Cape Peninsula
University of Technology

FACTORS THAT AFFECT THE FAILURE RATE OF TRADE TEST CANDIDATES IN TECHNICAL AND VOCATIONAL AND TRAINING COLLEGES IN CAPE TOWN, SOUTH AFRICA

by

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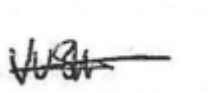
DECLARATION

I, Vuyiseka Vuyokazi Sityoshwana, declare that the contents of this thesis represent my own unaided work and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



Signature

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Date

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ABBREVIATIONS

CBT	Competency-Based Theory
DHET	Department of Higher Education and Training
JIPSA	Joint Initiative on Priority Skills Acquisition
NSDS	National Skills Development Strategy
NCV	National Certificate (Vocational)
PSET	Post-School Education and Training
RDP	Reconstruction and Development Plan
SETAs	Sector Education and Training Authorities
TVET	Technical and Vocational Education and Training
TTCs	Trade Test Candidates

ABSTRACT

The country has been struggling with shortages of skills and a high unemployment rate. The need for qualified technical artisans has grown rapidly. There is a high failure rate of trade tests by student artisans, which is causing damage to the country's skills development efforts. According to the 2017 Parliament Portfolio Committee on Education report, there were about 4,007 trade test candidates in quarter 3 of 2017/2018 who were tested and only 2,190 candidates passed the test, a number that contributes to the shortage of skills in the country.

Problem statement: The country has been struggling with shortages of skills and a high unemployment rate. The need for qualified technical artisans has grown rapidly. There is a high failure rate of artisan trade test candidates (TTCs), which is causing damage to the country's skills development initiatives. This failure rate of TTCs remains a fundamental barrier to fulfilling the artisan demands of the country.

The main research question was formulated as follows: "What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?" The aim of study was to explore the factors that affect the high failure rates of TTCs at TVET institutions.

A qualitative approach was used as the research methodology to analyse the challenges TTCs experienced during the trial period, the quality analysis of the process and the data collection for the success rate and failure rate over a period of time.

- Research strategy: The research strategy presented a description of the research process and how it was applied. The strategy followed was that of a survey (qualitative).
- Data collection: Semi-structured Interview guides were used (Appendix B). An interview guide (Appendix B) was used to elicit the answers from the participants. The interviews were recorded, and notes were taken to support the recordings (Chapter 3, section 3.6).
- Data analysis: The collected data were transcribed and coded.

A total of 52 findings were realised. The following are the headline findings: i) instructors are unavailable to assist students to prepare for the trade tests; ii) there is a lack material in the workshops for trade test training for preparation of the TTC; iii) the TVET syllabus is outdated and some of the work required by the companies is not covered by the syllabus; and iv) the syllabus does not relate to new technology.

It is concluded that trade test preparation poses some challenges because of the learning processes that are not covered by TVET colleges, and the lack of resources needed by the

student to prepare for the trade test. While TVETs provide valuable training, there is still a gap between what is demanded by industry and what TVET institutions are able to provide.

Ethics: Participants signed an informed consent document and were made aware of the confidentially of their participation. They were also informed that they may stop participating at any point in the research.

Keywords: Trade test candidates, artisan, TVET, certification, trade test centre.

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DEFINITION OF CONCEPTS

Trade test	"A trade test [is] qualified and accepted by the National Artisan Moderation Body (NAMB), directed by a qualified skill assessment centre" (Quality Council of Trade and Occupation, 2016:6).
Trade test centre	According to the Skills Development Act 97 of 1998, a trade test centre is defined as "a test centre recognised by the Quality Council for Trades and Occupations (QCTO) to conduct a trade test on behalf of every registered occupation and can contain a place of work" (DHET, 2015:11).
Technical Vocational Educational and Training (TVET)	Ayonmike and Okeke (2018:2) define TVET as "a different kind of learning that contains the acquirement of job-related skills for supportable maintenance".
Artisan qualification	"Work-related requirement permitted by the Minister for endorsing an individual as an artisan" (DHET, 2015:11).
Certified as artisan	"Certificate hand[ed] out by the QCTO for an achievement of a work-related qualification recorded proceeding to National Qualification Framework (NQF)" (Quality Council of Trade and Occupation, 2016:4).

CHAPTER 1: INTRODUCTION

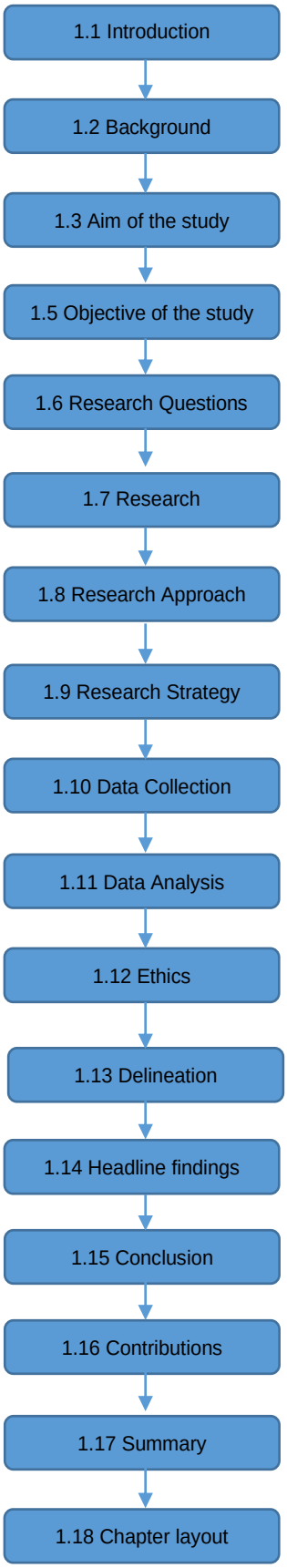


Figure 1.1: Layout of Chapter 1

1.1 Introduction

Government is faced with the task to improving the quality of life of the country's population by creating access to basic services and by the reorganisation of economic, educational and social systems. As the struggle to govern the citizens intensifies, communities' intolerance is on the rise, while policymakers grapple to find a way to achieve their manifestos presented at the polls. During the last few decades, the economy has turned for the worse, with resulting job losses. The need for qualified technical artisans has grown rapidly. As a result, government has made changes to policies in order to bridge the gap between facing unemployment, skills insufficiency and training institutions, taking into consideration the level of education of most the youth.

The White Paper for Post-School Education and Training (DHET, 2013a) has a vision for the post-school teaching and training (PSET) system. This is achieved by expanding access, increased excellence, and a more grounded and increasingly helpful connection between teaching and training institutes and the working environment (DHET, 2013a). The national economy is currently experiencing slow growth. The slow growth is, among other things, because of the lack of competency in the industrial sector due to several shortages of qualified, competent and experienced artisans (Braňka, 2016). A goal of 19 000 qualified artisans was established for 2020–2021, however, only a total of 15 107 artisans were produced (DHET, 2021a). For 2030, a goal of 30 000 skilled artisans has been set (DHET, 2017). To qualify, a trade test must be successfully completed by the apprentice. A trade test is a test that an apprentice with relevant trade qualifications undergoes a competency test to become a qualified artisan in terms of the Skills Development Act 97 of 1998: Regulations: Trade test section 26B government policy. The student's successful accomplishment of the trade test is needed in order to become a qualified artisan.

Technical and vocational education and training (TVET) institutions have remained in place by the government to support trade industries by producing trade artisans to fill the shortfall in qualified and competent artisans. Unfortunately, the high failure rate of trade test candidates (TTCs) is hampering the efforts of government to close the gap in the trade industries.

1.2 Background to the problem statement

There is a high failure rate of TTCs that has negatively impacted on the economy of South Africa and damaged the country's skills development outlook. As part of the National Skills Plan, there is a goal of 30 000 artisans per year that must be achieved by 2030 but only an overall of 24 050 apprentices accomplished their training programmes in the 2019/20 financial year (DHET, 2020b:85). Considering South Africa's low level of skills, it is not surprising that much of the blame is attributed to obsolete skills, apartheid and the previous racially exclusive apprenticeship scheme that is still haunting the skills revolution of the country (Gamble, 2021). Apprenticeship quality and relevance issues as well as apprenticeship requirements in

apprenticeship programmes negatively impact on the completed employment supply pipeline (Windapo, 2016).

“As Africa’s economy grows at a rapid rate, more skilled labour is needed, but trained professionals are in short supply” (Siwela & Van der Bank, 2018:1). “Globalisation, climate change mitigation, and digital transformation have made it necessary for skills to evolve at an accelerated rate” (DHET, 2020a:87). These rapid economic shifts create skills shortages and mismatches between workers in the labour market and responsive programmes in Higher Education Institutions. It is always necessary to have artisans in order to sustain this economy (DHET, 2020a).

Lubbe (2020:15) posits that “poor quality training and a lack of commitment on the part of the government and industry appear to be major contributors to the skills shortage”. Windapo (2016) and Lubbe (2020) refer to low educational standards and claim that there is a connection between work quality, a lack of teaching, certification and a skills shortage in industry. What has been reported as a contributing factor, among others, is that candidates do not have sufficient workplace training experience and subsequently most applicants lack the prerequisite competencies. The most fundamental is the alignment between training and trade testing, matching curriculum with industrial demand and providing a rationale for employer investment in the TVET sector. The competence of vocational TTCs is still very low and consequently so is their preparedness for industry.

Skill shortages and mismatches, especially in key sectors of the manufacturing economy, continue to impede industrial and technological development as the economy fails to produce the skills needed for mining, engineering and manufacturing (IPAP, 2018). Further needs-based skills development in these sectors is urgently needed, especially in light of the rapidly evolving Industrial Revolution (IR).

The reality of institutional adjustment needs to be carefully considered. Industrial support to support the economy has multiple foundations and must be accompanied by a complex set of interlocking and mutual support programming organised by the vision in the National Development Plan (NPC, 2012a). “The building of industrial capabilities is depended on competitive candidates through the education system and investor interest in PSET programmes. It is impossible for an economy to master highly advanced and complex industrial capabilities if these basic and intermediate capabilities are not in place” (IPAP, 2018).

The low supply of craft and engineering skills can be attributed to: i) ineffective career guidance; ii) privatisation of some state-owned enterprises (SOEs); iii) budget cuts for organisational training development; and iv) the transition from traditional apprenticeships of learners related

to the lack of experiential learning opportunities. These attributes have contributed to the quality and relevance of training at vocational schools (TVETs) (Siwela & Van der Bank, 2021). It is imperative to analyse factors that influence vocational students' knowledge as comprehended throughout the theoretical period of their training, trade testing and employability (Fitriyanto & Pardjono, 2019).

Because of a subsequent downgrading of formal science-based knowledge in favour of 'practice,' a curriculum imbalance developed, which persists in TVETs today, giving rise to ongoing contestation and controversy about the curriculum (Gamble, 2021). Otchia and Yamada (2021) explain the turmoil surrounding South Africa's TVET reform as a major cause of the ambiguity and context-specific nature of its capabilities that have hindered the development of common certification standards increase. According to recent developments in competency theory, the impact of education on skills should be measured when workers apply for work, rather than the level of exposure in school and the absorption by TTCs of what schools teach (Otchia & Yamada, 2019).

1.3 The problem statement

The failure rate of TTCs remains a fundamental barrier to fulfilling the artisan demand of the country. The failure to meet the set artisan targets for three consecutive years shows the importance of the high failure rate of TTCs, as passing a trade test is a prerequisite to becoming a qualified artisan (DHET, 2021b). Research and policies, including the National Development Plan (NDP), indicate that there is a serious scarcity of skilled artisans. However, the SA Artisan Movement challenges this narrative. After consultation, a generally accepted target of 30 000 artisans per year was set in South Africa (Jewison et al., 2020). There is a considerable shortfall in work production among artisans in South Africa, which is attributed to 24% to 45% of learners passing the trade test every year (Puchert et al., 2021).The country has failed to meet the approved targets (DHET, 2018a).

To address the challenges of commercial growth, as well as the growth in youth unemployment, artisan training and development is seen as crucial (NSDS III) (Department of Trade and Industry, 2019). "When the demand for skills exceeds the supply of skills, a skills shortage occurs. Employers are unable to find employees with the necessary skills in the labour market at the going rate of pay and under current working conditions due to a lack of a sufficiently skilled workforce" (DHET, 2020a:85). It is well established that there is a shortage of artisans in South Africa, which negatively impacts on the economy, and that artisan development is crucial (Smit et al., 2021). Furthermore, the abilities scarcity has a direct impact on the productivity and competitiveness of organisations that rely on these scarce skills, especially at a time when large numbers of experienced workers are retiring (Siwela & Van der Bank, 2021).

The development of artisan skills requires a strengthened workplace learning environment and a related increase in company involvement, both of which have proven difficult in South Africa (Wedekind, 2018). Although TVET colleges have been retitled, modernised and given new governance models, policymakers and industries continue to claim that the TVET system does not meet their needs (Allais et al., 2021). It is unclear why apprentices fail their trade tests. There is little research conducted on the failure rate of trade tests by TTCs.

1.4 Research question (RQ) and research sub-questions (RSQs)

RQ: What are the factors that affect the failure rate of TTCs in TVET colleges?

RSQ 1.1: What are the challenges TTCs face when they attempt to do the trade test?

RSQ 1.2: How are the TVET curricula aligned to industry needs?

RSQ 1.3: How can TVET institutes improve preparing competent artisans and ensure a higher trade test pass rate?

RSQ 1.4: How employable are the TTC graduates?

RSQ 1.5: What possible challenges are TVETs facing to ensure they prepare a fully compliant apprentice with skills and knowledge to meet industrial demands?

1.5 Aim of study

The aim of the research was to explore the factors that affect the high TTC failure rates in TVET institutions, and how apprentices can improve their competency and be better qualified to do the work.

1.6 Objectives of study

The objectives of the research were to:

i) Examine the challenges TTCs face when they attempt to do the trade test.
ii) Assess whether the curriculum provided by TVET complies with the needs of the manufacturing and service industries.
iii) Determine the learning processes to assist TTCs in passing their trade test.
iv) Determine the employability of TTCs.
v) Assess whether the skills provided by the TVETs comply with the needs of industry after TTCs successfully completed their trade test.

1.7 Research methodology

1.7.1 Introduction

A qualitative approach was used when analysing the challenges TTCs faced during the trial period, the quality analysis of the process and the data collection for the success rate and failure rate over a period of time.

1.7.2 Research philosophy

1.7.2.1 Ontology

Ontology is the study of “what”, that is, “existence”, which is related to the nature of being and the actual structure of self (Crotty, 1998). Ontology is “an understanding of what is, of the kinds of objects, properties, events, processes, and relations that exist in all areas of reality, is scientific theory” (Smith, 2003:155). Ontology is based on objectivism and subjectivism (Cohen et al., 2007:7).

i) Objectivism

Objectivism is “the view that human behaviour is the result of forces acting out in the external world that humans cannot control and find difficult to comprehend” (Huizing, 2007:93). The objectivist argument is based on the “separation of subject and object of knowledge so that the focus is exclusively on the object, typically with the claim that no subject or substantial self exists” (Delanty & Strydom, 2003:14).

ii) Subjectivism

According to subjectivism, “understanding, truth, and meaning are all dependent on the cultural and physical context people inhabit, along with their understanding of the way the world functions” (Huizing, 2007:6). Subjectivism was chosen because it allows the participants to express opinions or feelings based on a person’s perceptions.

1.7.2.2 Epistemology

Epistemology is the study of “what counts as knowledge, where knowledge is located, and how knowledge increases” (Cunningham & Fitzgerald, 1996:36). Epistemological suppositions are concerned with how learning can be made, obtained and conveyed, and being able to be understood (Scotland, 2012:9). Epistemology is mainly divided into positivism and interpretivism, although there are more divisions (Saunders et al., 2016:133).

i) Positivism

“The epistemological perspective of positivism emphasises the importance of objectivity and evidence in the search for truth, and the researcher has no effect on the reality” (Al-Saadi, 2014:2).

ii) Interpretivism

Interpretivism is “connected with the philosophical viewpoint of idealism, and is used to group together numerous approaches, such as social constructivism, phenomenology, and hermeneutics; methods that reject the objectivist concept that meaning exists in the world independently of consciousness” (Collins, 2010:136). Interpretivism was chosen because people determine the nature of reality, rather than objective and external factors.

1.8 Research approach

Research approaches towards concept development can be “deductive, inductive or abductive” (Saunders et al., 2019:153).

1.8.1 Deductive approach

A deductive researcher works from “the top down based on a theory and hypotheses, followed by data addition or opposition to the theory” (Creswell & Clark, 2007:23).

1.8.2 Abductive approach

Abduction perception serves the purpose of understanding surprising, ambiguous or other mysterious phenomena in order to fill the gaps in our beliefs and maintain or restore their coherence (Thagard & Shelley, 1997). In the abduction method, “the research process begins with” amazing facts or puzzles “and the research process is dedicated to explaining them” (Bryman. & Bell, 2015:27).

1.8.3 Inductive approach

An inductive approach provides a “systematic and easy-to-use method for analysing qualitative data that can produce reliable and valid findings” (Thomas, 2006:139). The inductive approach was chosen because it makes a clear connection between the research objectives and the summary findings of the raw data, contribution towards the development of the theory.

1.9 Research strategy

The research strategy presented a description of the research process and how it was applied. The strategy followed was that of a survey (qualitative).

1.9.1 The survey

A qualitative survey was chosen for this research, following a process of defining and examining variation within populations in a qualitative way. In this type of survey, the number of people sharing the same characteristic (value of the variable) is not counted, but rather the amount of meaningful variation (relevant dimensions and values) that exists within that population is counted (Jansen, 2010).

This study used qualitative methods to analyse the challenges TTCs faced. Qualitative research is more participative in nature, and this allowed the researcher to use inputs from a sample of participants, who were: i) 12 TTCs; ii) six (6) lecturers; iii) five (5) company supervisors; and iv) four (4) trade test practitioners.

1.9.2 Unit of analysis

The unit analysis is the trade tests passed and failed by the TTCs.

1.9.3 Units of observation

The units of observation (27) are: i) TTCs (12); ii) lecturers (6); iii) company supervisors (5); and iv) trade test practitioners (4) (section 3.5.3).

1.9.4 Sampling

The population of the study is defined as consisting of TVET colleges, companies, TTCs, lecturers, supervisors and trade test practitioners. The TTCs were chosen from the TTCs who did the trade tests in the Occupational Department of the TVET institutions. The sampling method used was a non-probability, non-randomly and conveniently sampling technique.

1.10 Data collection

Semi-structured interview guide were used (Appendix A). An interview guide (Appendix A) was used to elicit the answers from the participants. The interviews were recorded, and notes were taken to support the recordings (section 3.6). The process of ensuring trustworthiness of data includes certain research procedures that researchers engage in during their research activity and in their reports. Among the four general criteria Lincoln and Guba (1985) use to determine trustworthiness, they mention the following. There are four of these: credibility, transferability, dependability, and confirmability.

1.11 Data analysis

The data analysis was done in Excel using the transcriptions of the interviews. Once transcribed and validated (transcriptions were given to the participants to verify the correctness and intent of the answer), key concepts were coded and presented as a summary of the question per P (section 3.7; section 4.3; Tables 4.2 & 4.3). A transcribed interview coding was created. A code is “a detailed structure considered by the investigator to capture the primary content or essence of the data” (Theron, 2015:4). Charmaz (2006:46) refers to coding as “key link between data collection and explaining the meaning of the data.” This was then followed by a second coding, which was phrased by shortening and grouping alike keywords. After the second round of coding, categories and themes were identified (section 4.3; Tables 4.4 & 4.5).

1.12 Ethics

Research ethics includes adhering to the research guidelines and maintaining self-respect (Fouka & Mantzorou, 2011). Kelman (1977) posits that an assault on secrecy occurs once confidential information, such as views, approaches, sentiments and proceedings, is shared with others without the participant's knowledge. The researcher was alert of the need for the ethical requirements that are required by the Cape Peninsula University of Technology Research Committee. The following ethical practices in relation to the research were followed:

i) Performing research in a scholarly and responsible manner and taking responsibility for its design, methodology, and execution.
ii) Following the principles of honesty, clarity, comprehensiveness, accountability and openness to public scrutiny.
iii) Honesty, clarity, integrity, accountability and public transparency are the principles we follow.
iv) The participants were informed about the purpose of the research, are able to participate according to their own will, confidential assurance was done in order to protect the participants.
v) Diffusion of study findings for peer analysis.
vi) Credit of all sources of information and support.
vii) Not abusing study results or situations for own advancement.
viii) The participants participate voluntarily in the research. A consent document was signed by each participant, indicating that they are participating out of free will and that they can withdraw at any time they chose to do so (Appendix A).
ix) The participants were guaranteed confidentiality as explained in the consent letter. All names and any form of identification were removed from the data and pseudonyms were used.

1.13 Delineation

The research did not focus on Report 191 National Engineering Education (NATED) Certificate and National Certificate (Vocational) (NCV)(students currently pursuing Nated programme or NCV) , or on apprentices who are currently enrolled in a TVET college.

1.14 Headline results

In Chapter Four, the findings are formulated, constructed on the study of interview responses gathered throughout the study procedure. A total of 52 findings were discovered. The following are the headline findings:

Headline finding 1: Instructors are unavailable to assist students with preparing for their trade test.

Headline finding 2: Material is lacking in the workshops for trade test training and preparation of the TTCs.

Headline finding 3: The TVET syllabus is outdated and some of the work required by the companies is not covered in the syllabus.

Headline finding 4: TTCs that passed the test and became competent in their trade are permanently employed by most companies.

Headline finding 5: The syllabus does not relate to new technology.

1.15 Conclusion

There is a shortage of qualified trade resources. Furthermore, the current syllabus used by TVET colleges does not relate to what is done in industry. There are challenges with the processes of learning before attempting the trade test. The process of learning used does not comply with the industry's needs.

1.16 Contribution

The research has identified some of the challenges encountered by TVET colleges when running apprenticeships. The curriculum needs to be reviewed and aligned with the technology being used in industry, and a shortage of resources needs to be attended to.

1.17 Summary

This chapter introduced the research and provided background to the lack of certified competent artisans in the industry and reasons contributing to the decline. There is still uncertainty as to why candidates fail these tests, as stated in the problem statement. The chapter also outlined the aims and objectives of the study. The main research question was also formulated: "What are the main factors affecting the failure rate of trade test candidates in TVET colleges?" The aim of the research was to explore the factors that affect the high failure rates of TTCs in TVET institutions. Qualitative research methodology was chosen as a method study. The research method was also selected to provide answers to the research questions. Ontology and epistemology philosophy were explained. The data collection methods used were interviews and interview guidelines. Data analysis was applied using coding. Ethical considerations were also outlined and explained clearly. The contribution, conclusion and main research headings were outlined.

1.18 Chapter layout

Chapter 1: Introduction – Proposal highlighted what the research was about, explaining topics and objectives of the research, along with methods that were used.

Chapter 2: Literature Review – The literature review will provide an overview of the topic researched and the purpose of the research will be discussed with respect to the literature.

Chapter 3: Research Methodology – Techniques will be applied to identify, select, process, and analyse information about the topic, for instance the research will be a case study and qualitative techniques will be used to analysis of the data.

Chapter 4: Analysis and Findings – The study that will be taken from the answered interview questions, will be analysed and finding will be summarised.

Chapter 5: Discussion – Interpretation of the impact of the findings of the research problem being investigated, and to clarify any new understandings of the problem.

Chapter 6: Conclusion and Recommendations – The results found will be concluded and recommendations will be suggested in order to improve.

