clearance letter is attached in the Appendix section. Though ethical clearance was granted by the university, as a researcher, I still needed to consider issues of consent and not harm. Since the videos were posted on YouTube, by an independent organisation and not the lecturers or the TVET colleges themselves, getting informed consent would have been impossible. Legewie and Nassauer (2018), in instances like this, research may continue without seeking consent if the videos have captured a novel occurrence, and their analysis will provide insight into rare phenomena. This was the case with these online videos. With regards to anonymity, Legewie and Nassauer (2018), stipulate that the context in which the videos were captured needs to be considered, whether the spaces are public or private, as well as the platform in which these videos are shared. As such YouTube is considered a public space since anyone who can access YouTube can view the video; as such, using the videos without consent is not considered unethical (Legewie & Nassauer, 2018). Finally, they state that the actors' expectations should also be considered, the actors in this case were aware that the videos were going to be publicly available for teaching purposes

4.9 Rigour, Credibility and Sincerity

While qualitative research differs from quantitative research concerning the criteria for quality research, qualitative research still needs to meet a standard of best practices. One of them is self-reflexivity and transparency. As a researcher, collecting my data, I acknowledge that I embarked on this journey with certain biases. As an educator, I had preconceived ideas of what pedagogical actions are best, and I had certain expectations from TVET lecturers. To minimise the impact this bias, I employed a conceptual framework and triangulated my analysis using two approaches. analytical toolkits. The vocational pedagogy dashboard served as an observation checklist and observation guide, directing me as to what to look at and what to record. To improve research rigour, I relied first on my peer group. In this group, we discussed each video and critiqued each other’s analysis and dashboard recordings. These discussions were overseen and facilitated by my professor. This was further strengthened by analysing multiple videos.

4.10 Chapter Summary

This chapter has detailed the methodological approach that was used in this study. The first part of the chapter described the paradigm within which this study was framed and provided an explanation for the adoption of a qualitative research design. This was followed by a justification for using the case study methodology and a description of the case that was investigated in this study. The collection, analysis and management of data were discussed. The last section focused on the ethical aspects that were considered in designing and conducting this study.

The next chapter presents the findings of the data analysis.

CHAPTER 5: RESULTS

5.1 Introduction

This chapter discusses the results of the analysis of 17 videos that were loaded on a YouTube channel to support students during the emergency remote teaching period. These videos were analysed qualitatively using both inductive and deductive methods, using the vocational pedagogy dashboard as well as the semantics dimension of Legitimation Code Theory. The data was analysed to make explicit the pedagogical patterns displayed by TVET lecturers in the lessons and to evaluate the potential impact these patterns of pedagogy have on knowledge growth in this educational sector, with the intent to provide recommendations for the development of teaching practices.

This chapter begins by describing the results derived using the vocational dashboard as an analytical toolkit. This is followed by the results from the semantic density analysis.

5.2 Vocational Pedagogy Dashboard Analysis

The vocational pedagogy dashboard analysis toolkit (Hugo & Louton, 2020) is divided into five sections that focus on different dimensions of vocational pedagogy. This section presents results in the order described in the vocational pedagogy dashboard (Hugo & Louton, 2020).

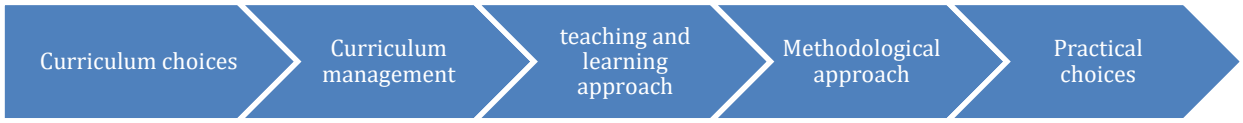

Figure 8 Flow chart demonstrating the order in which result will be presented, based on the vocational pedagogy analysis toolkit (Hugo & Louton, 2020)

5.2.1 Curriculum Choices

Curriculum choices reveal the aims and objectives for each subject. Most of these aims and objectives are stipulated in the curriculum documents, stipulating the types of skills, knowledge, attitudes and values that lecturers need to teach. In the vocational pedagogy dashboard (Hugo &

Louton, 2020) these aims and objectives are divided into two parts, the first part lists the skills and knowledge, and the second part lists attitudes and values that students need to develop in order to practice their intended profession. The findings reported in this section will only outline the skills and knowledge outcomes achieved in the videos analysed.

*5.2.1.1 **Knowledge***

Due to the nature of the lessons, I focused on two types, Know How and Know That. Knowledge by acquaintance, which is gained through physical interaction with the relevant materials or processes has not been included as a focus of this study. This type of knowledge, while relevant to epistemic ascent, can only be acquired through our senses, such as smell and taste, and these could not be observed in the videos.

While Know That is about the underlying propositional knowledge required for practice, Know How focuses on the performance of an action. Both these types of knowledge have different elements that need to be explored for the development of occupational competencies. Four key themes form part of Know-That, namely the knowledge of the tools of the industry, materials to be used, procedures employed as well as propositional knowledge underpinning practice.

*5.2.1.1.1 **Tools of the Industry***

Knowledge of the tools required for a trade is one of the fundamentals for practising in an occupation. Of the videos analysed, only two lessons included the teaching of tools. Both lessons were from the utilities group of subjects. The lessons focused on naming the tools and specifying what they are used for. However, there were some differences in how these were taught. The lesson on plant propagation (L4) began with the naming of the tools while a picture of the different tools was displayed. Then the lecturer showed the physical tools, naming them as well as their function. The physical tools were different from those in the picture; however, the lecturer pointed out that the tools were only examples. Here is an excerpt:

> 4:17 We have a pruning shear, which looks like this one. With this equipment, we are going to cut the scion and the stalk that we are going to use for our propagation.

The video on jewellery design and manufacturing (N4) only showed the physical tools. The

lecturer used the tools to provide some details about the characteristics of the tools:

> 1:44 This is a flat file; a soft, flat file. We use it mostly when you have to take out the marks from your ring after you have rolled it into the shape you want. (inaudible) we mostly use it on the outside of your ring. This is a half-round file as you can see it's different from the flat file since it's half-round…

The tools were also classified, and the different types within the group were named.

> 2:17 …these are buff sticks; you use the buff sticks from the coarse one to the medium one and then the softest one. (inaudible) these are used to take out the marks from the file that you used to file…

The relationship between the tools was also highlighted.

> 1:22 …a mallet and a ring mandrel go together. This is used so that you are able to make it bigger or make it smaller.

These findings indicate that the lessons on tools sought to teach the students the names of the tools, their physical characteristics, and their functions. They also highlight the different methods and teaching resources which lecturers used to achieve the same curriculum objectives.

5.2.1.1.2 ***Materials***

While the lessons on tools introduce students to the instruments that they will use in the workplace, materials are the things that students will need to manipulate to create products or deliver services, Half of the theory video on food preparation (L3) focused on the teaching of materials. To achieve this, the lecturer used different pedagogic tools to discuss the different materials. The lecturer unpacked certain ingredients by providing the different types, and sometimes examples, of the ingredients. With each type, the lecturer explained when the ingredient should be used.

> 11:24 …so let us talk about flour. The wheat flour is most commonly used for cake and biscuit making. Then the rye flour may be used for gingerbread. The rice flour is commonly found in shortbread to give the crispness…

> 12:48…then the sugar, the sugar improves the flavour. It gives a golden-brown colour.

> The sugar contributes to the characteristics of tenderness and moisture, lightness, and browning. Then we've got different types of sugar. It can be granulated sugar, it can be brown sugar, it can be the icing sugar, it can be castor sugar.

The lecturer also gave details about parts of some ingredients.

> 13:28…the fat in the egg yolk also acts as a shortening, they add flavour, they add nutritional value. They add colour. The egg yolks, they contain the natural emulsifier which helps to produce a smooth batter. Then the whole egg contains 70% of water then the egg whites, they contain about 49% of water so which means the egg they add liquid…

Similarly, the carpentry and roof construction (L2) video explored parts and their relationships. This lecturer used a diagram to show how the parts come together to form a structure.

> 3:50 We have got a few members, we have got your major one which is going to be your tie beam, we have got your wall plates which the whole roof is going to sit on top. We have got the queen post and the king post; we have got your rafts. We also have your web, on this side and then we have got an area which is going to be created by the overhanging part of the roof, which is going to be referred to as the cleave.

Lessons also seemed to foreground knowledge about the functions of structure. An example is the video on fitting and turning (L2), which gave a general overview of the functions of the milling machine. The lecturer gave examples of products that can be produced from the machine.

> 0:46 We're going to look at what can be done by this machine: quite a number of different machining operations, from surface milling, machining gears, machining keyways, and dovetails T slots. All those different operations can be performed on the milling machine.

The result indicate that the teaching of materials was most prevalent in subjects from the utilities and physical material categories, revealing that lecturers relied mostly on lecturing to teach

these. However, their teaching resources varied from actual physical tokens, to image representations. Similar to the teaching of tools, what emerged from the result was the use of structure-function ontologies as a teaching tool. However, lecturers also focused on the parts of structure, their relationship as well as part-whole relationships.

5.2.1.1.3 ***Procedural Knowledge***

Procedural knowledge refers to knowledge of the steps that one needs to undertake in the performance of a certain task. Students need to be able to articulate step by step how they would perform an activity under normal circumstances. All the videos discussed some form of procedural knowledge to some extent, depending on the job that students were being trained for. Not all lecturers displayed the steps on a slide or on a board for students to see. Some lecturers only explained verbally what students needed to do for task completion.

From the business studies group, the applied accounting lesson iterated how students should treat each transaction to record the transactions in the relevant accounts journal.

5.2.1.1.4 ***Propositional Knowledge***

Coupled with the need to be able to identify the step is the need to justify why things are done in a certain way and not another: why certain actions are justifiable in some circumstances, but a different course of action is required in another. Propositions declare the rule and underlying principles. The rules ranged from simple ‘must’ rules, to conceptual relations that students could employ when making decisions about the best course of action.

The extract below, is taken form the lesson on Applied Accounting (L2), and it demonstrates an example of a simple rule that students need to remember when entering information into any of the accounting journals.

> Remember in the CRJ and in all of your journals you must enter your transactions in date order: meaning the first transaction that took place during the month is the first one that goes first into your journal. (Applied Accounting, L2)

Simple propositions also included knowledge on simple facts such as those shared in the lesson about the three levels of government (Public Administration, N6). In this lesson the lecturer names the constituents of parliaments for each level as well as their role. Below is an extract from this lesson.

> …at the provincial level we have the premier who heads the executive arm at the provinces. And the premier heads what we call the executive council and the executive council is made up of members selected by the premier.

Lecturers used lecturing as the teaching method when teaching propositional knowledge; however, the resources they used differed based. For instance, during the Public Administration lesson, the lecturer presented his lecture using PPT slides, with diagrammatic presentations for the hierarchical ordering of the members of parliament. Whereas the Accounting lecturer simply stated the fact as he was demonstrating to students what to do. In the lesson on Engineering fabrication, the lecturer taught students how to separate the oxygen cylinder and gauge as well as the pipes from those of acetylene by stating that these are always in different colours, and by also presenting physical tokens of these components for students to see.

Simple facts and rules were not the only propositions taught; in some of the lesson, lecturers taught students some conceptual relations that students needed to know to make decisions when they were in the workplace. For instance, in the Engineering fabrication lesson, the lecturer taught the students about the different types of fires they will experience when operating the oxy-acetylene cutting system

> …it's a carburizing flame, if it's a carburizing flame it tells you that acetylene is more than the oxygen, if it is a neutral flame tells you that the acetylene is equal to the oxygen, if it's an oxidizing flame tells you that the oxygen is more than the acetylene. So, they are special application where you can use an oxidizing flame or a carburizing flame, for an example the oxidizing flame if you want to weld copper…

Equipped with this knowledge students should be able to make decisions when adjusting the

pressure of the gases using their gauges based on the type of material they are trying to cut. Such conceptual relations were also taught in Math lessons. In the math lesson on differentiation (L4) the concepts were abstract, with the lecturer demonstrating how to apply the math differentiation formulas with practical examples representing the rate of change. In the lesson the lecturer presents the distance formula that uses time while representing the formula on a graph. Throughout the lesson, the lecturer then uses this formula to calculate different equations.

In conclusions, the videos observed reveal that that the TVET curriculum is structured such that it foregrounds the teaching of Know that, introducing students to the tools and materials that they would need when they enter the workplace. These tools and materials are not only named and described, but their functions and physical characteristics are discussed, such that the relationship between the physical form of each tool or structure and its function is made clear. In some instances, the structures are simplified by breaking them down into smaller parts.

The result also indicated that the curriculum mandates the teaching of procedural knowledge and propositional knowledge. Lecturers described a step-by-step guide on the operation of certain procedures. And further explained the rules or the scientific underpinning for practice. Where necessary, lecturers provided the relevant facts.

5.2.1.2 ***Skills***

The different subjects offered at TVET colleges are geared towards different occupations requiring different types of skills. Skill refers to the ability to perform routine tasks that can only be performed by someone who has been trained in their performance. As a member of an occupation, one is required to be competent in the skills specific to the particular job and, also, to possess what is referred to in the dashboard as ‘general skills.’ These skills allow one to develop further than the confines of the occupation; one can use these skills to join related occupations or pursue different avenues. The following section explores the skills taught in the TVET sector based on the videos analysed.

5.2.1.2.1 ***Specific Skills***

There was a clear distinction between the skills taught in the utilities and engineering subjects and those taught in the fundamentals and the business studies group. The engineering and

utilities subjects were geared towards more practical, procedural skills involving the use of tools and materials, whereas the fundamentals and business studies were geared toward routine tasks that require inferential skills and abilities. However, all the lecturers favoured the use of demonstrations as the methodological tool of choice. Therefore, their teaching was largely based on the examples that they were working with.

The teaching of skills was always accompanied by the teaching of procedural knowledge which has been elaborated on in the section about know-that. The lecturers used the demonstrations to name the steps required to complete a task. For example, to explain grafting the plant propagation lecturer (L4) demonstrated two methods of grafting, namely: the whip and tongue method and splice grafting. The methods were distinguished through the naming and demonstration of the step.

> 23:19 You have to cut the scion. After cutting the scion you are going to cut in a diagonal, you are going to cut your scion diagonally. After cutting it diagonal you go to cut your rootstock. You also cut your rootstock diagonal at the opposing ends. You cut your rootstock diagonal then you are going to join them together. You join them together after joining them together you get a tape, you wrap it. In this case, we are using plastic, but you can also use a plastic, or you can use a tape that you use to then close with the tape.

In this example, the lecturer dictated the steps that one has to follow to successfully perform a graft. This followed an explanation of factors that affect this process; however, the lecturer did not provide any explanation as to why certain steps are to be performed in a specific manner. This was similar to how most of the accounting lessons were taught. The lecturers entered each transaction into a specific column with no justification other than what loosely could be summarised as “this is A, we write A under B.”

Below is an example of a lecturer demonstrating how to record transactions from source documents in a cash register journal taken from the applied accounting lesson (L2). The lecturer reads the transactions from the source documents and then turns around to record them in the journal outline drawn on his board. While I will list only one transaction, the same process was followed until all the transactions, for all three different journals, were covered.

> 2:25 Your document number is going to be 313. The date is going to be on the first.

> Remember, we've already indicated over there the month. Your details: it's a loan from ABSA bank, so you will say ABSA bank and then that R50, 000. And that's supposed to be entered into the analysis of receipts. And then also take that amount and put it into your bank. And then, after that, you will look: after bank is all your additional columns that you have opened inside of your CRJ. If this loan does not have a column which to enter the amount, you will take it through to sundries. It is a loan from the bank, your amount is going to be 50, 000 and your details is going to be 'loan'.

In contrast, other lecturers used the demonstrations to further elaborate on theoretical concepts or underlying principles to support their actions. An example of this is found in the food preparation cakes and biscuits (L3) lesson:

> 4:01…I'm still doing the creaming method, of which I'm mixing the butter and the icing sugar until creamy, smooth and fluffy. Why do we need to do the creaming method? Why do we mix them together? It's because when you cream the butter and sugar it forms the air pockets of which we spoke about. Different types of leavening agents: number 1, it's biological; number 2, the chemical leavening agent. As well as the natural leavening agent. So, in this method we are using the natural leavening agent, of which it's air. And that the natural leavening agent we've got air and steam. So, when we cream the butter and sugar together it forms air pockets of which those air pockets, they act as leavening agent during baking…

To supplement their explanations, other lecturers made use of drawing and diagrams to not only show what they were doing but to demonstrate procedural knowledge. These patterns of movement between the actual work and the illustrations created movement to and from explanations based on actual work done to concrete explanations and sometimes to abstract concepts.

The math lesson on differentiation (L4) displays such patterns very clearly. The lesson is on using differentiation rules on tangents. This particular question uses a hypothetical bird that runs from point A to point Z. To answer the questions, the lecturer drew a line labelled AZ. As the lecturer worked with the scenario, she annotated the text to explain to students what was happening. This pedagogic approach was used for all the scenarios that were presented in the lesson.

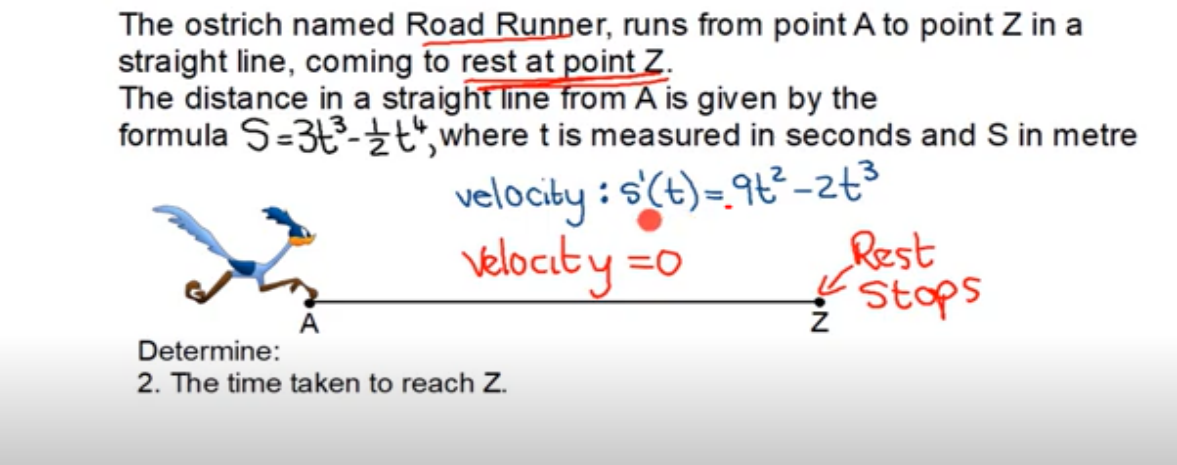

Figure 9 A mathematics question on the rate of change annotated by the lecturer

In the image above, the lecturer identifies Z, which is the focus of the question. She explains what happens at Z using the given scenario to demonstrate that the velocity at this point is zero. She then uses this inference to calculate the time taken to get to Z. The formula leads to two possible answers, which she solves by referring to her diagram again. She again makes notes on the diagram as she explains why the correct answer is the second one and not the first. This is shown in the image below.