References: Information gathered from the literature will be referenced and a bibliography indicating where the information was accessed will be listed.

Appendixes: Evidence that was gathered in process of doing of the research is attached e.g., letter of consent and interview guide (Appendix A).

CHAPTER 2: LITERATURE REVIEW

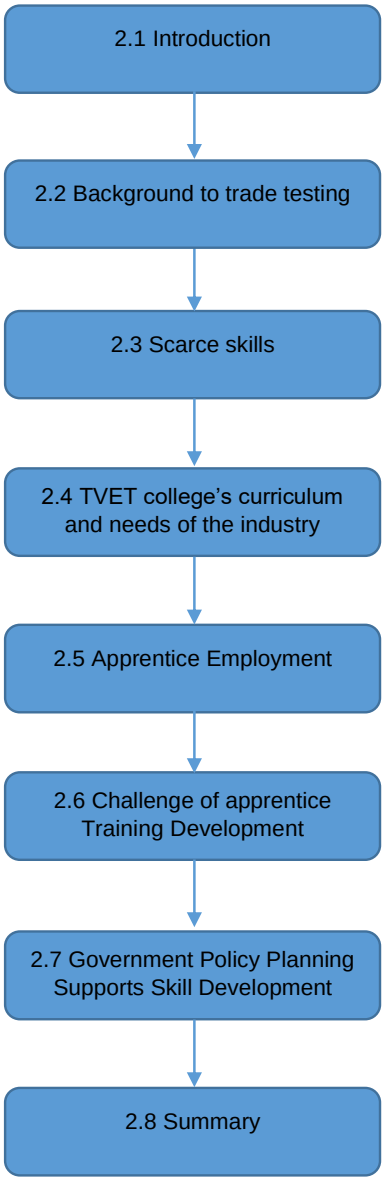


Figure 2.1: Layout of Chapter 2

2.1 Introduction

In this chapter, the researcher reviews the literature on processes undertaken to bridge the shortage of skills in SA and how the processes intend utilising technical, vocational education and training (TVET) colleges for training apprentices to become qualified artisans. The literature was searched using Cape Peninsula University of Technology library databases such as Scopus, Google Scholar, EBSCOhost, and ProQuest. Keywords identified from the title, problem description and survey questions were used as a guide to searching the literature. Additional keywords were identified from the literature and the iterative process continued.

The literature review comprises the following: i) background to trade testing; ii) scarce skills; iii) TVET curriculum; iii) apprentice employment; iv) challenges faced by apprentices; v) government policies; and vi) summary.

2.2 Background to trade testing

The research traces the background of artisan training back to the arrival of European settlers in the 1600s with the importance of foreign origins and links to the system of slavery (Mbatha et al., 2014). Wedekind emphasises two significant historical facts:

> "First, that after 1652, Dutch traders and early settlers imported slaves to provide the artisan labour required to build farms and towns; second, that in 1775, a slave revolt took place within the Dutch colonies" (Wedekind, 2013:39).

> "The concept of apprenticeship originated as an integral part of slavery in 1775, allowing slave owners to 'apprentice' the children of male slaves and free Khoisan or Hottentot women until they were adults" (Wildschut & Meyer, 2018:2).

The systematic raiding of African homesteads to capture children and youth for slavery continued, even though slavery was outlawed as a condition of independence from Britain (Wildschut & Meyer, 2018).

Thanks to the mineral revolution in the early 19th century, with the discovery of diamonds in 1867 and gold in 1886, the period of industrialisation required an upswing in the skills of craftsmen to supplement demand. Terblanche and Bitzer (2018) refer to how the School of Trades opened in 1909, which absorbed most of the training in the mechanical, carpentry, carriage construction, printing, blacksmithing, water system and electrical trades.

The training of the African race as artisans in the constructing trade in South Africa was permitted, but the Group Areas Act 41 of 1950 restricted the environment of work for African's as they could only work in nominated areas (Jordaan & Ukere, 2011). Many Africans were denied the opportunity to learn the skills that would enable them to be trained as artisans because of apartheid training and employment practices (Akoojee, 2013; Von Maltitz, 2018).

Apprenticeships in the 1980s were defined by corporations, technical colleges and large public and private sector employers. The apprenticeship system has flourished in state-owned enterprises, including Eskom, Iscor and Transnet, as well as in the private sector, including automotive and mining companies (Mzabalazo Advisory Services, 2017). Existing training and associated capabilities are extremely difficult with available datasets because of the four paths to artisan status and the complexity of the new training system. The routes are available in order to trade test the apprenticeships that pave the way towards becoming a qualified artisan. A trade test is undertaken when an apprentice with relevant trade qualifications undergoes a

competency test to become a qualified artisan in terms of Section 13 of the Manpower Training Act 56 of 1981 dealing with apprenticeship (South African Government, 2007). Vollenhoven (2016) explains several routes to becoming an artisan. Vollenhoven (2016) elaborates in more detail on how an apprentice undergoes a commercial test before the end of the contract period, after passing the commercial test, and is released from the contract, which is called an apprenticeship employment under Article 13 of the Manpower Training Act 56 of 1981. In addition, a Section 21 apprentice may also qualify as an artisan without a commercial examination because of a system already in place that is intended to support employees who have many years of experience. In Article 28 of the Manpower Training Act 56 of 1981, a worker with a certain number of years of experience may take a commercial test after a process to recognise prior learning (RPL). Since 1994, the successful application of RPL has been an education and training policy priority (SAQA, 2019).

2.2.1 Qualifying for apprenticeship

Apprenticeship trade test candidates (TTCs) are selected from technical high schools with a requirement of Grade 12, which is equivalent to N3 on the Report 191 National Engineering Education (NATED) with Mathematics, Physical Science, Technical Drawings and trade subjects. Students who have attended TVET colleges enrol for NATED Engineering courses, where they are able to qualify as an apprentice using the N2/Level 3 qualification. According to the Department of Higher Education and Training (DHET) (2021b), in order to apply for a trade test, candidates need to have a minimum of Grade 11 (technical Grade 11), including a trade subject.

In terms of the Manpower Training Act of 1981, NATED (or Report 191) programmes (also known as N programmes) are programmes traditionally associated with apprenticeships. Both pre-matriculation (N1–N3) and post-matriculation (N4–N6) programmes are traditionally offered, with the latter mainly focused on theory. Engineering programmes are offered as quarterly programmes and business programmes as semester programmes (Papier et al., 2017).

In technical high schools, students are being trained in technical engineering subjects from Grade 8. The technical high school subjects allow students from grades 8 and 9 to discover different fields, which enables them to choose suitable careers. From grades 10–12, students are introduced to technical engineering NATED programmes (N1–N3) involving Mathematics, Science, Technical Drawings and Trade Theory. Pieter (2014) stated that the technical education requirement for the trade test is a National Technical Certificate Level 2 (N2), which is obtained at technical colleges. He further highlights the fact that the major subjects for the Level 2 certificate are Mathematics, Engineering Drawings, Engineering Science and Trade Theory. After Grade 12, a student can qualify for an apprenticeship.

DHET (2018a) describes the kinds of apprenticeship programme available to students from technical high schools. The fast-tracked artisan programme is targeted at learners who have completed an N3 qualification but who could not find apprenticeships with employers. The learner enters the workplace directly (i.e. not as an apprentice) and is required to do 80 weeks of workplace training (26 of which may consist of practical training in a simulated classroom environment) before writing a trade test.

In TVET colleges, there are two ways to qualify for an apprenticeship and become a craftsman. TVETs offer technical and vocational education and training programmes to learners who have completed at least Grade 9 at the school level (DHET, 2016). Learners who have attained a Grade 9 qualification can do a National Certificate (Vocational) (NCV), starting from L2–L4, which will lead them to qualify for an apprenticeship. The second option is to follow the NATED route, where a student can start from N1–N2. The NATED route for Technical Engineering is fast tracked, in that the work done at a technical high school for a year is completed in a period of 3 months. According to DHET (2018a), there is an integrated vocational certificate that caters to those who have completed Grade 12, but is extended to those who leave school after completing Grade 9 and enrol in an integrated vocational certificate, integrated into a TVET college.

In addition, there are more opportunities for learners with Grade 12 certificates. In general, public TVET colleges offer three types of degrees and partial degrees, specifically (DHET, 2015:16):

i) The NCV offers three levels, namely levels 2, 3 and 4 on the National Qualifications Framework (NQF). NCV is an alternative professional learning pathway for grades 10, 11 and 12 in the school system.
ii) The NATED Certificate is offered at six N-levels (N1–N6) for term-registered engineering studies.
iii) Vocational and partial qualifications, including work place-based learning (WPBL), are closely linked to needs and opportunities in the workplace. Many work-study programmes are funded by the sector education and training agencies (SETAs) and the National Skills Foundation (NSF) through a revenue funding system.

2.2.2 Recognised prior learning route

RPL is a form of assessment that recognises the learning experiences of adults through education and training (Harris, 2000). The RPL programme provides people who have not studied for a long time with the opportunity to obtain a qualification and/or to earn credits that will allow them to return to formal education (Nel, 2010; Makhatsane, 2020). Skilled workers who have worked in the same field for many years can follow the RPL route.

Craftsman workers were created in the artisan production system by the apartheid system denying access to educational opportunities leading to trade certification (DHET, 2014). Bolton (2011:25) refers to RPL as “a process of assessing a learner’s prior learning and experience against the learning outcomes for a particular trade qualification”. Jordaan et al. (2018) agree with the Bolton’s (2011) definition. RPL is an option for a potential student with exposure to a certain trade field to apply for artisanship. The RPL award includes a competence certificate showing which curriculum topics have been approved or what additional training is recommended. This allows one to obtain full or partial qualifications (including journeyman/trade Certificates) (Machard et al., 2016).

Artisanal Recognised Prior Learning (ARPL) entrance requirements for candidates seeking to participate following the RPL route to become qualified (DHET, 2016:11) are:

i) The ARPL standard form is completed according to the National Artisan Moderating Body (NAMB) contract with the support of the DHET ARPL unit.
ii) Candidates with formal work experience must have five years of work experience related to all professions, and this experience must be in the specific profession in which the candidate has experience.
iii) Minimal experience in a few years can be obtained with a variety of traceable employers.
iv) If possible, all ARPL applicants should have a Level 4 Adult Basic Education and Training Certificate or an equivalent certificate (Basic Learning Component Certificate). Candidates who do not meet this requirement must complete a basic course to fill the knowledge gap at a vocational school or other selected institution during the ARPL process.
v) All certified trade testing centres must maintain records of all approved candidates and make those records available to DHET as needed.

2.2.2.1 Apprenticeship in the South African context

Apprenticeship training is an exceptional form of education as it combines company-based training with vocational schooling (Jansen & Pfeifer, 2017). Vollenhoven (2016:19) refers to apprenticeship as “a historical connection between apprentice system which had a slightly difference between theory and practical”.

Technical training provides not only scientific knowledge, but also practical and applied skills (Eze et al., 2018). TVET colleges are seen as the main driver of apprenticeships, where large numbers of artisans can be qualified (Von Maltitz, 2018). Apprenticeship training has traditionally been delivered through a block release system whereby employers signed on apprentices and then send them to a public college for three months each year to complete theory-based courses, known as NATED programmes.

Apprenticeship training programmes cover the following areas i) automotive technician; ii) electrical; iii) gas fitting; iv) industrial electrician; v) ironworker-reinforcing; vi) metal fabricator; vii) millwright; viii) sheet metal; and ix) welder apprentices. The requirements for these relevant trades of artisanship were explained for TVET colleges and technical high schools in section 2.2.1. TVETs colleges and companies offering apprenticeships need to be accredited with the Quality Council for Trades and Occupations (QCTO) board. There are channels that must be followed when registering the trades with the relevant SETA or QCTO and requirements differ from SETA to SETA. TVETs accredited with SETAs are required to submit all required documents according to the trade and SETA requirements.

2.2.2.2 Apprenticeship in other countries

South-eastern Nigeria was the site of the development of Nigeria's apprenticeship system, which is currently used throughout the country. Private small-scale and cottage businesses in Nigeria offer apprenticeship training (Sani et al., 2021). In Germany, Switzerland, Denmark, and Austria, apprenticeship vocational training models have been adopted from successful and well-tested initiatives to improve the quality of vocational education, develop a skilled workforce and reduce unemployment (Kithinji, 2022). Another widely studied modern training system is the German dual training system (Franz & Soskice, 1994). In these programmes, teachers teach technical knowledge in public schools and certified trainers (corporations) provide work-related training. The government is investing in the provision of public schools and vocational training is provided by businesses or individuals (Sedigh et al., 2019).

2.3 TVET colleges

TVET/further education and training (FET) colleges in South Africa were established and managed in accordance with the Higher Education Act of 1923, to provide both theoretical and industrial training (Terblanche, 2017). The public sector in South Africa had four types of institutions that offered post-matric education. These included public colleges, technikons (now called universities of technology), colleges of education and technical colleges (technical vocational educational and training) (Sebola, 2022). Nationally, there were 50 large multi-campus TVET colleges since the new institutional landscape document on the merger of 152 technical colleges in 2001 (Papier et al., 2017).

Colleges have been required to establish or adopt working relationships with SETAs since 2009, in order to generate opportunities for students and graduates alike to benefit from experience in workplaces while studying, as well as from work placements upon graduation (Kraak & Paterson, 2016).

The South African post-school and TVET college system experienced immense institutional strain during the two decades of unrelenting reform since 1994 (DHET, 2018a). The strained

experienced included the insertion of new state performance measures, institutional mergers and new curricula demands. As part of the National Training Strategy Initiative (NTSI), the foundation has been laid for a state-driven reform agenda for vocational education and training, designed to shift from the market-led system that the apartheid regime introduced in the 1980s towards a more structured, employer-driven, competency-based system (National Training Board, Republic of South Africa, 1994). The 'privatisation' of artisan training under the auspices of newly created industry training boards resulted in the ultimate erosion of the apprenticeship system, with little uptake under the new system from the employers (Gewer, 2016). Colleges still formally set their national technical education programmes as a requirement for an apprenticeship, despite their content being seriously outdated, and employers are forced to teach trade theory again at their own expense (DHET, 2018a).

2.3.1 Legislative framework of apprenticeship

During an apprenticeship, a candidate is required to follow the rules of the Manpower Training Act 56 of 1981 where a contract agreement must be drawn up between candidate, TVET college and the employer. The Skills Development Amendment Act 37 of 2008 (South African Government, 2008:36) states that, "before the start of the apprenticeship a written agreement should be concluded to define the rights and obligations of the apprentice, the employer, and where appropriate the vocational education and training institution, related to learning and working conditions". The agreement lasts for the period of the apprenticeship. Before a learner goes for theoretical learning, a contract agreement must be given to them (DHET, 2015). When apprentices begin their training, this approach will ensure that they have all of the necessary components (knowledge, practical and workplace). Apprentices would not have to struggle to find jobs after completing their knowledge and practical training at a TVET college. The work environment will be available from the start.

Govender and Davison (2019) describe the contract/agreement, in which there is a duration of 96 weeks of apprentice at chosen provider, that is, a TVET college, during which time they will be receiving theory and practical (N2/L3) training involving work exposure. After the apprenticeship, TTCs are able to apply for trade test assessment. Once the trade test assessment is completed and requirements are met the candidate qualifies to be an artisan. Based on the Skills Development Act 97 of 1998 (South African Government, 2015) and the Higher Education Laws Amendment Act 26 of 2010 (South African Government, 2010), a learning agreement is an agreement between a group of learners, employers, and a group of skills development providers (TVET colleges). The Skills Development Act 97 of 1998 furthermore explains the terms of a learnership agreement for the company, the apprentice and the skills provider:

The company must:

i) Employ the apprentice for the period detailed in the arrangement.
ii) Teach the apprentice detailed everyday work knowledge.
iii) Offer the apprentice the education and training specified in the agreement.

The apprentice must:

i) Work for the company.
ii) Attend the specified education and training offered.

The skills development provider must:

i) Provide education and training specified in the agreement.
ii) Provide the apprentice the support specified in the agreement.

2.3.2 Certification of artisans in the TVET sector

Before a candidate undergoes a trade test, the submission of application form to accredited trade test centre must be done. The candidate submits a completed application form, identity documents with qualification required (N2 minimum requirement), service letter from company and original logbook. Applications are submitted to a relevant SETA, if all required paperwork meets requirements, then a date is given to the TTC. According to DHET (2015:12), referring to the Skills Development Act 97 of 1998, the requirements when making application at and accredited trade test centre are:

i) Submission form in the format determined by the NAMB.
ii) Proof that the applicant has completed the entry requirements specified by the QCTO for the listed trade qualification.
iii) Proof that the applicant has completed all the curriculum components required for an artisan qualification.
iv) Proof of compliance with any medical or legal requirements applicable to the relevant trade as may be provided in any other law or required by a professional body for the listed trade.

In addition, DHET (2013b:3) refers to the Skills Development Act 97 of 1998 trade test regulations, highlighting that when the trade test centre has received the serial number of the applicant, the trade test centre accredited to QCTO must respond within five working days with written signed notice indicating:

i) The trade test serial number issued by national trade testing system.
ii) The date on which the trade test will be conducted.
iii) The listed trade which will be tested.
iv) The venue, time and duration of the trade test.

After receiving the trade test details, the TTCs undergo trade test preparation training for ±2 weeks before the assessment. If the candidate is unsuccessful in two of the assessment activities, they are given a chance to apply to redo the two assessments failed within a period of a year. If the candidate fails to apply within that period, they will need to redo the whole process of trade testing all over again.

TTCs contracted under a learning agreement are allowed three trade test trials. These should occur during the learning agreement. For example, the law stipulates that after trying three commercial exams within the contract period of a learning programme, those who are not yet found to be legally competent can refer to their previous perceptions of knowledge. Candidates taking the journeyman exam must issue a certificate in the format specified by NAMB from an accredited journeyman exam office within three business days of completing the trade exam.

2.4 Scarce skills

South Africa faces a serious shortage of skills, which, if not addressed, could severely limit economic growth and significantly limit South Africa's chances of competing with other countries in the world (National Planning Commission, 2012a). South Africa does not have enough professional artisans of significant enough quality to support an industrialising economy (Tshele & Agumba, 2014). There are more than 30 000 artisans targeted by government annually who must qualify in order to meet the development plan target by 2030. Joint Initiative on Priority Skills Acquisition (JIPSA) has highlighted the significant decline in the number of people who have undertaken trade tests and recognised that physical measures would need to be taken to boost artisan training if the country wants to meet the demands of its major infrastructure projects (JIPSA, 2010). Richardson (2007, cited by Mateus et al., 2014) argue that there are many causes of the lack of skills in South Africa: i) lack of investment in skills development; ii) education; iii) rapid structural changes associated with low overall unemployment; iv) repeated influx of employment in parts of the economy; and v) weakness in the education system. Manual trading is a professional category that strongly reflects these issues (Naidoo & Hoque, 2017).

There are claims about the shortage of craftsmen and the ability of technical and vocational education and training systems to create the required quantity and excellence of the craftsmen involved (Mbatha et al., 2014). There are many countries that are struggling with high youth unemployment and these countries seek to improve their TVET systems in order to reduce the transition between school and work (Albanese et al., 2017). Artisan development is mainly delayed by the failure of apprenticeship systems and the lack of involvement from the providers of education and training (Mateus et al., 2014). Most of the population has been prevented from accessing vocational training, which has created a "missing generation" of artisans in the South African labour market (Kruss & Wildschut, 2015). In sectors that are suffering from skill

shortages in engineering, manufacturing and construction, apprenticeship tariffs have not improved (OECD/ILO, 2017).

Wildschut and Meyer (2018) said that since the 1980s the artisanal system output has dropped, which has resulted in a shortage of engineers and construction field artisans due to a recession. The high demand for engineering skills and the absence of capability in trade fields exists globally (Van Rensburg & Darko, 2018). The shortage of skilled artisans in South Africa is a major problem that directly affects the artisan training and development programme (Govender & Davidson, 2019).The Western Cape Government (2018) reports a skills shortage mainly in the fields of mathematics and science, and especially in fields such as engineering and ICT. The skill shortage shows in the increasing deficiency of vocational and technical skills (artisans), such as electricians, welders and mechanics.

2.4.1 TVET colleges developing skills

The history of the TVET sector in South Africa can be traced back to the 1920s when technical colleges were established to back the government's manufacturing plan and to ensure a continuous source of skilled labour (Pienaar et al., 2016). During the 1960s, South Africa's economy started growing and when the artisan training system was unable to produce artisans in numbers, these skills were imported from countries like the United Kingdom.

At its peak in 1985, the system trained 13,500 TTCs passing their trade tests yearly to be qualified as artisans (Mzabalazo Advisory Services, 2017). In 1985, 26,000 people applied to do a trade test in an engineering field, but this number fell to 3,000 by 1995 (Wedekind & Mutereko, 2016). The discriminatory political landscape contributed to a particularly negative discourse on vocational education and training and links the learning pathway system to the systematic exclusion of race (Mbatha et al., 2014). The outcry from employers over the decline in the number of skilled craftsmen led to a revival of the apprenticeship system since 2008, with efforts (Strategic Development Policy) to address the discriminatory nature of delivery through a range of mechanisms aimed at concurrent system development and transformation using the Growth, Employment and Redistribution (GEAR) policy implementation (Kruss & Wildschut, 2015).

Apprenticeships are now used by several governments around the world as a policy control to address a wide range of social tribulations, including youth unemployment, skills mismatches, skills deficiencies, economic problems and social exclusion (Chankseliani et al., 2015). Standards of training for artisans and other mid-level skills are low, as are the numbers registered in vocational and occupational education programmes (Allais, 2012). The quality of delivery is unpredictable and quantity rates of the colleges are at a new low level. The institutions

set up through the levy-grant system, the SETAs and the NSF have been much criticised (Allais, 2012).

The merSETA (2019) statistics showed 87,599 trainees in apprenticeships and 95,505 on-the-job learners. The main trades accomplished through apprenticeships in motor mechanics, diesel fuel injection mechanics, electrical engineers, fitters and millwrights are available. In the same period of 2002 to 2019, a total 53,058 apprentices qualified as artisans in the sector and another 53,072 learners successfully completed their learnerships (merSETA, 2019). Welding applications, automotive components, manufacturing and assembly, production technology, automotive repair and maintenance and metals production were among the most popular learnership programmes completed by students in 2019 (merSETA QMR). The merSETA programme started in 2002 and continued up to 2019. Sixty one percent (61%) of the students who registered have qualified to be artisans, indicating that the number of artisans qualifying is below the targeted.

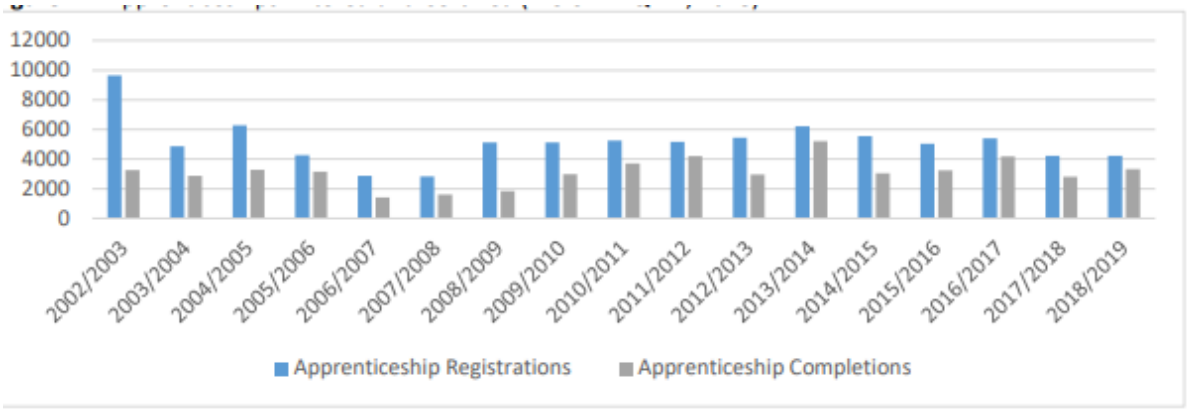


Figure 2.2: Apprenticeships entered and certified
(Source: merSETA, 2018:40)

2.4.2 SETA involvement with TVET colleges

According to DHET (2016), SETAs are required to implement their sector skills plans by facilitating the provision of improved industry skills to contribute to the goals of the National Skills Development Strategy (NSDS). TVET colleges have been delegated by the Skills Development Act 97 of 1998 (South African Government, 2015) and the Further Education and Training Act of 1998 to develop the capacity to offer and manage learnerships with the relevant SETAs (Vollenhoven, 2016). TVET colleges form a critical component of the current training capacity of artisans (merSETA, 2018).

According the merSETA QMR data, the main trade areas studied in TVET Colleges are in the manufacturing sector, including, among others, electrical engineering, boilermaker, diesel mechanic, engineering and related design (merSETA, 2019). The SETA is to act as an

intermediary to confirm that a competent workforce is developed in line with industry requirements. Because such a key focus is the development of the current workforce, TVET colleges apply for funding grants from SETAs, which assist in running apprenticeships. SETAs' discretionary grants cover programmes aimed at helping both existing workers and potential new entrants to the labour market (PSETA, 2019). PSETA (2019) details the service providers eligible for the scholarship. This is a public, private, national public school or state academy and only if it can provide all or substantive parts of the required qualifications, is it categorised as a TVET institution. The government of every country in the world promotes technical/vocational education because it helps TTCs obtain both theoretical knowledge and technical skills required of the 21st century.

2.4.3 Artisan development through apprenticeship

Artisan development through traineeships teaches a diverse series of responsibilities that contains classroom exercise in theory as well as hands-on applications. The training of skills through apprenticeship improves competency and knowledge in the performance of projects to international standards (Kaoma & Muya, 2016). Naidoo and Hoque (2017) emphasise the main focus on craft schools and apprentices to create more craft workers for the economy. The effectiveness of such on-the-job training is an important factor in the growth of production of skilled craftsmen.

2.5 TVET colleges' curriculum and industry needs

According to Terblanche (2017), a curriculum is defined as a planned fixed educational practice and training as the act of teaching brought around through the course. Curriculum is well-defined by "means of technical study of theoretical programmes beginning from a need analysis to the design of effective graduate profiles, programme/course objectives, content, sequencing, methodologies and education assessment" (Shettar et al., 2015:87). The curriculum for a particular course has been planned with a perfect balance between the participation of legendary scholars and industry experts for each university (Manivannan & Suseendran, 2017). Ben-Peretz and Craig (2017) say that the industry's contribution to development of curricula is needed for the universal teaching of TTCs. Since 1994, the South African TVET institutions have tried to mend a curriculum that was out-of-date and unresponsive to a development of the economy, and have also addressed the low output rate of TTCs. Furthermore, TVET institutions lost contact with industries, which impacted on the little knowledge of new and emerging industry needs (Terblanche, 2017).

"TVETs are considered as an education that has both theoretical and practical work that is given through industries" (Terblanche, 2017:19). An operative TVET curriculum trains students for small, middle, medium and complex skills that relate to the apprentices' school-level awareness to meet entrance requirements (Terblanche & Bitzer, 2018). The formation of the QCTO in 2010

took new courage for curriculum improvement. It was involved in making sure of the excellence and industry relevance of occupational qualifications and developing replacement programmes for the old-fashioned TVET curricula (Terblanche & Bitzer, 2018).

The collaboration between the university and the industry is an increasing trend, advantageously important to the both partners. Colleges and industry have different motivations, but a common interest to collaborate as well (Predrag et al., 2014). The goals of the apprenticeship curriculum do not always match the goals of the workplace because of their different rationality in the workplace (Fjellström, 2014). From the perspective of learning content and educational approach, it is very important for businesses and educational institutions to provide learning that is further applicable to labour market desires and professional profiles (Field et al., 2014). Analysing work-related skills and practices is an important first step in the curriculum development process (Nieuwenhuis et al., 2019). Involving employers in the training of apprentices can also help to align the demand and supply of artisans (OECD/ILO, 2017). Employers can show that their curriculum and qualifications meet the needs of the labour market. This can improve the value and employment outlook associated with the training programme (Dolphin & Lanning, 2011). Improving competition between TVET institutions and initiatives is important, primarily at the local level, and globalisation and technological changes create a polarised labour market for high-paying and low-paying jobs (OECD/ILO, 2017).

2.5.1 TVET college curriculum

According to DHET (2015), the importance of the programme is based on its ability to be appropriate, available and sensitive to the skill needs of the industry. The curriculum creation, implementation and monitoring process should focus on this source. The established curriculum creates conditions for trainees to learn theory and instructors to convey real-life experiences.

Wheelahan (2015:751) argued that:

> "TVET curriculum differs from academic qualifications because the purpose of academic curriculum is to invest TTC into a body of knowledge in academic disciplines. The purpose of vocational curriculum is to invest TTC into a field of practice and the theoretical knowledge that supports practice as the basis for participating and manufacturing each."

Figure 2.3 illustrates the four key aspects of a deliberative learning outcome: task, performance, guidance and assessment. Task components can be viewed as assignments with one or more goals (Fjellström & Kristmansson, 2019).

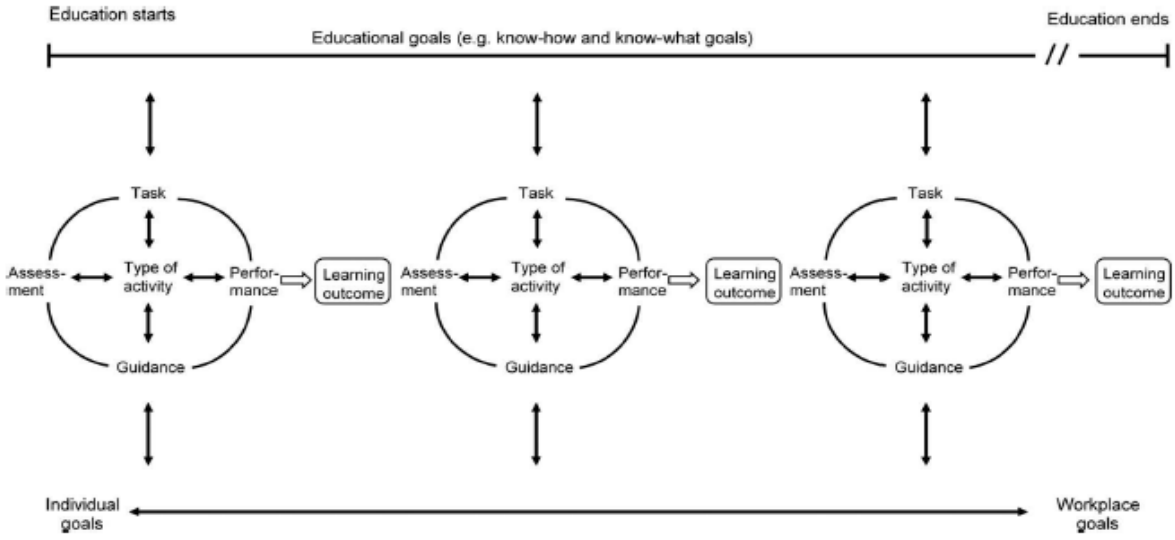


Figure 2.3: Four key aspects of a deliberative learning outcome: task, performance, guidance, and assessment (Source: Fjellström & Kristmansson, 2019:5)

Countries such as Canada and Spain have developed a method called the Develop a Curriculum Method (DACUM) for their TVET colleges. The DACUM method is structured in five main phases (Norton, 1997:28, cited by Bankolé & Nouatin, 2020:49), namely: i) curriculum analysis; ii) curriculum design; iii) instructional development; iv) training implementation; and v) programme evaluation:

i) **Analysis**: This phase consists of job analysis by identifying training needs and by the definition of the standards based on the selection of tasks.

ii) **Curriculum design:** After selecting tasks training needs, the second phase is to establish a method for shaping training purposes per task and to formulate a training plan.

iii) **Instructional development:** This phase is mostly based on the development of competency profiles, guides or modules for the training, guiding of the curriculum and the lesson plans. It ends with a pilot test, which helps to improve or revise materials. According to Norton (1997, cited by Bankolé & Nouatin, 2020), pilot testing and curriculum materials revision are very important and require time and financial investment because of their function in the learning achievement.

iv) **Training implementation:** This stage deals with the training delivery. It includes the planning of the training activities and requires related resources (equipment, trainers, trainees, facilities and so forth) and formative evaluation.

v) **Programme evaluation:** The fifth stage includes summative evaluation, follow-up on training and an impact evaluation of the training programme on labour market outcomes.

2.5.2 CBT in TVET colleges (apprenticeship)

Competency-based training (CBT) is a method for designing learning that is driven by industry and demand (outcomes-based), outcome-based programmes (curriculum), a set of learning activities and tests that govern the training (Malek et al., 2022). The CBT curriculum emphasises the development of knowledge and skills through instruction, reading and assessment, in conjunction with academic reporting, which tracks the TTCs' progress (Mpisili, 2022). According to Mulenga and Kabombwe (2019), the intention of the CBT application is to assist beginners to accumulate and practice knowledge, skills, values and attitudes to cope with the troubles and demanding situations they face of each day lives. Education systems typically adopt the CBT approach to pedagogical design as a framework for all educational and training practices (Sani et al., 2021). As a skill-based assessment method, CBT assessment is based on the use of complex situations that confront the learner with the unexpected and force them to use unfinished and complex responses (Al-Hattami, 2020).

The concept CBT curriculum has been around since 1957 in the United States of America (USA). The Soviet Union launched the first Sputnik satellite into outer space in 1957, which triggered the whole idea of a competency-based curriculum (CBC) (US Department of Space, 2009). The CBT curriculum is known as an object-based pedagogy. These approaches were conceptualised for vocational training in North America in the late 1960s, based on the Taylorist principles of the reorganisation of work and the appropriate methods to train for it (Fichtner, 2015). A CBT programme includes the identification of skills, knowledge and techniques related to a particular practice (Mulenga & Kabombwe, 2019). The CBT approach, or performance-based teacher education (PBTE), was used in its earliest forms to develop a curriculum for teacher pre-service programmes. It was determined in this case what makes for 'competent' school teaching practices. As early as the 1970s, PBTE or competency-based teacher education (CBTE) was defined and standardised by the American Association of Colleges for Teacher Education.

In 1971, Elam, their spokesman, offered a definition of the term in his 'State of the Art' address (Mulenga & Kabombwe, 2019). Elam (1971:6, cited by Mulenga & Kabombwe, 2019) indicated the following 'essential' characteristics of PBTE:

> "The student is expected to demonstrate the following skills, behaviors, and knowledge, derived from explicit conceptions of teacher roles and designed to allow assessment of a student's behavior in relation to specific competencies made public in advance:
>
> i) Criteria to be employed in assessing competencies are:
> - based upon, and in harmony with, specified competencies
> - explicit in stating expected levels of mastery under specified conditions, and
> - announced in advance
>
> ii) Evaluation of the student's abilities:

- focuses primarily on the performance of the performer
- demonstrates knowledge of planning for, analysing, interpreting, or evaluating situations or behavior
- aims for objectivity

i) Rather than based on time or credit hours, the rate of progression is determined by demonstrated competency.
ii) The curriculum aims to facilitate the development and assessment of student proficiency for specific abilities."

As part of a national reform programme implemented in the late 1980s and early 1990s in Australia, CBT was required for all accredited professional education programmes (Kim, 2015). African countries adopted CBT as a means of securing competent personnel able to thrive in the comprehensive market and apply skills gained in their studies to solve world problems (Nombo, 2022).

"In TVET institutions, Curriculum Based and Training (CBT) has been implemented by the government through Curriculum Based Assessment (CBA), resulting in a shift in society through the development of a culture of skills that improves trainee employability" (Okelo et al., 2021:346). Competency-based programmes have several features (Malek et al., 2022). Countries such as USA, Britain, Canada, Australia, South Africa and Singapore have followed the competency-based method to schooling and training (Ansah & Ernest, 2013).

2.5.3 CBT in South Africa

The CBC was adopted by South Africa in an attempt to change attitudes of South Africans and prepare them with the skills to survive in 21st century challenges. South African scholars preferred referring to their work as outcomes-based education (OBE). According to Christie (1995, cited in Jansen, 1998:322), the term has its origins in the competency debates in Australia and New Zealand. With its emphasis on learner performance and individualised teaching, the South African OBE inherited the American CBTE perspective (Mulenga & Kabombwe, 2019).

2.5.4 CBT in other African countries

After a severe shortage of engineers, technicians and artisans, South Africa pioneered the competency-based curriculum in 1998 in Africa. Kenya's current education system produces more managers and supervisors than technicians and craftsmen. This development includes a move from the conventional to competency-based education and training (CBET) (Cheruiyot, 2022). The TVET curriculum in Kenya applies the one-way vocational threshold concept through innovation and project work (Ngware et al., 2022). The implementation of CBET in TVET institutions through curriculum-based assessment (CBA) is a shift in society through developing a culture of skills from the employability of the trainee that can have a positive impact on the economy of Kenya academic achievement and economic growth for (Okelo et al., 2021).

The Zambian education system began revising its curriculum only in 2013 from a knowledge-based one, which it had used since its independence from the British in 1964, to a competency-based or outcomes-based curriculum (Mulenga & Kabombwe, 2019). According to the 2013 study, in the Zambian programme of study, apprentices should be developed as keen, life-long learners, confident and productive individuals, autonomous learners with values and the skills to succeed in school and in life (Zulu, 2015).

Using the generic term “competency-based curriculum”, Taasisi ya Elimu (2013, cited by Muneja, 2015), indicated that the last curriculum review in Tanzania was conducted in 2005. The aim of this curriculum was to strengthen learners’ skill acquisition.

2.5.5 CBT in other countries

The council in Malaysia has made a serious and earnest effort to implement reforms in the TVET-based education system through the CBT system in skills training centres (Malek et al., 2022). Because of the lack of adequate governance that would link training providers with the private sector, CBT has only been partially implemented in the Arab states.

Many efforts have been made to identify the competencies that are relevant to the labour market as part of the shift to outcomes-based training. The idea of CBET first entered official discourse in the United Kingdom when the youth training scheme was established in 1981 in part to address the escalating rates of youth unemployment (Mulenga & Kabombwe, 2019). Australia implemented the CBC in 1990 (Smith, 1996). As a result of changes in the economy and the pace of technology, there were observed weaknesses in the skill levels of the Australian workforce (Mulenga & Kabombwe, 2019).

2.6 CBT assessment

In CBT, TTCs’ performance is assessed to determine whether they have met performance requirements. As part of the evaluation process, various approaches are used: i) observation: observing the student as he performs the activity; ii) product: examining something that had been made or created by the TTC; and iii) asking: asking TTC questions that can be answered orally or in writing (McClarty & Gaertner, 2015:2). Under the CBT system, the assessment of students during industrial attachment is carried out by industry assessors, with regular monitoring taking place (Anane, 2013).

The theoretical and practical modules of occupational qualifications have formative assessments. After completing the workplace component, the final assessment is the trade test. Formative assessment is done at the TVET colleges, while summative assessment is completed after workplace experience.

The development of competency assessment guidelines for each trade (knowledge, practical skills and workplace capabilities) (DHET, 2015:36) are as follow:

i) Nominal abilities reflect a superficial conceptual understanding of the subject and cannot be considered competent by an individual at this level. They are considered "risk groups" (merSETA, 2012).

ii) Functional ability is the development of basic technical knowledge and skills learned independently, which have not yet been integrated and absorbed (Rauner et al., 2012). Functional ability is the development of isolated, learned basic knowledge, the development of rudimentary knowledge and skills that have not yet been integrated and absorbed (Rauner et al., 2012).

iii) It is important to understand the relationship between work processes and workplace conditions as part of processual competence. At this level of competence, economy and customer focus (Rauner et al., 2012:164), as well as the ability to communicate clearly and systematically through written and verbal accounts as well as technical drawings are important skills (merSETA, 2012:7).

iv) The fourth and highest level ability: overall design ability—diverse operational and social contexts in which the task is fully understood and performed (merSETA, 2012; Rauner et al., 2012:1). The result is solutions that are unique (merSETA, 2012).

2.6.1 Implementation of CBT curriculum: Access to resources

In order to implement the CBET curriculum, there are two major types of resources available. A good educational programme depends on a number of factors, including human resources, teaching facilities, libraries and classrooms equipped with the appropriate equipment, as well as a variety of other factors (Kanyonga et al., 2019:6). In order to implement CBT effectively, adequate resources are needed, including trainers whose numbers are in proportion to the number of students (Kanyonga et al., 2019). Curriculum change requires the use of effective resources, and training staff and students with limited resources or poor working conditions can perform poorly (Kanyonga et al., 2019).

There are many benefits (Table 2.1) of the CBT approach for employers and trainees. Curriculum development and development for CBT are determined by employment standards (Malek et al., 2022). Skills-based training is a demand-and-demand-driven education and training programme, whose products are highly sought after by employers.

Table 2.1: Benefits of the CBT approach for employers and trainees

Benefits of the CBT approach for employers and trainees	
Employer	**Trainee**
Employers and industries can identify the skills and standards they need and performance an imperative character in the design, growth, planning, implementation and evaluation of training programmes through CBT.	Computer-based training education focuses on the acquisition of specific skills and builds self-confidence through work preparation, accurately communicating what is expected of trainees and improving work preparation.
The CBT assists with recruitment by identifying the skills needed for a specific job or occupation.	By identifying transferable skills, CBT improves employability, facilitates the transition from education to work and, at the same time, improves labour market liquidity.
Competency-based job descriptions give you more flexibility in assigning jobs and allow you to group similar jobs into a single job description. This process prolongs the life cycle of the job description and makes it easier to write.	CBT promotes international and regional accreditation of training programmes, thereby improving employment opportunities for those who have completed the training programme.
CBT builds organisational capacity and assists staff development by identifying the exact skills needed improvement.	CBT offers learners more flexible learning options. Apprentices may also be given the opportunity to self-assess and modify their performance as they grow up.

Figure 2.4 is a flowchart that shows 16 proposed steps when implementing CBT, explained in five parts (ILO, 2020:15):

i) The first step in selecting CBT occupations is to gain a deep understanding of the goods and services that are in demand in an economy, the occupations that are related (either for employment or self-employment) and any unmet training needs. Without identifying the actual labour market's needs and opportunities in advance, training is unlikely to result in better employment prospects.

ii) The process of identifying competencies and competency criteria used by learners and training providers.

iii) CBT for low- to medium-level skilled training is described in this chapter in three steps. It is the next step after identifying and verifying the competencies that will be supported that the training programme will be developed.

iv) Implementing effective training techniques, managing the learning process, designing and conducting student assessments, and certifying CBT graduates.

v) Maintaining relevancy of CBT programmes audience: Curriculum developers, private-sector representatives, TVET centre managers. Since the job market is dynamic, all training packages need to be adapted to the varying needs of this market. Training programmes are not very relevant for too long and should be regularly assessed for market relevance and inclusiveness.

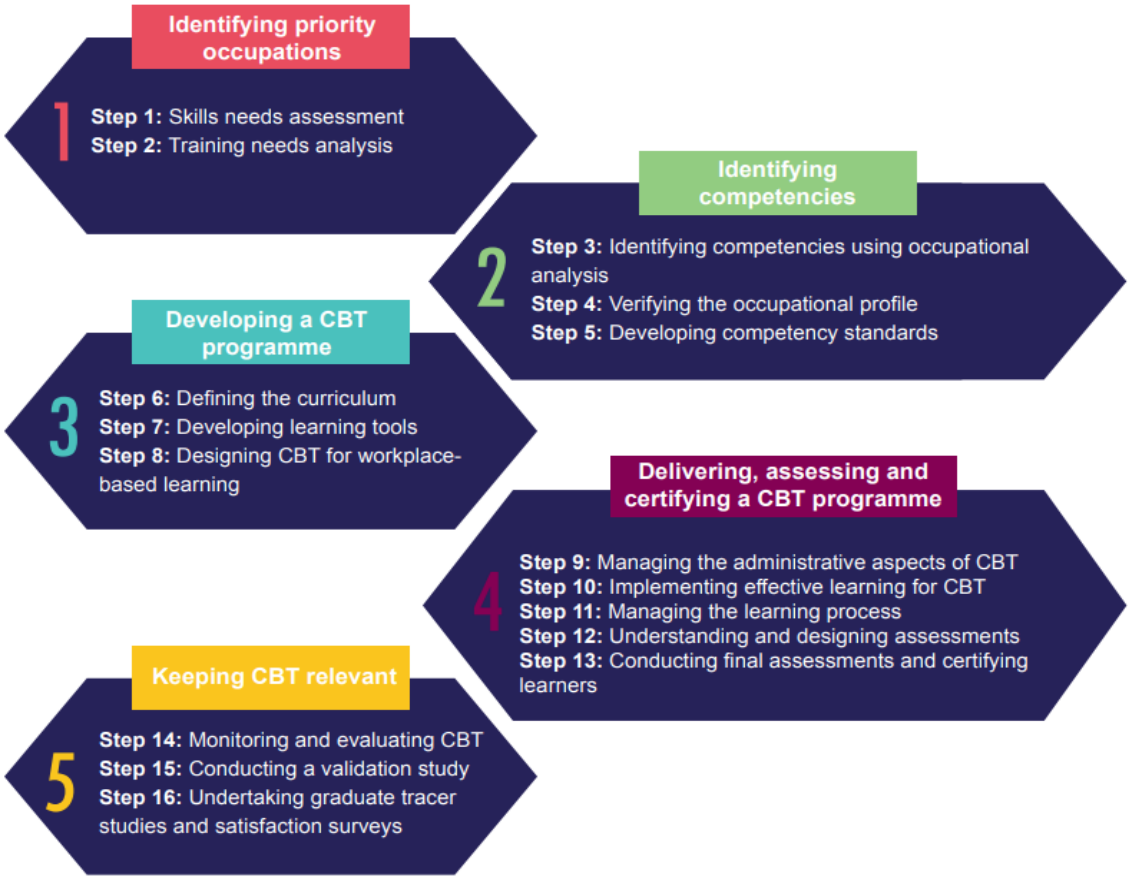


Figure 2.4: Sixteen proposed steps to implement competency-based theory (CBT) (Source: ILO, 2020:14)

2.6.2 TVET college apprenticeship lecturers

Lecturers play an important role in achieving the nation's objectives. The lecturers must be competent and efficient to carry out the task given to them by the university/TVET colleges (Mohd et al., 2020). The value of TVET college lecturers determines the eminence of TVET college credentials, programmes, conveyance and systems (Schnobel, 2019). According to DHET (2015), trainees' ability to learn and acquire their profession is limited by the expertise of teachers. For this reason, it is important to prioritise teacher growth in order to become a well-trained and skilled craftsman.