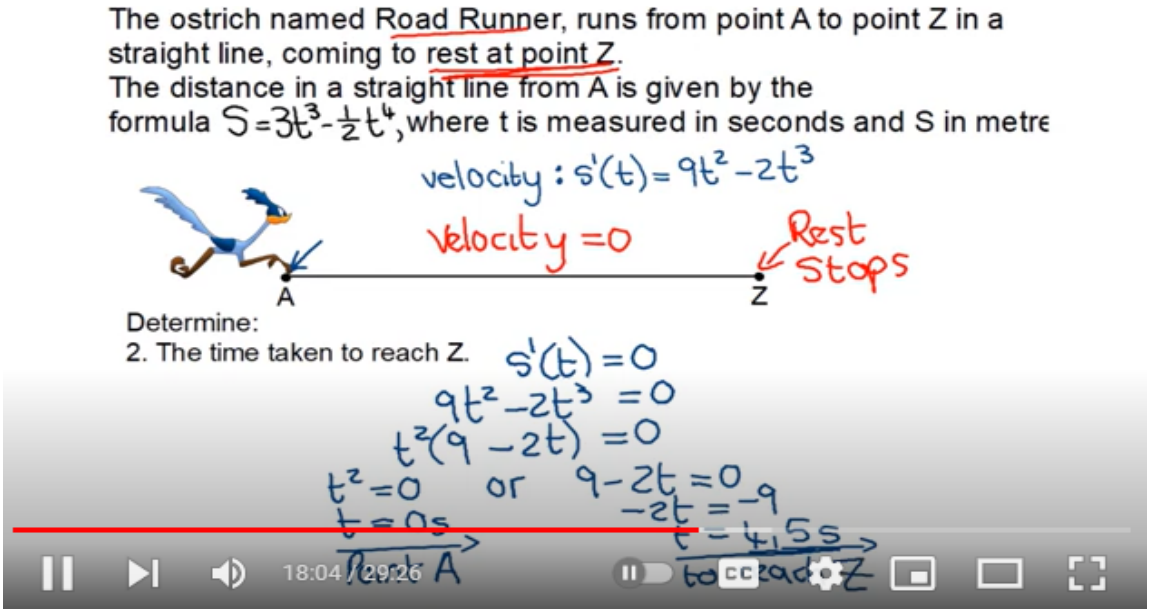

Figure 10 An example from the mathematics lesson, demonstrating how to calculate the rate and make sense of the answer

5.2.1.2.2 ***Thinking Skills***

Lessons geared toward inferential skills displayed similar patterns to those focusing on practical skills. In these lessons, lecturers tended to favour coaching, where their pedagogic approach involved steering students towards the desired outcome and then providing the correct answer. The extract below is taken from the English lesson on cartoons, comic strips and pictures (L4). The lesson aims to teach students how to interpret images. The extract is taken from where the lecturer explained how to interpret comic strips and respond to exam questions on comic strips. The lecturer began by reading the comic strip to the students, highlighting the important aspects that students needed to focus on. She then read the question and, instead of just giving out the answer, directed students towards the correct answer. This is a strategy she used for two types of writing, namely: the comic strip and the cartoon.

> 7:02 Next, comment on the woman's body language. Now remember, it's 2 marks: you need to be very careful, so you need to talk about two things. Now what is the body language? She stands as though she is so fed up: when you fold your arms, you're almost reaching the end of your wit. What's the reason you would fold your arms? It's because you've got a lot of questions. So that is one of the body languages. Then let's look at where she's standing. She doesn't seem like she's moving. She doesn't even seem like she is listening – especially when you fold your arms like that. Do you think she is listening? Two things we could say: she doesn't believe what the man is saying and that it actually seems like she is agreeing with the boss – that's the reason she would fold her arms and just look straight at him.

Following the exercise on comic strips and cartoons, the lecturer moved on to an exercise on pictures and images. In that instance, the lecturer moved away from coaching and demonstration, providing only affirmations that the students have acquired enough knowledge and skill to be able to tackle the related question. Since the students had not answered or dealt with questions on photos and images before, this opportunity offered them an opportunity to apply learnt knowledge to new environments. A similar shift was observed in the mathematics lesson, where the lecturer worked with students on one example. Thereafter, the lecturer allocated students time to work out a mathematics problem of the same kind.

5.2.1.2.3 ***Functional Literacy and Communication***

Being functionally literate refers to the ability to read, write and engage in basic numerical tasks. According to Lucas and Claxton (2014), there are debates on how best to teach these skills in the TVET context. The main question relates to whether these skills should be embedded in the technical and vocational subjects or if subject specialists should teach them. In South Africa, subjects geared toward functional literacy are compulsory for students who are studying for the NCV qualification. The NATED program also offers mathematics, English, and communication for some of their qualifications. I analysed four lessons from the Fundamental group, two English lessons, and two mathematics lessons. As each of these lessons formed part of a set of videos, I chose one mathematics and one English set to analyse.

It was evident that both mathematics and English relied on examples of manifestation of the phenomenon being explored. Teachers used examples of scenarios to explain how to apply the rules or how to achieve certain tasks. However, one lesson was an exception to this. The English lesson on job finding did not refer to specific contexts and offered a simple explanation of a hypothetical situation. The purpose of the job-finding module was to prepare learners for the experience of looking for a job, as well as being on the other side, where they were looking for candidates for their companies. The lecturer explained to students the sequential steps involved in looking for a job: from getting qualified, to looking for job advertisements, through to applying and going to interviews to finally landing a job. To achieve this, the lecturer drew a flow chart of the steps on the board, providing a verbal explanation of each step as he went.

For those who would be involved in looking for candidates, the lecturer explained how to create job advertisements. This part of the lesson provided details on the features of an advertisement. The keywords were written on the board with each explanation offered.

The other English lesson, in contrast, was sequenced based on a past exam paper. Teaching was centred on the concepts that were examined in this paper. While this lesson was also theory-based, the lecturer did not rely only on lecturing as a pedagogical tool, but made use of coaching and demonstration and also allowed students to practise. The lecturer began the lesson with a brief description of cartoons and comic strips and their purposes. She then showed a cartoon directing students about what to look for when analysing a cartoon. Her use of commands indicated that she expected students to look at and analyse the cartoon with her, following her

instructions. This was followed by the question section, where the lecturer responded to questions based on the cartoon. Again, the lecturer used the questions as a guide to explain certain concepts, link this section with previously acquired knowledge, and to also explain to students how to arrive at the desired answer.

The same technique was used to answer questions about pictures, with the lecturer offering a certain amount of coaching and demonstration. However, the lecturer used the questions on comic strips to offer students an opportunity to apply the acquired knowledge. In this section, the lecturer only read the questions and informed students that they should be able to respond to these questions based on previously taught concepts.

The mathematics lesson on data handling began differently from the other subjects in that it began with a recap of the concepts learnt in the previous levels. Whilst most lessons made mention of concepts that students should have acquired by that point in their studies, this lecturer offered a detailed summary of what students should know. To do this, the lecturer offered definitions as well as examples of the types of data that students had learnt. From there, he went on to explain the main concept of the lesson and used an example to show students how to calculate the five-number summary. The lecturer had already worked out the answers and displayed the steps and the formulas for students to see, unpacking the formulas based on the example that they were working on.

The same technique was used to show students how to calculate all five summaries. After this, the lecturer offered students an example to work on by themselves. He allocated time to do this and waited for the students to complete the work. At the end of the allocated time, he displayed the correct answers. He then moved on to the next concept, which required that the students had grasped the previous concept. A similar strategy was used: the lecturer explained the concept, provided an example, and then allowed students to practise applying the learnt knowledge.

The mathematics lesson on differentiation did not include practice opportunities for students. However, unlike the previous example, where the lecturer had worked out the example before the lesson, this lecturer worked out each step in real-time, offering explanations and using graphic illustrations to explain what she was doing. The lesson was closely tied to the rules learnt in the previous lesson, exploring three different instances where the rule was applicable and how its application differed for each of those concepts. The lecturer began the lesson by offering an

abstract situation to explain the rule to be used. She proceeded to draw a graph and use this graph to arrive at the formulas that the students needed to answer the questions.

The lecturer further explained the concept by using a scenario involving a rocket, which was less abstract. She used the same strategy of drawing an illustration and then showing how she worked out each equation. As she worked out each equation, she explained what she was doing and why and also provided ways of ascertaining if the answers were correct. Lastly, the lecturer used synonymous terms interchangeably in her explanation. She also explicitly stated which terms offered the same meanings based on the context. By the end of the lesson, she had covered three different scenarios.

5.2.1.2.4 ***Technological Skills and General Work Skills***

Technological skills refer to the ability to integrate digital technologies, including software programs, into one's practices. The lesson recorded at the Festo plant factory demonstrated the need for students to grasp technological skills. In this lesson, the lecturer read a scenario for a circuit that the students were to build. From this, they needed to create a simulation of the circuit that they would build using a simulation application on the computer. The lecturer did not explain how he created the simulation on the app or how it worked.

In contrast, the lecturer teaching a lesson on creating a robotic system detailed the programming process step by step. The lecturer began this part of the lesson by writing the programming code on the board, and explaining what it did. Then he went on to demonstrate how to create this program on the computer, verbally stating what he was doing. After this, he demonstrated the results of the program, i.e., the traffic light coming on. This demonstration also offered the lecturer an opportunity to put into practice concepts that were covered in the previous lesson on parts of a circuit and types of switches.

This lesson was taught similarly to the lesson on office data processing, where the lecturer was demonstrating to students how to create files and folders. In this lesson, the lecturer began by defining important terms. She then displayed a window to show students the different parts of a window which she named as well as identified the functions. She then proceeded to show students different ways of creating files and folders on the computer.

Utility studies and engineering studies foregrounded the knowledge of safety in the workplace.

All the lecturers used lecturing to teach about work safety. However, there was a distinct difference between lecturers who were teaching safety as part of the assessed curriculum and those who were teaching it for practical purposes in the workspace, such as the workshop. In the workspace, the lecturers followed the safety protocols and reminded students of what they needed to do, such as wearing the safety gear and cleaning up before and after completing a work piece. Usually, these tips were offered in a few minutes.

In cases where safety protocols formed part of the assessed curriculum, lecturers allocated time within the lesson to go through the necessary safety considerations. Lecturers lectured by separating safety protocols into sequential order, i.e., safety before, safety during, and safety after, or separated them based on circumstances, namely: personal safety and environmental safety.

The English lesson on comic strips serves as an example of how the lessons that were not geared specifically to the teaching of general work skills taught these skills. The lesson relied on the comic strip to explore what is expected of employees in the workplace. In answering the questions, the lecturer went further to explain that in the workplace, one needs to keep a clean environment and utilise work time for work activities and not personal things.

In summary, the data indicates that the objectives of the curriculum as far as skills are concerned include the teaching of job specific skills, thinking skills, functional literacy skills, as well as technological and general skills. The teaching of job specific skills entailed demonstrations on how to use tools and materials, and how to work with numbers and symbols which included the development of inferential skills and abilities. The teaching of technologies was included when it was necessary to perform job specific tasks and activities. General work skills taught included establishing and maintaining safety measures in the workplace.

In conclusion, this section focused on the findings concerning curriculum choices. These choices represent the aims and objects of each lesson, as stipulated in the curriculum. The data indicates that the TVET curriculum foregrounds the teaching of both the job specific skills and knowledge, and transversal skills and abilities such as functional literacies and technological skills. This section thus began by looking at the findings on know that, focusing on tools, materials, procedural knowledge and propositional knowledge. The section on Know-how or skills, focused on job specific skills, thinking skills, functional literacy skills, technological and

general work skills.

The following section will describe the choices that the lecturers made about how to manage the curriculum.

5.2.2 Curriculum Management Choices

Hugo and Louton (2020) posits that are three aspects that lecturers need to consider when making decisions about how they manage their curriculum. They need to consider what content will achieve the intended aims and objectives, how content will be sequenced, and how the lecturer will pace the chosen content. This section presents the results from the data relating to the choices made by the lecturers in this regard.

Curriculum management refers to how teachers enact the curriculum within the confines of their classroom. The official TVET curriculum in South Africa is very prescriptive. Teachers have specific content to teach and a specific timeframe in which to achieve specific outcomes that are assessed. While the curriculum documents recommend how this can be achieved and which resources can be used, classroom dynamics call on teachers to make decisions specific to their environment. There are three key decisions that lecturers make when it comes to curriculum management: what content to teach, how to sequence it, and how to pace it.

*5.2.2.1 **Selection***

Evidence from the videos suggests that both the NCV and the NATED curriculum are driven by both the logic of the workplace and the science underpinning practices. These were presented most of the time using downward selection logic, where the lecturers listed the lesson objectives at the start of the lesson and worked systematically through the lesson to achieve the set objectives. However, there were instances, though limited, that indicated an emergent logic of selection embedded within the downward selection. For example, in the accounting lessons that covered making journal entries, the objectives were given as the ability to record the different transactions in the journal entries. As lecturers worked with a chosen example of a list of transactions, different types of transactions emerged which called upon the lecturer to explore the different ways in which each type was recorded. A similar pattern was observed in some mathematics, engineering, and English lessons. In these lessons, the lecturer chose a particular

activity, which unfolded in such a manner that while there was one main topic or concept, multiple related processes were explored.

What emerged from the data that was not in the initial framework was evidence of two other themes that underpinned the logic of selection: the organisation of space and assessments.

Organisation of space. Lessons that occurred in a workshop or the workplace focused on know-how in the practical sense or were driven towards preparing for the world of work, whereas lessons recorded in lecturer rooms foregrounded knowledge of the sciences or the theoretical underpinnings of practice. In the lesson on pneumatics and controls that was recorded in the factory, the lesson was not just practical, but it foregrounded the knowledge of the specific product that this particular factory produced, focusing more on contextually relevant practices.

Assessment. Most of the lessons had a strong focus on preparing for assessments. The lecturers kept reminding students what to expect in the exams, and how to respond to specific questions should they come up in assessments or the exams. This focus on assessment was also evident in that lecturers often used past examination papers as teaching materials.

*5.2.2.2 **Sequencing***

The sequencing of the lessons suggests a stronger incline towards the use of conceptual relations as the preferred logic of sequencing. Lessons in the physical materials groups usually explored parts and locations (in the sense of space), while those in the engineering, business and accounting, and utilities subjects based their sequencing mostly on types and instances of phenomena.

Part-Whole and Structure-Function. What emerged from the analysis is the relationships that were established such that the parts, for example, were not explored in and of themselves but as in space in relationship to other parts. This static relationship was used to establish the dynamic relationships, as they were brought together to form a structure, leading up to an exploration of the structural functions and the roles that each part played in the whole process.

Type Token. The same was observed in cases where types of materials were being taught: these were taught as types, and examples were given as tokens. In practical lessons, these tokens were used in specific processes to demonstrate specific concepts or relationships, which in some cases

displayed cause-and-effect relationships.

Pervasive Nature of the Curriculum. Another theme that emerged from the analysis was the pervasiveness of the nature of the sequencing as embedded in the curriculum and the recommended books. While this is not surprising given the structure and nature of the NCV curriculum, what is interesting is that even when lecturers did not make these connections explicit, by simply following the sequence as outlined in the prescribed books or the teaching plan, these connections could be revealed. This indicates an official curriculum based on and driven by the logic of conceptual relations.

5.2.2.3 ***Pacing***

The results indicated the existence of both heavy and slow pacing as well as light and fast pacing. Most of the mathematics lessons were spread out over five lessons, during which the lecturer taught different application of the taught concept, each lesson building on and requiring that students bring a certain level of understanding of the previously taught materials to apply the new context. In each lesson, the lecturer focused on one application of the rule: for example, in the second lesson the focus was on using the differentiation rules to determine rates of change, whereas the first lesson was just on the rules themselves and their application to tangents. Also, each lesson began with revision of the previously taught concepts to establish what was to be taught. This indicates a strong link between prior concepts and new concepts, rendering the content heavy. Since the lecturer worked with different examples for each concept, providing multiple opportunities for problem-solving, the lessons can be said to be slow.

This contrasts with some of the accounting lessons that were light and fast. An example is a lesson on accounting journals. In this lesson, the lecturer taught multiple types of journals, working with only a few examples in each type of journal to demonstrate how to transfer transactions from source documents into the different journals. And though each journal is different, how the process of filling them out was repetitive.

This section has built on the previous section by focusing on how the lecturers managed the curriculum. It demonstrated how lecturers selected, sequenced and paced the curriculum. The reported on indicates that the South African TVET curriculum is a well-planned curriculum, where knowledge sequencing can be attributed to ontological relations.

The following section will report on the findings about the lecturers' teaching and learning approach.

5.2.3 Teaching and Learning Approach

The teaching approaches employed by the lecturers demonstrate their views on how students learn and what their role as lecturers is in the process of teaching and learning. Assessing the teaching approaches of lecturers can be achieved by focusing on three aspects, namely the lecturers' view on what is knowledge and how students best learn, and what their role is in the process.

5.2.3.1 The role of the lecturer and the role of the students

In the lessons analysed for this study, lecturers had to act as the source of knowledge delivering what needs to be learnt to students who were assumed to be passive receivers of the knowledge. The lecturers controlled what needed to be taught and learnt and how. In these lessons, the lecturers did the most talking, providing answers to questions students had as part of their activities. The English lecturer teaching cartoons and comic strips and pictures (L4) approached teaching from a facilitative angle rather than an authority figure, occasionally prompting students to formulate their own views on certain questions. She used statements such as "What do you think?", "I don't know, what do you say?", and "Do you agree with me?" This demonstrated a view that students are not just passive consumers of knowledge, but can be guided into making up their minds about certain topics.

5.2.3.2 The role of students

Since there were no students in the videos, the video did not demonstrate whether students were actively engaging in the learning process. The assumption is therefore that students were, during this time, consuming the knowledge shared by the lecturers by observing the lecturers perform certain tasks, or respond to questions in certain activities. However, some lecturers invited students to further their knowledge by referring them to the prescribed book. In some lessons, time was allocated for students to practise applying the concepts taught to given examples; this was the case in the mathematics lesson on data handling (L4). This indicated that these lecturers trusted students to be able to work independently within set boundaries

5.2.3.3 View of knowledge

The lessons were presented such that the lecturers were the main source of knowledge, and in some lessons, like the math lesson mentioned above, students could practice what had been taught. Thus, the lecturers transferred knowledge to students.

This section on the findings on teaching approaches indicate a teacher-centred approach to teaching. The first part explained how lecturers used didactics, rather than facilitative methods of lecturing. This was followed by a brief description of the role of students as observed in these videos. To conclude this section, the lecturers' views on how students learn were explored. The next section will continue to build on the analysis of the choices made by lecturers about how best to teach TVET subjects by focusing on the methodologies that lecturers employed when teaching.

5.2.4 Methodological Choices

Methodological choices provide insights into the decisions made by lecturers in the process of achieving their lesson objectives. They reveal the lecturers' responses to the question "Which teaching and learning experiences will achieve the intended learning objectives in the best possible way?" These are based on student learning strategies. There are eight teaching and learning combinations proposed in the vocational dashboard. Hugo & Louton (2020) state that these are not the only options and that when using the dashboard, one has a choice about the terminology used, as the terms can be interchanged with other related terms. I have chosen to follow the language used in the dashboard.

*5.2.4.1 **Demonstrating and watching***

One of the dominant methods used across the lessons was teacher demonstrations. In a demonstration, the lecturer tackles a specific activity or performs a certain task. They go through each step of the process, providing explanations as they go. Thus, the lecturer unpacks procedural knowledge, looking at the different steps in an activity as individual segments, and then bringing these steps together in a certain sequence to accomplish certain tasks. According to the vocational pedagogy dashboard (Hugo & Louton, 2020), there are two learning strategies

associated with this teaching method: learning by watching and learning by imitating. For the former learning method, students watch the demonstration of how to or how not to perform a certain task. A demonstration offers students a visual template that they can later imitate. In contrast, when demonstrations are used coupled with imitation, students learn by mirroring the actions of the lecturer. For the lecturer, the process of demonstration not only relies on the performance of an action but also calls upon the lecturer to provide explanations and instructions.

While this method was observed in lessons across all four faculties, the objectives and learning strategies differed to some extent. Of the learning strategies, demonstration associated with learning by watching was the most dominant. Since the lessons were online, there is no way of ascertaining whether students watching the videos were imitating when called on to do so by the lecturers. For example, in the mathematics lesson on data handling, the lecturer demonstrated how to do a calculation and then requested students to prepare a piece of paper and a calculator to do the calculations along with him. The call to imitate was echoed across other subjects in the fundamental subjects. Some of the lecturers went as far as to offer students practice activities. Otherwise, most of the lessons were just demonstrations, with lecturers explaining things such as how to assemble equipment, how to perform certain tasks and how certain equipment worked.

These demonstrations included an in-depth focus on the parts (or materials) of the systems, providing details on what these are, their function, as well as their role in the whole process. This develops students' understanding of *how to*, as well as the *why* of the how to. A good example of this is the practical lesson on oxy-acetylene cutting. In this lesson, the lecturer demonstrates how to cut a piece of metal. This lecture is preceded by a video on theory lecture, where the lecturer unpacks the cutting system; thus, the demonstration begins with a review of this by naming the parts of the system. The lecturer then verbally details how students need to light the torch before actually lighting the torch.

Even during the practical performance of the task, the lecturer keeps explaining and instructing students on what to do and why certain results may be observed. This is in contrast to the demonstration methods observed in lessons, such as the accounting lesson, which focused on the *how* with little to no attention being given to the *why*. In these lessons, lecturers used a given scenario to show students how to enter transactions into specific journals. The lecturers read the transactions from the source and proceeded to enter the transactions into the appropriate column

of the journal. No explanations were given as to why the transactions were recorded in the specific column besides the reason that when a transaction does not have a specific column, we enter it into the sundry column. There was no explanation as to why it would not have a column, or why certain transactions have been allocated columns, even though it's implied that the same journal, for example, a CPJ, will have different columns under different circumstances.