A teacher with the right technical and educational skills must have crafting or equivalent crafting expertise and pass the aptitude test (Pintsuk-Christof, 2019). In order for teachers to succeed in their core business of teaching, they need to be supported as much as possible. The following interventions are needed to keep up with changing technologies and production techniques (DHET, 2015:15):

i) TVET colleges are becoming more specialised (aligned with industry in their geographical footprint) so that TTCs have access to workplace experiences.

ii) Hold regional and national workshops on pedagogy, new technologies and their applications to crafts, and best practices to enhance their ability to perform their duties.

iii) Partnerships between TVET colleges and the industry may donate state-of-the-art equipment. DHET may be directly involved in the partnership.

iv) Cooperation with universities in the development of instructor training programmes, expansion of instructor exchange programmes with other foreign vocational schools with double apprenticeship training.

2.6.3 Lecturers using pedagogy systems

In South African TVET colleges a pedagogy system has been introduced for lecturers in order to ease the way of teaching and learning. Pedagogies encompasses more broadly those contributions that assist teachers in educating students and augments learning that goes beyond that provided directly by more informed others (teachers, experienced workers, supervisors etc.) through instruction, storytelling and collaborative working (Billett, 2019). There are items used to represent the character of storytelling, the description provided framework and TTCs can engage and recall what they have been lectured (Billett, 2019). For instance, as a way of illustrating how narrative serves as a context, a way by which individuals can engage and a way to remember and recall what they have learned, storytelling contributes to individuals' mimetic learning (Bahl & Dietzen, 2019). A pedagogy practice goes beyond teacher-centred activities and includes practices that arise from engaging in work activities, interacting with others and working with artefacts such as partially completed tasks (Bahl, 2019). Work-based learning (WBL) is the process of observing and practicing the technical and educational skills developed by a student's teacher during a teacher's preparation programme (Ogwo, 2019). The methods of pedagogies practice are defined in and explained Table 2.2.

Table 2.2: Pedagogic practices in literature
(Source: Bahl & Dietzen, 2019:35)

Practice	Description	Purpose
Storytelling	Talk about work events and incidents.	Illustrate or capture the formulation of concepts or hypotheses to assist legitimate practitioners as decision-making professionals
Verbalisation	Speaking aloud while performing work tasks as a form of direct instruction can be associated with practical involvement.	Explain the thoughts and actions when performing a task.
Pedagogically rich activities	Workplace activities that are inherently pedagogically rich, e.g., handovers, discussion of cases or preparing for meetings.	Development of conceptual, concrete and strategic procedural skills.

Practice	Description	Purpose
Guided learning (close instruction)	Face-to-face interaction between more and less experienced peers drives learning parameters. Mock-ups, demonstrations, guided practice, progress tracking, and live advice removal (Collins et al., Newman, 1989), proficient in placing hands on novices to familiarise them with pottery; it allows novices to develop their skills and gain experience in an indecent manner, while also taking advantage of live instruction.	Modelling learned activities, providing guidance by example, and providing opportunities for refinement and improvement can extend what individuals can learn through self-discovery.

2.6.4 TVET college curriculum and industries WBL

Lucas et al. 2012:40, cited by Suharno et al., 2018:89) refer to the definition of where Lucas et al. define “the redefining of apprenticeship, the role of the employer in setting the standard, the explanation of the system to one standard or qualification per occupation, the freeing up of the curricula and of teaching methods, the robust testing of accomplishment, the funding of apprenticeship training and the generation of demand and supply”. This development requires understanding of how WBL experiences, such as apprenticeships or school-based vocational education and training (VET) including on-the-job training periods, are provided and made into effective learning opportunities (Rintala & Nokelainen, 2019). WBL in industrial classes in vocational high school is basically aimed at preparing middle-level skilled workers in the industry (Yoto et al., 2018).

The nature of work influences WBL and the nature of learning is influenced by work. Makovichy (2010) refers to the WBL experience as a way of life that involves participating in a community and learning from the lived experience thereof. TTCs are called workers in industries. They need to manage both working and learning at the same time. Peers and senior staff in the workplace assist in developing the confidence that is necessary for any employee to grow and learn (Bahl & Dietzen, 2019). The WBL is on the knowledge of practice on what is needed to understand and develop activities worksite.

Curriculum WBL includes engaging with work-related experiences for learning purposes and formalising the competencies developed during those experiences (Atkinson, 2016).

2.7 Apprentice employment

Apprentices receive vocational training to improve their capacity and specialised skills. Employers are compensated by reduced social fees and lower wage costs (Albanese et al., 2019). Unlike other training programmes, apprenticeship training is generally strictly regulated by the government and social partners. Although apprenticeships and WBL programmes support both young people and employers, many countries face numerous obstacles in expanding their accessibility (Albanese et al., 2019). Apprenticeships appear to be more

effective than other VET options in facilitating young people's job transition. Compared to other forms of training or academic training, it shows faster integration into the labour market, with more pronounced effects in large firms (Franz & Soskice, 1994; Parey, 2010). Apprentices are paid during the apprenticeship and at the end of the experience, centralised accreditation of training programmes creates transparency and promotes acceptance by employers (Dustmann & Schönberg, 2012).

The general objective of apprenticeship programmes is to raise employability and personal development of apprentices which will contribute to the development of a highly skilled and qualified workforce, responsive to labour market needs (European Union, 2019). The successful achievement of apprenticeship can ease the path into employment for young people, even if they do not find employment with the firm that provided the training place (OECD/ILO, 2017).

2.8 Challenges of apprentice training development

Teti (2017:18) refers to the challenges of apprenticeships as: i) containing unfavourable working conditions; ii) poor quality of training and response; iii) poor contact to training and mentoring inside the workplace; and iv) low salaries.

Damtew and Duncan (2015) elaborate on large gaps in college capacity. Contributing colleges seem to be under strain from the capacity of multiple projects. These are covered upon their normal activities, with staff contributing to the dual-track apprenticeship pilot project often changing. It is difficult to maintain steadiness in planning and implementing of the college components. The further consequence is that they choose TVET colleges as a last resort (Wedekind, 2013). Buzzeo et al. (2016) and, as a result, there is a delay in finding suitable candidates and a failure to screen candidates for essential criteria, which leads to delays and errors.

It is common for TVET colleges to require repeated reminders and guidance in order to perform tasks that should be standard in their operations, such as verifying applicants' biographical information and educational attainments, lesson planning and preparation and connecting with employers (Brink et al., 2014). In addition, a college's assessment of apprentices' knowledge and skill levels often differ dramatically from that of employers, suggesting that colleges staff lack familiarity with the performance standards in industries for which they are ostensibly preparing TTCs.

A combination of NCV syllabus with the work-based training has been challenging. Colleges are required to follow the NCV curriculum and aligning this with what is taking place in the workplace has been problematic. This is further worsened by the following (Mzabalazo Advisory Services, 2017:18):

i) There are different levels of workplace exposure to training – some apprentices are trained at the training facility of the workplace under simulated conditions whereas others are trained on site, in the production facility. This makes it very difficult for the college to gauge their levels of workplace training.
ii) The logbooks have not been sufficiently completed and signed-off by all employers (mentors) – this makes it even harder to control which apprentices received which workplace training and where the gaps have arisen.

Training provider organisations and practice have also been linked to apprenticeship accomplishment, with fewer apprentices in the private sector expected to complete than those in the public sector (Stromback & Mahendran, 2010). Employers are affected by apprentice dropout since they do not have the ability to recover their assets (Damtew & Duncan, 2015). Although apprentices are often unclear about their responsibilities, workplace employers and former apprentices argue that a poor attitude or lack of awareness in the apprenticeship is the main reason for apprentices not finishing their apprenticeships (Skills Development Scotland, 2015).

2.9 Government policy planning supports skills development

Modern and formal apprenticeships are frequently measured by: i) a rule that outlines the roles and responsibilities of all sponsors with the measures for skills standards, curriculum and the monitoring of the programmes; ii) an apprenticeship contract that sets out the rights and duties of company and apprentice; and iii) the national labour law with provisions on youth employment protection to regulate the work conditions of apprentices.

There are various government policies and plans have been developed over the last five to ten years by different organs of state (CHIETA, 2018). The discourse on TVET in South Africa is inextricably linked with a series of major policies enacted by the post-apartheid government, since democracy began in 1994, to envision the future state of country (Mahembe & Rasool, 2014). The major policies have been created around the concept of the state of development. These are: i) Reconstruction and Development Plan (RDP) (1994); ii) GEAR* (1996); iii) National Development Plan (NDP) (NPC, 2012a); iv) New Growth Path (NGP) (2011); v) Industrial Policy Action Plan (IPAP) 2 (IPAP, 2011), vi) Human Resource Development (HRD) Strategy for South Africa 2010–2030 (2009); vii) Skills Accord (2010); and viii) National Skills Development Strategy (NSDS) lll (2010). The policies have been a guide to bridge the gap between skills and job employment improvement in South Africa from the 1990s until now. All the policies have acted as a guide in order to run the development targeted by 2030.

In South Africa, the NAMB oversees the training and assessment of artisans, which can be carried out within or outside the apprenticeship system (World Bank, 2013). The policies include

the right way of developing skills and filling in the gap of South African unemployment. Many of the key policy outlines remain formulated and are in the early phases of implementation. The debate in studies is centred on an “awareness that policies exist not just as pronouncements but also as practices with concern being expressed with the failure of policy to achieve its stated outcome” (Powell & Lolwana, 2012).

2.9.1 Reconstruction and Development Plan (1994)

The Reconstruction and Development Plan’s (RDP) aims were to meet basic requests of people, the growth of the national human resources and monitoring the growth reconstruction and development. RDP was born when South Africa needed a new economic policy to revitalise and create an inclusive the economy. As part of the RDP, several policies and programmes were introduced that facilitated the achievement of long-term objectives of the plan, including “meeting basic needs, ensuring the development of human resources, building the economy, democratizing society, and implementing the RDP” (Dotto, 2019). The RDP intended to bring South Africa into the global economy by establishing a balanced and strong economy that addressed structural issues of employment creation, poverty eradication and basic needs as the core of reconstruction and development (Shangase, 2018). The RDP involved the reconstruction of many civic facilities (Sethole & Sebola, 2020).

The RDP objectives include providing all residents with water, energy, public health, work, housing, education, community guard, excellence healthcare, clean environment and community transportation as well as suitable nutrition. The RDP strategy was proposed to introduce a qualifications framework as well as outcomes-based and competency-based education to benefit all South Africans, a proposal which had been made earlier by the Congress of South African Trade Unions (COSATU) as a means of eradicating previous discriminatory educational practices. Education for adults, special education and early childhood education were cited as priorities (Needham, 2019). The RDP was hindered by a lack of funding, ineffective implementation and pressure from local and international capital. Two years later, the government’s apparent need for a new economic growth strategy prompted them to launch the GEAR macroeconomic policy in 1996 (Mlambo et al., 2022).

2.9.2 Growth, Employment and Redistribution (GEAR)

In 1996 the government revealed the macroeconomic policy known as GEAR. The purpose of GEAR was different from that of the RDP. GEAR focused on producing a competitive fast-growing economy. GEAR claimed that the South African economy remained rising at a rate of 3% per annum and that this doomed hopes for job creation. GEAR’s strategy was to attain a growth rate of 6% per annum and job creation of 400 000 per annum by the year 2000, concentrating capacity building on meeting the demands of international competitiveness. The adoption of the GEAR policy by the ANC government was indeed a radical departure from the

vision of a developmental state contained in the RDP. This policy was largely criticised especially by COSATU for its neoliberal approach. While the GEAR strategy was enough for the achievement of macroeconomic objectives, it clearly fell short on the social challenges of the country, most notably poverty reduction and employment creation as was envisaged. A GEAR blueprint appeared more open than am RDP blueprint because it noted that the private sector was an integral part of the process of economic development (Mlambo et al., 2022).

2.9.3 Accelerated and Shared Growth Initiative – South Africa

In 2005, Pumzile Mlambo-Ngcuka (former Deputy President of South Africa) announced the Accelerated and Shared Growth Initiative (ASGISA), which was launched in 2006. In South Africa, ASGISA was introduced in place of GEAR to overcome high unemployment and poverty by 2014 (Rapanyane, 2021). The original plan was in line with the Millennium Development Goals (MDGs). ASGISA's second goal was to improve South Africa's economic performance and create jobs. ASGISA was replaced on the final day of President Thabo Mbeki's term by the New Growth Path (NGP), the fourth economic policy under 62 Insight on Africa 14 (1) (Mosala et al., 2017).

2.9.4 The New Growth Path (NGP)

The NGP was released in October 2010 (Fine, 2012) in South Africa and it followed previous limited government income, high levels of unemployment, low consumer, spending, intervention with implementable policies, SMME'S development to create jobs and creating a positive environment for businesses. A few months after being alerted to the negative effects of GEAR, the South African government implemented the NGP, which was based on the notion of a developmental state, a departure from its neoliberal policy framework (Tetani & Sifuba, 2016). When the NGP was created it targeted the outstanding gaps for youth employment and encouraged skills evolution for South Africa with its short level of skills. The NGP's goal was to create five million jobs, reduce the unemployment rate from 24.4% to 15% and educate 100,000 young people by 2020. Of these, 30 000 were skilled engineers and 50,000 are skilled craftsmen (Eastern Cape Socio Economic Consultative Council, 2010).

2.9.5 National Skills Development Strategy III

The third wave of the National Skills Development Strategy (NSDS) III was launched in February 2011 (DHET, 2011), and addressed the wider economic strategy and policy framework, including the new economic growth path (which goals were to add 50,000 new artisans to the labour market by 2015), the Industrial Policy Action Plan 2 and the Human Resource Strategy for SA. NSDS III has eight goals, aligning to those of the DHET's strategic Plan.

NSDS III acts as an overall strategic guide to skills development and provides guidance for the SETAs' skills planning and implementation. NSDS III addresses the following pressing issues

that impact our economy's growth and ability to provide increased employment opportunities (DHET, 2011:6):

i) The low skills level and inexperience of many young people entering the labour market for the first time after completing formal secondary and tertiary education.
ii) Many long-term jobless people have no basic numeracy and literacy skills, no basic skills, and no work exposure training that would enable them to get a job.
iii) Skills shortages in artisanal, technical, and professional fields core to our economy's growth and development.
iv) Insufficient progress towards more appropriate (intermediate and higher) skills required for growth sectors in a knowledge economy.
v) Commercial growth and skills development initiatives are biased towards urban areas, which lead to a lack of skills for rural development.
vi) In the absence of coherent strategies within economic and industrial sectors, coupled with inadequate skills development to support and sustain growth and development.
vii) The failure of many businesses in the economy to equip their workforce for the transformation to a knowledge-based economy.
viii) Blockages include insufficient synergy between post-school subsystems (e.g., universities, FET colleges and SETAs); an unclear picture of the various roles of the skilled development system; inefficiency and waste in the system (TVET colleges, SETAs); and an unclear picture of the various roles of the skills development system.

According to McGrath et al. (2004), in 1994, trade unionists and employers formed a National Training Strategy Initiative which ultimately resulted in South Africa's NQF. Because of its focus primarily on formal education and training, the policy process excluded education providers. As part of the NSDS I released in 2001, private providers with learnerships and skills programmes were given priority. These skills development strategies were framed by indicators to monitor and record progress against key objectives. In NSDS 1, the focus was on increasing productivity (Needham, 2019).

2.9.6 Human Resource Development Strategy for South Africa 2010–2030

In many countries, business and governments work jointly to develop strategies to support human resource development (HRD) in order to eliminate a shortage of skills, foster economic growth and improve living standards (South African Government, 2009). The first comprehensive countrywide HRD Strategy was launched in 2001 (South African Government. 2009:10). The development and implementation of a credible HRD strategy is therefore consistent with the historical and current thrust of government's development agenda. HRD has been identified as a vital instrument in all government strategies to accelerate development (Boshomane, 2011). The orthodox conceptual definitions of HRD largely tend to focus only on

approaches that are aimed at utilising skills development and supply to promote economic growth (South African Government. 2009:10).

The Joint Initiative for Priority Skills Acquisition (JIPSA) gained significant achievements regarding, for example, the development of artisans (JIPSA, 2010). Work has concluded and then integrated into the national HRD strategy for South Africa from the end of 2009. In the revised HRD strategy (South African Government, 2009), lessons learned and initiatives started, but not completed, are considered (IPAP, 2011).

The Industrial Policy Action Plan (IPAP) is decisively rooted in government's global policy and planned to address the key challenges of economic and industrial growth and race-based poverty, inequality and unemployment. IPAP reflects the long-term development vision outlined in the National Development Plan (NDP) and is described together in a set of "drivers" and "packages" included in the NGP (IPAP, 2014). IPAP is working on economic and employment clusters in many areas. It subsidises to (IPAP, 2010:16):

i) Rural development through interventions in a range of sectors such as geo processes were, they define, manage and investigate information used to form decisions.
ii) Biofuels, forestry, cultural industries, aquaculture and tourism.
iii) Advanced technological competences through involvements in the nuclear, advanced materials, aerospace and ICT industries.
iv) A serious first step towards the systematic promotion of green and energy-efficient i.e., practices less water, adjusts energy efficiency, conserves natural resources, produce smaller amount of waste and providing healthier spaces for occupants.
v) Goods and services.
vi) Downstream mineral beneficiation.
vii) Reinforced relations between tourism and cultural industries.
viii) Stronger integration between sector strategies, skills development plans and commercialisation of publicly funded innovation.
ix) Macroeconomic stability.

2.9.7 National Development Plan of 2012

The NDP (NPC, 2012a) puts forward a new vision for South Africa for 2030, to develop and reshape society in several areas to create a better and more equitable life for all and, above all, "eliminate poverty and reduce inequality by growing an inclusive economy" (National Planning Commission, 2012b:24). The NDP seeks to address poverty, inequality, and unemployment by leveraging the collective energies of our people, developing an inclusive economy, strengthening the state's capabilities, and promoting leadership and partnerships in our society (Department of Social Development, 2016). According to the National Planning Commission

(2012b) for NDP projects, 11 million jobs would be created by 2030, suggesting that 90% of these new jobs would be created by small and rising enterprises.

2.10 Summary

The research aims to explore the failure rate of trade tests by TTCs, which is a stumbling block in the government's efforts to close the skills gap in the country. In this chapter, the researcher highlighted the processes that are linked to artisan development going through trade test processes which involve TVET colleges and apprenticeships, going through work exposure and policies that have been developed by government to bridge the skills gap. The policies have paved the way for growth in skills development, which have been introduced as a result of SETAs working hand in hand with TVET colleges to train the students who, at the end of the training, undergo a trade test.

In the chapter the researcher explained the RPL programme as an assessment that takes into consideration the years and the work experience of an individual in order for them to obtain recognised qualifications. Colleges were required to establish or adopt functional relationships with SETAs. This was done in order to pursue partnerships with higher education institutions and to establish workable relationships with employers in order to provide possibilities for TTCs and graduates to gain work experience while studying and to access work placements after graduation, respectively. The Skills Development Amendment Act of 37 of 2008 (South African Government, 2008:36) is one of the laws that govern the country's skills development. It states that "a written agreement should be concluded before the start of the apprenticeship to define the rights and obligations of the apprentice, the employer, and, where appropriate, the vocational education and training institution, related to learning and working conditions".

There are claims that there is a scarcity of artisans and that the TVET system is incapable of producing the requisite number and quality of artisans. Lecturer development must be stressed if TTCs are to become suitably trained and skilled artisans. Experienced colleagues and colleagues in the workplace can help one gain the confidence one needs in order to grow and learn. Despite the fact that apprenticeships and WBL programmes benefit both young people and companies, many countries confront significant challenges when expanding their availability. Apprenticeship programmes are designed to improve apprentices' employability and personal development, resulting in the formation of a highly skilled and qualified workforce that is responsive to labour market demands.

Furthermore, college assessments of apprentices' knowledge and skill levels frequently differ significantly from employer assessments, implying that college teaching staff are unfamiliar with performance criteria in the industries for which they are presumably training their students. Over the last five to ten years, several government programmes and strategies have been produced

by various state agencies. Since the onset of democracy in 1994, the TVET discourse in South Africa has been closely linked to a distinctive collection of main policies announced by the post-apartheid administration that envisions the country's future state. The third wave of the NSDS has been released, and it focuses on the overall economic strategy and policy framework, including the new economic growth path (which goals is to add 50 000 new artisans to the labour market by 2015).

The major policies highlighted in this chapter have been implemented and have served as a guide in order to bridge the gap between skills and job employment improvement in South Africa from the 1990s until now, and have acted as a guide in order to attain the development targeted by 2030. The policies were explained accordingly with the years of implementation which started from: i) RDP Plan (1994); ii) GEAR (1996); iii) NDP (NPC, 2012a); iv) NGP (2011); v) IPAP 2 (IPAP, 2011); vi) HRD Strategy for South Africa 2010–2030 (2009); vii) Skills Accord (2010); viii) NSDS lll (2010); and ASGISA.

CHAPTER 3: RESEARCH METHODOLOGY

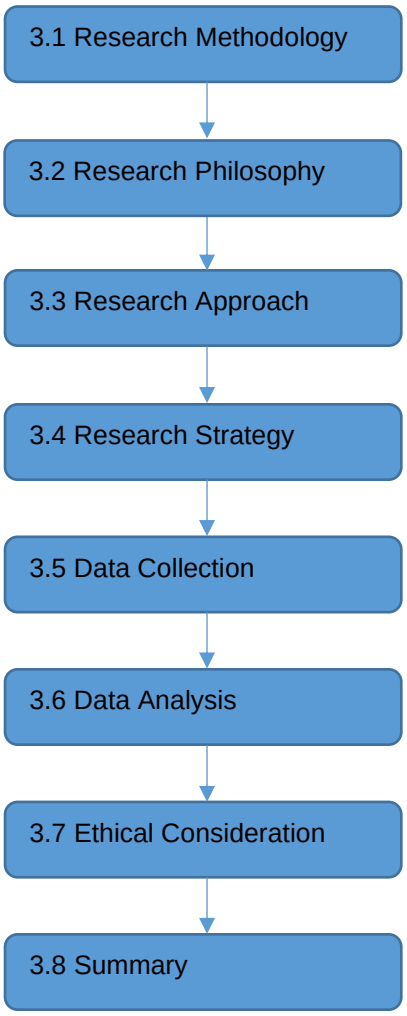


Figure 3.1: Layout of Chapter 3

3.1 Research methodology

The chapter is presented as follows: i) research methodology; ii) research philosophy; iii) research approach; iv) research strategy; v) data collection; vi) data analysis; vii) ethics; and viii) summary.

The methodology is “the procedure of activity that lies behind the choice and utilisation of specific strategies” (Crotty, 2003:3). The research methodology is defined by Leedy and Ormrod (2001:41) as “the common approach that the researcher uses when conducting a project”. In determining the appropriate method of research, one considers one’s “strategy, plan of action, process and design” (Crotty, 1998:3). The research methodology consists of the research philosophy, approach, strategy, data collection and analysis as well as ethical research.

Qualitative methods were used for this study. Qualitative research was chosen because it is more participative in nature and this allows the researcher to use inputs from a sample of trade

test candidates who have successful and unsuccessful done the trade test, Trade test practitioners who were examining the TTC when trade testing, lecturers and company officials. Saunders et al. (2016:566) emphasise that qualitative methods “are built on occasions and explore issue of real matter”.

3.2 Research philosophy

The research philosophy can be viewed as “the combination of attitudes, values, beliefs, procedures and techniques used to achieve a framework of understanding through which theoretical explanations are developed” (Trochim & Donnelly, 2006:15). Denzin and Lincoln (1998:163) explain philosophy and paradigms as “the perspective that manages the examiner in decisions of technique as well as in ontologically and epistemologically ways”. A paradigm is a shared worldview that represents the beliefs and values of a discipline and that guides how to solve problems (Schwandt, 2001). The research procedure has three significant pillars namely; ontology, epistemology, and methodology (Terre blanche & Durrheim, 1999). The research used qualitative techniques. The method is used because qualitative analysis can utilise a wide degree of methods and interpretive analysis hones in any one examination, although they ordinarily incorporate perceptions, interview meetings and an investigation of participants’ words (Denzin & Lincoln, 2011). Research philosophy consists basically of two concepts, namely ontology and epistemology (Saunders et al., 2019).

3.2.1 Ontology

Ontology is “an analysis on the state of being” (Crotty, 1998:10). Perry (1998) defines ontology as “a general understanding of a domain that includes a set of categories, relationships, functions, axioms, instances, and a set of relationships between concepts”. Guarino (1995) argues that sociology has been moulded by two larger ontological situations according to issues of authenticity and vision, as the ontological position is that of rationality. The subject of ontology is about of the categories of things that exist or may exist in a few spaces (Aliyu et al., 2015). Ontology emphasises “basic significance of respondents’ interpretation of the important issues and acknowledge that their distinctive vantage focuses will surrender distinctive sorts of understanding” (Snape & Spencer, 2003:11). Ontology is mainly divided into objectivism and subjectivism.

3.2.1.1 Objectivism

Based on the assumption that social phenomena and the categories used in everyday discussion have an existence that exists independently or apart from actors, objectivism is an approach that suggests that these categories are real rather than constructs (Bahari, 2010). Subjectivism holds that reality is a result of human cognition, whereas, objectivism holds that reality has an independent existence before human cognition (Brannick & Coghlan, 2007). Objectivism relies on the “understanding of natural science as a paradigm for studying human

knowledge, and therefore, employs data collection and interpretation methods similar to those used in natural science, including hypothesis testing, causal explanations, and modelling" (Al-Saadi, 2014:3). The objectivists argue that the scientific method "demands observable, reproducible facts, and these can only be found in overt behaviour" (Diesing, 1966:124). Objectivists are concerned with emphasising that "no matter what men are like, knowledge about them must be subject to impartial public verification and criticism and must in this respect be similar to natural science knowledge" (Ernest, 1961:478).

3.2.1.2 Subjectivism

Subjectivism "provides an alternative account in which human understanding and experience takes precedence over objective truth" (Lakoff & Johnson, 1980:3). Saunders et al. (2007:108) identify subjectivism as "the belief that social phenomena are a result of perceptions and subsequent actions of social actors". Subjectivism emphasises knowledge of the subject, which means that different interpreters can interpret the conduct of the other party in different ways (Janeþková, 2015:222). Subjectivists have argued that one of the unique characteristics of human behaviour is its subjective meaning, and science that ignores meaning and purpose is not social science (Diesing, 1966). The subjectivists are always concerned with what is unique about human beings and, therefore, contrast the social and the natural sciences (Ernest, 1961). Subjectivism is the "awareness that understanding and truth depend on the cultural and physical context in which people live as well as their mental frameworks about how the world works" (Putnam, 1983**:**31). In subjectivism, "understanding, truth and meaning of the world are shaped by interacting with the physical environment and by other people" (Huizing, 2007:93).

Subjectivism was chosen to guide this research because it allowed participants to express opinions or feelings based on a person's preferences and experiences.

3.2.2 Epistemology

Epistemology investigations are about the information and truth (Bagele & Kawulich, 2012). Scotland (2012:9) describes epistemological standards as "concerned with how to advance information experience that can be created, acquired, and communicated". Epistemology also provides a philosophical framework for determining what kinds of knowledge can be made possible, as well as how we can make them both adequate and legitimate (Maynard, 1994). The epistemological stance consists mainly of positivism and interpretivism (Saunders et al., 2019).

3.2.2.1 Positivism

Positivism focuses on developing generalised findings through experimentation and structured observations of reality with a scientific stance (Hussey & Hussey, 1997). Positivism poses that true knowledge can be gained through observation and experimentation (Rahi, 2017). The

positivism stance analyses logically and empirically real events. The positivists analyse the behaviour of the subject under study by identifying universal laws in observable reality (Kulatunga et al., 2007). Positivists believe that things and events in the outside world have clear ties to people's understanding of them (Stainton-Rogers, 2006:80). According to Tashakkori and Teddlie (1998:7), positivism "is based solely on observable facts and rejects speculation about ultimate origins".

3.2.2.2 Interpretivism

Interpretation epistemology is subjective. Interpretative positions consider reality to be different and subjectively based on implications and understanding (Saunders et al., 2009:141). The interpretation paradigm deals with understanding the world as it is from an individual's subjective experience (Antwi & Kasim, 2015). The knowledge generated from the research process is related to the time and context of the research, and researchers participate in the research interactively (Harrison et al., 2017). In the interpretive tradition 'there are no right or wrong concepts'. Interpretative research uses methods to generate qualitative data. Numerical data can be included, but they are rarely dependent (Moon & Blackman, 2014).

Interpretivism was chosen because people determine the nature of reality rather than objective and external factors.

3.3 Research approach

Research approaches can be divided into three broad categories known as deductive, inductive and abductive approaches.

3.3.1 Deductive approach

A deductive approach is described as the stage of the cognitive cycle in which abstract concepts are brought into concrete reality through empirical testing or observation (Kulatunga et al., 2007). The deductive approach, as stated by Bryman (2015:8), is "a method for considering the relationship between theory and research wherein the latter is carried out in light of hypotheses and ideas derived from the former". The deductive approach investigates research questions or hypotheses derived from a theory before testing or verifying them (Bahari, 2010).

3.3.2 Inductive approach

Inductive theory building, from the bottom up, is developed by identifying patterns and relationships in observations to form a theory about a certain phenomenon (Trochim & Donnelly, 2008). Creswell and Plano Clark (2007) define the inductive researcher as "a researcher who works from the "bottom-up, employing the contributors' views to build broader themes and generate a theory interconnecting the themes". The determination of the qualitative approach is with the view of Hussey and Hussey (1997:20), which defines qualitative research as "a

subjective approach that involves the analysis and reflection of evidence to reach an understanding of social and human practices". An inductive approach was followed as the contribution of the study was to fill the gap in the body of knowledge and to add to the theory applicable.

3.3.3 Abductive approach

The abductive approach is "a process of creating a descriptive proposal with a new idea" (Tan et al., 2018:3). Using an abductive approach involves collecting data about a "phenomenon, identifying themes, and explaining patterns, in order to develop a new theory or modify an existing one which you subsequently test through additional data collection" (Saunders et al., 2019:153). The abducting approach is **a** combination of deduction and induction (Suddaby, 2006). The abductive approach is sometimes referred to as reproduction (Saunders et al., 2019). An abductive proposal consists of a new concept accompanied by a description (Tan et al., 2018). In the abduction approach, the research process begins with "amazing facts" or "puzzles", and the research process concentrates on explaining them (Bryman & Bell, 2015:27).

3.4 Research strategy

The research strategy is a framework that assists researchers to select the best data collection procedures or sets of approaches to help answer their research questions and achieve their research objectives (Melnikovas, 2018). The survey strategy was chosen as the research strategy.

3.4.1 Survey

Pinsonneault and Kraemer (1993:77) define a survey as a "a method for gathering data about the characteristics, behaviors, or opinions of a large group of individuals". A research study is defined as "information gathered from a sample of people based on the answers to a question" (Check & Schutt, 2012:160). A survey can be quantitative (e.g., a questionnaire that utilises numerical ratings), qualitative (e.g., open-ended questions) or a combination of both (Ponto et al., 2010). In this study a qualitative survey was used.

3.4.2 Unit of analysis

The unit of analysis is specific and distinctive in recognising the parameters of the case by counting the participant(s), area and/or handle under investigation, and by assigning allotted time to uncover the case (Yin, 2014). For this study, the unit of analysis was the trade test that trade test candidates (TTCs) take before being qualified as an artisan. The focus was on exploring the factors that affect the high failure rates of TTCs in technical and vocational education and training (TVET) institutions.

3.4.3 Unit of observation

The unit of observation is the object from which the data comes to answer the research question. In total, 26 people were interviewed. The units of observation were: i) company mentors (5); ii) TTCs (12); iii) lecturers (6); and iv) trade test practitioners (4).

3.4.4 Sampling

The population was drawn from TTCs from the selected TVET college**s** who were successful (4) and unsuccessful (8). The population also included other role players such as industry practitioners and lecturers. The sampling method used was non-probability, conveniently, purposively selected. Where applicable, snowball sampling was used (Gray, 2009).

3.5 Data collection

Qualitative data sources incorporate perception and member perception, interviews and surveys, archives and writings, and the researcher's impressions and responses (Myers & Avison, 2002). The data were collected using interviews with a semi-structured interview guide questions (Appendix A).

3.5.1 Methods of data collection

3.5.1.1 Questionnaires

A survey could be "an arrangement of questions inquired to people to get factually valuable data almost a given subject" (Roopa & Rani, 2012:273). There are four different types of questionnaire designing for a survey (Roopa & Rani, 2012). The questionnaire for a survey was applied according to survey intent. These are:

i) **Questions on contingency/stratified questions:** these are questions that can only be answered if the respondent gives a specific answer to the previous question (Roopa & Rani, 2012).

ii) **Questions by matrix:** respondents are allowed to select a single answer option for each row of a grid. Matrix questions are used when a series of similar sub-questions are arranged in rows using the same answer choices.

iii) **Closed questions:** the participant can simply respond with "yes" or "no".

iv) **Open-ended questions:** used to obtain the participants reasoning/point of view. The questionnaire assisted in the face-to-face interviews (Appendix A). Roopa and Rani (2012**:**275) said that "an interviewer visits the person being surveyed in person in order to conduct a personal survey".

3.5.1.2 Interviews

There are several situations in which the interview is the most logical research technique (Gray, 2009). In particular, qualitative research uses interviews to explore the implications of central issues in the subject world (Quad, 2016). Interviews give a clear picture of an individual under

investigation covering the entire subject (Ritchie & Lewis, 2003). Interviews were done with six (6) lecturers, 12 TTCs, four (4) trade test practitioners, and five (5) company mentors. For the research, semi-structured interview guide questions were used (Appendix A). Koch (1996) suggests that semi-structured questionnaires are of an informative nature, following a versatile interviewing process. A closed-ended question can force participants to answer in a certain way (Creswell, 2012). Open ended questions are asked during interviews to get impartial responses (Creswell, 2012).

Before the interview request was scheduled, an email requesting a meeting and a consent letter were sent and a survey to prepare the interviewee was emailed. On the agreed upon date, the interviewee was again reminded of the interview date and time. Before the meeting started confidentially was again discussed and the consent explained to the interviewee. At the same time, permission to record the interview was asked from the interviewee. If the interviewee did not agree to a recording, minutes of the interview were taken.

After the interview, the recording was transcribed and email back to the interviewee in order to confirm the correctness of the transcription (Creswell, 2012).

3.6 Data analysis

In qualitative research, data analysis refers to the process of “systematically searching and organising interview records, observation notes, or other non-textual material collected by researchers to better understand the phenomenon” (Wong, 2008:14). Qualitative data analysis is a collection of processes and procedures that move from the collected primary analysis to “clarification, understanding, or awareness of the person and situation being investigated” (Chenail, 2012:248). Bogdan and Biklen (1992**:**147) describe qualitative data analysis as “running, arranging, breaking into manageable data”. The qualitative analysis procedure was divided into three main steps by Akinyode and Khan (2018:166), namely, reduction, exploration and integration of the exploration. Qualitative data may also include images, audio or video clips (e.g., patient audio and video recordings, radiographs and surgical videos) and other multimedia elements (Wong, 2008:14). Data analysis was done after the interviews were transcribed, presented in an Excel spreadsheet, coded and categorised (section 4.3). Once coded, the codes were categorised and a thematic analysis was done.

3.6.1 Interpretation of data

Interpretation means understanding what has been found, understanding results, interpreting results, drawing conclusions, extrapolating lessons, inferring, considering meaning and imposing order in a world. (Patton, 2002:134). An interpretive process begins with developing codes, forming topics from codes and organising those topics into larger abstractions for

understanding data (Creswell, 2013:187). The data was converted to text. The codes were associated with research questions, research sub-questions and interview questions.

3.6.2 Data coding

Charmaz (2001:165) describes coding as the “critical link” between information collection and the clarification of meaning. According to Saldaña (2015:3), “coding in its most essential shape is the basic operation of distinguishing sections of meaning in your information and naming them with a code, which can be characterized as a word or brief state that typically relegates summative, striking, essence-capturing, and visual information”. In a qualitative inquiry, a code is most often a word or short phrase that says something about a portion of data that is language-based or visual (Strauss, 1987).

According to Miles and Huberman (1994), coding and coding techniques use a case-oriented approach strategy known as “partially ordered display” to analyse the case study data. The method for encrypting field notes and documents consists of three stages described by Neuman (2011:510), which are: transparent encryption, axial encryption and selective encryption. i) Open coding involves identifying and naming field notes and supporting documents representing segments relevant to the research topic. Open coding focuses on terminology, expressions, and content. ii) Axis coding is done by evaluating and analysing the original codes found in the previous procedure mentioned above. During this phase, categories and patterns were identified and organised according to causality, significance, and consistency. iii) Selective coding even as the third and final coding method includes selective scanning of all known codes for comparison.

3.6.3 Coding in qualitative data

Linneberg and Korsgaard (2019:12) state that “an inductive coding analysis creates codes from the information by utilising expressions or terms utilised by the participants themselves”. Saldaña (2013:9) states that “when code is connected and reapplied to subjective information, you’re arranging a handle that grants information to be segregated, gathered, regrouped and relinked in arrange to solidify meaning and explanation”. In an inductive technique, the primary coding cycle uses witnesses, while the further coding cycle is more pro-driven, since ideas, points and estimations from existing theories bring the examination to a higher level of discourse. Coding involves revisiting every aspect of the data the researcher has collected, even those that may have missed during the data collection process (Linneberg & Korsgaard, 2019).

3.6.4 Categories and coding

To codify is “to arrange things in a systematic order, to make something part of a system or classification, to categorise” (Saldaña, 2013:3) (Appendix A). Bernard (2011:338) compactly

states that examination is “the search for designs in information and for thoughts that offer assistance clarify why those designs are there within the to begin with place”, while coding, decisions are made about each specific element in the data to determine whether or not it is important (Linneberg & Korsgaard, 2019). From the first to the second pattern of coding, codes advance all along, getting more direct in the later stages, when a second pattern of coding includes “characterizing, focusing on, joining, integrating, abstracting and conceptualising, and hypothesis building” (Saldaña, 2015:58). After several rounds of coding and analysis (Strauss & Corbin, 1998), themes emerged.

3.7 Ethical considerations

The term ethics refers to a “way of life” or a set of social norms that distinguishes between acceptable and unacceptable behaviour (Akaranga & Ongong’a, 2013:8). The ethics of research are vital to our everyday life, requiring that it is important to protect the dignity of research subjects and publish well what the research studies (Fouka & Mantzorou, 2011:4). It is through ethics that individuals and groups can consider how they should conduct themselves from a moral standpoint, in other words, what ought to be done (Vanclay et al., 2013). When planning and designing a qualitative study, researchers need to consider the ethical issues that may arise in this process and how they will be addressed (Creswell, 2013). The starting point for considering ethical concerns are four principles (Beauchamp & Childress, 1983:45): i) autonomy – respect human rights; (ii) benefits – do well; iii) not masculine – do no harm; and iv) justice, especially fairness.

Ethical clearance from the Research Ethics Committee (REC) of the Cape Peninsula University of Technology was obtained. Consent letters were submitted to the REC and a memorandum of agreement (MoA) was signed (Appendix A).

Consent can be obtained by following these steps: i) consent should be freely given (voluntary); ii) subjects should fully understand the purpose of the experiment; and iii) involved persons need to be competent to consent (Connelly, 2014:54). Companies were asked to sign consent letters before interviews are conducted, ethical considerations were explained to the participating candidates.

When a researcher uses anonymous surveys, the participants’ identity is truly unknown (Fleming & Zegwaard, 2018:211). The participants participated voluntarily and were assured of confidentiality. The participants could also at any time withdraw from the research.

3.8 Summary

The research approach adopted was inductive, allowing the researcher to explore people’s real points of view. A qualitative survey strategy was followed. Purposive, non-random and

convenient sampling techniques were used. The unit of analysis was identified as the trade test failure rate. The unit if observation was: i) company mentors (4); ii) TTCs (12); iv) lecturers (6); and v) trade test practitioners (4).

Data collection was completed by means of booking interviews using semi-structured questions. Data were analysed by coding, summation and theme development. Ethical considerations were applied throughout the research process.

In Chapter 4, the researcher will present the analysis of the data collected from the surveys and interviews, and illustrate the findings from collected data.

CHAPTER 4: RESEARCH ANALYSIS AND FINDINGS

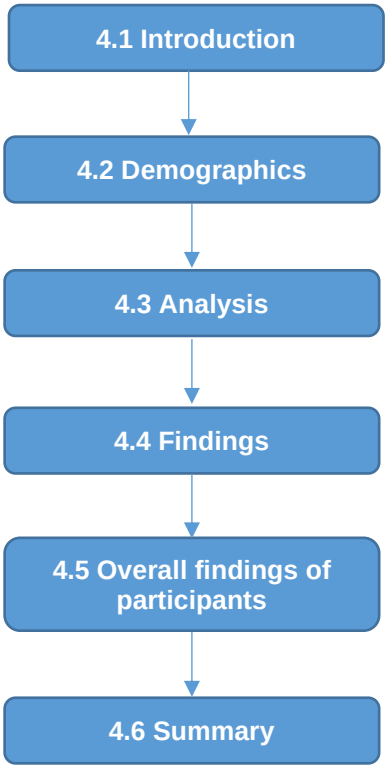


Figure 4.1: Layout of Chapter 4

4.1 Introduction

The aim of the research was to explore the factors that affect the high failure rates of trade test candidates (TTCs) in technical vocational education and training (TVET) institutions. The research questions focused on the following objectives:

i) Examine the challenges TTCs face when they attempt to do the trade test.
ii) Assess whether the curriculum provided by TVET complies with the needs of the manufacturing and service industries.
iii) Determine the learning processes to assist TTCs in passing their trade test.
iv) Determine the employability of TTCs.
v) Assess whether the skills provided by the TVETs comply with the needs of industry after TTCs successfully completed their trade test.

The sampling method used was a non-probability purposive method. The information on which this research is based was derived from different sources to increase the credibility and validity of the results.

The participants engaged in the research on their own terms and gave descriptions and an analysis of their understanding of the questions posed. The participants were: i) from four (4)

companies; ii) 12 TTCs; iii) sic (6) lecturers; and iv) four (4) trade test practitioners. The interviews were divided into four groups, namely: i) TTCs (12) who had completed their apprenticeship; ii) lecturers at a TVET college (6); iii) companies employing TTCs (5); and iv) trade test practitioners (4). Trades include electrician, fitting and turning, mechanical fitter, welder, boilermaker, millwright, and pipe fitter. The information generated provides useful insights into the research question as deduced from the interview guides questions used in the interviews.

The analysis comprised four components: i) TTC interview analysis; ii) lecture interview analysis; iii) company interview analysis; and iv) trade test practitioner analysis.

4.2 Demographics

The demographics of the four groups are discussed as follow: i) demographics of TTCs, ii) lecturers, iii) companies and iv) trade test practitioners. Table 4.1 shows the participants represented from the two TVETs, trade practitioners and companies.

Table 4.1: Demographics of the research participants

Participants	TVET 1	TVET 2
Lecturers	6	0
Trade practitioners	2	2
Trade test candidates	*Trade*	*No. of Participants*
	Electrical	5
	Fitting and turning	3
	Welding	2
	Fabrication	2
Lecturers	*Position*	*No. of Participants*
	Assistant lecturer: Electrical	1
	Assistant lecturer: Fitting and turning	1
	Lecture: Electrical	2
	Lecture: Welding	1
	Lecture: Pipe fitting	1
Companies	*Position*	*No. of Participants*
	Transport	1
	Fabrication	2
	Local government	2
Trade practitioners	*Occupation*	*No. of Participants*
	Electrical	1
	Fitting and turning	1
	Welding	1

*TVET- Technical Vocational Education and Training

4.2.1 Demographics of TTCs

The study involved 12 TTCs who have taken part in the research. The participants included seven (7) female and five (5) male TTCs, of which four passed and eight failed the tests in different engineering trades. The trades of the participants were: i) electrical (5), ii) fitting and turning (4), iii) welding (2); and iv) fabrication (1).

4.2.2 Demographics of lecturers

Six lecturers engaged in the study consisting of one female and five males. Their positions were: i) two assistant lecturers (one fitting and turning, one electrical); and ii) four senior lecturers in the electrical (2), welding (1) and pipe fitting (1) disciplines. The lecturers had been in the TVET college industry for between two and six years, with field experience of approximately five years each.

4.2.3 The companies that participated

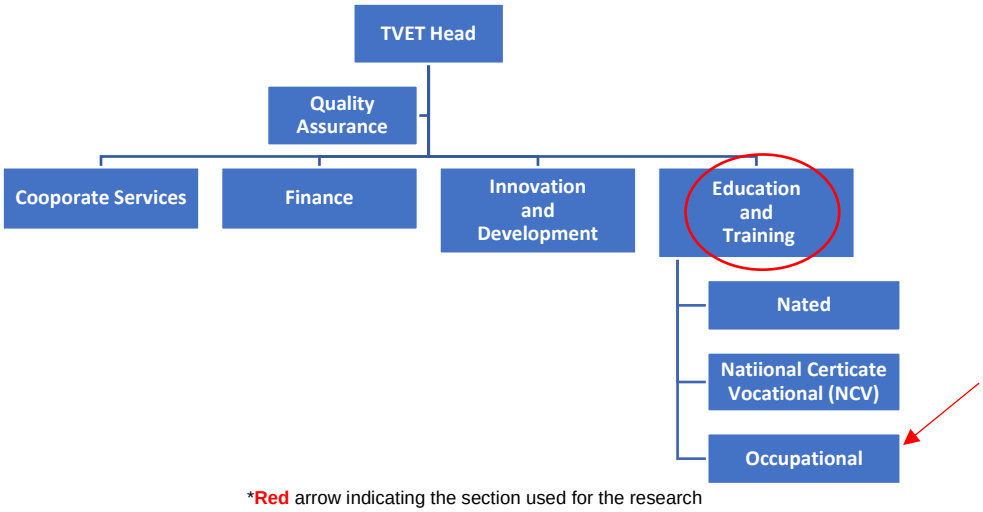
Four companies participated. The companies were from the following industries, i) transport rail; ii) fabrication (two companies); and iii) a municipality (fitting & electrical artisans). The age group of managers and supervisors who participated in the study was 35+ years, with average of ±8 years' experience in their respective fields.

4.2.4 Trade test practitioners

Four trade test practitioners participated in the research. The participants were made up of i) electrical, ii) fitting and turning, iii) welding; and iv) fabrication, all with work experience of ±10 years and TVET college experience of ±6 years.