Another notable difference with the lecturers' use of demonstration was the purpose of the demonstration. Some lecturers used demonstrations to prepare students for the workplace, whilst others used the opportunity to prepare students for assessments. However, both objectives were achieved through the elaboration on part/whole relations, structure/functions, explanations and, to varying degrees, the use and identification of types and tokens. This allowed this lecturer to not only detail the specific information of the task at hand but also offer generalizable knowledge as well as details of other types of equipment and how these work in contrast to how the one at hand functions. For an example of how this manifested, refer to the notes on the lecture on the milling machine (5.2.1.1.2) and the cakes and biscuits (5.2.1.2.1) lesson.

5.2.4.2 ***Lecturing and listening***

Lecturing is a teaching method characterised by talking more than anything else. Students learn from this type of teaching through listening, taking down notes, and memorising what the lecturer speaks about. This type of teaching centres around the lecturer as the main source of knowledge. As such, the teacher uses their platform to give instructions, explain processes as well as provide reasons for certain phenomena. In the videos observed, lecturers were usually accompanied by visual aids, in terms of pictures or illustrations of parts, as well as concrete examples of parts. This type of teaching opens up opportunities for students to make real what they are being taught, as it bridges the gap between abstract, general knowledge and concrete knowledge.

In other instances, especially in the engineering and the utilities faculties, lecturer-based lessons tended to precede the more practical, demonstration-oriented lessons. During these lessons, lecturers mapped the terrain of what they would be doing practically. This included the introduction and definitions of terms, characterising parts and materials, detailing the functions of a structure, or listing and elaborating on the procedures to be performed. Different methods or types were also discussed. For example, the roof lecturer identified the different types of roofs,

the cakes and biscuit lecturer explained the different mixing methods, and the lecturer teaching on asexual plant reproduction looked at the different methods of asexual reproduction. Teachers also provided lectures on topics such as health and safety.

Other lecturers chose to work with both lecturing and demonstration in one instance of teaching. A lecturer on the PLC system incorporated lecturing, the use of illustrations, as well as actual demonstrations to unpack his content. This type of teaching allowed him to move with his students from general abstract concepts, which were unpacked through the use of illustrations, and were ultimately made specific through the creation of an electric circuit using the program that was taught. This differed from the plant propagation lecturer's methodological choices, which used demonstration and lecturing. Instead of providing a practical demonstration for each aspect taught, he used demonstrations to unpack certain concepts, while others he explained verbally with no demonstration.

The methodological choices made by the accounting lectures warrant a discussion here. At first glance, it appears they are employing lecturing as a teaching strategy. However, very little lecturing takes place as most lessons involved teachers demonstrating how to do journal entries. This is not to say that they did not use lecturing at all, but that they used it less than the lecturers from the other faculties. In these lessons, lecturers read aloud transactions from the source document or an activity in the student's book. Each transaction was treated in a standard way, with the teacher reading from the source, and then going through each column stating if the transaction should be noted there or not. The columns were not discussed beforehand to explain which transactions were to be recorded there or why these should or shouldn't be recorded as such. There were no discussions about how to choose the correct terminology to use in the journal. Furthermore, not all lessons offered a contextual background on the journals themselves, thus differentiating them from the other journals. Rather, the lessons began immediately with the recording of the transactions. For instance, in the lesson on Applied Accounting L2, the lecturer explained what a CPJ is and how it differed from the CRJ, whereas in the lesson on Applied Accounting L4, the lecturer went straight to reading the transactions and recording them on the journal, even though he was doing both journals simultaneously as both payment and receipt transactions were listed together. In the absence of the unpacking of 'know that', the students would be required to learn by watching instead of listening. This is characteristic of demonstration more than of lecturing.

To make this point clearer we can compare two lessons from this faculty. The first lesson had two distinct phases: a lecturing phase and a practice phase. This lesson focused on personal income tax. The lecturer began the lesson by defining the term ‘personal income’. This included giving examples of things that constitute income as well as scenarios about income situations which needed to be declared when conducting personal tax returns. From this section, the students acquired the ‘know that’ required to execute the duties of a tax practitioner. In the last phase of the lesson, the lecturer went through a previous exam paper and assisted students in answering the questions. Even though the exam questions did not require students to support their answers, the lecturer provided reasons.

In the second lesson, the lecturer began by identifying the topic to be covered. He immediately indicated that he would be working with an example from the student’s book that focused on “how to post transactions from source documents into a cash book.” He then proceeded to read the question as written in the textbook before demonstrating how to deal with such questions. This was something the students would be required to do, both for assessments as well as in the workplace. At this point, the lecturer had not yet explained which transactions were to be recorded in the cashbook or the sections the journal is divided into. After this, he read from the source document and demonstrated how students should treat such transactions by writing it in the appropriate column. Much of his speech involved verbalising what he was doing or reading the question. This lesson was representative of many of the lessons from the business studies faculty. While the lecturers don’t work with physical materials, their lessons centre on how students perform certain duties, representing both the world of work as well as the requirements for assessments. The transactions vary, exposing students to ways of dealing with different types of transactions in the workplace or on assessments. Thus, the students observe the possible actions that they may need to perform. The lesson concluded by looking at how the columns were related to each other mathematically. This summed up everything that had been done. Ultimately, learning was derived more from observing the lecturer's actions than from listening to what the lecturer said.

This section has identified two teaching and learning methods observed in this study. Similar to the result on teaching and learning approaches, these results cannot be taken to fully represent the range of methodologies that TVET lecturers employ during their face-to-face lessons, as the

choices were restricted by the absence of students.

5.2.5 Discussion of the Vocational Pedagogy Dashboard Results

The results reported in this section revealed that vocational pedagogy results from a dynamic relationship between curriculum management, pedagogical choices, knowledge types, and the theoretical views on knowledge that emerge from the choices lecturers make. Each of these elements plays a role in knowledge growth and the development of expertise.

Concerning the knowledge types, the results indicate that both Know-how and Know-that are imparted in the TVET subjects. However, lecturers engage with different manifestations of each type, reflecting a connection to the potential jobs for which students are being prepared. In subjects where students are educated to perform specific technical tasks involving the application of skills—such as those in engineering and fundamental subjects—the knowledge of tools and materials is an element of Know-that not found in the other faculties. This Know-how is always taught alongside procedural knowledge, a form of Know-that that appears not only in skilful activities but also in other technical or routine tasks, such as those found in accounting subjects within the business studies faculty or mathematics lessons within the fundamental's faculty. The teaching methods employed by lecturers differ when teaching procedural knowledge, with those from engineering, fundamental and business studies favouring demonstration over lecturing, while lecturers from the utilities utilise both lecturing and demonstrations. The choice of teaching method seems linked to the task being taught and the resources required, for example, in the lesson on plant propagation. Furthermore, the results suggest that lecturing as a teaching method is used to equip students with propositional knowledge, consisting of simple facts, rules, and conceptual principles underlying practice. The prevalence of these forms of Know-how in the lessons indicates that, at the very least, TVET graduates will be able to explain what they are doing or need to do, why they are doing it, and what they need to accomplish it.

Regarding the physical performance of tasks, the study results indicate that remote teaching and learning deprive students of opportunities to practice and improve their skills under expert supervision. However, it also offers unique opportunities for students to observe how tasks are performed at a pace that suits them, as they can pause, rewind, and replay as needed. Additionally, the results revealed differences in how lecturers performed demonstrations. Some tasks were repetitive and routine, with the lecturer providing little rationale for why they are

performed in that manner. Others served to demonstrate how routine tasks are executed while also integrating the teaching of Know-that and providing demonstrations or visuals of novel situations to prepare students for the workforce. The absence of scientific justification for how tasks are performed hinders students' ability to transfer knowledge to new or complex situations. Again, these differences may be linked to the medium of work, as this was more prevalent in business studies than in other faculties. Other forms of skills observed in the videos included critical thinking skills, general work skills, and literacy skills.

With regard to overall knowledge and skills, the results indicate that TVET colleges provide students access to a broad range of knowledge and skills necessary for developing expertise. The sequencing of these forms of knowledge suggests that teaching in the TVET sector aims for a holistic development of expertise, enhancing both what students can articulate and what they can execute. Knowledge growth seems to influence the sequencing of knowledge concerning the transition from Know-that to Know-how, as well as in knowledge complexity through the ontological ordering of concepts.

The choices lecturers make regarding teaching methods may have been constrained by remote teaching; therefore, while we infer from the results that teaching and learning in the TVET sector is teacher-led, reflecting behaviourist and cognitivist approaches to teaching and training, there is evidence that some lecturers adopt learner-centred approaches in their pedagogies. The observed choices also indicate a close link between the knowledge being taught and the teaching approach employed.

These results collectively suggest that the decisions lecturers make when teaching in the TVET sector are driven by knowledge. Decisions about curriculum management, approaches to teaching and learning, as well as practical choices, are all based on the type of knowledge that lecturers are teaching at that moment. Consequently, if vocational pedagogy is a product of the decisions lecturers make while teaching, viewing and teaching the different forms of knowledge as a dichotomous endeavour may prove detrimental to the development of expertise.

5.2.6 Analysis Conclusion

The purpose of the vocational pedagogy dashboard (Hugo & Louton, 2020) analysis the

pedagogical practices of the TVET lecturers as observed in the online videos. The vocational pedagogy dashboard (Hugo & Louton, 2020) conceptualises TVET pedagogy as a series of decision-making, and this first part of this chapter described the decisions made by lecturers at each step of the decision-making process. It began by describing in detail the choices made about the aims and objectives of TVET. These choices were stipulated in the curriculum, and could also be observed in the prescribed books. For the purposes of this study, this section only reported on the findings on skills and knowledge aims and objectives.
The section that followed elaborated on the choices that lecturers made about how best to manage the curriculum. It detailed how lecturers sequenced their content either based on the sequence found in the prescribed books, or relied on ontological categories to dictate knowledge sequencing. It also detailed how lecturers paced their lessons.

After presenting the findings curriculum management choices, a brief discussion on the teaching and learning approaches adopted by the lecturers was presented. To conclude the first part of this chapter, findings on the methodologies used by the TVET lecturer in the analysed videos were presented. The next part will report on the findings on knowledge practices displayed by the lecturers in the observed videos.

5.3 Semantic Analysis of Knowledge

To gain better understanding of the knowledge structures that exist within the TVET sector, a semantic analysis was performed using the semantic dimension of Legitimation Code Theory (Maton, 2009). The following section will the details the results of this analysis.

5.3.1 Exploring Semantic Gravity and Semantic Density in TVET Education

The second aim of this research project was to analyse the knowledge practices in the vocational and technical education sector, as observed in the videos. The knowledge analysis was conducted using Maton's (2009) Legitimation Code Theory. From this analytic framework, the semantics dimension was chosen. This dimension of Legitimation Code Theory states that knowledge is underpinned by two semantic principles: semantic gravity (SG) and semantic density (SD) (Maton, 2012, Maton & Doran, 2017). While all knowledge practices have semantic density and gravity, what differs is the semantic strengths and how these change over time. Semantic gravity reveals the extent to which knowledge practices are determined or depend on their context

(Maton, 2014), while semantic density looks at the degree of condensation of meaning within words, sentences, and phrases (Maton & Doran, 2017). Therefore, semantic gravity and semantic density look at abstraction and condensation, respectively. Semantic density is specific to its context, meaning that semantic density strengths are not inherent to the words or phrases but are derived from their context; thus, a term may have strong density strength in one context but be of weaker semantic density in another context. According to Maton (2012), vocational and technical education is underpinned by strong semantic gravity and weak semantic density (SG+; SD-). This is due to the nature of learning in vocational and technical subjects which is based mostly on the world of work. That is, TVET students typically know how to do the work with little consideration for the sciences in which these practices are based. Shay & Steyn (2016) similarly describe professional knowledge as strong in semantic gravity and semantic density (SG+; SD+), meaning that professionals not only perform their duties but possess a body of propositional knowledge on which to base their judgements during their practice. This study revealed that knowledge practices in the analysed videos had varied semantic density and gravity strength and these existed in different combinations in different contexts.

5.3.2 Semantic Gravity

Due to its practical nature, vocational and technical knowledge is said to be of strong semantic strength (Maton, 2012). Thus, the teaching of vocational and technical subjects tends to be more practical, involving the use of concrete materials or acts which simulate the work environment, such as completing journal entries in accounting or role-playing in the health services sector.

The analysis conducted in this study seemed to confirm this understanding, as many of the lessons were underpinned by very strong semantic gravity. Much know-how was taught through demonstrations and modelling, where the lecturers physically completed a work task. While most of these lessons occurred at the TVET college, one lesson on pneumatic controls was recorded at a factory shop, making the semantic gravity strength relatively stronger than most of the videos. However, the other videos were recorded in the workshop (engineering fabrication, milling machine) or practice rooms (cakes and biscuits), which simulate the world of work. This simulation extended to the attire worn by the lecturers, from the health and safety apparel in the engineering subjects to the chefs' attire in the cakes and biscuits lesson.

Figure 11 An image of the oxy-acetylene lecturer explaining the PPE

Figure 12 An image of the Cakes and Biscuits lecturer wearing her Chef's attire and demonstrating how to prepare the working area

In the subjects that work with symbols rather than physical materials, such as accounting and

maths, the strength of semantic gravity was increased through demonstrations. However, the semantic strength was slightly weaker where the lectures relied on drawing and illustration to relay their messages. In both examples, lecturers used examples from the recommended textbooks or past exam papers to cover specific content. In the case of accounting journal entries, the lecturers used the board to illustrate how accounting books look, or what students expect to find in the exam papers. They then used these illustrations to enter the financial transactions and perform other related tasks. While these actions are strong in semantic gravity, their strength is weaker than that which was observed in the lessons using physical materials.

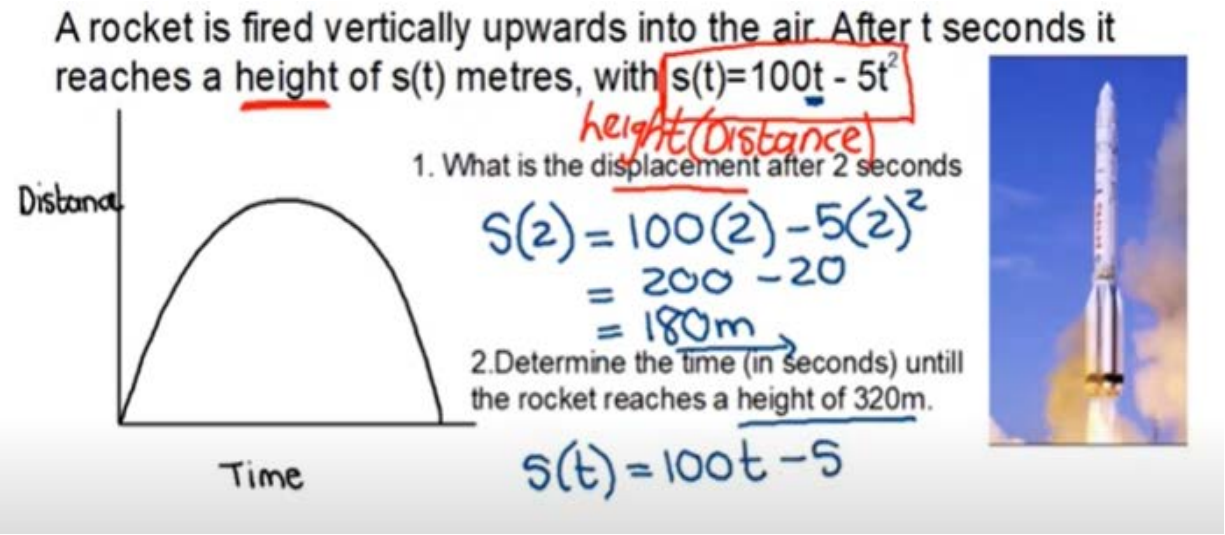

Figure 13 An image illustrating how the mathematics lecturer incorporated an image of a real rocket to respond to a question about the rate of change when a rocket is fired

Figure 14 An image from a lesson on accounting showing a lecturer demonstrating how to complete an accounting journal

The lessons from the materials group revealed similar strength of semantic gravity. This allowed lecturers to explore structures or materials that were not physically available, or which could not be available due to the size or type of task being performed. These included lessons on plumbing, where bringing the process to the lecture room would have been impossible. In these lessons, the lecturers made use of photos and drawings or illustrations of their materials to explain concepts or processes. While this practice meant weaker semantic strength, it was also beneficial for focusing on specific details which tend to be obscured during practical activities.

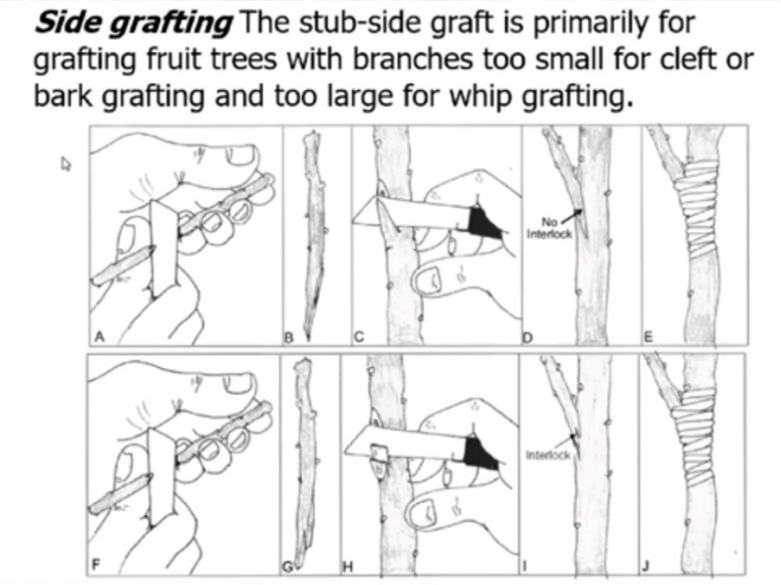

Figure 15 An image of an illustration of side grafting. Together with Figure 13, they display two different images of different semantic gravity strength

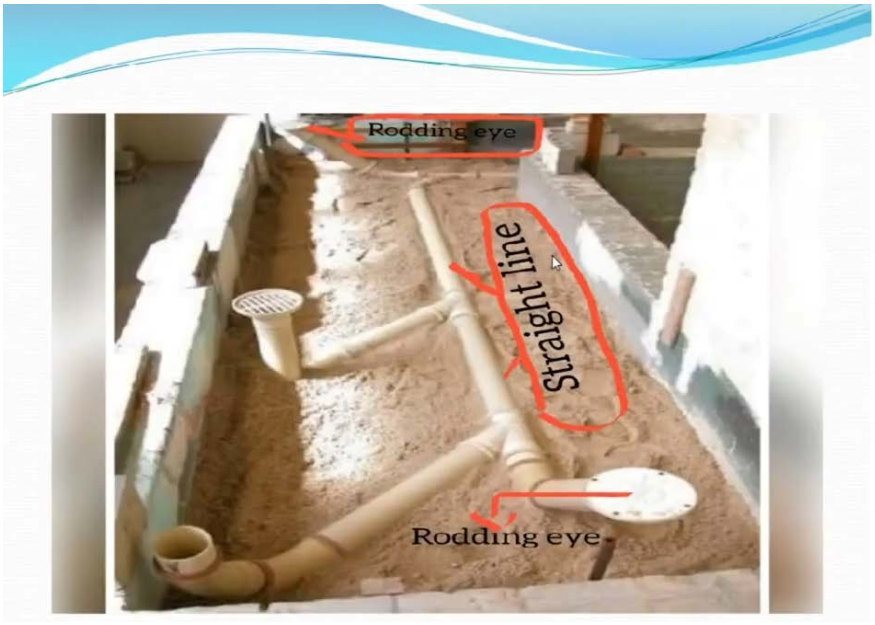

Figure 16 An image used in the lesson on plumbing which is of a stronger semantic gravity strength than the illustration used in the plant propagation lesson

Physical materials, photos and drawings were not only used to elaborate on procedures but also to teach about tools, materials, and parts of structures. Used together, photos, drawing and physical materials resulted in semantic gravity strength changes, as concrete structures are of stronger semantic strength in comparison to drawings, photos and illustrations. Lecturer used concrete materials to discuss functions and processes, but then weakened gravity strength by introducing photos or illustrations of the smaller parts of the structure that are not visible.

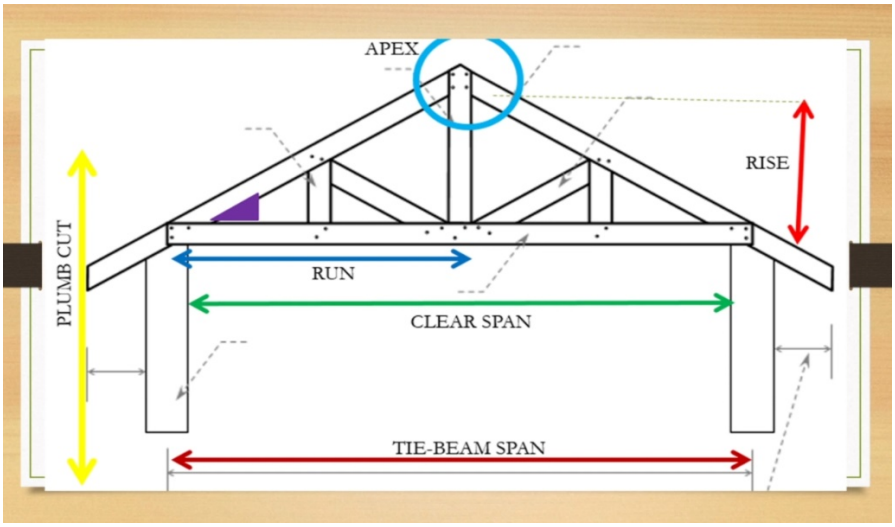

Figure 17 Illustration used to teach about the different parts of a roof

Figure 18 An image of the oxy-acetylene lecturer drawing an illustration of an orifice which is too small for students to see on the physical object he is carrying.

Figure 19 An image of the tools used in plant propagation that the lecturer used together with concrete tools.

However, not all know how lessons or lessons on materials were strong in semantic gravity. Other lessons were abstract, with no references made to any specific contexts. In these lecture-style lessons, lecturers presented content using PowerPoints presentations with no concrete or physical representations of concepts being discussed. Topics in these lessons included describing the characteristics of materials (e.g., cakes and biscuits theory).

Strong semantic gravity was also observed in lessons on propositional knowledge, such as the lesson on conflict management and the English lesson on cartoons and comic strips, which created strong semantic gravity through illustrations and images. However, not all the lessons on

propositional knowledge were of strong semantic gravity strength, as some propositions were taught through lecturing, with notes usually displayed on slides and the lecturer reading through them.

This section has highlighted that teaching TVET subjects is not always contextual and specific and that lecturers draw on a multitude of teaching techniques and resources to expose students to more than their immediate environment. The following section details the result on semantic density.

5.3.3 Semantic Density

Semantic density analysis reveals the degree of condensation of meaning within a practice. This can be done by analysing terms, phrases, or passages over time and how meanings are related to each other during the practice, in what Maton & Doran call a 'constellation of meaning' (Maton & Doran, 2021). Technical and vocational knowledge is viewed as tacit knowledge and is thus said to be characterised by weak semantic density.

Since the study was concerned with the unfolding of the pedagogic practices of the lecturers and their possible implications for knowledge building over time, the analysis focused on epistemological condensation which focuses on how words are combined in phrases and passages and how these phrases and passages are linked or related to each other over time.

Semantic density in the videos analysed was structured around creating connections between concepts rather than the use of semantically dense vocabulary. The lessons analysed displayed varying semantic density strengths, ranging from weak semantic density to strong semantic density. Weak semantic density was observed in lessons where the lecturers dealt with naming and identifying tools, materials, or parts of a structure or system. This section is taken from a drainage lesson:

> …wastewater pipe is the pipe that is connected to wastewater fittings to convey (transport) wastewater to the gulley, floor channel etc. Waste fixtures are those fixtures that are used, examples are our bathtubs, our wash-hand sinks our sinks, our toilets our bidet. Soil water- water containing liquid excreta. Soil pipe- pipe that carries soil water, normally in South Africa we use what is called the 110mm diameter pipes. The bigger the diameter the more the flow of sewage.

The above extract is taken from the drainage lesson. In this section, the lecturer defined the terms used in drainage. Some of these terms are parts of the drainage system but the lecturer does not make this connection explicit at this point. Similarly, the lesson on plant propagation provides us with an example of a pedagogic instance where semantic density is low, as the lecturer identifies and names the tool. He provides us with some details on when to use each tool. There is no explicit link between the tools and the methods of propagation.

> …we are having a sealant or wax that we are going to use after our plant propagation. We use the sealant to seal or cover the wound. We have a pruning shear which looks like this one, this material we are going to use it to cut the scion or rootstalk that we use. Pruning knife that looks like this one, we are going to use it to open or to cut where we are going to insert our scion…

These lessons can be contrasted with the ring-making lesson, in which the lecturer was also teaching about the tools involved in making a ring. However, the lecturer worked with stronger semantic density. She not only named the tools, but related each tool to the sequence involved with making a ring:

> …this is a flat file, a soft flat file. We use it mostly when you have to take out the marks from your ring after you have rolled it into the shape that you want. This file you mostly use it on the outside of your ring.

Other lessons characterised by weak semantic density were the accounting lessons, in which the lecturers worked to complete journal entries. In these lessons, the lecturers recorded transactions in the journal without providing explanations as to why certain entries were recorded in specific columns and not others. Below is a note I made while analysing a lesson on financial management:

> He records details about these transactions with no explanation or description as to why and how the transactions are recorded in a particular manner, for example, he writes the b/f under the Fol column for the opening balance transaction, but for succeeding transactions he doesn't record anything under this column. He also uses abbreviations and numbers under the Doc column without explaining why he uses one over the other for particular transactions.

In other instances, semantic density was strengthened by highlighting the causal relationship either between parts or in a process. An example of this form of strengthened semantic density is taken from a lesson on drainage systems

> …pipes must be laid in a straight line as and as far as possible avoid laying pipes under buildings and that for one obvious reason your pipe could break. If they break, they could leak; if they leak, the sewage could contaminate your property… (extract from drainage lesson)

> I want to show you what happened in the first scenario, you see you've heard the noise, why is there a noise, that's a backfire because I've touched the plate. It differs, sometimes it switches off or sometimes a backfire… (extract from engineering fabrication).

Though the above examples do not refer to a specific rule or theory, they communicate a more general understanding of general phenomena that students may encounter in different contexts.

Other lecturers legitimised knowledge by classifying concepts and ideas into types or classifications. Though classifications items and or concepts possess some shared meanings, they are also different, and each can carry meaning in its own right. In the carpentry and roof construction lesson, the lecturer identifies two types of roof design. He then proceeds to distinguish between the two types, which followed the discussion about roof structures and their functions which he had previously elaborated on. Thus, both designs are related to the function of the roof and students understand that both designs can fulfil the role of being a roof, even though they are designed differently.

Similarly, the plant propagation lecturer began his lesson by describing that asexual plant reproduction is the second type of plant reproduction, and he distinguishes it from sexual plant reproduction, which he had already taught. He further distinguishes between subtypes of asexual plant reproduction by describing the different methods of asexual reproduction.

It is worth noting that semantic density strength does not translate to good or bad teaching; rather, it articulates the integration of knowledge into a larger schema or the lack thereof. The observations listed above focused on segments from the lesson analysed and not on how the semantic density strength varied throughout the lesson. Such an analysis is insufficient to

determine the effect that the lessons have on knowledge growth. To understand of how these knowledge practices unfolded over time, the next section details how semantic density and gravity unfolded in a few lessons.

5.3.4 Semantic Gravity and Density Over Time

While the above analysis highlighted the existence of different semantic gravity and semantic density strengths individually, practices are characterised by the existence of both semantic gravity and semantic density. However, since semantic gravity and semantic density vary in strength, the combination of semantic gravity and semantic density in their differing strengths reveals different semantic codes. Furthermore, one can analyse how these codes change over time, during practice, to create semantic profiles. These changes can occur within the semantic code or across semantic codes. To demonstrate these codes and changes, I will present a few lessons for analysis.

Roof Construction L2

The first example is taken from the analysis of the lesson Carpentry and roof construction L2. The lesson on roof construction is divided into numerous distinct phases. The phases are listed at the beginning as the learning objectives. Each phase is characterised by a different semantic code, and the unfolding of these codes creates a distinct profile.

Phase 1: The lesson on roof construction begins with the lecturer stating the objectives of the lesson. The objectives are stated in simple language, and are not context-specific. The lecturer then proceeds to list the functions of a roof individually. Since these functions are general, the semantic gravity is very weak, but also due to the language used and the fact that he is listing the functions, he maintains weak semantic density, too (SG- -; SD - -). However, he quickly unpacks the functions by concretizing them by talking through two images: one with a roof and one without. The images serve as tokens or representations of the actual house, but they are not very strong in terms of semantic gravity. Thus, while semantic density has remained weak, semantic gravity has strengthened a little (SG--; SD - -).

Phase 2: In the next phase of the lesson, the lecturer teaches the parts and components of a roof structure. In the context of the whole lesson, the lecturer moves from the discussion of the whole roof structure, which is semantically stronger in gravity, to a discussion about parts. But the

lecturer uses an illustration on the roof to make the parts visible to students, thereby maintaining relatively strong semantic gravity. The discussion on parts starts with weak semantic density as the lecturer simply locates and names the individual parts. He proceeds to establish the relationships between specific members in what he calls the ‘special components.’ The semantic density is thus strengthened through abstraction.

Phase 3: This abstraction leads to the condensation of parts back into a whole as the lecturer proceeds to distinguish between two types of roof designs. The lecturer presents the characteristics of each design as lists on a slide (SG- -) before he provides an image of the roof design (SG-) and makes similar comments. The discussion on each design is weak in semantic density; however, by comparing the two types, he locates each in a classification and thus strengthens the density. He also links the two designs to a common factor, which is the methods used in the construction of the roof truss.

Phase 4: At this point, the lecturer identifies two methods of building a roof truss, which he distinguishes between by naming where they are built (SG- -; SD- -) and even provides an alternative name for the one method (nail plate roof truss- prefabricated roof truss). But he quickly moves to strengthen semantic density by providing the types of joints that are used in each method. Here he begins discussing these as abstract concepts (SG- -), using his hands to try to illustrate how the members of the roof are connected; this is followed by the same explanation using two illustrations. This strengthens SG, but SG is slightly weakened further when the lecturer displays the actual images of the joints on actual roof trusses. This phase is concluded with an explanation of the advantages and disadvantages of the prefabricated truss. This strengthens semantic density, as it further distinguishes between the two methods of building a roof truss.

Phase 5: This section zooms in on a part of the wall called a wall plate. This abstraction further strengthens the semantic density of the lesson while weakening semantic gravity. The lecturer begins by providing the functions of the wall plate; this is unpacked by providing an image which he uses to explain the functions fully. He then introduces an illustration of a house structure which he uses to explain how to position the wall plate.

Advanced plant production L4

The second lesson is taken from the utilities faculty. The lesson is an L4 lesson titled ‘Advanced Plant Production’. The topic covered in the lesson is ‘asexual plant propagation’.

Phase 1: The lecturer begins by introducing the topic and stating that this is the second lesson on the topic of plant production and will focus on the second type of plant reproduction. At this point he briefly describes the two types. While not many details are provided, this action locates the knowledge within a larger schema of knowledge that students already possess. By comparing the characteristics of asexual plant reproduction to that of sexual plant reproduction he establishes the connection between the two, thereby enhancing semantic density. Part of the introduction includes the naming of the tools used during asexual plant propagation. The tools are identified systematically in that they are named in the order in which they are used during the propagation process. Semantic gravity during these phases varies between three degrees: the use of an actual example of the tool or material, a picture of the object, and a drawing of the object. Thus, while semantic density remains weak during this phase, semantic gravity fluctuates between these three levels as the lecturer shows all three tokens for each tool or material.

While the lecturer uses this phase to establish or identify the tools, which represents low semantic density, the lecturer makes use of some technical words. Words such as ‘scion’ that are used in the field of botany need to be understood based on their meaning as prescribed in the field. This highlights a link between this vocational knowledge and the science underpinning this practice. Other technical words are used throughout the lesson. The words are, however, used within a group of everyday words. Therefore, while the words are technical, they are used in a manner that does not require that one be a specialist in the field to understand them. Words of this nature are repeated throughout the lesson, in the same manner.

> …we have a pruning shear, which looks like this one. This equipment we are going to cut the scion and the stock we are going to use for our propagation.

Phase 2: In this phase, the lecturer begins with weak semantic density as he lists the different methods of asexual plant propagation. Each method is described using a single sentence. There are no examples given to explain or unpack the concepts, this keeps the semantic gravity very weak (SG- -; SD -). However, the lecturer strengthens the semantic density by unpacking each method and by explaining the different subtypes and the methods that can be used for each category of asexual plant propagation. He also provides the steps to be undertaken during the

different processes. With each subtype explained, the semantic density is strengthened as more content is provided, thereby increasing the complexity of knowledge. During the process of elaborating on the types and providing subtypes, the lecturer employs different semantic strengths. For example, the discussion about the cutting methods is very weak in semantic gravity (SG--): the content is discussed using notes on a slide and no tokens are used. But when the lecturer explains grafting, he physically demonstrates how the grafting is done, making semantic gravity very strong (SG ++).

Phase 2a: The first method the lecturer describes is cutting. He begins by defining what it is and when to use this method. He then proceeds to teach different methods of cutting. For each method, he describes what is it, and how it is done. He identifies three methods of cutting wood, two methods of cutting the leaves, and one method for cutting at the root. These methods are discussed further, as the lecturer proceeds to describe steps to undertake during cutting. The content is discussed in a general manner, meaning weak semantic gravity.

Phase 2b: After detailing the steps, the lecturer moves to unpack the grafting method. Unlike cutting, the lecturer begins by providing details on the factors that affect grafting. During this phase, the lecturer provides examples of cause-and-effect relationships. Semantic gravity remains very weak until the lecturer progresses to the steps involved in grafting. During this phase, the lecturer uses what he terms ‘propagation material’ and a propagation knife to demonstrate the different methods of grafting. This strengthens the semantic gravity.

Unlike Lesson 1, which used part-whole relations to strengthen and weaken semantic density, Lesson 2 focused on types and subtypes to increase the complexity of the lesson. Both lessons displayed varying levels of semantic gravity to relay different types of knowledge.

5.3.5 Applied Accounting L2

The third analysis is of a lesson from the business and accounting field. In this Level 2 applied accounting lesson, the lecturer implies that the lesson focuses on exam preparation and that the content is at Level 2. The semantic gravity remains of similar strength throughout the lesson. The lecturer works with three pieces of paper, which he identifies as a cash register roll, cheque counterfeits and deposit slips. He also records the transactions on the board, on which he has drawn how the accounting books look. Both the papers and the illustrations on the board are representations of actual concrete objects that are not used in the lesson; thus, semantic gravity is

weaker than when working with the actual materials. This is in line with Lucas's (2014) grouping of accounting subjects under the symbol's groups of subjects. The lecturer does weaken the semantic gravity occasionally when he identifies general formulas, which he applies to the problems being solved.

> Remember: with sales comes again your cost of sales. And remember: for this transaction the mark-up is 75% on cost. I'm gonna show you quickly how to calculate that. The formula is: you take your sales and you multiply by a hundred and divide by a hundred plus the mark-up. That will give you your cost of sales. For this transaction, your formula will be 15 412 times 100 divided by 175. That answer will be 807.

Semantic density is also relatively low, even though the lecturer works with subject-specific technical terms. These terms are used amongst everyday words in a sentence, though one cannot explain the concepts or how they work, but through observation, one can understand how to work with them. Even when used together with other technical terms, they are used in such a manner that one doesn't need to be an expert to understand them. The lecturer can be said to work with parts-whole ontology in that the individual columns of the journal are parts that make up the whole, which is the journal. However, the lecturer works with very weak semantic density strength in that he does not explain what each column represents, which transactions are recorded in which column and why, or what the relationship between the columns is, if any. Rather, the lecturer identifies them as he works, establishing their existence but not connecting them to each other.

He also works with types and token that represent receipt and payment transactions. For each type, he explores different tokens to demonstrate how certain rules are applied or what process to follow. Initially, these two types are not identified or related. But when he has completed recording the payment transactions, he connects them by stating that in the cash receipt journal one records all payments made, whereas in the cash payment journal, one records the amounts of money that are received by the company. These are linked with the different source documents, i.e., CPJ with cheque counterfeits and CRJ with cash register rolls. At this point, the lecturer also adds two more types of journals: the creditor's journal and the creditor's allowances journal. In this way, the lecturer increases the semantic density strength by increasing the number of types of journals to which students are introduced:

> Remember, in the CRJ and in all your journals you must enter your transactions in date order – meaning the first transaction that took place during the month is the first into your journal. Remember, as well: what I usually tell my students is that your source documents basically give you all the information that you need in order to enter into your journals. Pretend they are a table in which you have to enter your information. So, you will take all of the information that is in your source documents as it is. They provide all of the information that you need and you will enter them in each relevant column of your CRJ, CPJ, and so forth.
>
> When I look at my transactions, I've got duplicate receipts. The first one says a loan from ABSA Bank, R50, 000. Let's enter that into the CRJ. [*turns to the board to record the transaction].* Your document number is 313. The date is going to be on the first – remember, we've already indicated over there the month [*pointing to an area where the month is written].* Your details: it's a loan from Absa bank, so you will say Absa bank. And then, that's R50 000, and that's supposed to be entered into the analysis of receipt. And then you also take the amount and you put it into your bank. Then after that you will look after bank, it is all your additional columns that you have opened inside your CRJ. If this loan does not have a column in which to enter their amount you will then take it through sundries. It is a loan from the bank, your amount is 50 00, and your detail is going to be a loan.

The results detailed in this section reveal that the TVET lecturers relied on different teaching methods and teaching materials, resulting in varied semantic gravity and semantic density strengths. While the lessons focused on simple concepts, lecturers were able to build complexity by establishing conceptual relations between them.

5.4 Chapter Summary

This chapter has presented the results that were derived from analysing the online videos in an attempt to answer the first two research questions. It began by presenting the results on the types of knowledge that exist in the TVET sector, how lecturers managed the curriculum, and the teaching methods employed by TVET lecturers as displayed in the online videos. The second section focused on the results obtained from the semantic gravity and semantic density analysis, highlighting the knowledge practices that exist in this sector. It further looked at the organising

principles as they varied during each pedagogic episode.

The next chapter will expand on these changes in semantic gravity and semantic density strength to reveal the archetypal pedagogies that exist in the TVET sector. The description of these archetypes will further be supported by a detailed description of the ontological categories used by the lecturers to ensure epistemic ascent.

CHAPTER 6: PEDAGOGIC ARCHETYPES

6.1 Introduction

The previous chapter presented a detailed description of the findings obtained from analysing the data using both the vocational pedagogy dashboard (Hugo & Louton, 2020) and the semantic codes of the Legitimation Code Theory (Maton, 2009). These analytical toolkits were employed to analyse the pedagogical practices of the lecturers as well as the underlying knowledge practices displayed in these pedagogies. The second and third objectives of this research were

1. To categorise and describe the pedagogical patterns that emerged from the pedagogical choices made by lecturers during the lessons as captured in the vocational pedagogy dashboard (Hugo & Luoton, 2020); and
2. To analyse and examine how the pedagogical patterns enable or hinder knowledge growth using Maton's Legitimation Code Theory (2009)

To achieve these objectives, the concept of semantic profiling from the Legitimation Code Theory (Maton, 2009) was employed to identify the archetypes and predict how they influence knowledge growth. This chapter will discuss in detail the pedagogic archetypes that emerged as a result of the pedagogies and knowledge practices. Subsequently, ontological categories will be introduced and applied to these pedagogies to enhance understanding of how the archetypes contribute to knowledge building.

6.2 Introduction to pedagogic archetypes

The main purpose of this research was to identify and describe the patterns of pedagogy that were observed in the online videos and to investigate the possible impact these knowledge patterns have on knowledge accumulation. To do this, the practices of lecturers over a prolonged period were analysed, and the semantic gravity and semantic density strengths as they varied throughout each episode were plotted on a graph. This mapping of semantic density and semantic gravity changes revealed the corresponding pedagogic patterns, highlighting the knowledge that these pedagogic actions legitimise. As previously stated, semantic gravity focuses on the degree of context dependence of meaning: the stronger the semantic gravity, the more knowledge is situated. However, through different forms of abstraction, lecturers can

weaken semantic gravity, making it feasible for students to acquire occupational knowledge and skills that they can apply across multiple contexts. Alternating between weak and strong semantic gravity is important for knowledge transfer as it equips students with both specific and general knowledge. Furthermore, they can identify the underpinning scientific principles, which allow them to generalise their tacit knowledge to novel contexts.