4.2.5 TVET colleges

Two colleges participate in the research; both are located in Cape Town. The colleges gave consent for their staff to participate (Appendix A). TVET colleges focus on vocational and occupational education and training. They prepare TTCs to become functional workers in a skilled trade. TVET colleges have four departments in their structure, namely: i) cooperative services; ii) finance; iii) innovation and development; and iv) education and training. Corporate services deals with employment of lecturers and provide support for human resources-related issues and training. Finance deals with procurement processes and supply chain. Innovation and development deal with fundraising for the college, marketing, placement of TTCs into the industries and a student support system. The education and training department deals with teaching of the TTCs, with three sections, namely: i) NATED (three months course starting from 4–6 to qualify a Grade 12 is required); ii) National Certificate (Vocational) (NCV) (year course starting from levels 2–4, which is equivalent to grades 10–12); iii) Occupational (apprentice programmes require an N2/NCV3 to qualify). The department that was selected for this study is Education and Training, which has three sections, as displayed in Figure 4.2.



*Red arrow indicating the section used for the research

Figure 4.2: TVET structure

The occupational lecturers were selected from the three sections because the lecturers managed occupational projects. The following trade departments from TVET 1 participated: i) electrical; ii) fitting and turning; iii) welding; iv) fabrication; and v) pipe fitting. TVET 2 nominated trade test practitioners in i) electrical and fitting; and ii) turning trades to participate.

4.3 Analysis

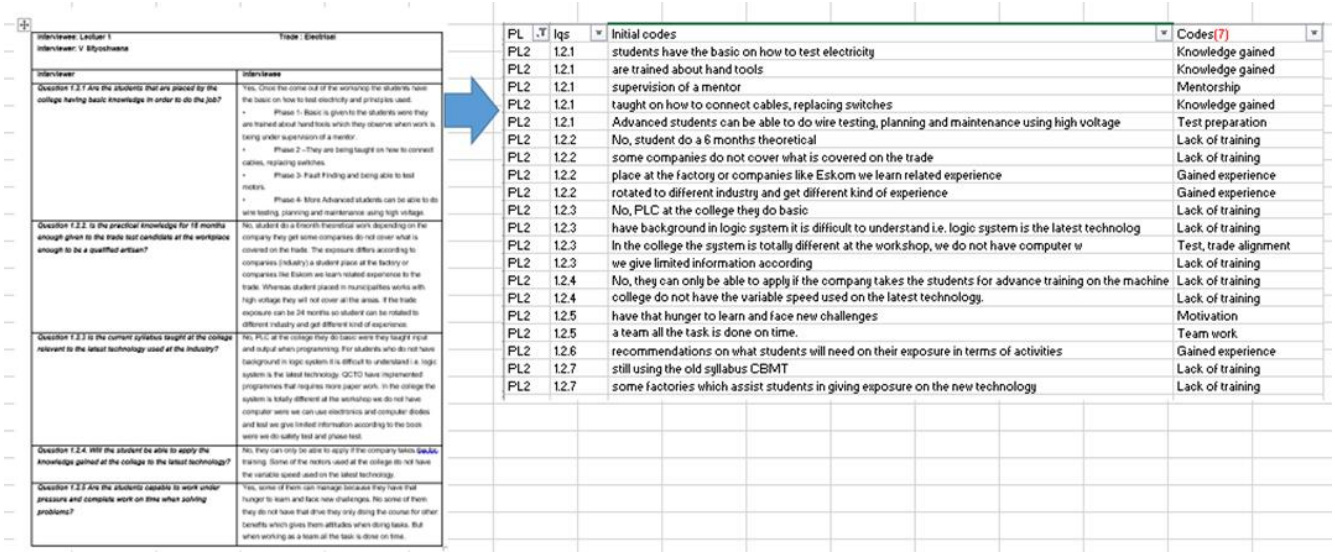
The participants' responses were transcribed (Appendix CT1.1). Table 4.2 presents a transcription from the interview conducted with an electrical lecture from TVET. Once transcribed, the transcriptions were mailed to the participants for validation of the transcription. After this, the transcriptions were captured in a spreadsheet (Table 4.3; Appendix CT1.1 & C1) and then coded (Table 4.3; Appendix C1).

Table 4.2: Example of a transcribed coded interview (Lecturers Responses; Appendix C)

Interviewee: Lecturer 1 Trade: Electrical **Interviewer: V Sityoshwana**	
Interviewer	**Interviewee**
IQ 1.2.1: Do the students who are placed by the college have basic knowledge to do the job?	Yes, once they come out of the workshop the TTC have the basic on how to test electricity and principles used. • Phase 1: Basic is given to the TTC were they are trained about hand tools which they observe when work is being under supervision of a mentor. • Phase 2: They are being taught on how to connect cables, replacing switches. • Phase 3: Fault Finding and being able to test motors. • Phase 4: More Advanced TTC can be able to do wire testing, planning and maintenance using high voltage.

Interviewee: Lecturer 1 Trade: Electrical Interviewer: V Sityoshwana	
Interviewer	**Interviewee**
IQ 1.2.2: Is the 18 months of transferring knowledge to the TTCs at the workplace enough for them to become qualified artisans?	No, student do a 6-month theoretical work depending on the company they get some companies do not cover what is covered on the trade. The exposure differs according to companies (industry) a student place at the factory or companies like Eskom we learn related experience to the trade. Whereas student placed in municipalities works with high voltage they will not cover all the areas. If the trade exposure can be 24 months so student can be rotated to different industry and get different kind of experience.
IQ 1.2.3: Is the current syllabus taught at the college relevant to the latest technology used in industry?	No, PLC at the college they do basic were they taught input and output when programming. For TTC who do not have background in logic system it is difficult to understand i.e. logic system is the latest technology. QCTO have implemented programmes that requires more paper work. In the college the system is totally different at the workshop we do not have computer were we can use electronics and computer diodes and test we give limited information according to the book were we do safety test and phase test.
IQ 1.2.4: Will the student be able to apply the knowledge gained at the TVET to the latest technology provided by industry?	No, they can only be able to apply if the company takes the for training. Some of the motors used at the college do not have the variable speed used on the latest technology.
IQ 1.2.5: Are the TTCs capable to work under pressure and complete work on time when solving problems?	Yes, some of them can manage because they have that hunger to learn and face new challenges. No some of them they do not have that drive they only doing the course for other benefits which gives them attitudes when doing tasks. But when working as a team all the tasks are done on time.

Table 4.3: Example of creating a summary and codes from responses



PL	Iqs	Initial codes	Codes(7)
PL2	1.2.1	students have the basic on how to test electricity	Knowledge gained
PL2	1.2.1	are trained about hand tools	Knowledge gained
PL2	1.2.1	supervision of a mentor	Mentorship
PL2	1.2.1	taught on how to connect cables, replacing switches	Knowledge gained
PL2	1.2.1	Advanced students can be able to do wire testing, planning and maintenance using high voltage	Test preparation
PL2	1.2.2	No, student do a 6 months theoretical	Lack of training
PL2	1.2.2	some companies do not cover what is covered on the trade	Lack of training
PL2	1.2.2	place at the factory or companies like Eskom we learn related experience	Gained experience
PL2	1.2.2	rotated to different industry and get different kind of experience	Gained experience
PL2	1.2.3	No, PLC at the college they do basic	Lack of training
PL2	1.2.3	have background in logic system it is difficult to understand i.e. logic system is the latest technolog	Lack of training
PL2	1.2.3	In the college the system is totally different at the workshop, we do not have computer w	Test, trade alignment
PL2	1.2.3	we give limited information according	Lack of training
PL2	1.2.4	No, they can only be able to apply if the company takes the students for advance training on the machine	Lack of training
PL2	1.2.4	college do not have the variable speed used on the latest technology.	Lack of training
PL2	1.2.5	have that hunger to learn and face new challenges	Motivation
PL2	1.2.5	a team all the task is done on time.	Team work
PL2	1.2.6	recommendations on what students will need on their exposure in terms of activities	Gained experience
PL2	1.2.7	still using the old syllabus CBMT	Lack of training
PL2	1.2.7	some factories which assist students in giving exposure on the new technology	Lack of training

From the transcribed interview (Table 4.2) the first initial coding (258 codes) was created. An example is shown in Table 4.3. In Appendix CT1.2, the full list of codes is presented. This was followed by a second coding by shortening and grouping alike keywords and concepts (80). After the second coding, fourteen (14) categories were identified, as shown in Table 4.4.

Table 4.4: Example of second round of coding to create categories

PCs	Iqs	Initial codes	Codes(258)	Revisited codes(80)	Categories(14)
PT3	1.1.4	colleges is accredited	Traing accreditation	Training accreditation	Accreditation
PT3	1.1.4	facilities provided like workshops accreditated	Traing accreditation	Training accreditation	Accreditation
PL2	1.2.5	have that hunger to learn and face new challenges	Motivation	Behavior	Behaviour
PL2	1.2.5	a team all the task is done on time.	Team work	Behavior	Behaviour
PT1	1.1.2	TVET college students sometimes lack cogency	Behaviour	Behavior	Behaviour
PT3	1.1.2	Lack of practice	Lack of practice	Behavior	Behaviour
PC1	1.3.2	tackle on their own without supervising them	Work unsupervised	Independence	Behaviour
PL1	1.2.4	Most of it but not all	Personal different skills	Skill	Behaviour
PL1	1.2.5	capable at solving problems	capable	Behaviour	Behaviour
PL1	1.2.5	Not all the students have the same skill of set	Different personality strengt	Behaviour	Behaviour
PL3	1.2.5	Not all of them are fast learners some are slow learners	Personal different skills	Skill	Behaviour
H	1.2.5	Depends on the students	Different personality strengt	Different personality strength	Behaviour
PL5	1.2.5	Students are capable to work under pressure	Capable	Indepandance	Behaviour
PL5	1.2.5	depends on time of an individual	Behaviour	Behaviour	Behaviour
PT1	1.1.1	Students are not preparing	lack of practise	Behaviour	Behaviour
PT1	1.1.1	nerves get to easily	Focus	Behaviour	Behaviour
PT3	1.1.2	Student turn to memorise tasks	Memorisation	Memorisation	Behaviour
PT3	1.1.2	Lack of understanding	Focus	Behavior	Behaviour
PT3	1.1.2	Panic	Stress	Behavior	Behaviour
PT3	1.1.2	Lack of concentration	Motivation	Behavior	Behaviour
PC1	1.2.2	more experience makes a good artisan	Familarity exposured in field	Expert	Career Development
PC1	1.2.3	lack of practical side	Inexperienced	Incapable	Career Development
PC1	1.3.3	more you work the more the exposure you gain	Familarity exposured in field	Expert	Career Development
PC 2	1.2.1	Students that are placed by NCIP more up skilled.	More Skilled	Familiary exposed	Career Development
PC2	1.2.1	The Merseta struggle more because it's difficult for company to start on stretch	Lack basic skill	Incapable	Career Development
PC 2	1.2.2	as artisan you get experience by getting more practical's	Familarity exposured in field	Expert	Career Development
PC3	1.2.2	able to work on some of the repetitive task	Familarity exposured	Career Development	Career Development
PC3	1.2.3	through years of working you gain experience	Familarity exposured in field	Expert	Career Development

Accreditation
Behaviour
Company Apprentice
Curriculum Alignment
Employment Opportunities
Foundational Knowledge
Funding
Mentorship
Monitoring and Evaluation
Motivational Support
Resource Deficiency
Skills development
Training Equipment
TVET and Industry 4

Table 4.4 presents the 14 categories developed. After categories were developed, the RSQs were aligned according to themes. Table 4.5 shows the themes with the RQ and RSQs (Appendix F).

Table 4.5: Themes shown according to RSQs

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?		
RSQ 1.1	**What are the challenges TTCs face when they attempt to do the trade test?**	**Theme**
IQ 1.1.1	Have you received enough training for the trade test?	Career Development Resource Deficiency Skills Development
IQ 1.1.2	How many times have you taken the trade test?	Behaviour Resource Deficiency Skills Development
IQ 1.1.3	Which task(s) did you struggle with?	Behaviour Resource Deficiency Skills Development
IQ 1.1.4	Why do you think you struggled with some tasks?	Behaviour Career Development Curriculum Alignment Resource Deficiency

*RQ = Research question; RSQ = Research sub-question

4.4 Findings

4.4.1 Introduction

The findings are presented in this section, with an in-depth analysis of the findings generated from data collected and transcribed from interviews with participants. Findings are categorised by sub-research questions, which are grouped as i) trade tested candidate' responses; ii) lecturer responses; iii) company responses; and iv) trade test practitioner responses.

4.4.2 TTC responses

The analysis in this section is based on the TTC questionnaire (Appendix A). The interview questions (IQ) are aligned to the RQ and RSQs. Interview questions answered by the TTCs are IQ 1.1.1 to IQ 1.1.9 and IQ 1.4.1 to 1.4.3. Participants are numbered from P1 to P12. The responses are further organised under each interview question.

4.4.2.1 RSQ 1.1: What are the challenges TTCs face when they attempt to do the trade test?

IQ 1.1.1: Have you received enough training for the trade test?

All participants, except for P7 and P8, acknowledged receiving trade test training before going for the test. They have alluded to experiencing challenges with discrepancies in their training in comparison to what they were prepared for. P2 stated the following: "At college we were given enough modules to prepare for the trade test and 2 weeks of preparation. Most of the things are done at work like college work" (Appendix BT 1.2). Participants (P1, P2, P3, P4 & P5) had over three years of in-service training to prepare for their trade test. Some of the participants (P7 & P8) amplified the unavailability of college instructors to assist. For example, P7 said: "My challenge for not being competent on fitting was caused by not having a lecture at the college while we were on practical phases" (Appendix BT 1.7). P1, P9, P10 and P12 had little time for preparation and were not exposed to all practicals that were done at the trade test centre.

Three of the 12 participants (P1, P2 & P9) noted that the material at their disposal was not sufficient to use during the preparation for the trade test. P1 specified that: "I gained four years' experience while other TTC had no training or the training that had been receive did not involve all or some of the practical's that were asked during the trade test" (Appendix BT1.1). P9 said: "I had long time to prepare for myself. The only challenge were [sic] material that was not enough" (Appendix BT1.9). P2 stated that: "the college does not have enough material. We use the same material with NCV TTC which make us to have shortage of material when we are preparing" (Appendix BT1.2). P4 and P5 did in-service training at their companies and had mentors, and were adequately prepared for the successful completion of their apprenticeships. P4 said: "I have prepared myself for 4 months and that was enough" (Appendix BT1.4). This

was followed by P5 who argued the following: “I did workshop preparation for 3 months with support of lecturer and went for the trade test final preparation at the centre before the trade date which was 3 days” (Appendix BT1.5).

Finding 1: Trade test preparation by the TTCs is insufficient or lacking

Finding 2: Trade test training for the TTCs is insufficient or lacking

Finding 3: Instructors are unavailable to assist students with preparing for their trade test

Finding 4: Material is lacking in the workshops for trade test training and preparation of TTCs

IQ 1.1.2: How many times have you taken the trade test?

Of the 12 participants, seven (7) (P1, P2, P5, P7, P8, P11 & P12) attempted the trade test more than once. The other participants (P3, 4, 6, 9, & 10) passed at the first attempt. The participants who passed at the first attempt shared how they had months of practise and that there was a shortage of wire material, which was a constant problem at the college. P3 shared how he passed: “I struggled a little bit with bracket activity even though I passed the task which I had to weld” (Appendix BT1.3). P9 stated the following: “On the 1st attempt, I had long time (3 months) to prepare for myself. The only challenge was with wire material that was not enough” (Appendix BT1.9). P10 quoted: “I was lucky to have chosen a task that I had practised before which made it easy for me to pass” (Appendix BT1.10).

Finding 5: On average, TCCs failed their trade test twice

IQ 1.1.3: Which task(s) did you struggle with?

Seven (7) participants (P1, P2, P5, P7, P8, P11, & P12) who attempted the trade test more than once said they had difficulties with the practicals and the condition of the equipment used at the college and the centre. P1 said:

> The fittings they had at the trade test centre were not in good conditions and was never alert about the conditions. When I arrived at the centre, I had knowledge of practical and theory (drawings). So, on Hydraulics everything was leaking, I am blaming the college. They do not service the material learners are using same material as the trade test candidates (Appendix BT1.1).

P2 argued: “There’s a vice instrument used to check correctness of the holes, at trade test centre they use a Vernier calliper of which we not even sure if its properly calibrated and I blame the trade test centre for failing” (Appendix BT1.2). P7, a fitting and turning student, stated that

he: “had problems with DTI alignments. Hydraulics were not taught at the college because we did not have a fitting lecture” (Appendix BT1.7).

Finding 6: The instrument used for measuring correctness was not in a good condition

Finding 7: Hydraulics were not taught at the college as no lecturer was available

IQ 1.1.4: Why do you think you struggled with some tasks?

The participants highlighted the struggles that made them repeat the trade test and they blamed the equipment and the college for not giving enough training, and some had personnel behaviour problems. P8 argued that: “there was not enough time for preparation” (Appendix BT1.8). P11 mentioned that: “nerves under pressure and careless mistake made me fail for the 1st attempt Isolating and second attempt current transformers were it failed due to not following instructions” (Appendix BT1.8).

Finding 8: There was not enough time for preparation

Finding 9: Nervousness, being under pressure, and careless mistakes resulted in failure

IQ 1.1.5: Does the material used at the trade test centre different from the college training material?

Eight (8) of the participants (P1, P2, P3, P4, P6, P7, P9 & P12) said the material used at the trade centres did not differ that much from the material used at the TVET. However, P3 stated that: “at the college you’re only given one colour code wire which is 1 mm panel wire. At the trade test station centre you are given another size of wires according to the task selected for you”. P11 argued that, in his experience:

> The material has different size with the same in quality type and enough at the trade test centre where as at the college we are trained there’s a shortage of material. However, we were struggling to get long nose and flat ministers as well as screw drivers at the college were we are trained (Appendix BT1.11).

Finding 10: Material differ in terms of characteristics such as wire colours, different screw drivers, etc.

IQ 1.1.6: How would you describe the mentor/lecturer support you received in preparation for your test?

Credit was given to a considerable number of facilitators, unreservedly, for their support and the information shared, to the extent that participants could not fault them for what transpired during

their test at the centre. P2 said: “Lecturers were good, the mentors at the workplace were very supportive” (Appendix BT1.2). P11 indicated the following: “Our mentor was perfect, communicated well with us and she was always help full” (Appendix BT1.11). Contrary to P2 and P11, P8 argued that there was poor support, and P4 stated that: “one timer at the trade test centre was faulty and the staff at the centre wanted to fail me” (Appendix BT1.4). P7 expressed dissatisfaction at how poorly the TTCs had been prepared, with P12 blaming their failure on a lack of support from the mentors and college lecturers. The fitting and turning participant, P7, stated that: “the support given as fair, but believes he was not given enough knowledge and training” (Appendix BT1.7). P12 stated the following:

> I have prepared trade test at two different colleges. The 1st college we did not get much needed support and we had to figure some of the work ourselves. The second college gave me more exposure and with mentors they assisted on some of the jobs on the logbooks however, not all the work on the logbook were covered (Appendix BT1.2).

P11 mentioned that: “they neither can put blame on a lack of support nor on the time dedicated by their mentors to prepare them for such” (Appendix BT1.11).

Finding 11: The TTCs have different opinions on the lecturers’ support

IQ 1.1.7: Do you think you are getting enough information before your training on what is expected?

Participants agreed that they received sufficient information about the training. P2 said: “Yes, each individual when he applies for apprenticeship information is give and after you will be placed on the trade, you have applied for” (Appendix BT1.2). P10 stated: “Yes, information is given about the relevant trade” (Appendix BT1.10). P11 said: “Yes, enough information was given” (Appendix BT1.11). P12 agreed that basic information is given about the trade on what it is all about. However, the information given is not enough. They need to explain to us more about exposure you get at the workplace” (Appendix BT1.12).

Three (3) of the 12 participants (P1, P3 & P9) were of the opinion that they did not received adequate time to prepare for their trade test. They stated that the three days given to them did allow them sufficient time to familiarise themselves with the machines at the centre. P9 stated that: “It will better if we prepare at the trade test centre for a week and not 3 days” (Appendix BT1.9). P3 state that: “for instant on my 1st day I did only one activity because I had to align the panels that they used and the ones I am used to from the college. A week can be enough at the centre to get used to the environment” (Appendix BT1.3). Although happy with the information received before training from their respective colleges, participants were of the opinion that they needed at least two weeks at the centre to prepare themselves for the trade test.

Finding 12: TTCs received adequate information on what to expect before the trade test

Finding 13: TTCs need more time to prepare for trade tests

IQ 1.1.8: Is there any support after failing the trade test?

P1, P2, P10, P11 and P12 agreed that support after failing the trade test had been given, whereas P7, P8 and P9 disagreed, stating that support was not given. P3, P4, P5 and P6 opted not to answer the questions since they passed on the 1st attempt. P1 said: “I did get support, on, it has been up to me to make a follow-up. I was given a chance to go for my second attempt” (Appendix BT1.6). P2 also shared that: “I was taken to counselling and my bosses tried to figure out the cause of the failure of trade test and supported me by giving motivation” (Appendix BT1.2). P10 stated: “The college give support to candidates that fail” (Appendix BT1.10). There were also some other challenges. For example, P8 argued that: “the funder does not give 2nd chances, so no support was given after I have failed”. P7 stated that: “I had to go work to gather money to prepare for my 2nd attempt” (Appendix BT1.7). P9 mentioned that: “there was not much support given, it will better if we prepare at the trade test centre for a week not 3 days so we can be able to get used to the environment” (Appendix BT1.9).

Finding 14: There are challenges such as the lack of funds to prepare for the trade tests

Finding 15: In some cases, there were no support given to the TTCs

Finding 16: In some cases TTCs did receive support

IQ 1.1.9: What support do you think should be given to TTCs after failing initially?

The responses on this question were unanimous in that the participants felt that the waiting period after failing the first test was too long and, in-between, there is little support from the TVET to get TTCs to do the test again. Unfortunately the time lapse resulted in TTCs losing the knowledge that they gained. P12 mentioned that: “preparations must be longer. A week is not enough and also trade test dates are too far some of the stuff are easily forgettable” (Appendix BT1.12). Four participants (P1, P2, P3, P6, P9, P10 & P12) recommended that a three-week waiting period was enough. P6 said that the second attempt: “must be done after 3 weeks or a month” (Appendix BT1.6). P9 stated that: “it would be better if one can apply after failing so the second attempt could be earlier and not after few months” (Appendix BT1.9). P10 suggested that: “a second chance and trade test dates must be closer between one or two weeks” (Appendix BT1.10).

P7 suggested that funding be made available to sufficiently support candidates who needed extra time for preparation. Funding is needed for faulty equipment that needs to be either fixed or replaced. The workshop is too small for the number of TTC. The funding will assist in expanding the workshops as there are too many candidates receiving training. P11 added by saying that: “they need working machines, buy more material for practical’s and use the funding in also extending the workshops” (Appendix BT1.11). This could also assist some institutions to replace their machinery and ensure that they are competitive with trade test centre machines or those in the industry.

P1 and P3 touched on the psychological impact trade testing has on TTCs and appealed for moral support and motivation after failing the first test, because they become demoralised and even consider not coming back. P1 suggested that: “positive words (encouragement) to TTC must be given that you can make it and the candidate must be given more time for preparation to practice the valid stuff” (Appendix BT1.1).

Finding 17: The waiting periods between trade tests are too long

Finding 18: There is a lack of funding to support the TTCs in preparing for the tests

Finding 19: There is a lack of moral support for TTCs

4.4.2.2 RSQ 1.4: How employable are the TTC graduates?

IQ 1.4.1: Are there any apprentices employed by the company?