Similarly, a range of semantic density strengths provides students with opportunities to grasp both simple and complex ideas, as well as general and abstract concepts. As stated, semantic density relates to the degree of condensation of meaning within a term, phrase, or passage. Pedagogic periods unfold over time, during which lecturers can employ various pedagogic tools to adjust the degrees of epistemological condensation. Epistemological condensation considers not only individual concepts but also how these are unpacked and interrelated during the pedagogic instance. The different methods lecturers use with clauses and their choices regarding the sequencing of knowledge contribute in distinct ways to epistemological condensation.

Variations in both semantic gravity and epistemological condensation can be used to trace how knowledge structuring changes during a lesson or how a concept or unit of study is taught over a period of time. By plotting the changes in semantic gravity and semantic density on a graph, with time as the y-axis, one can observe different pedagogical patterns.

The findings showed that different patterns of pedagogy are used in the TVET sphere, highlighting the diverse ways in which lecturers engage with the intended aims and objectives as well as their context and resources. Three patterns of pedagogy emerged as archetypal pedagogic patterns. For the first archetype, lecturers worked fluidly between strong and weak semantic gravity as well as weak and strong semantic density, creating a wave-like pattern. For the second archetype, lecturers worked at the same level of semantic strength for both semantic gravity and semantic density, creating a flat line. These lecturers did very little to simplify knowledge or introduce more complex knowledge structures. They also did very little to ground the knowledge in the immediate context or to introduce more abstract ideas. For the third archetype, lecturers worked with both know how and know that at different semantic gravity and semantic density strengths, but were less fluid. These lecturers were able to contextualise abstract ideas and simplify complex concepts. Still, they did not link concepts together or show how simple ideas are used to create more complex constellations or classifications of ideas and meanings. These actions created patterns resembling downward escalators.

These three archetypes reflect different strategies for structuring and delivering knowledge in the classroom, impacting how effectively students can engage with and apply the taught concepts. The wave pattern type is generally more effective for fostering a deeper understanding and versatility in knowledge application, while the flatline approach can restrict learning to either overly simplistic or excessively abstracted knowledge (Maton, 2013), depending on the form it takes.

To demonstrate how these three archetypes were used during the lessons, Sections 6.2, 6.3 and 6.4 present a lesson illustrating each of the archetypes. The first lesson (Section 6.2) is on oxy-acetylene in engineering fabrication, a topic that is taught in the fourth unit of NCV Level 2. The lecturer used two lessons to cover the content: a theoretical lesson was followed by a practical demonstration of the cutting process. During both lessons, the lecturer weakened and strengthened semantic gravity and semantic density, creating wave patterns, exemplifying the progressive complexity model. The second lesson (6.3) is on applied accounting (NCV Level 2). The lecturer demonstrates how to enter transactions from the source journals into different accounting journals. The lesson covers six journals, and each journal is taught separately, resulting in the Conceptual linkages and consistency model archetypal pedagogy. While most of the accounting lessons focused on a single type of journal per lesson, they all worked in the same manner, creating low-flatline. The third lesson (6.4) is on asexual plant propagation (NCV Level 4). The lecturer indicates that this is the second lesson on the topic of plant propagation. Unfortunately, I was unable to access the first video on sexual plant propagation, as it was not posted on the YouTube channel. This lecturer's pedagogy exemplifies the Conceptual clusters and linkages archetype.

6.3 Progressive Complexity Model

This archetype emerges from the dynamic interaction between semantic gravity and semantic density during the teaching process. Lecturers employing this pattern effectively navigate between abstract and concrete concepts, weaving between theoretical explanations and practical demonstrations. This pedagogic approach is characterized by a continuous oscillation, where lecturers start with abstract concepts (weaker semantic gravity), which are then concretized through practical examples or demonstrations (stronger semantic gravity). Simultaneously, these transitions involve variations in semantic density, where the integration and layering of knowledge increase as more abstract concepts are linked with practical applications. The 'wave'

results from this rhythmic movement between levels of abstraction and practicality, fostering a robust learning environment where students can see the practical application of theoretical knowledge.

To demonstrate this pedagogic archetype, I present an analysis of the teaching of oxy-acetylene cutting for engineering fabrication and design. This topic was taught over 2 sessions: the first dedicated to theory and the second one was dedicated to practical application. The theorical and practical lessons were clearly distinguishable from each other by the teaching and learning environment: the theory lesson was recorded in what appeared to be a lecture room, while the practical lesson was taught in a workshop.

6.3.1 Lesson 1: Theory

The lecturer begins the lesson by stating that the lesson is on oxy-acetylene cutting, without stating the aims and objectives of the lesson. To begin, he breaks down the term ‘oxy-acetylene’ to its root words, ‘oxygen’ and ‘acetylene’, and then identified the causal relationship between the two gases – namely, that acetylene burns in the presence of oxygen. He explains the functions of oxyacetylene by presenting points using a slideshow and briefly explaining them further. The discussion is abstract, with weak semantic gravity. Semantic density begins at a strong state, as students are introduced not only to a compound term but to the causal relationship between the two gases. However, semantic density strength is not maintained for long, as the lecturer quickly moves from the relationship between these two gases to the function of oxy-acetylene as a single entity.

The lecturer proceeds to simplify the oxy-acetylene system by focusing on the individual components that make up the cutting system. Each part is discussed in detail, listing important characteristics. The lecturer explains the role or function of each part in the process. This equips the students with the necessary propositional knowledge for understanding why oxy-acetylene cutters work the way they do. The lecturer uses both illustrations, exposing students to how parts look, and in other cases shows them an actual part and demonstrates how it works. The demonstrations build on students’ knowledge of how things work within the system. Whilst exposure to the concrete objects prepares students for the actual work environment, simple diagrams offer two pedagogical advantages: they make it easier to focus on the small details that are not easily visible to students – thus building on the knowledge that they have acquired – and

they strip away unnecessary detail, it makes it easier for students to understand what the lecturer is talking about. During this phase, the lecturer moves between strong semantic gravity (illustrations) to stronger semantic gravity (concrete objects) and also strengthens semantic density by exploring the relationships between the parts themselves, and the whole system. This phase of the lesson forms the upward escalator of the semantic profile, moving from weaker semantic gravity strength to stronger semantic gravity strength. Eventually, the lecturer pulls everything together into one system by displaying a picture of all the parts that come together to form the oxy-acetylene cutter. He reinforces the content that he had covered, emphasizing the order in which the system is connected.

In the next phase, the lecturer explains the process of assembling the cutting system, starting with the cutting and choosing the correct air pressure for the workpiece, and explains how to light the torch. At this point, the lecturer only articulates what needs to be done to put the equipment together. When he teaches about types of fire, he displays an image showing the three types, and verbally makes distinctions. He uses the same pedagogical approach to introduce the cutting process. He raises the aspect of good workmanship, briefly explaining the correct way to hold a torch, and uses images (illustrations and a photo) to show how different distances between the torch and the workpiece affect the workpiece. Equipped with such knowledge, students would be better able to self-manage and evaluate their work as they would know how the final product would look when the job is executed correctly as well as how it would look if it was not done correctly.

This lesson concludes with a short assessment, which the lecturer uses to reinforce the concepts that have been taught. The assessment is taken from a previous formal assessment task. One of the questions requires that students describe a concept that the lecturer did not discuss during the lesson. The lecturer uses this moment to introduce the concept to students, so, rather than encouraging the students to remember, as had been the case with previous questions, he immediately provides an answer. This concludes the lesson.

6.3.2 **Lesson 2: Practical**

The second lesson is a continuation of the previous lesson, as stated by the lecturer. This indicates that the knowledge to be acquired in the second lesson will build on previously learnt concepts. The lecturer also distinguishes the second lesson from the first lesson by using a

different teaching and learning environment: the second lesson takes place in the workshop, rather than the lecture room. This gives a clear indication that this lesson will shift from a focus on theoretical know that and know-how to a more practical understanding of know how.

The lesson begins with the teaching of the safety measures required in a workshop. The lecturer is dressed appropriately in personal protective equipment and uses what he is wearing to identify the safety clothing, using hand signals to point to and touch specific items as he names them. The information that the lecturer shares is highly contextual, with very little semantic density as he only names the items he is wearing. This part of the lesson is not directly linked to the previous lesson but forms the basis for the rest of the lesson. It also strengthens the semantic density of the two lessons as it equips students with knowledge that they will be necessary for working in the workshop.

The next phase of the lesson reviews the theoretical knowledge taught in the previous lesson. The lecturer begins by identifying the components of the ox-acetylene cutting system. The first components he identifies are the cylinders; he uses visuals from the previous lesson to identify the different cylinders. More specifically, he identifies them using the colour scheme he introduced in the previous lesson, but builds on this slightly by adding that even the heights are different – the acetylene is shorter than the oxygen. In contrast to the lesson, where the lecturer discussed the individual components, for this lesson the system is already assembled. He identifies the regulators, the torch, and the nozzle. Semantic gravity is strengthened with very little strengthening of semantic density as students have already learnt the concepts being discussed.

The lecturer shifts from teaching about a static understanding of the system to a more dynamic understanding. While the focus is on the torch and lighting the torch, this action is dependent on understanding how the other components function and their roles in the system. This contrasts with the previous lesson, where the students were introduced to the steps in a more general way. In this lesson, the lecturer makes it more practical and specific, while constantly referring to concepts from the first lesson. For example, the lecturer demonstrates how to open the gas cylinders, while reminding students of the order for opening the gases. He then went through each component, opening the gauges, adjusting their pressure as necessary, while describing in details what he was doing. At the end the students get to see the actual flame, instead of an illustration like in the previous lesson.

The semantic density is strengthened by exploring the sequence for extinguishing the torch. In the previous lesson, the lecturer moved from lighting the torch to discussing how to choose the correct working pressure. Thus, the concept of switching off the torch is new and adds to the complexity of the lesson by increasing the knowledge constellations, by adding a new step into the sequence or knowledge of how the torch works. Prior to this moment the lecturer had introduced students to how to switch on the torch, and how to control the pressure, and thus the fire, and now he added an extra step.

Part of the practical demonstration offered students exposure to both visual and auditory elements of using the torch: the system made different sounds that changed or disappeared with an adjustment in either oxygen or acetylene supply. In one instance, when the lecturer explains that you must release the gases, and releases the gases, students can hear the sound of the gases escaping through the torch.

After switching off the torch, the lecturer proceeds to introduce the workpiece to be used in the lesson. This introduction serves as a review of the concepts related to choosing the correct nozzle, however, the review was done in such a manner that it focused specifically on preparing to cut a metal plate that the lecturer was using for the demonstration. This downward shift in semantic density strength is very short as the lecturer quickly moves towards the practical demonstration of cutting the plate. He begins this by introducing two new materials: the boilermaker chalk and the 1-meter ruler. The lecturer also introduces a new set of steps that students need to follow when they are going to cut a workpiece. The information is very specific and is guided by the lecturer's actions, and thus is very strong in semantic gravity. The language used is very simple; however, the lecturer builds complexity by introducing the steps and explaining them individually, as described next.

Step 1: Making the marking. The lecturer demonstrates and explains to students how to measure and mark their measurements, comparing the boilermakers’ mark to a mark that is used in an everyday context.

Step 2: Switching on the torch. The lecturer first introduces another piece of personal protective equipment – instructing the students to put on their gloves before they switch on the torch. During the process of switching on the torch, the lecturer goes through like he had taught them previously. This time, he brings the students' attention to the sound made by the system when he

adjusts the oxygen:

> … [15:06] you see there is a soot here, it's coming out. Then, after that, open up the – what? The oxygen. You hear it: it’s making a sound. So, I don't need that sound. I adjust it. It’s now in a neutral flame.

The students are further introduced to new details about the torch and its connection to the flame. The lecturer tests if the lever on the torch is working and assesses this by judging the type of flame produced when he applies pressure to the lever. The semantic gravity is slightly weakened as the focus is no longer on the whole system but rather on two components and their effect. Semantic density is increased because of this exploration of cause and effect.

Step 3: The cutting. The lecturer further strengthens the semantic density by increasing the knowledge constellation by adding something new to students’ theoretical know how. He begins by highlighting the positioning of the hands and arms during the cutting process. He emphasises three dimensions: the speed, the distance of the torch from the plate, and the concept of preheating. These are explained and he demonstrates them.

Around 17:12 the torch backfires. He uses this moment to remind students of the concept of backfiring that was introduced in the first lesson, explaining the cause of backfiring. After the pause to explain backfiring, he reminds students of the first step in the actual cutting, which is preheating. He then instructs students to watch carefully as he will demonstrate backfiring. A distinct sound can be heard as the torch backfires.

Step 4: Evaluation. The lecturer uses the completed workpiece to compare it to an old cut. What the lecturer looks at is similar to what was discussed in theory lesson, on quality control. The lecturer instructs students to observe that the new plate has smoother edges than the old one, which he attributes to the distance between the torch and the work-plate. While the lecturer doesn’t state that students need to evaluate their workpieces after they finish, one can assume that it’s the case.

Step 5: Switching off the torch. In the final stage of the cutting process, the lecturer switches off the torch. Similar to his demonstration of switching on the torch, he goes through each step for the switching of the torch. He concludes the lesson by recapping the importance of safety gear.

6.3.3 Analysing the Progressive Complexity in Oxy-Acetylene Cutting Lessons

An analysis of the two lessons reveals a series of minor variations in semantic gravity and semantic density strength embedded within a bigger wave-like pattern. At a macro level, the lecturer discusses the oxy-acetylene cutting system, its structure and function. To teach the necessary skills and knowledge, the lecturer begins by providing a list of the functions of the system as a whole. The system is unpacked by breaking it down into its parts. As the lecturer provided more details about each part, more details were attributed to the oxy-acetylene cutting system, thereby condensing more ideas into the oxy-acetylene cutting concept. At a micro level, the lecturer works with weakening semantic density strength, as he moves from describing the functions of the whole system to identifying the parts, characterizing them and describing their functions. Returning to the macro wave, the lecturer weakens semantic gravity strength as he explains how the parts are assembled and positioned within the system. This downward shift quickly changes to an upward trajectory as the lecturer describes how to use the oxy-acetylene cutting system by elaborating on the steps, for lighting the torch. Semantic density is further strengthened as the lecturer shifts to focus on the choice of nozzles and types of fire. This abstraction from the whole system to a focus on the individual component brings more density as more details are given about the nozzle characteristics and their relationship to the work that needs to be done. Prior to this the lecturer had described and detailed the characteristics of each component building a static understanding, at this point the lecturer shifts to offer a more dynamic understanding of how the parts function in relation to each other. He also a shift from a very specific understanding to a general application of the rules. Semantic density is then weakened again as the lecturer reviews the concepts that have been taught, using concrete examples to demonstrate. At this point, the focus of the lesson returns to its starting point: the function of the cutting system. However, in contrast to the lecturer's previous listing of the functions of oxy-acetylene, he demonstrates how the system works. However, within this concretization, the lecturer builds complexity as the concept of oxy-acetylenes is extended beyond a fire that is caused by the presence of oxygen and acetylene.

Hugo (2015) states that establishing connections between ideas and concepts, and joining them into a bigger schema, is important for knowledge accumulation and understanding; he argues that revealing these connections is an important pedagogic act undertaken by a lecturer. As students get acquainted with the minor elements and build these up into bigger themes it becomes easier for them to remember and, over time, these elements become a single unit of reference. Hugo

(2015) argues that this is what separates novices from experts, as experts work from a bigger schema than novices.

This lesson that demonstrates the progressive complexity archetype, illustrates how a lecturer works with both single elements and their parts, and then links these up into a larger concept. The more the students work with oxy-acetylene, the stronger these relationships become. Thus, this pedagogic archetype can be said to be conducive to knowledge growth.

6.4 Conceptual Linkages and Consistency Model: A Flatline Archetype

In contrast to the dynamic wave pattern, the flatline archetype represents a pedagogic strategy where there is minimal fluctuation in semantic gravity and semantic density throughout the teaching session. This approach can manifest in two forms:

> **Low-Flatline**. Here, the teaching remains highly contextual and specific, with very concrete references and minimal abstraction, resulting in strong semantic gravity but weak semantic density. The knowledge imparted is highly specific to the context and lacks the depth or complexity that allows for broader application. This form often leads to limited student engagement with the deeper, underlying principles of the subject matter.
>
> **High-Flatline:** This occurs when the teaching involves complex concepts presented without sufficient unpacking or contextualization, maintaining high semantic density but weak semantic gravity. Students face challenging, dense content that remains abstract and difficult to grasp or apply in practical contexts. This approach can hinder students from accessing powerful knowledge and developing a comprehensive understanding.

In most of the lessons analysed in this study, the pedagogic archetype displayed was that of a low-flatline. In these videos lecturers worked with a problem, or a number of problems, that could be solved by following the same steps or procedures, or applying the same rules. After watching the lecturer work for a long enough time, a viewer would be able to replicate the lecturers' actions. In the case of students, they may achieve competence in task execution, but fall short when it comes to justifying their actions or responding to emerging crises because they lack knowledge of the underlying principles.

6.4.1 Applied Accounting lesson

This is a lesson on applied accounting offered at NCV Level 2. According to the lecturer, the students would learn how to take transactions from source documents and enter them into accounting journals. In essence, the lesson is very practical, with strong semantic gravity as the lecturer demonstrates to students the process of recording financial transactions in the relevant accounting journal. However, the semantic gravity strength varies between the source documents and the accounting journals, rendering the accounting journals weaker in semantic gravity strength compared to the source documents. While the journals are more abstract, source documents are specific instances of business transitions that the business has engaged in. The journals are more general, containing information about numerous transactions grouped under specific categories. During the lesson, the lecturer constantly moves between the source documents and the journals, which he draws on the board.

In terms of semantic density, journals can be said to be of strong semantic density strength. Unlike the source documents, which are proof of specific transactions, journals are recordings of transactions which are ordered systematically. With each transaction listed in the source document, students need to make decisions about which column to use for the recording of the transaction. Each transaction explored in the lesson is used as an instance of a particular type of transaction that is to be recorded in a specific type of accounting journal in a specific manner.

While these shifts in both semantic gravity and semantic density strength are significant, they occur in a very peculiar manner. The lecturer reads from the source document and follows the steps, which are specific to the transaction with which they are working. The lecturer does not indicate general rules for the recording of these transactions, but rather works with examples that offer the same semantic gravity and semantic density strength.

Presentation of the lesson

In the introduction to the lesson, the lecturer indicates that the lesson is exam-focused, naming the source documents that the students may receive during the exam. At the beginning, the lesson is not very strong in semantic gravity because, while the lecturer has lists to represent the sources and has illustrations of journals, he has not yet started working with them concretely. Semantic density is very weak. The lecturer then introduces the source documents that he will be using, stating which source documents will be used for which journal. He explains general rules

applicable to all journals as well as how to enter the information by treating the journals as tables in which to record the information.

Cash receipt journal examples

The lecturer begins the next part of the lesson with very strong semantic gravity by reading the transaction that he will demonstrate. He extracts details from this transaction and records them on the journal illustration on the board, weakening semantic gravity as the semantic density increases. The process is done simply, with little explanation for why information is written in specific columns or in a particular manner. (In the excerpt below, the names of the columns in the CRJ that were filled in for this particular transaction are underlined).

> I look at my transactions. I've got duplicate receipts. The first, one starting from the 1st of September, 2015, will be receipt number 313. It says it's a loan from Absa Bank :R50000. Let's enter it into the CRJ. Document number is going to be 313. The date is going to be on the 1st. Remember, we've already indicated over there the month [points to the top of the journal]. Your details – it's a loan from Absa Bank, so you will say 'Absa Bank'. And then that's R50, 000 that's supposed to be entered into the analysis of receipts. And then you also take that amount and you put it into your bank. Then after that you will look: after bank, it's all your additional columns that you have opened inside your CRJ. If this loan does not have a column in which to enter that amount, you will then take it to sundries. It is a loan from the bank: your amount is going to be '50 000' and your details will be 'loan'.

The lecturer continues to teach how to work with a CRJ by going through two more examples. The second transaction follows the same pattern as the first: the lecturer reads from the source document and uses the information to fill in the journal. However, this transaction adds to what the students have already observed by exploring a different type of transaction: while the first transaction focused on income in the form of a loan, the second is an instance of rental income. Whereas the source documents used to complete the first transaction were both the deposit slip and a receipt, the second transaction only makes use of the receipt. These variations serve to strengthen the semantic density, by introducing a different type of transaction and by introducing a different process for completing a journal entry. Furthermore, the lecturer's use of the term 'bank' serves to strengthen the density of the term as he uses it to express three different

meanings: ‘bank’ as an institution; ‘bank’ as the action of depositing money at the institution; and ‘bank’ as the process of documenting the value of a transaction in the column ‘bank’. The following extract show the lecturer speaks as he completes the journal entry. (To demonstrate the different uses of the term ‘bank’ I have used different formatting styles. The column headings are underlined).

> …the next transaction is on the 7thof the month. Receipt number 314… receipt number 314, under document number. The date is the 7th. And then the transaction says ‘rent from Eastern Carpets R3 400’. I'm going to enter under details – enter ‘Eastern Carpets’. The amount is then R3 400, which you put under the analysis of receipts. And then you will take that amount to the next column. Now, before we do that, we must remember that you've been given your deposit slips. I've got in front of me three deposit slips: DS 21 22 and 23. Remember the job of your deposit slips are to help you so that you know when you should put an amount under the column bank. It is not every day that we **bank**. The deposit slips are going to assist us to be able to know on which days we are going to take money to the bank. Deposit slip number one was for R50 000 on the 1st of September; the next one is on the 9th of September. Now, if we look at this transaction, it says the 7th. So, we need to ask ourselves: am I going to put now money inside of the bank if I didn't **bank** on the 7th because my deposit slip says I **banked** on the 9th? The answer to that is then ‘no’. So, for this particular transaction, I am NOT going to have an amount on the bank. I'm going to then continue with the transaction. It's rent from Eastern Carpets. There is no additional column open for rent, so I'm going to take it straight to Sundries 3 400. And that is rent. But I'm not done there – because we do teach in Applied Accounting Level 2 you must indicate whether that is a rent expense or rent income. It's in the CRJ – money that has been received – so there is going to be rent income. Please remember to do that as well for your activities, tests, assignments, and examinations.

The third transaction is a sales income, demonstrating to students how to continue after they did not bank and how to record transactions from a cash register roll. With the sales transaction, the lecturer uses the sales and cost of sales columns for the first time, and with this he introduces the formula for calculating the cost of sales, which clarifies the relationship between the two. Again, semantic density is strengthened by introducing a new type of income – sales income – and by demonstrating a slightly different process for making a journal entry.

Each transaction is taught as a standalone transaction; however, all the transactions are treated in the same manner. The same details are extracted from the source documents: the date, source document number, monetary value, and source of income. The same process is followed when the lecturer explains the process for completing a payment journal as well as the other journals.

Cash payment journal examples

The lecturer clearly indicates a shift in focus from the CRJ to the CPJ and begins by identifying the source document that he will be using for this section as the cheque counterfoil. The lecturer follows the same process, using three transactions as an example of cash payments. The first transaction is a payment for computer repairs, the second is a payment of wages, and the last is payment towards a credit account. The lecturer records each transaction by reading and entering the results in the relevant column; like the CRJ, the lecturer does not provide much detail to explain the choice in columns, or the exact details or terms used in the journal:

> Remember: enter transactions in date order. Document number 465: this cheque counterfoil was issued on the 11th (date column). The name of the payee was Computer's Premier. I'm going to enter information here [pointing to the column titled name of payee]. Then, that cheque was R250 and it was issued for repairs, so I will enter 250 in the column bank. Then I check my additional columns that I had to open. There are no repairs there. And if there is no additional column, remember: you go to sundries and you put in 250. That check was issued to that company for repairs [writes in the detail's column in the sundry section]. The next example I will make is with cheque counterfoil number 466. Cheque counterfoil number 466 was a cash check issued for wages R2 500. This was issued on the 14th, so I entered document number 466. The date for that was the14th. This was a cash cheque [writes 'cash' in the detail's column]. It was issued for wages. The amount was R2 500. If we look at additional columns, there is no wages: I will take it straight to sundries – R2500 – and the details for that is 'wages.

This extract displays the similarities in the way the lecturer works with each transaction. The lecturer takes each transaction from its concrete, contextual base and adds it to a complex network of other transactions. This is done in a standardized manner, such that a student who has carefully observed the lecturer can apply the same standardized process to new transactions, even

if they are of a different type. The process is iterative, with each transaction serving to reinforce the ground rules, enabling students to observe the different possible transactions and how to work with them.

The journals themselves also present a form of fractal practice, where teaching activities are similar, yet they represent different levels of complexity. The accounting journals taught in the lessons shared numerous structural similarities, as well as similarities in how the transactions were recorded, but there were still numerous differences too. The initial columns are similar, such that the key to correctly completing the journals is to ensure that you use the correct source document for the correct journal. Even with the additional columns, the process remains fairly easy: if there is no column, write the entry under ‘sundries.

At the end of the CPJ demonstration, the lecturer compares the two journals. First, he explains that the CPJ is for recording information from the cheque counterfoils. He then explains what the cheque counterfoil is, stating that it is a source document that is filled out when issuing a cheque. He explains that cheques are issued when making payments towards suppliers, or payment of expenses. He explains that the CRJ is for recording money that has been received, explaining that the cash register roll is when you are selling, duplicate receipts for when you receive money, and the deposit slip is used to deduce when to record under the bank column.

In the first part, the lecturer introduces two types of journals to the students. The journal, which has weak semantic gravity, by introducing examples of the transactions associated with each journal, the lecturer strengthened semantic gravity. This is achieved by focusing on specific source documents that are only applicable to each journal; and using each source document to introduce other specific instances of transactions that would be the focus of the lecturer during the lesson.

However, as the lecturer works with each transaction, recording it in the journal, the semantic gravity is weakened, and this is accompanied by the strengthening of semantic density through the systematic organisation of information about each transaction into the journal and introduction of not only the types of transactions – for example, rental income – but also introducing a specific instance of this type of transaction.

Each transaction provides us with a nuanced view of the changes in semantic gravity and semantic density, as they play out within each escalator. But by zooming out and focusing on

each journal type about the rest of the lesson we can observe downward shifts as the lecturer explains the process for filling in each type of journal by providing examples.

At the end of teaching the two journals, the lecturer changes the direction of flow as the lecturer moves directly from working with the specific details of the chosen transactions to providing a general definition of the journal and their links to the different source documents. During this period, the lecturer also introduces the other journals that he will cover. But even with these journals, the lecturer uses the same pedagogic style, doing one or two examples of transactions.

6.4.2 Analysing Pedagogic Consistency and Conceptual Linkages in the Lesson

As this was the only video lesson on applied accounting I could find by this lecturer, I could only trace the semantic profile created by the lecturer over a shorter pedagogic episode: a single lesson. To support any claim that will be made, I would like to reference other lessons in applied accounting. In contrast to the lesson discussed above, which demonstrates to students numerous accounting journals, the other accounting lessons focused on one specific journal, and almost all of them had no follow-up video. This suggest that, under normal circumstances, lecturers use a single lesson to teach one specific journal, rather than a few examples from each journal.

The lecturer in this lesson displayed a unique pedagogic archetype, which could be observed in most accounting and accounting-related subjects as well as some engineering subjects. Lecturers embodying this pedagogic archetype worked with very little detail, focusing on demonstrating how things work and or how calculations are done. This maintained very strong semantic gravity while keeping semantic density fairly weak. This allows students to observe what needs to be done under slightly different circumstances. Students get to view the lecturers demonstrate how to do things but it’s up to the student to determine their understanding of the existing patterns. As such, lesson complexity is not built through variations in semantic density, although it plays a significant role, but rather through exploring as many instances or examples as possible. Know that is then a product of know how, in the practical sense.

In this particular lesson, the focus was on recording business transactions in different business journals. To do this, students needed to know the different types of source documents in which the transactions were recorded and which documents are used for completing different journals. The lecturer worked with both source documents and journals. The lecturer demonstrated how to organize financial details in the journal. These journals are weaker in semantic gravity and

stronger in semantic density as compared to source documents. The different source documents served as concrete proof of very specific transactions that the business entered into, making them very strong in semantic gravity. However, there was nothing very complex about these source documents.

The complexity in the lesson was built by the introduction of different types. First, the lecturer worked with different types of accounting journals. The differences between these journals are stated briefly and each journal was linked to a specific source document. Second, the lecturer worked with source documents. Each accounting journal is associated with a specific source document. Furthermore, within each source document type, the lecturer worked with different types of transactions. Each transaction served as the strongest point in terms of semantic gravity and the weakest in semantic density. Each transaction functioned as a token used to demonstrate to students how specific financial transactions are treated.

6.5 Conceptual Clusters and Linkages

The last archetype is slightly more dynamic than the second archetype, with lecturers working through the different strengths of semantic gravity and semantic density. However, there is no continuous oscillation between weak and strong semantic gravity and weak and strong semantic density. Lecturers who used this archetype worked systemically to shift from abstract and general ideas to more concrete applications of concepts. When the lecturer had achieved the desired level of extraction, they moved on to the next concept. Each concept is left at its exemplification or application, with no consecutive upward shift towards abstraction or generalisations.

An example of such a lesson is the lesson on asexual plant propagation. As this lesson is described in detail in Chapter 5, the discussion here will be briefer than for the lessons illustrating the other two archetypes.

In this lesson, the lecturer has an overarching topic: asexual propagation. After connecting this topic to a previously learnt concept, the lecturer shifts to a stronger semantic gravity state, naming and displaying the tools used in asexual plant propagation. The functions of each tool are also listed with the tools. After the lecturer posits the tools, he shifts back to the concept of propagation, listing and describing the different propagation methods used in asexual

propagation. These descriptions are very general; however, the lecturer achieves a certain level of condensation by expanding on the students' understanding of asexual propagation. This understanding becomes the reference point that the lecturer returns to teach each method.

The lecturer builds on the concept of asexual propagation by elaborating further on each technique. For each technique, the lecturer identifies sub-types and then provides examples of each sub-type. For example, he names the onion as the type of plant on which soft-wood cutting can be performed. Furthermore, the lecturer explains how each method is performed, describing the materials used for each method. The lecturer then moves from the slightly concrete examples to a more general state by explaining the steps involved in each method. A similar type of simplifying\ is followed for each method of propagation, with the lecturer providing a bit of explanation, then providing sub-types and, in some instances, instantiations through demonstrations.

6.5.1 Analysing Conceptual Clusters and Linkages

An analysis of this lesson reveals a connected series of downward escalators. Complexity in is achieved through condensations rather than abstraction. The more classifications that the lecturer introduces, the more details that students have to deal with. As the lecturer works through each level of sub-types, more meanings are attributed to the level before it. As we move up from the sub-types, the higher-level classifications are then used to represent the lower sub-types.

6.6 Semantic Structures in TVET Pedagogy

6.6.1 Ontological Categories in Vocational Pedagogy and Their Relevance to Semantic Profiles

By segmenting the semantic profiles, it becomes possible to better explain and understand vocational pedagogy through the use of ontology and its categories. Ontology, the study of things that are or may exist, investigates the defining characteristics of things and the relationships between different structures and entities. Ontological categories provide us with descriptive taxonomies for identifying and describing different structures and their properties, occurrences, the order in which these occur, and the relationships that exist (Smith, 1998). The results of this

and other studies (Winberg & Hollis-Turner, 2021) indicate that vocational knowledge and skills comprise knowledge about physical structures such as tools and equipment, processes, and procedures – such as making journal entries or understanding the steps for conflict resolution. This knowledge can be categorised using the following ontologies:

1. Part / Whole: Part-whole ontologies focus on the intricate relationships between parts and the whole (Hugo & Mokoena, 2023). An understanding of the functional interdependence of parts is crucial for diagnostic purposes, as students can then identify broken parts in a system not only by identifying the physical broken component, but can also predict the sources of the problem by viewing the structure as a whole or attempting to get the structure to work.
2. Structure / Function: Structure-function ontology defines the relationship between how the structure is composed – in terms of its parts, properties, and other characteristics – and the function that the structure performs (Smith, 1998).
3. Type / Tokens: These ontologies represent the relationship between broad concepts and ideas with their instances of occurrences or concrete forms of being. These particular beings are not in themselves the type or universal form, but rather a representation of that form, for example, using a specific dog to explain the characteristics of all dogs (Hugo, 2020).
4. Cause / Effect: Cause-effect ontologies relate beings or events in terms of causation and causality. While causation identifies the relationship between specific entities, causality provides us with a more universal rule about the relationship. Cause-effect relationships are important in technical training as they facilitate an understanding of why certain procedures are necessary, or what result can be expected from certain interactions or actions. An understanding of cause-effect relationships is also beneficial when diagnosing issues with systems or explaining diagnostic issues.
5. Rule / Exception: These ontologies describe the typical properties of the members of a group and the typical rules that can be applied to a way of doing. They also define those members or operations which form part of the group but should be treated differently.
6. Concrete / Abstract Integration: Concrete-abstract relations explore the relationship between practice and the sciences underlining those practices

6.6.2 Analysing the Archetypes Using Ontological Categories

The lesson explored as an example of the progressive complexity archetypal pedagogy was the lesson on oxyacetylene cutting. The lesson begins with the lecturer stating a universal rule about the relationship between oxygen and acetylene, which is that acetylene burns in the presence of oxygen. This relationship is later explored when the lecturer explains the different types of flames, how different proportions of oxygen and acetylene produce different flames, and how each flame is used for different purposes. The lesson proceeds to discuss the individual components (parts) and their characteristics. These are later integrated into the larger system (whole). This integration is done such that students develop an understanding of the interdependence of the components. The transition not only focuses on the static connection but also highlights the functional integration.

Structure-function categories can also be used to make sense of the knowledge practices displayed by the lecturer. When the lecturer begins the lesson, after stating the relationship between oxygen and acetylene, he names what oxyacetylene cutting is used for (function). During the exploration of parts, the lecturer details what each part (small structure) does or contributes to the system (bigger structure). For example, he states that the regulators control the flow of the gases from the cylinders into the pipes. The lecturer also details how each part is structured in such a way that it can perform its function. For instance, the lecturer introduces the nozzle and describes the orifices found on the nozzle. While he does not immediately explain how and why different nozzle sizes are used, he indicates that he will come back to this. When he does come back, he positions this section between assembling the cutting system and the actual cutting process. This links the nozzle sizes (structure) to the type of work that needs to be done (function).

Both of these ontological categories reveal a pedagogy where the lecturer works seamlessly through the different semantic strengths. Each of the concepts (parts) is connected to the next. This differs from how flatline pedagogies handle the relationships between parts and whole, or structures and their function. In the lessons classified as using flatline archetypes, lecturers either focused solely on specific parts, without linking them to the whole, or focused heavily on the whole, without detailing the parts and how they form the whole. For instance, the lesson on accounting journals focused on each journal without explaining how the columns in each journal are linked or necessary for recording transactions. The need for this exploration is highlighted in

the lecturer's comments, such as: “If we don’t have a column for it, we take it over to sundry accounts,” implying that under different circumstances there may be a column (part) in another journal (whole) that would accommodate that particular transaction. From a structure-function perspective, this lesson fails to adequately connect the structure (the journal) to its function. This was true of all the types of journals covered.

Lessons characterised within the conceptual linkages and consistency model tended to focus excessively on one thing or concept, without linking it to other related concepts. When the lesson was on teaching about parts, the parts were characterised or detailed without linking them to the larger structure, or explaining part-whole relationships. Lessons exploring type-tokens either focused on types, without practical examples, or specific tokens, without generalizing to the broader category. This can be seen in the accounting lesson, where the lecturer focused on the examples of transactions that were listed for the business example that the lecturer was working with. All explanations provided were specific to the transactions being recorded and were not linked to general information that students could apply to unfamiliar contexts. On the rare occasions that general rules were given, they were only given on a need-to-know basis, without any real explanation being provided.

This contrasts with the approaches used by those lecturers whose lessons were within the progressive complexity model, which engaged with type-token classifications. These lecturers used type-token distinctions to illustrate general categories and specific instances, enhancing students’ ability to apply concepts variably. On some occasions, they went as far as to provide physical or concrete examples. Abstract reasoning was applied to concrete experiences, connecting theoretical knowledge with practical application. This can be observed in the oxyacetylene cutting lesson: broadly, through the linking of the theory and practical lesson, and also through examples of this linking that are found throughout the lesson, such as when the lecturer deliberately causes backfiring and then explains what causes it.

6.6.3 Potential Impact on Knowledge Transfer and Work Preparedness

It is widely accepted that the role of TVET institutions is to equip young people with the necessary skills and knowledge required for the world of work. According to Maton (2014; Maton et al., 2016) pedagogical actions that allow lecturers to work with the different knowledge

codes found across the different planes on the semantic plane have a positive effect on knowledge growth. Thus, knowledge growth can be defined as the progression from lower-order skills to higher-order skills and abilities, as described by Winch (2013a),

The lessons used to demonstrate the archetypal knowledge practices that exist within the TVET sector showcased lecturers who were demonstrating *a way of doing something*. The first lesson on oxy-acetylene cutting demonstrated how to assemble an oxy-acetylene system and how to use it to cut a metal plate. The accounting lessons demonstrated how to use source documents to complete accounting journals. These lessons introduced to students the first-level form of know-how, which is a technique (Winch, 2010; 2013b). At the end of all these lessons, the students should have had a basic understanding of *a way of doing something*. Furthermore, the lecturers introduce the basic level of know what knowledge: the naming of the different components, in the case of the oxy-acetylene lesson, or the names of the different source documents and journals, in the case of the accounting lessons.

Winch (2009) claims that a TVET qualification indicates that a person can perform what the qualification suggests they can do. Thus, knowing how to do something is not sufficient. Rather, one must be able to intentionally utilise the known technique in a contextually appropriate manner whenever required. This represents a know-how ability of a slightly higher order than a mere technique; Winch (2017) refers to this as a ‘skill’. The attribution of a skill to an individual necessitates that the person is not only capable of acting appropriately but also able to justify their actions. This requires possessing know-that abilities beyond mere naming. The Progressive Complexity Model, exemplified by the oxy-acetylene lesson, not only establishes or names the different components but also introduces the various characteristics of the individual parts, detailing the function of each component not just for the part itself but also for the role it plays within the entire structure. This understanding enables one to explain what they are doing and why. It also significantly aids in troubleshooting issues with equipment or other malfunctioning structures. The transition from individual parts to their functional integration assists students in understanding the interdependencies among components. This corresponds to the skills level of epistemic ascent. It further establishes an entry point into the debates and communications that occur in the field of practice (Winch, 2013a). This also equips individuals with sufficient knowledge to make inferences about their situations based on the propositions and the relationships between them.

Whilst the accounting lessons which are examples of the Conceptual Linkages and Consistency Models, do not rise to the level of explicitly establishing constellations between terms and actions, Gamble (2001), in her study of cabinetmakers, identified a similar pedagogy, in which students are not taught the specifics but, rather, acquire their abilities by observing and through practice. By working with the different types of journals and examples of financial transactions for each journal, the lecturer can relay basic conceptual elements and their relations which are sufficient for entry into the accounting subjects. Winch (2013a) declares that, while curriculum design should aim at more comprehensive methods of teaching this knowledge, demonstration and replication are some of the ways it could be taught without being explicit about these relationships.

Even though the lessons do not specifically rise to the level of projects and project management skills, the oxy-acetylene lecturers began to introduce elements of planning and evaluation. Between the two lessons, the lecturer introduced different types of torches and when each type should be used. This information could be used when planning specific job assignments and ensuring that one acquires the necessary tools for the work at hand. By exploring the cause-and-effect relationships between the flame, smoke, and gases, the lecturer imparted systemic knowledge that could be used to make judgements during occupational activities.

6.6.4 Implication for Vocational Pedagogy

Lucas et al. (2012) define vocational pedagogy as, amongst other things, the science of teaching; understanding these ontologies provides us with the science of teaching vocational subjects. By making these ontological relationships explicit for students, students can better comprehend, remember, and apply knowledge. Thinking about ontological categories does not necessitate those lecturers make these explicit to their students, but rather that lecturers use their knowledge of these ontologies to structure and sequence their lessons. By making these connections through their teaching strategies, lecturers make it possible for students to connect new information with other knowledge structures, thereby making it easier for students to remember what is being taught (Hugo & Mokoena, 2023). This echoes the views of Killbrink et al. (2023), who state that students learn better when they are given sufficient detail about the critical aspects of items they are learning about.

The relationship between the lecturers' pedagogical decisions and ontological categories is reflected in other research findings (Gamble, 2001; Hugo & Mokoena, 2023; Kilbrink et al., 2023). This indicates that lecturers have an appreciation of the dynamic relationship offered by the ontological categories and that they are, to a certain extent, already engaging this appreciation when making pedagogical decisions.