Of the 12 participants, seven (7) were employed after finishing the trade test and five participants (P4, P6, P9, P10 & P11) said they are unemployed. P5 stated: “Employed as an assistant lecture due to companies, companies wanted people who have more than 3 years’ experience” (Appendix BT1.5). P11 elaborated further on why he was unemployed and said: “I am currently unemployed, I only got employed 2 months after my trade test then retrenched due to company losing business” (Appendix BT1.11).

Finding 20: Seven TTCs were employed after finishing the trade test and five remained unemployed, indicating some employability but not as strong as expected

IQ 1.4.2: Is the work that you are employed for related to the trade you have qualified in?

Of the seven (7) employed participants (P1, P3, P5, P8 & P12), five (5) said they were working in the field they qualified for, while P2 and P7 indicated that they were employed in different positions not related to qualification. P7 was employed in radiation protection, which is not relevant to what he studied. P1 stated: “I attended apprentice at a private company then we

were sent to the TVET. According to my contract after the trade test was passed, we will be employed.'' (Appendix BT1.1).

Finding 21: Most of the TTCs employed are working in their field of training

IQ 1.4.3: How many years/months did it take to get the job after you have qualified?

Of the five apprentices employed in their studied field of trade, four (P3, P5, P8 & P12) took approximately seven months to get employment after they were qualified, while one apprentice was employed immediately after qualifying. P1 said that: "because I did the training at the private company, I was sent to the college for theory. I knew I was going work there after the apprenticeship" (Appendix BT1.1). P2 said that: "5 months the company employed us doing apprenticeship absorb us" (Appendix BT1.2). P3 explained that: "It took me three months to get a job, one of the TTC I was studying with recommended me to the company" (Appendix BT1.3). P5 stated that after being an apprentice, he was employed because of the demand for his trade in the company. It took P7 six months to find a job, which was in a non-related trade. P8 got a job after 7 months.

Finding 22: It is difficult to find employment (can take up to eight months if not more) after passing the trade test

4.4.3 Lecturer interview responses

The analysis in this section is based on the lecturer questionnaire (Appendix B). The interview questions (IQ) are aligned to the RQ and RSQs. Interview questions answered by the lecturers are IQ 1.2.1 to IQ 1.2.5 and IQ 1.3.1 to 1.3.2. The responses are organised under each interview question. Participating lecturers (PLs) are numbered PL1 to PL6 (Table 4.1; Chapter 4; section 4.1). The PLs teach: i) electrical; ii) welding; iii) fabrication; iv) pipe fitting; and v) fitting and turning.

4.4.3.1 RSQ 1.2: How are the TVETs curricula aligned with industry needs?

IQ 1.2.1: Do the students who are placed by the college have basic knowledge to do the job?

All the PLs agreed that the TTCs had the basic knowledge to do the job. The TTCs were taught the Competency Based Modular Training (CBMT) syllabus. The PLs elaborated on how they were prepared during the theory part and practical tests given before being placed in the industry.

PL1 stated: "CBMT at host companies covers all basic info relevant to the trade" (Appendix CT1.1). PL6 mentioned that: "we teach them the basic skills and do competency test before

they leave for industry" (Appendix CT1.6). PL2 elaborated on the phases electrical TTCs go through before being placed to the industry.

According to PL2, there are four phases:

i) **Phase 1:** Basic hand tools. TTCs are taught the theory about the tools as well as safety details when working in the field, and the use of the tools with the safety when using the tools.
ii) **Phase 2:** In this phase TTCs apply what has been taught theoretically. TTCs are trained using equipment and tools, and then they are given scenarios by drafting circuits before connection and installation is made.
iii) **Phase 3:** Fault finding are tested by giving TTCs completed circuits and they then have to check the problem on the circuits.
iv) **Phase 4:** More advanced TTCs can do wire testing, planning, and maintenance using high voltage (Appendix CT1.2).

PL3 said that: "we train TTCs according to industry's needs" (Appendix CT1.3). PL4 said that: "in college workshops they get introduced to basic introduction of work environment machinery and parts" (Appendix CT1.4).

Finding 23: All the PLs agreed that the TTCs have the basic knowledge to do the job

IQ 1.2.2: Is the 18 months of transferring knowledge to the TTCs at the workplace enough for them to become qualified artisans?

PL1, PL4 and PL6 were of the opinion that 18 months is sufficient time, whereas PL2, PL3 and PL5 had a different perspective. PL3 and PL5 said that for TTCs to be adequately exposed, they need to be placed at a company where all aspects requiring trade experience are covered. PL2 elaborated:

> TTC do a 6 months' theoretical work depending on the company they get; some companies do not cover what is covered on the trade. The exposure differs according to companies (industry), a student place at the factory or companies like Eskom where they are training relates to the trade experience. Whereas student placed in municipalities works with high voltage and they will not cover all the areas (Appendix CT1.2).

The PLs articulated that companies focus on different components, and not everything required by the logbook is covered by the trade companies. A logbook is a progressive record of learning that reflects the time spent on the job during all the time the period of the training. This document contains elements necessary for the completion of the training. The coverage is depended on the field of the industry in which they are placed in. PL1 stated that: "not all companies cover everything relevant to electrical" (Appendix CT1.1). The PLs suggested that the practical field

experience needs be done in 24 months and the student must rotate for exposure to different industries.

Finding 24: TTCs have not been exposed to all aspects they need for artisanship when placed in industry

Finding 25: Companies focus on different components and not on what is required by the trade logbook

IQ 1.2.3: Is the current syllabus taught at the college relevant to the latest technology used in industry?

All PLs stated that the syllabus is outdated. The industry has moved on to the latest technology available. The participants highlighted that there is a difference between the old manual machines used in college workshops compared to computerised machines with systems that are used in the industry. PL5 stated that: “some of the syllabus is outdated and some of the stuff done at the companies are not done in the syllabus” (Appendix CT1.5). The other view was that the college cannot always afford upgrading to the current technology as per demand. PL6 said: “Colleges does not have all financial aid to buy new technology machines convenience basis” (Appendix CT1.6). PL2 explained that in the electrical environment:

> For PLC system at the college TTC are tough manual connection theory based using codes without being tested whereas at the industry it’s a computerised system and can see practically. For TTC who do not have a background in the logic system, it is difficult to understand i.e. logic system is the latest technology. QCTO has implemented programs that require more paperwork. At the college, the systems are different than those at the workshop. There are no computers where we can use electronics and computer diodes to test, we are given limited information according to the logbook where we do safety test and phase test (Appendix CT1.2).

Finding 26: The TVET syllabus is outdated and some of the work required by the companies is not covered in the syllabus

IQ 1.2.4: Will the student be able to apply the knowledge gained at the TVET to the latest technology provided by industry?

Three participants (PL1, PL3 & PL5) agreed that for some components, TTCs can apply knowledge to the latest technology. PL2, PL4 and PL6 argued that TTCs would be able to do the work with the latest technology when the TTCs have been trained by the host companies. Most of the companies introduce the TTCs to the system they are using. PL2 stated that: “student can only be able to apply if the company takes the TTC for advance training on the machine” (Appendix CT1.2). PL6 shared that: “we only have 6 months with the TTC at the

college and the lack of technology advanced machine does not help" (Appendix CT1.6). The TVETs still have old machines and the participants explained that one of the motors used at the college did not have variable speed, as used with the latest technology. PL3 also added that: "for fitting and turning TTCs if they can get training on the CNC machine which is the latest technology it can be easy to work on the industry exposure" (Appendix CT1.3).

Finding 27: TTCs cannot apply their theoretical knowledge when entering the trade environment

Finding 28: The lack of advanced machine technology does not support the TTC training and readiness to enter industry

IQ 1.2.5: Are TTCs capable to work under pressure and complete work on time when solving problems?

The PLs agreed that TTCs can work under pressure. PLs shared that there are TTCs who manage to work under pressure because they have the hunger to learn and face new challenges. However, some TTCs do not have the drive and, as a result, they only do the course for other benefits (stipend), which gives them attitudes when doing tasks. PL2 articulated that TTCs are different as you find fast leaners while other TTCs who take their time (Appendix CT1.2). PL5 shared that: "you will find passionate, goal-driven TTC[s], and at the same time, some TTC[s] need to be pushed" (Appendix CT1.5). PL1 highlighted that: "all TTC[s] are capable [of] solving problems but "not all the TTC have the same skill of set" (Appendix CT1.6).

Finding 29: Some TTCs are able to work under pressure and solve problems while others are not

4.4.3.2 RSQ 1.3: How can TVET institutes improve preparing competent artisans and ensure a higher trade test pass rate?

IQ 1.3.1: How often does the college benchmark with industry by involving problem solving done by industry in activities given to TTCs?

PLs (PL3, PL4 & PL5) shared that, most of the time, monitoring of companies is conducted, which assists in spotting the problems that occur in the industry and communicate this back to what the TTCs need to be exposed to. PL3 said that: "they are doing monthly company monitoring visits" (Appendix CT1.3). According to the PL2, some companies provide recommendations on what TTCs will need exposure to in terms of activities. PL6 differed and said: "We very seldom have enough time to spend in the industry to diagnose what problems may occur" (Appendix CT1.6).

Finding 30: Generally benchmarking between TVETs and industry does take place

IQ 1.3.2: Are any workshops conducted by industry and the TVETs to align the syllabus with the latest technology?

Based on the PLs responses, workshops are not conducted. Companies do train TTCs on the job and give them exposure. PL1 stated that: “the mentors from the industry are the ones who train the TTC on latest technology” (Appendix CT1.1). TTCs are exposed by the college based on the logbooks. PL5 highlighted that, since the industry is production-driven, time for having workshops is limited. PL2 said: “No, the college still uses the old syllabus, which is CBMT, some factories assist TTC in giving exposure to the new technology” (Appendix CT1.2). PL4 stated that: “no, workshops/Companies like Vaalmac/Lesedi cover most of the student’s logbooks and introduce them to work environment” (Appendix CT1.4).

Finding 31: Workshops between industry and TVETs are not conducted

4.4.4 Company interview responses

The analysis is based on the company interview guide question(Appendix A). The interview questions (IQ) are aligned to the RQ and RSQs. The interview questions answered are IQ 1.4.4 to IQ 1.4.5 and IQ 1.5.1 to IQ 1.5.5. Participants are numbered PC1 to PC4. The responses are further organised under each interview question. The four companies that participated were from transport (1), fabrication (2), and local government (2).

4.4.4.1 RSQ 1.4: How employable are the TTC graduates?

IQ 1.4.4: Are any apprentice TTCs employed by the company?

Most of the companies employ apprentices when they have opportunities to do so. According to their perspective, PC6 stated that: “all trade tested candidates who became competent on their trade are becoming permanently employed by the company” (Appendix DT1.6). PC2 shared that: “due to the depreciation of jobs given by suppliers, it has been difficult to employ the trade apprentice after the training” (Appendix DT1.2).

Finding 32: TTCs who passed the test and are competent in their trade are permanently employed by most companies

IQ 1.4.5: How do you find the knowledge they have gained? Can they work on a task without being supervised?

Ps agreed that TTCs are able to work without being supervised in some aspects of the job. PC1 stated that: “a task can be tackled without being monitored, most of the time, and that is what is

required on the logbooks" (Appendix DT1.1). PC2 mentioned that: "it will always be about exposure in other tasks" (Appendix DT1.2). The programme focuses on basics, and the specifications are obtained through experience and from the workplace. PC5 also added that: "the minute TTC get used to the tasked that are being trained to it become much easy to work on their own without being supervised" (Appendix DT1.5).

Finding 33: The knowledge TTCs have gained is adequate to do the job unsupervised

4.4.4.2 RSQ 1.5: What possible challenges are TVETs facing to ensure they prepare a fully compliant apprentice with skills and knowledge to meet industrial demands?

IQ 1.5.1: Do the TTCs who are placed by the college have the basic knowledge to do the job?

Of companies interviewed, three PCs (PC2, PC4 & PC5) were of the opinion that the apprentices have sufficient understanding to conduct the job. PC5 explained that: "the apprentices have been exposed to theory and less practice" (Appendix DT1.5). Contrary to PC2, PC4 and PC5, PC1 said: "No, TTC only have theory from the college practical side is taught by industry" (Appendix DT1.1).

PC2 said that: "I have noted that apprentices coming from the public colleges start from scratch with the basics" (Appendix DT1.2). PC4 expressed that: "TTC who joins the programme are not familiar with the plant experience and learn basics in training centres, but they are exposed at the plant when working with mentors who guided them on tasks, explaining and making sure that TTC understand fully" (Appendix DT1.4).

Finding 34: Generally, TTCs placed by TVETs do not have the basic knowledge to do the job

IQ 1.5.2: Is the practical knowledge of 18 months transferred to the TTCs at the workplace enough to be a qualified artisan?

All of the companies interviewed considered the 18 months sufficient time to qualify as an artisan under the National Artisan Moderation Body (NAMB). Even though it is an adequate amount of time, PC1 shared his perspective: "From my understandings of becoming qualified artisans you need to gain years of experience and working more with more practical problem-solving situations" (Appendix DT1.1).

PC2 stated: "Yes, enough but as artisan you get experience by getting more practical's" (Appendix DT1.2). PC3 believed that: "it is enough as they were guided by the logbook to complete all the task[s]" (Appendix DT1.3). PC4 said: "The exposure is enough because the TTC are tested based on what they have learned at college" (Appendix DT1.4)". PC5 shared

that the experience gained by the apprentice is based more on what is in the logbook given by the TVET college, which negates the different aspects of practically required in industry.

Finding 35: The practical knowledge of 18 months transferred to the TTCs at the workplace is enough to be a qualified artisan

Finding 36: Despite the knowledge gained at TVETs, there is still a gap in training at TVETs in terms of what is needed by industry

IQ 1.5.3: Does the syllabus of the TVETs relate to the latest technology used in industry?

Five PCs (PC1, PC2, PC3, PC4 & PC5) shared the perspective that colleges still work with old machines, whereas the companies are into the latest technology. PC2 said: “No, the syllabus does not relate, for example, we are using the recent technology even though we have the old machines and we do not use them on our new projects” (Appendix DT1.2). Companies provide training on the new technology for the TTCs. PC2 further described how they have stopped using old machines with new projects and that they require new technology. PC4 stated that: “in the workplace they deal with actual task, the training centre provides basic training and what is given on logbook is outdated” (Appendix DT1.4). PC4 furthermore explained how the gauges instrument used by companies and colleges are not the same, companies use laser gauges, whereas colleges still use manual Vernier’s and rulers to measure techniques.

PC5 mentioned that their training is related to the latest technology: “as we provide training if there are new machines or programs” (Appendix DT1.5). Recommendations made by companies are that they need stakeholder engagement with all sectors and must look into the new technology and material used, upgrading to digital scales.

Finding 37: The syllabus does not relate to new technology

Finding 38: Companies use the latest laser gauges whereas colleges are still using Vernier’s and ruler measuring techniques

IQ 1.5.4: On the newly qualified artisan, what is your opinion on the exposure they have gained and is it enough?

PC1 and PC2 agreed that the newly qualified artisan needs to gain more exposure to different projects, which means the current exposure is insufficient. PC1 argued that: “with artisan the more you work the more the exposure you gain” (Appendix DT1.1). PC2 also said: “No, still need to be more exposed in different kinds of projects” (Appendix DT1.2). PC3 had a different perspective and was indecisive, expressing the following opinion: “Yes/No, some of the jobs

that we do are not related to what is on the logbook there are components we do not cover" (Appendix DT1.3).

PC4 stated: "Yes, on basics but on the plant no. With actual work you need more exposure" (Appendix DT1.4). PC5 considered the exposure sufficient to get trade test certification. PC5 said that: "the exposure they gain is enough because they receive workplace and institutionalize training for more than 18 months" (Appendix DT1.5).

Finding 39: The exposure that new artisans gain is not enough for industry

4.4.5 Trade practitioners and occupational managers responses

The analysis in this section is based on the lecturers' questionnaire (Appendix B). The interview questions (IQ) are based on the RQ and RSQs. Interview questions answered by the lecturers are IQ 1.1.10 to IQ 1.1.12 and IQ 1.3.1 to 1.3.2.

Interviews were conducted at two (2) colleges, and four (4) participants from different trades were interviewed, namely fitting, electrical, welding and fabrication. Participants are presented as PT1, PT2, PT3 and PT4.

4.4.5.1 RSQ 1.1: What are the challenges TTCs face when they attempt to do the trade test?

IQ 1.1.10: Do you think there is a high failure rate among trade test candidates?

Most of the participating lecturers disagreed (PT2, PT3 & PT4) that there is a high failure rate. PT2 said: "No, because they are being trained well" (Appendix ET1.2). PT3 stated that: "out of 10 TTCs who tested, assessors say that 6 passes [sic] at 1st attempt". PT4 also stated that: "trade test may not reflect fully the whole training of apprentice, student may be trained on bedding steels whereas in the industry it is not relevant for instance, the industry work with the latest machines and at the centre it's still the old version" (Appendix ET1.4). PT1 argued that: "TTCs are not preparing themselves well enough and nerves get the better of them" (Appendix ET1.1).

Finding 40: Among the assessors, 50% believe the success rate is low, while the other 50% think it is average

IQ 1.1.11: What is the cause of the high failure rate, in your opinion?

The response was overwhelming in terms of the lack of exposure TTCs have. However, views of participating lecturers on why differ. PT1 said that: "the lack of financial resources for private

TTCs. TVET college TTC sometimes lack cogency" (Appendix ET1.1). PT2 pointed to TTCs not having sufficient exposure in different types of welding (Appendix ET1.2).

PT3 mentioned that:

> Students do not prepare enough they turn to memories tasks that they have practice from the college. The machines at the trade test centre are different so student are supposed to apply the same principle they have learned from the college when tackling the tasks. As trade test practitioner when we are marking we check if all the instructions are followed for an example TTCs tend to ignore to follow instructions a 110 watt is specified on the question paper given to student to use on a panel, the student will turn to ignore the question because of pressure and lack of concentration they used a power is not specified on the question paper since at the college they normally use 100 watt when they practice (Appendix ET1.3).

PT4 again reiterated that: "what's on trade test does not relate to the work practical exposure given to student meaning the syllabus is outdated" (Appendix ET1.4).

PT4 explained that:

> In the old days when they use to fail, it was because systems were complicated and there were few trade test centres. Nowadays when student are preparing for this assessment, before the trade test date, they first must get used to the machine preparing and applying the same method they have learned at the work environment. The method used by the college of preparing the student before assessment indicates there's a gap between what they are being taught at work and what they are assessed on (Appendix ET1.4).

Participants recommended that TTCs be assessed based on what they are exposed to in industry. In doing so, there is no need to prepare them before the assessment.

Finding 41: TVET College TTCs sometimes lack cogency

Finding 42: TTCs ignore instructions, not reading them properly and not following the processes given for the assessment

Finding 43: TTCs were nervous, lacked concentration, and panicked on the day of the test

Finding 44: There is a gap between what they are being taught at work and what they are assessed on

IQ 1.1.12: Do you think colleges are capable of producing qualified candidates based on their performance?

Participants (PT1, PT2 & PT3) were of the opinion that the colleges can produce artisans. PT1 said: "Yes, they have highly qualified artisans with lots of experience training those TTC and

preparing them for trade test" (Appendix ET1.1). PT2 also stated: "Yes, because their instructors are highly skilled and have lots of experience" (Appendix ET1.2).

PT3 said:

> Yes, the colleges is [sic] accredited under NAMB and follows CBMT syllabus, with workshops that start from phase 1-4. Part-time classes to accommodate working people. There are facilities provided like workshops accredited the same as trade test centre were they are trained. Important for the student to be discipline were they are timed by stop watch (Appendix ET1.3).

PT4 disagreed with the other participants. PT4 stated: "If the TTCs were trained properly at college and workplace, there's will be no need for them to prepare, the minute the colleges gives them prepare before trade it means there are gaps in between college and industry which were not covered" (Appendix ET1.4).

4.4.5.2 RSQ 1.3: How can TVET institutes improve preparing competent artisans and ensure a higher trade test pass rate?

IQ 1.3.3: Do you think colleges prepare the TTCs correctly for the trade?

All the PTs responded positively to how colleges do preparation in advance before the trade test date. PT1 stated: "Yes, they are given 20 days preparation time and assign one person to oversee trade test preparation" (Appendix ET1.1). PT2 said: "Yes, because they are being trained in all types of welding and positions" (Appendix ET1.2). PT3 said:

> Yes, Trade test centre preparations before trade tests are conducted separated rooms than they were student are monitor on their understanding and assisted in preparing for trade day with similar machines available. Also prepared on list of task that might be done on trade test. When they get to the trade test room they use different panels what's important is to follow the correct processes (Appendix ET1.3).

PT4 posited: "If you have learned how to do thing at college and work at the company, there's no need to be prepare the student because if they prepare the minute before trade meaning there is a huge gap in between college and industry on what is being trained" (Appendix ET1.4).

Finding 45: TVETs adequately prepare TTCs

IQ 1.3.4: How can colleges prepare the TTCs to do better?

Four participating lecturers (PT1, PT2, PT3 & PT4) shared their views. PT1 stated that: "more one on one interaction between student and facilitator is needed" (Appendix ET1.1). PT2 mentioned that: "to check what the industry needs" (Appendix ET1.2). PT3 said that: "TVET must monitor TTCs from company side, making sure what is done at the college is implemented

and for working TTCs there's a centre of specialisation were lecturers communicate with companies and do check-ups on work that is being done industry is implemented at colleges" (Appendix ET1.3). PT4 said that: "the college needs to make sure that the lecturers are people who are more into the new technology and be able to visit companies and relate to what is happening in the industry so the assessment can reflect to reality being applied" Appendix ET1.4).

Finding 46: There is a lack of interaction between the between student and facilitator

Finding 47: Industry needs are neglected and need to be addressed in the training

Finding 48: There is a lack of TVET monitoring of what TTCs do at the company

Finding 49: Lecturers lack knowledge of new technology

4.4.5.3 RSQ 1.5: What possible challenges are TVETs facing to ensure they prepare a fully compliant apprentice with skills and knowledge to meet industrial demands?

IQ 1.5.5: How does the failure rate of TTCs affect industry?

The PTs expressed different points of view. PT1 stated that: "industry are [sic] running short on artisans as the older artisans are retiring and the flow of new blood is slow" (Appendix ET1.1). PT3 said that: "industry is working with TVET colleges. The pass rate will be affected, the colleges failure rate cost companies money. Colleges cannot produce failures to industry because processes in company production will fail and cost millions" (Appendix ET1.3).

PT4 said:

> TTC that qualify struggle to get jobs due to the limited exposure on company processes and lack of experience, that's why we need companies to work more with TVET colleges so TTCs can be exposed to company processes. The passing rate of TTCs can be high if they determine industry requirements with what they teach TTCs. What is needed is a link or connection between industry and colleges where some of the elements of workplace are addressed in order to save companies from retraining new artisans, which they will also save on training costs on the new systems they are using (Appendix ET1.4).

Finding 50: There is a shortage of artisans as seniors are retiring and replenishment is slow

Finding 51: The high failure rate of TTCs is costing companies money

4.5 Overall findings of participants

Presented below are the findings from the interviews with participants, which were transcribed from the collected data. The findings have been categorised according to the RSQs (Table 4.6).