6.7 Chapter Summary

This chapter has responded to two of the questions guiding this research, which are: what are the main knowledge practices that exist in the TVET sector; and what are the possible implications of the pedagogic practices on knowledge growth? In response to these questions, this chapter presented three pedagogic archetypes which were observed in the videos analysed; namely, the progressive complexity archetype, the conceptual linkages and consistency archetype, and the conceptual clusters and linkages archetype. These archetypes emerged from the analysis of changes in semantic gravity and semantic density strength over time, which revealed that the different decisions made by lecturers when enacting vocational pedagogy resulted in different teaching and learning experiences. This chapter further explored the potential implications of these pedagogies for knowledge growth – especially in reference to knowledge transfer, as the mandate of vocational institutions is to equip students with skills and knowledge that they can apply to different situations and contexts as the need arises. Finally, the chapter elaborated on ontological categories that emerged as important concepts for understanding variations in semantic strengths, as well as for understanding how these changes affect knowledge growth.

The next chapter highlights the major findings and limitations of this study. It also draws conclusions from the data presented, and uses these conclusions to make recommendations for future research and practice.

CHAPTER 7: CONCLUSION

7.1 Introduction

To conclude this thesis, this chapter summarises the major research findings in response to the study's aims and objectives and the research questions that drove the study. The chapter highlights the value that this research adds to the literature and practice on the teaching and training of vocational and technical subjects, and discusses the limitations of this study. Recommendations are made for future research and for practical actions that can be taken by TVET practitioners and curriculum developers.

7.2 Major Findings

The main objective of this study was to analyse and describe the basic pedagogic patterns used by TVET lecturers as observed in the online videos. To achieve this, the data was qualitatively analysed using the vocational pedagogy dashboard (Hugo & Louton, 2020) and the semantics dimension of the Legitimation Code Theory (Maton, 2009). The first analytic tool enabled the exploration of four aspects of vocational pedagogy, namely: the aims and objectives in terms of knowledge and skills; curriculum management; approaches to teaching; and the methods and practical choices made in teaching. It is noted that the videos used in this research were recorded under emergency conditions and do not provide a full picture of the traditional classroom dynamics. However, Hodges et al. (2020) state that emergency remote teaching materials are produced by adapting the teaching content that was initially planned for traditional face-to-face teaching. As such it can be assumed that the content, pedagogies and knowledge practices noted in this research represent the traditional classroom practices. The following section summarises the results with reference to the three sub-questions that drove the study:

1. What kinds of knowledge are taught in the TVET sector?
2. What kinds of pedagogical patterns are displayed by the TVET lecturers in online videos made during the pandemic?
3. How do these pedagogical patterns impact knowledge building in the TVET

sector?

7.2.1 What Kinds of Knowledge are Taught in the TVET Sector?

The results of this study revealed that TVET colleges offer students access to a range of types of knowledge and skills. Most subjects from the utilities faculty, engineering, and business and accounting faculties targeted the teaching of work-specific skills, such as baking a cake, cutting a workpiece using an oxy-acetylene cutter or transferring transactions from source documents to accounting journals. These lessons focused on procedural knowledge, detailing the sequences of operations. The results demonstrate that the teaching of procedural knowledge was not the only form of know-how being taught, but students were also being introduced to the knowledge of the basic techniques that they needed to perform the specific tasks. This type of knowledge was not as prevalent in the fundamental subjects. This is not surprising though, as these subjects are intended to give students general knowledge in preparation for further studies (Houston, et al. 2010).

Students were also taught about the tools, pieces of equipment, and materials that they needed for work. Lessons on tools focused on identifying the tools and their function and, in some instances, provided explanations on how each tool was structurally suited for its function. The knowledge of structure-function was also foregrounded in lessons on pieces of equipment, such as the oxy-acetylene cutting. In lessons that were centred on teaching about bigger structures, such as the roof and the milling machine, systems such as the oxy-acetylene cutting system, PLC and the pneumatic systems, lecturers encapsulated the part-whole relations. The teaching of materials was observed in subjects within the utilities faculty, and these foregrounded the teaching of the properties of these materials, including the cause-and-effect relationships between some of these materials.

Findings also point to a focus on knowledge of general work skills, such as keeping safe while at work by wearing personal protective gear or ensuring that equipment is safe to use. Functional literacy skills were only taught in the fundamental subjects, indicating that the South African TVET curriculum is built on the idea that functional literacies are best learned from specialists (Houston et al., 2010). The teaching of technological skills was largely neglected, with only two of the analysed lessons teaching work skills that needed the use of some form of technology to execute. These findings resonate with those reported by Mtshali (2022), who found that civil

engineering lecturers indicated that they had challenges teaching ICT skills to their students.

While the above-mentioned skills and knowledge are mostly stipulated in the curriculum documents for each subject, lecturers also taught knowledge on thinking skills, craftsmanship, self-managing, resourcefulness, and social responsibility. While this study does not ascertain that these are not listed in the aim and objectives for each subject, unlike the skills and knowledge identified above most of these were embedded and implied by the way the lecturers conducted themselves during demonstration.

The results on the types of knowledge structures underpinning TVET knowledge indicate that much of TVET knowledge practice is underpinned by strong semantic gravity. The teaching of work-specific skills such as techniques, procedures, industry tools, and processes was achieved through the use of concrete examples. Lecturers either demonstrated what to do or provided actual, concrete tokens of physical materials or tools. Semantic gravity strength was weakened through the use of illustrations, images and photos. In the case of symbolic subjects, lecturers taught using worked examples, keeping semantic density fairly strong.

Though most of the practice displayed strong semantic gravity, there were also instances of weak semantics gravity, where lecturers used lecturer-style teaching to teach the properties of materials.

The results also indicate that the knowledge practices in TVET subjects are also underpinned by weak semantic density. Lecturers used non-technical language to explain the content to the students. However, lecturers were able to strengthen or weaken epistemological semantic density through the use of conceptual relations. The lecturers explored relations such as part-whole, structure-function, and type-token.

7.2.2 What Kinds of Pedagogical Patterns are Displayed by the TVET Lecturers in Online Videos Made During the Pandemic?

To summarise the pedagogic patterns that were found, a discussion of how the lecturers managed their curriculum and the methodological approaches they adopted is warranted.

Curriculum management

The results of this study indicate a lecturer-controlled curriculum, which is based on a very

restrictive curriculum model. Most lecturers selected, sequenced, and paced the content based on the curriculum document stipulations, or what was set out in the prescribed books. The content selection was assessment-focused, with lecturers using past examination papers as practice examples. Furthermore, the selection of content was closely linked to their decision about the selection of space. Lessons focusing on techniques and skills were conducted in workshops, industry, or school-based practice venues.

The results on sequencing of content further indicate that the content in the curriculum is sequenced based on ontological categories such as part-wholes, structure-function, and sequence ontology. Pacing was restricted by time as lecturers tried to pack as much content as possible into single videos, which meant that at times some concepts were briefly explained even though further elaboration could have been beneficial.

Methodological Approach

The teaching approaches observed during this study resonated with those indicated in the vocational pedagogy dashboard (Hugo & Louton, 2020) and other literature. Lecturing and demonstration were the most prevalent teaching methods. In their theory of vocational pedagogy, Lucas et al. (2012) propose that certain learning methods are better suited for learning certain types of knowledge and different mediums of work. However, the teaching methods observed in this study were mostly lecturing or demonstration. In some instances, a combination of both was adopted, with lecturing always preceding the demonstrations.

Pedagogical patterns

Plotting the changes in semantic gravity and semantic density strength on a continuum produced different pedagogical patterns. Of these patterns, three emerged as dominant pedagogical archetypes. The first pedagogic archetype is that of using different teaching resources, teaching methods and ontologies to facilitate learning. The lecturers who followed this archetype broke down abstract concepts into simpler ideas and broke down whole structures, systems, and processes into smaller parts. Each part was then interrogated, giving students important details about their characteristics and their position and function in the whole. This was supported by the lecturers introducing concrete examples of these parts or the use of photos, images, and illustrations. Later, the lecturers joined these parts together to form the whole structure or system or linked the explanations to a more general understanding or rule. Furthermore, these systems

and structures were elaborated on to identify their dynamic function. Lecturers who used examples, or tokens to explain concepts, did not stop there – they connected the types and tokens into broader categories, giving students a broader understanding that went beyond the particular example being discussed. In summary, these lecturers oscillated between stronger and weaker semantic gravity and weaker and stronger semantic density, creating a wave-like pattern.

The second pedagogic archetype was that observed when lecturers explained concepts for students without linking them back to more abstract or general understanding. These lecturers broke down structures, systems, and processes into parts and steps, providing concrete or specific instances to facilitate understanding. However, they did not proceed to link these back together or explain to students how these apply beyond the specific instance. They were not related to each other in any way, such that multiple ideas or concepts were taught as segmented ideas, which did not extend to contexts beyond the immediate learning context. Plotting these lessons on the graph reveals a series of downward escalators, as lecturers moved from weaker semantic gravity to stronger semantic gravity.

The final archetype was characterised by maintaining the same semantic gravity and semantic gravity strength throughout the lesson. The lecturers who employed this pedagogical approach did very little to explain ideas or provide specific examples. If they were working with concrete examples or specific instances, they did not connect these instances to a broader category or a more general understanding. These lecturers did very little to show students how they could apply the taught concepts to situations beyond the immediate environment. Since most of the lessons observed displayed weak semantic density, plotting these lessons on the graph created a low-flatline.

These patterns resemble those found in literature, such as the teaching of law (Clarance, 2015) the teaching of English at the university level (Arguelles-Alvarez & Morton, 2023), and the teaching of science (Georgiou et al., 2014). While these studies do not specifically reflect teaching in the TVET sector, they report on the teaching subjects within professional qualifications.

7.2.3 How do these Pedagogical Patterns Impact Knowledge Building in the TVET Sector?

The primary goal of technical and vocational education and training is to prepare students for work by equipping them with the necessary knowledge and skills. However, students need to be given enough knowledge and skills to be able to apply these when they get to the workplace. However, not all knowledge practices are conducive to knowledge transfer or cumulative knowledge growth. Knowledge practices observed in the low-flatline archetype are focused on specific knowledge and skills, without exploring the more general 'know that' that would allow knowledge transfer and accumulation. As such, students who have been taught using these pedagogies are restricted to specific roles and denied access to powerful knowledge that would allow them to pursue further studies or contribute to the development of their practices. According to Maton (2009, cited in Kilpert & Shay, 2013), failure to make explicit the underlying disciplinary knowledge that governs practice means that, in the future, students will encounter challenges with applying their learning in different contexts.

Knowledge practices within the broken escalator archetype, where lecturers simplify concepts by providing context-dependent examples or using simple everyday language, which were discussed without explaining how these fit into the big picture, also hindered knowledge growth. These knowledge practices significantly influence knowledge growth. First, they equip students with the ability to deduce from abstract concepts the necessary knowledge to apply to their specific context. However, because they have not been introduced to ways of linking the particular to the general, students struggle to link their decisions with the necessary theoretical underpinning (Maton, 2013). Second, such knowledge practices indicate that knowledge growth is possible; however, the practices promote the accumulation of knowledge as segmented ideas and concepts thus restricting the potential of this growth. Instead of students understanding the dynamic relationships between part and the whole, for example, they conceive the parts as independent structures with a list of characteristics and details that student can memorise and recall. While this can be beneficial for assessment purposes, it fails to prepare students for making professional judgement in the field of work.

Greater potential for knowledge growth is found with the third pedagogic archetype, the 'wave'. The pedagogic and knowledge practices delineated in this archetype allow students to observe

lecturers as they demonstrate how things are done, and enable them to see tangible representations. Unlike pedagogical practices that are characterised by 'downward escalators', these lecturers scaffold the knowledge, decontextualising it and using more technical terms enabling the students to apply the knowledge to novel situations.

7.3 Implications of Findings for Vocational Pedagogy: A Discussion on the Role of Knowledge in TVET and Potential Enhancements

The focus on improving teaching and learning in the TVET sector through improved teacher qualifications has highlighted the scarcity of data on the scientific underpinnings underlying the vocational pedagogies. Vocational pedagogy, as conceptualised in the vocational pedagogy dashboard (Hugo & Louton, 2020) and other literature, reveal the actions of the TVET lecturers while relating them to teaching and learning theories. These conceptualisations fail to account for the role of knowledge in decision-making and the enactment of an effective vocational pedagogy. The emergence of ontological categories in this research has echoed sentiments around the importance of thinking about the broader aims of each teaching and learning episode and contextual realities such as teaching materials and resource availability. The conceptualisation of knowledge in vocational education has largely been shaped by the view that there is a clear distinction between Know-How and Know-That and that the institutions responsible for vocational education and training should be maintained such that the teaching of these two forms of knowledge remains exclusive. Recent developments have pointed to a need for a more inclusive approach that recognises that the development of knowledge and skills is intertwined and that the separation of the two harms the development of expertise. Horden et al. (2022) assert that approaching knowledge and skills in vocational education from the perspective that the training of the "hands" should be confined to the workplaces and the training of the "mind" confined to the TVET institutions is detrimental in two ways. Firstly, the speed at which workplaces are changing due to technological advancements makes it difficult for training institutions to keep up with the new processes and procedures for acting in the workplace. This means that institutions will most likely always be teaching outdated systemic knowledge. Secondly, he states that since workplaces are dynamic, decisions made are always taken under complex operating conditions, thus a good understanding of the standard operating procedure for processes is necessary for professional judgment.

Thinking about knowledge in TVET lends itself to thinking about the type of professionals we

are producing. The ideal TVET graduate, according to Winch (2013b), should be able to perform routine tasks, but also be able to modify his or her actions based on the context in which they are operating, and finally, they should be capable of justifying their actions. Therefore, TVET should be about providing students with opportunities to observe and participate in specific practical actions in real-life situations. So that when they get to the workplace, they can recognise and be able to perform routine actions. It should also provide students with explanations of how things work and why they work in that way. So that when they encounter issues or problems with faulty equipment, they can identify the sources of the problems based on their understanding of how the equipment works. For the same reasons, students should be afforded knowledge on the structures, equipment, or tools that they are working with, but also how these structures are structured so that they can do what they are meant to do. This also equips students with enough sense to be able to find alternatives when faced with limited resources or find themselves in unusual circumstances. Students need to know the steps or sequences for the actions that they are partaking in but also why these particular orderings are necessary for the execution of their occupations and their final products. As such, TVET lecturers should be intentional in their pedagogy, aiming to bridge the gap between practical hands-on training with theoretical knowledge.

They should constantly weave these two together, making very clear the connections between their specific context and a generalist view of the workplace. This can be achieved through practical training as college-based workshops or other forms of WIL. But can also be achieved through the use of images or photos, video simulations and other related resources. By foregrounding the dynamic interaction between structures and their components or steps in a process and the final products, we can avoid the accumulation of inert knowledge.

7.3.1 Recommendations for Policy Development and Lecturer Practices

The result of this study indicates that improving teaching and learning in the TVET sector through upgrading TVET lecturer qualifications necessitates that those qualifications foreground teaching both vocational pedagogy and the nature of knowledge. The White Paper on vocational lecturer qualifications should mandate that those involved in the development of TVET lecturer qualifications need to develop modules that focus on knowledge, how knowledge is structured and how this knowledge structuring during teaching enables or hinders the development of expertise. Lecturers should be trained on ontologies and how these can be used to link know-

how and know-that during teaching. The results reveal that the current TVET curriculum is structured and sequenced based on conceptual relations. Making these and their relevance to epistemic ascent explicit to TVET lecturers in policy documents or during teacher training could further enhance TVET teaching. Furthermore, stronger links should be established between TVET institutions and sites that offer practical or WIL-based training. WIL programs must include a structured teaching, learning and reflection component where students will be guided to make connections between what they have been taught in the classroom and what they are learning and doing in the field.

With regards to lecturer practices, improving TVET teaching and learning requires that TVET lecturers become intentional about integrating the different types of knowledge into their teaching practices. Lecturers should, as far as possible and necessary, include opportunities for practical demonstrations, and when doing practical work, include opportunities for reflecting and linking theoretical knowledge to what is being done. When thinking about their vocational pedagogy, the lecturers should think about how they will structure their lectures such that that is a smooth transition between contextualised and decontextualised knowledge and general and abstract concepts. Finally, lecturers should strive to make visible the conceptual relations between concepts being taught. This can be achieved by incorporating different types of teaching resources or other forms of visual demonstrations.

7.4 Evaluation of the Study Methodology

This study made use of a case study methodological approach to research. This allowed the researcher to get a thorough understanding of each teaching video, affording the researcher detailed insights into the pedagogical actions of lecturers. By viewing online videos instead of conducting physical classroom observations, the researcher was able to collect data from different colleges, lecturers, and subjects, which would not have been possible otherwise. By employing purposive sampling methods, the researcher was able to get a glimpse into the multiple subject offerings available in the TVET sector in South Africa. This benefit was enhanced by the fact that the videos were already posted online, meaning that as a researcher, I had the opportunity to view almost all the videos and engage in peer discussions about the videos before selecting my data set.

The data collected was analysed using both deductive and inductive data analysis methods. Inductive analysis was based on both the Legitimation Code Theory (Maton, 2012) framework and the vocational pedagogy dashboard analytical toolkit (Hugo & Louton, 2020). Deductive analysis allowed the researcher to identify and frame the observed pedagogical patterns within an already existing body of research. Concepts such as the grouping of vocational subjects as proposed by the vocational pedagogy theory (Lucas et al., 2012) made it easier to manage and categorise data. Furthermore, these categories were used for data sampling, as the aim was to include the different subjects offered by TVET colleges in South Africa. As a result, the data sample consisted of lessons from the Accounting and Business, Fundamentals, and Engineering and Utilities faculties. The final sample attempted to fairly represent TVET college offerings by including videos from subjects across the different levels of study and ensuring that both theory and practical lessons were included. Inductive data analysis was a reflexive process, including myself, my professor, and my colleagues. This meant that most of the videos were analysed by more than one person and were discussed on numerous occasions.

7.4.1 Reflections on the Efficacy of the Vocational Pedagogy Dashboard and Legitimation Code Theory

The analytical toolkits used in this study were chosen for their suitability to answer the research questions. The vocational pedagogy dashboard (Hugo & Louton, 2020) was used to seek answers to questions about the types of knowledge taught in TVET colleges in South Africa by identifying the aims and objectives of TVET. The toolkit was beneficial for identifying the pedagogical choices made by the lecturers, including choices about curriculum management, teaching approaches, and teaching methods. The Legitimation Code Theory (Maton, 2009) framework expanded on the analysis of pedagogical actions by focusing on the organising principles used in the lecturers' practices. By making use of a translation device, this analytic framework bridged a gap between the current theories on vocational knowledge and skills and the current practices of TVET lecturers.

7.5 Limitations of the Study

While this research has made strong recommendations for policy and teaching within the TVET sector, it is important to think about these recommendations in the context of the limitations posed by the conditions under which the videos were produced and the study methodology

employed in the research process. The following section highlights the challenges encountered during the research process and the limitations imposed on this study.

7.5.1 Challenges Encountered During the Research

The initial research objective was to analyse the pedagogical actions of expert lecturers in their classrooms; however, the outbreak of COVID-19 mandated that data could only be collected remotely, with the result that the main research objective had to be revised. Although this was a challenge initially, the establishment of a website specifically created for posting video lessons for students presented the opportunity to view lessons created by multiple lecturers working at different colleges across the country – colleges with different contexts and access to resources. However, during the process of data gathering and analysis, this website was taken down; as such, videos from other colleges were not accessible. This meant that the analysis of these videos could not be included, as we no longer had access to the videos and could not provide them should the need arise. This mandated seeking out other data sources, which led to the discovery of the Jelo Creatives YouTube channel. Unlike the initial site, which had videos from most of the colleges across South Africa, the Jelo Creatives account only broadcast videos from a few colleges.

7.5.2 Constraints on Generalizability and Data Interpretation

This study was conducted using a case study approach. Case study research limits the size of the data sample, thereby preventing generalisation of the results. Moreover, the data set consisted mostly of individual teaching episodes, analysed without any contextual grounding. This may have influenced how the data was interpreted. As the lessons were recorded in response to an emergency brought on by the onset of the COVID-19 pandemic, the lecturers were teaching in unprecedented situations and with no students present. These videos thus fail to capture the dialogical nature of teaching and learning, and limit the lecturers to certain teaching methods that do not require students to engage in the teaching process, such as coaching. Furthermore, the actions of lecturers and their choices of what to teach could have been affected by the presence of others who are not their students, as the person recording the videos and the knowledge that they will be recorded. This could have impacted their pedagogical actions and should be considered when making sense of the results. While attempts were made to analyse the pedagogical patterns over a prolonged period, the website only had a limited number of videos

for each lecturer teaching the same topic. Since some videos mentioned preceding videos that were not posted on the site, it would be valuable to explore how these lessons were sequenced and to observe the resultant pedagogic pattern. The generalisability of these results is thus hindered by this mismatch between the videos available for analysis, the actual number of videos recorded, as well as the number of lessons allocated to specific topics within the curriculum.

7.6 Future Research Possibilities

This research used Hugo & Louton's (2020) vocational pedagogy dashboard and the semantics dimensions of Maton's (2009) Legitimation Code Theory as a theoretical framework, making it possible to study the actual teaching processes of TVET lecturers and to study knowledge as it exists in the TVET sector and the interaction between these two concepts. However, pedagogy also encompasses the relationship between lecturers and students, the roles given to students during pedagogic episodes, and the lecturers' role during this process. The online videos limited lecturers to a specific role, influencing their teaching methodologies, curriculum management, and other pedagogical decisions. More research focusing on knowledge and vocational pedagogy, using both the vocational pedagogy dashboard (Hugo & Louton, 2020) and Legitimation Code Theory (Maton, 2009) could contribute towards the development of a wholistic view of TVET, creating a space for TVET lecturers to share and learn from each other and their practices. The application of ontology to the study of vocational knowledge would contribute to the development of vocational pedagogy by providing a structured and systemic way of understanding knowledge. This suggests that future research should approach vocational knowledge from the ontological perspective to foster a common framework between the different faculties and different forms of knowledge.

7.7 Conclusion

The purpose of this study was to examine the pedagogical actions of TVET lecturers as observed in the online videos produced during the lockdown period. This thesis has reported on the findings of this study, describing the types of knowledge foregrounded in the TVET sector as well as the pedagogical archetypes that exist within this sector as observed in the online videos. Using the vocational pedagogy dashboard toolkit (Hugo & Louton, 2020), the study was able to trace the decisions made by TVET lecturers as they taught their respective subjects, focusing on their decisions about the aims and goals, content selection, sequencing, and pacing, as well as the

methodological choices they made. The semantic dimensions of the Legitimation Code Theory (Maton, 2009) enabled analysis and comparison of the knowledge structures underpinning the pedagogical practices of lecturers from different faculties.

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Appendix A: Ethical Clearance

HSSREC applicationInvestigating the pedagogical patterns displayed by TVET lecturers in online videos investigated by Covid-19, (Madondo, Thembeka (206518115)

NB:
Please click on **Edit** on the top right of the screen to view the full information and make changes to the application. If there is no edit button visible to you, you may be unable to edit the application as it is may be with someone else at the moment.
However, you can view the application by clicking on Ethics Applications on the left menu. If there are many applications displayed, you can filter for the application you are looking for.
If you require more help, you can find Ethics User Guides here, OR you can contact the Ethics Office here OR using the Ethics Office contact details here.

Type of ethics review: HSSREC application

Title: Investigating the pedagogical patterns displayed by TVET lecturers in online videos investigated by Covid-19

Date of approval: 05.07.2024

Principal Investigator:

Madondo, Thembeka (206518115) - School Of Education (Ended)

Research site(s):

The research will use online data in the form of YouTube videos.

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

Miss Thembeka Madondo (206518115)
School Of Education
Pietermaritzburg

Dear Miss Thembeka Madondo,

Original application number: 00025485
Project title: Investigating the pedagogical patterns displayed by TVET lecturers in online videos investigated by Covid-19

Exemption from Ethics Review

In response to your application received on , your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

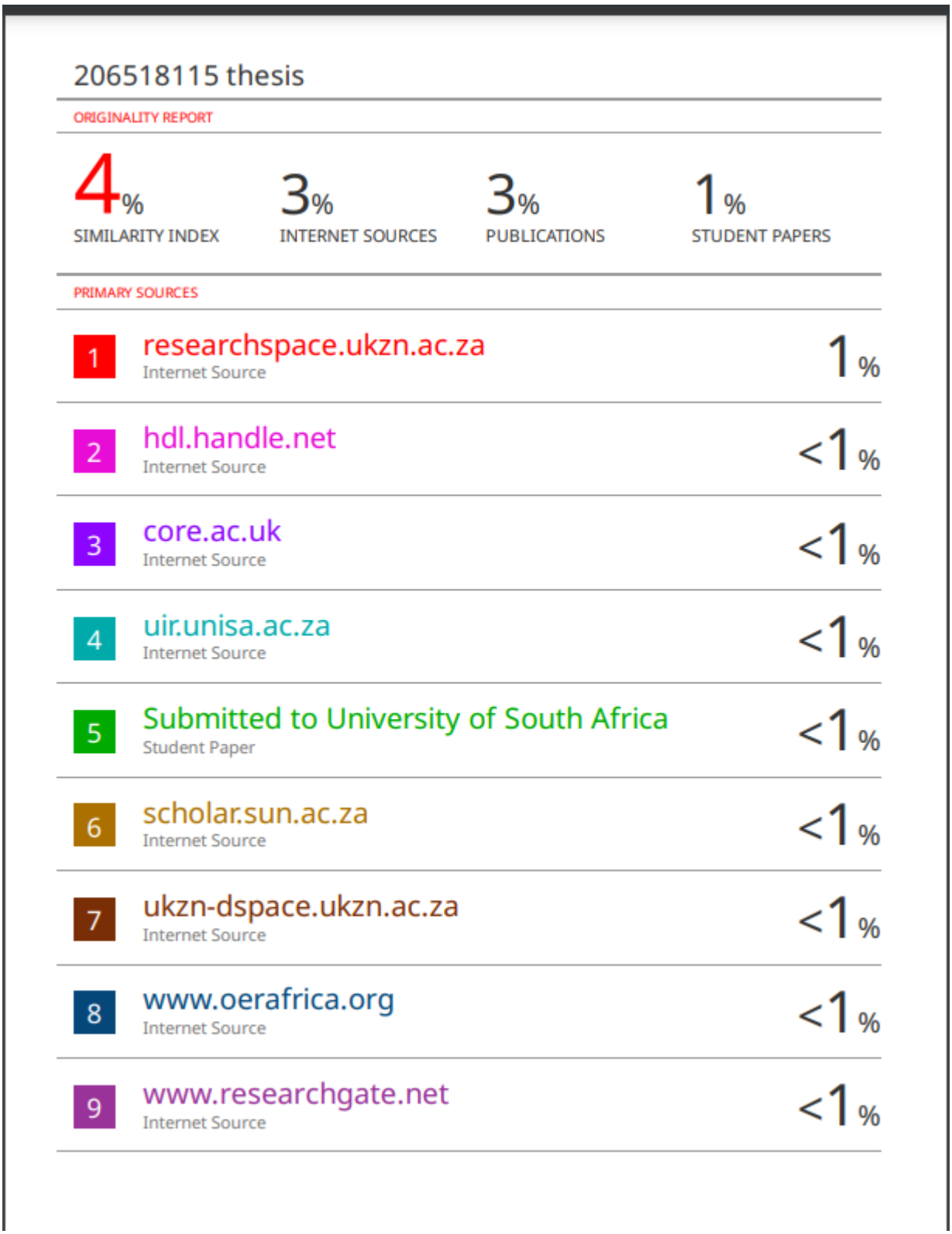
I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted]

Prof Phumlani Erasmus Myende
Academic Leader Research
College Admin Office:Hum

Appendix B: Turnitin Report



206518115 thesis

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Appendix C: Analysis of pedagogical choices toolkit (Hugo & Luoton, 2020)

ANALYSIS OF PEDAGOGICAL CHOICES USED IN A LESSON		
CURRICULUM CONTENT COVERED		
Skills, abilities and knowledge		
	Specific skills, abilities and knowledge	
	Functional literacies	
	Technological skills	
	General workplace skills	
	Communication skills	
	Thinking skills	
Attitudes and values		
	Specific attitudes and values	
	Craftsmanship	
	Professionalism	
	Self-management	
	Collaboration	
	Social responsibility	
CURRICULUM MANAGEMENT CHOICES		
C / O	Selection of content	Closed/open?
C / O	Sequencing	Closed/open?
C / O	Pacing	Closed/open?
TEACHING / LEARNING APPROACH		
T / C	View of knowledge	Transferred/constructed?
C / F	Role of lecturer	Controls/facilitates?
P / A	Role of student	Passive / active?
METHODOLOGICAL CHOICES		
DW	Demonstrating/watching	
L L	Lecturing / listening	
DI	Demonstrating / imitating	
IP	Instructing / participating	
PC	Practising /coaching	
GC	Generalising / coaching	
PF	Problem solving / facilitating	
E	Exploring / advising	
PRACTICAL CHOICES		
T / P	Means of knowing	Theory/practical?
N / E	Prior knowledge	Not engaged/engaged?
N / R	Nature of tasks	Not real world/real world?
N / S	Visibility of processes	Not shown/shown?

C /W	Use of space	Classroom/workshop?
I / S	Approach to tasks	Individual/social?

Appendix D: An example of the Vocational pedagogy (Hugo & Louton, 2020) analysis

Skills, abilities, knowledge

The lesson was about the preparation methods used in baking. The focus was on folding and whisking as used in making a swill roll. She demonstrates how these methods are used. After that she recaps what had been done in the previous lesson, reviewing the ingredients used in making cakes and biscuits. She also summarises the preparation methods used in making cakes and making biscuits. She further explains different processes of making biscuits.

1.	2. Specific skills abilities and knowledge	3. using the folding and whisking method
4.	5. Functional literacies	6. mathematical / measuring skill, knowledge of utensil names, knowledge of methods terms (e.g. folding/whisking)
7.	8. Technological skills	9.
10.	11. General workplace skill	12. Cleanliness
13.	14. Communication skills	15.
16.	17. Thinking skills	18.

.

Curriculum management

According to the lecturer this lesson is the last lesson in group of lessons that tackled preparation methods in making cakes and biscuits. She then moves through the content in today's lesson at her own pace, and covers the content in a sequence that is pre-set by her.

	Selection of content	Closed
	Sequencing	closed
	Pacing	Closed

Teaching /learning approach

a) View of knowledge

The lecturer is the source of knowledge, and the students are not involved in negotiating the knowledge or the transfer thereof. So students are to listen and observe the lecturer who informs them what to do, when to do it and how to do it.

b) Role of the teacher

The lecturer controls the lesson, from content selection, sequencing and pacing. She decided which parts of the lesson to demonstrate and when to provide a lecture.

C) Role of student

The students are to passively observe the lecturer as she makes the cake starting from preparation all the way through to the finished product.

T/C	View of knowledge	Transferred
C/F	Role of lecturer	Controls
P/A	Role of student	Passive

Methodological choices

The lesson can be said to be rendered in two parts. Firstly, the lecturer demonstrates the baking of a swill roll from preparation through to serving. As she does this she explains what she is doing and the significance of doing it in that manner. When the cake is ready the lecturer recaps what had been taught in previous lessons about the preparation methods, ingredients and general workplace etiquettes.

DW	Demonstrating/ watching	practically bakes a Swiss roll
LL	Lecturing/ listening	recaps what was learnt in previous lesson, explains as she does her work
DI	Demonstrating/ imitating	
IP	Instructing/ participating	not used
PC	Practising/coaching	not used
GC	Generalising/ coaching	not used
PF	Problem-solving/ coaching	not used
EA	Exploring/advising	not used

Practical choices

The lecturer makes not reference of previous knowledge in the teaching of baking a Swiss roll, however when she does the lecture at the end she recaps on all that students have done with regards to preparation methods. She uses practical demonstration to show students the two methods of preparation that she wanted to teach, namely whisking and folding. The student are however not physically involved in this task, or given a task that would allow them to practise these skills.

T/P	Means of knowing	practical
N/E	Prior knowledge	partially engaged

N/R	Nature of tasks	demonstration by lecturer is authentic
N/S	Visibility of processes	
C/W	Use of space	recording of a workshop/ baking kitchen
I/S	Approach to task	no task

Appendix E: Translation Device

Code	Indicator	Example from data
SG--	Teacher explains a rule, concept that applicable across different context (rule of thumb)	If I have a formula describing distance in terms of time, in other words the formula will tell me how this object distance will develop in at every single time then I represent this graphically like it can be a straight line it can be maybe another type of graph depending on what this distance formula which was given. So the gradient of this distance graph, remember the gradient between two points is y2 minus your over x2 minus x1. And the y value will be distance 2 minus distance 1 and the X value will be time 2 minus time at 1…
SG -	Lecturer explain concept making references to an actual object or process/ explaining a concept using a simple scenario	…I have in front of me cash register rolls, receipts and deposit slips which we are going to use in order to enter all the information you need in to the cash receipt journal…
SG+	Lecturer uses images/ photos of object to explain concepts	Here we can see this is a 110mm reduced by 50mm (at this point the lecturer is showing an example of a pipe that he has already explained in the lesson)
SG++	Lecturer uses illustrations, diagrams to explain a concept	Now we we'll do a simple diagram to illustrate how a vacuum tank works (lecturer turns around to do a drawing on the board)
SG++++	Lecturer explains using concrete objects or the explanation is based on an example	…this is a relatively small milling machine,…we will start at the top, and right at the top we find our head, this whole portion here is known as the head (lecturer shown the milling machine, uses his hands to locate the head on the machine)

Code	Indicator	Example from data
SD--	Simple everyday terms are used, so the lesson is easy to understand even if you don't have knowledge of the occupational/ academic field	The cylinders are usually painted maroon and is fitted with the left-hand threads, that is acetylene. And the pressure it is compressed at 1700 and

		2000KPa
SD -	Technical terms are used within a cluster of everyday terms so that no specialist knowledge is required to understand what is being taught	…if the employees want to use the petty cash, they firstly fill the petty cash request form then they took the petty cash request form to the petty cashier…
SD+	technical terms are used to name an item or process, or they are used to denote the properties of the concept, or the process, the teacher uses simple language to explain these terms	…it (drainage) is the introduction of the correct amount of water into your drainage system, your sewer pipes, to allow for the flow of drainage
SD++	Use of technical terms to highlight relationships with other concepts through types and categories types or locating the concept in time, space or within a process	…we need a post adjustment trial balance. What is a post adjustment trail balance? It's a trail balance that is prepared after preparing the income statement
SD++++	Use of highly technical terms, in a way that only people within the specific academic/professional field can understand	

Appendix D: Example of the Legitimation Code Theory Analysis (Maton, 2009)

Level one: Introduction (Time: beginning- 1:04 min)

The lecturer begins the lesson by stating the lesson topic. He proceeds to unpack the topic by unpacking the terms contained within the lesson topic, specifically oxy-acetylene which he unpacks by separating the two words that make the term and defining each word in simpler language. He then combines the words to explain what oxy-acetylene cutting is, acetylene is correlated with oxygen, highlighting that the burn. two put together causes acetylene. *"**acetylene is a gas, it's a gas that is combusting with oxygen to do the cutting…"***

He builds on the knowledge further by unpacking the uses of oxy-acetylene cutting. The functions are listed on the slide, however the lecturer further elaborates on the points listed thus further unpacking and weakening SD.

Level two: Components of oxy-acetylene (1:05-9:30)

The second phase builds on the first phase by introducing the students to the compositional relations contained within the oxy-acetylene cutting system. This is achieved by breaking the cutting system down into the main components, namely the acetylene, oxygen, regulators & gauges, hoses and the cutting torch. The whole part relations are unpacked by zooming into each main component to explore its characteristics, parts as well as function, While the lecturer unpacks each component individually (separately) links are made between each component.

For the main components, the lecturer clearly indicates a shift from one concept to the next by verbally stating that the focus is moving to the next component, (for example, ***so now, we will discuss now about the oxygen; another component is the regulator).***

The lecturer achieves condensation by augmenting, both through the identification of the parts and also through the characterization of the parts. While the relationships between the individual parts are not explored specifically (positioning), the parts are compared with each other through phrases (**for example when the lecturer describes the oxygen component, he refers to the acetylene comparing the colour of the cylinders as well as the pressure inside the cylinders.)**

The lecturer simplifies information about the oxygen and acetylene component by instantiating the cylinders, through the display of drawings of the cylinders. These drawing highlight the colour of the cylinders as well as how the cylinders should be kept.

The colour codes associated with the oxygen and acetylene are constantly mentioned with the other parts, implying a relationship between the gas/ air and the other parts even though the relationship is not made explicit.

Unlike the cylinders, for the proceeding parts (i.e. regulator, torch and hoses) the lecturer begins by showing a concrete example of the component instead of an image. This strengthen SG. Not only does the lecturer show the parts but he also demonstrates how to use them, using his hands to locates the parts of the component which he is naming and to elaborate on the statements he is making.

To simplify further on the structure of one of the components (nozzle) he draws an illustration on the boards and explains using the illustration. This facilitates better understanding, compared to the concrete nozzle that he showed initially as the particular area he was talking about was not visible to students.

The lecturer also differentiates between two types of cutting torches, as part of unpacking knowledge about torches but he also identifies cutting torches as one of the subtypes of torching, by naming and showing the welding torch.

The lecturer ends this phase by naming the parts that he has covered, after showing a slide with images of all the components he has covered.

Level three: Assembling the oxy acetylene (procedural) (9:35-

This section focuses on mostly on procedural, know how.

3A Connecting the cutting system

The lecturer begins this phase working at a higher SD. He indicates this shift by stating that "***lets check now how to do the assembling the oxy-acetylene apparatus"*** with oxy acetylene referring to all the components (i.e. the focus will now be on joining the components together).

The phase follows and builds on the knowledge from the previous phase, the knowledge taught/learnt in the first phase has implications on the knowledge being taught in this phase. The lecturer specifically asks students to remember some concepts from earlier in the lesson. This connects the previous phase to the next phase (***…Remember I said to you both cylinders should stand in an upright position…).*** This phrase requires students to remember what the lecturer means by the "two cylinders" and all the knowledge taught so far. This links to the knowledge and also signifies a higher SD starting point the next phase.

The phase is unpacked using sequential sequencing, the lecturer makes use of terms such as ***then, once you have; start with, after that.*** The lecturer displays the main points on a slide, however he unpacks each point further. The lecturer physical dramatizes what the students need to be doing for each step. He strengthens SG at some instances by showing the action on the actual component.

3B Lighting the torch

The further builds on the network of knowledge by moving the SD of the lesson a little higher. He connects this phase to the previous phase by stating ***once you have connected you can light up the torch.***

This phase is procedural again, relying on the sequential terms employed in the first part of this phase. However, the lecturer goes through a safety check that students need follow before lighting the torch **(KT)** before going through the procedure**.** The lecturer also uses the physical torch to demonstrate how to go about lighting. The lecturer provides physical ques for the end of the process

Level four: Cutting (Classifications)

The lecturer indicates the strengthening of SD by stating

Once I've done that I can do what, I can start I can start the cutting

This sentence indicates a shift in SD moving the lesson a level higher, whilst connecting the previous phase to the following phase.

4A Plate sizes

The lecturer begins the lesson by displaying a slide with the different cutting pressures and nozzles. He unpacks the knowledge by adding more details to the information on the slide. To further unpack and link the knowledge with earlier phases, he uses the diagram he had previously drawn of nozzle. He weakens SD by moving away from the numerical plate sizes/ pressures to general terms such as thick/thin.

4B Types of flames

So, remember I spoke about the flames…

The lecturer uses this phrase to link the next phase to previously learnt knowledge (level 3B 12:25- ***after you have light it, it will show a flame***). The lecturer displays a slide with three images/ illustration of three types of flames. The images are used to unpack the knowledge around the types of flames. The lecturer again unpacks by adding more details than what is displayed on the slide. He distinguishes between the flames based on their acetylene/oxygen composition.

Level five: Quality check

Once you have cut through your metal, there is vertical lines…

In this phase the lecturer teaches students about how to evaluate their cutting. At this stage the lesson has moved from defining what oxy acetylene cutting is, to the components of the oxy acetylene apparatus through to how the apparatus is assembled and how the flame is started. It has also covered how to choose the correct nozzle, and to choose the correct flame for the given work piece and also how to cut the work (speed of cutting). This has gradually moved SD up higher and higher as the knowledge is connected and builds up on the knowledge from the previous phase.

The lecturer begins this phase again using a slide which shows points that the lecturer will discuss but it also shows diagram which we later discover is a simple illustration of a cross section of a work piece. Though the lecturer does not specifically state this, he draws similar illustrations (he draws three illustrations with different positioning of the lines) on the board adding an illustration of a cutting torch to demonstrate how the distance of the cutting torch from the workpiece affects the quality of the piece.

The lecturer indicates that he has covered all the lesson objectives by specifically stating that he has come to the end of the lesson on topic three.

Level six: Assessments

This phase allows students an opportunity to apply what they have acquired in the lesson and also to practise- for exams. The activity seems to have been taken from a book or a previous exam paper as its an image of an extract. This section is grounded on the activity (higher SG), the lecturer reads the questions, briefly makes reference to what has been taught, writes the answer on the board. The writing on the board simplifies the work for students