Table 4.6: Overall findings aligned to the RQ, RSQs and IQs

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?		
RSQ 1.1	**What are the challenges TTCs face when they attempt to do the trade test?**	**Findings**
IQ 1.1.1	Have you received enough training for the trade test?	Finding 1: Trade test preparation by the TTCs is insufficient or lacking Finding 2: Trade test training for the TTCs is insufficient or lacking Finding 3: Instructors are unavailable to assist students with preparing for their trade test Finding 4: Material is lacking in the workshops for trade test training and preparation of TTCs
IQ 1.1.2	How many times have you taken trade test?	On average, TCCs failed their trade test twice
IQ 1.1.3	Which task(s) did you struggle with?	Finding 6: The instrument used for measuring correctness was not in a good condition Finding 7: Hydraulics were not taught at the college as no lecturer was available
IQ 1.1.4	Why do you think you struggled with some tasks?	Finding 8: There was not enough time for preparation Finding 9: Nervousness, being under pressure, and careless mistakes resulted in failure
IQ 1.1.5	Does the material used at the trade test centre different from the college training material?	Finding 10: Material differ in terms of characteristics such as wire colours, different screw drivers, etc.
IQ 1.1.6	How would you describe the mentor/ lecturer support you received in preparation for your test?	Finding 11: The TTCs have different opinions on the lecturers' support
IQ 1.1.7	Do you think you are getting enough information before your training on what is expected?	Finding 12: TTCs received adequate information on what to expect before the trade test Finding 13: Student need more time to prepare for trade tests
IQ 1.1.8	Is there any support after failing the trade test?	Finding 14: There are challenges such as the lack of funds to prepare for the trade tests Finding 15: In some cases there were no support given to the TTCs Finding 16: In some cases TTCs did receive support
IQ 1.1.9	What support do you think should be given to TTCs after failing initially?	Finding 17: The waiting periods between trade tests are too long Finding 18: There is a lack of funding to support the TTCs in preparing for the tests Finding 19: There is a lack of moral support for TTCs
IQ 1.1.10	Do you think there is a high failure rate among trade test candidates?	Finding 40: Among the assessors, 50% believe the success rate is low, while the other 50% think it is average
IQ 1.1.11	What is the cause of the high failure rate, in your opinion?	Finding 41: TVET college TTCs sometimes lack cogency. Finding 42: TTCs ignore instructions, not reading them properly and not following the processes given for the assessment. Finding 43: TTCs were nervous, lacked concentration and panicked on the day of the test. Finding 44: There is a gap between what they are being taught at work and what they are assessed on.

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?		
IQ 1.1.12	Do you think colleges are capable of producing qualified candidates based on their performance?	
IQ 1.5.5	How does the failure rate of TTCs affect industry?	Finding 50: There is a shortage of artisans as seniors are retiring and replenishment is slow Finding 51: The high failure rate of TTCs are costing companies money
RSQ 1.2	**How are the TVET curricula aligned to industry needs?**	**Findings**
IQ 1.2.1	Do the students who are placed by the college have basic knowledge to do the job?	Finding 23: All the PLs agreed that the TTCs have the basic knowledge to do the job
IQ 1.2.2	Is the 18 months of transferring knowledge to the TTCs at the workplace enough for them to become qualified artisans?	Finding 24: TTCs have not been exposed to all aspects they need for artisanship when placed in industry Finding 25: Companies focus on different components and not on what is required by the trade logbook
IQ 1.2.3	Is the current syllabus taught at the college relevant to the latest technology used in industry?	Finding 26: The TVET syllabus is outdated and some of the work required by the companies is not covered in the syllabus
IQ 1.2.4	Will the student be able to apply the knowledge gained at the TVET to the latest technology provided by industry?	Finding 27: TTCs cannot apply their theoretical knowledge when entering the trade environment Finding 28: The lack of advanced machine technology does not support the TTC training and readiness to enter industry
IQ 1.2.5	Are the TTCs capable to work under pressure and complete work on time when solving problems?	Finding 29: Some TTCs are able to work under pressure and solve problems while others are not
RSQ 1.3	**How can TVET institutes improve preparing competent artisans and ensure a higher trade test pass rate?**	**Findings**
IQ 1.3.1	How often does the college benchmark with industry by involving problem solving done by industry in activities given to TTCs?	Finding 30: Generally benchmarking between TVETs and industry does take place
IQ 1.3.2	Are any workshops conducted by industry and the TVETs to align the syllabus with the latest technology?	Finding 31: Workshops between industry and TVETs are not conducted
IQ 1.3.3	Do you think colleges prepare the TTCs correctly for the trade?	Finding 45: TVETs adequately prepare TTCs
IQ 1.3.4	How can colleges prepare the TTC to do better?	Finding 46: There is a lack of interaction between the between student and facilitator Finding 47: Industry needs are neglected and need to be addressed in the training Finding 48: There is a lack of TVET monitoring of what TTCs do at the company Finding 49: Lecturers lack knowledge of new technology
RSQ 1.4	**How employable are the TTC graduates?**	**Findings**
IQ 1.4.1	Are there any apprentices employed by the company?	Finding 20: Seven TTCs were employed after finishing the trade test and five remained unemployed, indicating some employability but not as strong as expected

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?		
IQ 1.4.2	Is the work that you are employed for related to the trade you have qualified in?	Finding 21: Most of the TTCs employed are working in their field of training
IQ 1.4.3	How many years/months did it take to get the job after you have qualified?	Finding 22: It is difficult to find employment (can take up to eight months if not more) after passing the trade test
IQ 1.4.4	Are any apprentice TTCs employed by the company?	Finding 32: TTCs who passed the test and are competent in their trade are permanently employed by most companies
IQ 1.4.5	How do you find the knowledge they have gained? Can they work on a task without being supervised?	Finding 33: The knowledge TTCs have gained is adequate to do the job unsupervised
RSQ 1.5	**What possible challenges are TVETs facing to ensure they prepare a fully compliant apprentice with skills and knowledge to meet industrial demands?**	**Findings**
IQ 1.5.1	Do the TTCs who are placed by the college have the basic knowledge to do the job?	Finding 34: Generally, TTCs placed by TVETs do not have the basic knowledge to do the job
IQ 1.5.2	Is the practical knowledge of 18 months transferred to the TTCs at the workplace enough to be a qualified artisan?	Finding 35: The practical knowledge of 18 months transferred to the TTCs at the workplace is enough to be a qualified artisan Finding 36: Despite the knowledge gained at TVETs, there is still a gap in training at TVETs in terms of what is needed by industry
IQ 1.5.3	Does the syllabus of the TVETs relate to the latest technology used in industry?	Finding 37: The syllabus does not relate to new technology Finding 38: Companies use the latest laser gauges whereas colleges are still using Vernier's and ruler measuring techniques
IQ 1.5.4	On the newly qualified artisan, what is your opinion on the exposure they have gained and is it enough?	Finding 39: The exposure that new artisans gain is not enough for industry

*RQ = Research question; RSQ = Research sub-question; IQ = Interview question

Table 4.7 is summary of findings drawn from the analysis; the findings are based on the feedback given by the TTCs, lecturers, companies and trade practitioners.

Table 4.8 is based on the findings, which are grouped accordingly with the RQ and RSQs. Themes were created from the transcribed data after coding (tables 4.3–4.5), categorisation and were revisited ending with 10 themes.

Table 4.7: Findings with themes, RQs and RSQs

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?			
RSQ 1.1	**What are the challenges TTCs face when they attempt to do the trade test?**	**Findings**	**Theme**
IQ 1.1.1	Have you received enough training for the trade test?	Finding 1: Trade test training for the TTCs is insufficient or lacking	Skills development

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?			
		Finding 2: Trade test preparation by the TTCs is insufficient or lacking	Career Development
		Finding 3: Instructors are unavailable to assist students in preparation for their trade test Finding 4: Material is lacking in the workshops for trade test training and preparation of TTCs.	Resource Deficiency
IQ 1.1.2	How many times have you taken trade test?	Finding 5: On average, TCCs failed their trade test twice	Behaviour
IQ 1.1.3	Which task(s) did you struggle with?	Finding 6: The instrument used for measuring correctness was not in a good condition	Behaviour
		Finding 6: The instrument used for measuring correctness was not in a good condition	Skills development
		Finding 7: Hydraulics were not taught at the college as no lecturer was available	Resource Deficiency
IQ 1.1.4	Why do you think you struggled with some tasks?	Finding 8: There was not enough time for preparation Finding 9: Nervousness, being under pressure, and careless mistakes resulted in failure	Behaviour
IQ 1.1.5	Does the material used at the trade test centre different from the college training material?	Finding 10: Material differ in terms of characteristics such as wire colours, different screw drivers, etc.	Behaviour
IQ 1.1.6	How would you describe the mentor/lecturer support you received in preparation for your test?	Finding 11: The TTCs have different opinions on the lecturers' support	Behaviour
IQ 1.1.7	Do you think you are getting enough information before your training on what is expected?	Finding 12: TTCs received adequate information on what to expect before the trade test Finding 13: Student need more time to prepare for trade tests	Skills development
IQ 1.1.8	Is there any support after failing the trade test?	Finding 14: There are challenges such as the lack of funds to prepare for the trade tests	Funding
		Finding 15: In some cases there were no support given to the TTCs Finding 16: In some cases TTCs did receive support	Behaviour
IQ 1.1.9	What support do you think should be given to TTCs after failing initially?		Career Development
		Finding 18: There is a lack of funding to support the TTC in preparing for the tests	Funding
		Finding 17: The waiting periods between trade tests are too long Finding 19: There is a lack of moral support for TTCs	Behaviour

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?			
IQ 1.1.10	Do you think there is a high failure rate among trade test candidates?	Finding 40: Among the assessors, 50% believe the success rate is low, while the other 50% think it is average	Curriculum Alignment
IQ 1.1.11	What is the cause of the high failure rate, in your opinion?	Finding 41: TVET college TTCs sometimes lack cogency. Finding 42: TTCs ignore instructions, not reading them properly and not following the processes given for the assessment. Finding 43: TTCs were nervous, lacked concentration, and panicked on the day of the test. Finding 44: There is a gap between what they are being taught at work and what they are assessed on.	Behaviour Curriculum Alignment
IQ 1.1.12	Do you think colleges are capable of producing qualified candidates based on their performance?		
IQ 1.5.5	How does the failure rate of TTCs affect the industry?	Finding 51: The high failure rate of TTCs is costing companies money	Career Development
		Finding 50: There is a shortage of artisans as seniors are retiring and replenishment is slow	Skills development
RSQ 1.2	**How are the TVET curricula aligned to industry needs?**	**Findings**	**Theme**
IQ 1.2.1	Do the students who are placed by the college have basic knowledge to do the job?	Finding 23: All the PLs agreed that the TTCs have the basic knowledge to do the job	Career Development
IQ 1.2.2	Is the 18 months of transferring knowledge to the TTCs at the workplace enough for them to become qualified artisans?	Finding 24: TTCs have not been exposed to all aspects they need for artisanship when placed in industry	Career Development
		Finding 25: Companies focus on different components and not on what is required by the trade logbook	Curriculum Alignment/
IQ 1.2.3	Is the current syllabus taught at the college relevant to the latest technology used in industry?	Finding 26: The TVET syllabus is outdated and some of the work required by the companies is not covered in the syllabus	Curriculum Alignment
IQ 1.2.4	Will the student be able to apply the knowledge gained at the TVET to the latest technology provided by industry?	Finding 27: TTCs cannot apply their theoretical knowledge when entering the trade environment	Behaviour
		Finding 28: The lack of advanced machine technology does not support the TTCs' training and readiness to enter industry	TVET and Industry 4.0
IQ 1.2.5	Are the TTCs capable to work under pressure and complete work on time when solving problems?	Finding 29: Some TTCs are able to work under pressure and solve problems while others are not	Behaviour

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?			
SQ1.3	**How can TVET institutes improve preparing competent artisans and ensure a higher trade test pass rate?**	**Findings**	**Theme**
IQ 1.3.1	How often does the college benchmark with industry by involving problem solving done by industry in activities given to TTCs?	Finding 30: Generally benchmarking between TVETs and industry does take place	Career Development
IQ 1.3.2	Are any workshops conducted by industry and the TVETs to align the syllabus with the latest technology?	Finding 31: Workshops between industry and TVETs are not conducted.	TVET and Industry 4.0
IQ 1.3.3	Do you think college prepare the TTCs correctly for the trade?	Finding 45: TVETs adequately prepare TTCs	Skills Development
IQ 1.3.4	How can colleges prepare the TTC to do better?	Finding 46: There is a lack of interaction between the between student and facilitator	Mentorship
		Finding 47: Industry needs are neglected and need to be addressed in the training	
		Finding 48: There is a lack of TVET monitoring of what TTCs do at the company	Monitoring and Evaluation
		Finding 49: Lecturers lack knowledge of new technology	Skills development
RSQ 1.4	**How employable are the TTC graduates?**	**Findings**	**Theme**
IQ 1.4.1	Are there any apprentices employed by the company?	Finding 20: Seven TTCs were employed after finishing the trade test and five remained unemployed, indicating some employability but not as strong as expected	Employment Opportunities
IQ 1.4.2	Is the work that you are employed for related to the trade you have qualified in?	Finding 21: Most of the TTCs employed are working in their field of training	Employment Opportunities
IQ 1.4.3	How many years/months did it take to get the job after you have qualified?	Finding 22: It is difficult to find employment (can take up to eight months if not more) after passing the trade test	Employment Opportunities
IQ 1.4.4	Are any apprentice TTCs employed by the company?	Finding 32: TTCs who passed the test and are competent in their trade are permanently employed by most companies	Employment Opportunities
IQ 1.4.5	How do you find the knowledge they have gained can they work without being supervised?	Finding 33: The knowledge TTCs have gained is adequate to do the job unsupervised	Skills development
RSQ 1.5	**What possible challenges are TVETs facing to ensure they prepare a fully compliant apprentice with skills and knowledge to meet industrial demands?**	**Findings**	**Theme**

RQ: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?			
IQ 1.5.1	Do the TTCs who are placed by the college have the basic knowledge to do the job?	Finding 34: Generally, TTCs placed by TVETs do not have the basic knowledge to do the job	Skills development
IQ 1.5.2	Is the practical knowledge of 18 months transferred to the TTCs at the workplace enough to be a qualified artisan?	Finding 35: The practical knowledge of 18 months transferred to the TTCs at the workplace is enough to be a qualified artisan Finding 36: Despite the knowledge gained at TVETs, there is still a gap in training at TVETs in terms of what is needed by industry	Skills development
IQ 1.5.3	Does the syllabus of the TVETs relate to the latest technology used in industry?	Finding 37: The syllabus does not relate to new technology	Curriculum Alignment
		Finding 38: Companies use the latest laser gauges whereas colleges are still using Vernier's and ruler measuring techniques	TVET and Industry 4.0
IQ 1.5.4	On the newly qualified artisan, what is your opinion on the exposure they have gained and is it enough?	Finding 39: The exposure that new artisans gain is not enough for industry	Skills development

*RQ = Research question; RSQ = Research sub-question; IQ = Interview question

The themes were grouped accordingly with research questions and sub-question after they were joined to the finding from the transcribed data (Table 4.6). Following the grouping of the themes linking of the findings to the themes was done (Table 4.7). After all the linkage was conducted, the following was developed: i) career development; ii) skills development; iii) employment opportunities; iv) curriculum alignment; v) funding; vi) resource deficiency; vii) behaviour; viii) mentorship; ix) TVET and Industry 4.0; and x) monitoring and evaluation.

4.6 Summary

The aim of the research to explore the factors that affect the high failure rates of TTCs at TVET institutions. The following research sub-questions were asked:

RSQ 1.1: What are the challenges TTCs face when they attempt to do the trade test?

RSQ 1.2: How are the TVET curricula aligned to industry needs?

RSQ 1.3: How can TVET institutes improve preparing competent artisans and ensure a higher trade test pass rate?

RSQ 1.4: How employable are the TTC graduates?

RSQ 1.5: What are the possible challenges TVETs are facing to ensure they prepare a fully compliant apprentice with skills and knowledge to meet industrial demands?

After the data were collected, the information was transcribed, followed by an initial coding with 258 codes. Codes were revised, which resulted in 128 codes. Fifty-one (51) findings were drawn from the analyses. In total, 14 categories were identified, resulting in 12 themes aligned to the research question and research sub-questions.

TTCs shared their viewpoints and suggestions regarding the trade test processes, which could assist the college when running apprenticeships. The TTCs highlighted their challenges throughout the apprenticeship and after they had passed the trade test. These challenges were: i) Instructors are unavailable to assist student in preparation for the trade tests; ii) there is a lack material in the workshops for trade test training and preparation of the trade test candidates; iii) there is a lack in trade test training for the TTCs; and iv) hydraulics were not taught at the college as no lecturer was available. There was not enough time for preparation.

The companies and trade practitioners gave input on how the colleges could attempt to involve industry in order to improve how things are done and linking of industry to the training done at the colleges. It was found that trade test preparation by the TTCs is insufficient or lacking. Instructors are unavailable to assist student in preparation for the trade tests. The study also found that there is a lack of interaction between the students and the facilitator, and also that the curriculum that they study at the college does not align with the work done in industry.

Ten (10) themes were developed: i) career development; ii) skills development; iii) employment opportunities; iv) curriculum alignment; v) funding; vi) resource deficiency; vii) behaviour; x) mentorship; ix) TVET and Industry 4.0; and x) monitoring and evaluation.

These themes are discussed in Chapter 5.

CHAPTER 5: DISCUSSION

Figure 5.1: Layout of Chapter 5

5.1 Introduction

In this chapter, the results presented in Chapter 4 will be discussed. The results are considered in relation to the research questions, aim, objectives and the themes developed in Chapter 4. The aim of the research was to explore the factors that affect the high failure rates of trade test candidates (TTCs) at technical and vocational education and training (TVET) institutions. The discussion is directed by the themes as established from the findings and categories shown in section 4.4, Table 4.7.

The themes are: i) career development; ii) skills development; iii) employment opportunities; iv) curriculum alignment; v) funding; vi) resource deficiency; vii) behaviour; x) mentorship; ix) TVET and Industry 4.0; x) monitoring and evaluation.

5.2 Themes

5.2.1 Career development

The *career development* theme addresses SRQ 1.3, which looks at the process of undergoing trade tests. Development has a useful and important outcome to career development (Adnyani & Dewi, 2019). Career path development should be based on the uniqueness of an individual's characteristics to have a greater impact on career. Every student should receive specific instructions based on their characteristics (Nor et al., 2021). TVET colleges formalise the acquisition and development of career management skills by ensuring that procedures and measures are in place to ensure the planning and implementation of skills programmes appropriate career management. A well-planned career path has been shown to increase career maturity for career decisions. Some people make undesirable choices about their future profession as a result of a lack of interest or yes/no knowledge of their own (Willner et al., 2015). Career development is a method of growing different employability to accomplish the chosen career (Adnyani & Dewi, 2019). Career development is a stage that can be used by corporations to preserve, grow employee output and prepare for an employee's future career (Cederyana & Supriyati, 2018). Appropriate work experience is essential for employees, in order to deliver work satisfaction for each employee who will have an outcome on improving their performance (Adnyani & Dewi, 2019).

PC1 believed that: "new qualified artisan[s] lack experience and [the] more you get to do different kinds of jobs the more the exposure you gain" (Appendix DT1.1). PC3 added by saying that through years of working, you gain experience.

5.2.2 Skills development

In South Africa, technical apprentices and artisans are frequently reported to be scarce and in high demand (Pandor, 2018). TVET colleges in South Africa are governed by the government

of South Africa's Continuing Education Act 16 of 2006 (Sebola, 2022). The Act states that the objective is to facilitate the acquisition of knowledge, practical skills, career skills and the development of attributes related to earning an income, entering a particular profession or entering a higher education institution. Considering the neoliberal assumptions, it is said that training leads to productivity, while skills lead to employability. If youth are well-equipped with occupational knowledge and skills, they would have better employment prospects than youth without such skills (Wudneh et al., 2022). The theme addresses RSQ 1.3, which examines the process of undergoing a trade test. The findings have pointed out that TVET colleges need to be updated in terms of syllabus and technology being used. Once the syllabus and technologies have been updated, the academic lecturers need to be reskilled and be aligned to what the industry is using.

In addition to training and skills development, TVET colleges are established to create self-employment jobs instead of market job seekers (Lange et al., 2020). A TVET college is intended "to provide a greater chance for, access to, and advancement in post-school education, which also includes skills training and gaining knowledge/attitudes needed in the labour market" (Gaffoor & Van der Bijl, 2018). Skills development in South Africa is governed by the Skills Development Act 97 of 1998 (South African Government, 2015). A TVET college is an essential part of today's artisan capacity training. Activities focused on artisan development remain critical, since 30,000 artisans are predicted to be in demand by 2030 (merSETA, 2020:40).

PC1 posited the following: "Industry are [sic] running short of artisans all the older artisans are retiring so the flow of new blood is slow" (Appendix ET1.1). In many cases, vocational education can be an effective way to bridge the gap between the curriculum in school and the workplace. Another argument is the use of vocational education to better align demand for local economic skills with supply (Allais, 2012). PL1 stated that: "we [are] still using the old syllabus CBMT, there are factories which assist TTC in giving exposure on the new technology" (Appendix CT1.1). The TVET colleges need to align the education syllabus to meet the current technology. Literature indicates that TVET teachers need to be retrained and upskilled in order to be equipped with the necessary knowledge and skills (Badenhorst & Radile, 2018; Wedekind & Mutereko, 2016). PL6 said that: "we only have 6 months with the TTCs at the college and the lack of technology advanced machine does not help" (Appendix CT1). Reform of the apprenticeship system related to skills development in the informal sector (Adams et al., 2013). Chapter 2, section 2.4 covers the system that the TVET colleges and government have used to develop skills by apprenticeship in South Africa. From previous decades they have worked with sector education and training authorities (SETAs) in order to develop artisans.

The TVET provides knowledge and skills that lead to employment (Gideon et al., 2022). In light of the current demand for specific skills and knowledge, as well as the labour market's

requirement for TVET colleges, institutions must develop programmes that promote whole youth development (Ngware et al., 2022). TVET colleges cover different aspects of training, starting from standard courses such the National Certificate (Vocational) (NCV) and the National Engineering Education (NATED) Certificate, which are covered within a period of six months to a year. The technical education and training programmes are post-secondary educational programmes that are practical and consist of technical abilities to perform a task or be supervisory in nature. They last from a month up to four or five years, and are typically post-secondary (Malek et al., 2022). Education, training and skills development related to a wide range of occupations, manufacturing, services and livelihood sectors are found in TVET colleges. People acquire skills and a wide range of knowledge and attitudes (UNESCO, 2019).

There are different approaches to supporting skills development and employability across countries (Tasli-Karabulut, 2019). According to Okon (2020), TVET colleges encompass both formal and informal education systems, where formal courses include NCV (Chapter 2; section 2.1.1) and formal courses such as NATED with a three-year duration, whereas informal courses involve small projects for skills development for the community. Short courses in community development start from Level 1, providing training for one to four days that includes practical work and apprenticeship. The apprenticeship covers theory for six (6) months and practical work in the field for 18 months.

This theme, *skills development*, addresses RSQ 1.3, which examines the process of undergoing a trade test. In the preparation of the trade tests, apprentices often face challenges, as P8 said, one of the challenges was that: “there is not enough time for trade test preparation” (Appendix BT1.8).

5.2.3 Employment opportunities

Traineeships have remained recognised as an operative device for levelling the transition for young people between school and workplace (OECD/ILO, 2017). The link between internship and workplace demonstrates business investment in learning (Mieschbuehler et al., 2015). Based on the analysis, TTCs are employed during apprenticeships, once completing the programme. However, of concern is that only a few TTCs are permanently employed. *Employment opportunities* answer RSQ 1.4, which focuses on determining the employability of the TTC. For example PC4 indicated the following: “We employ the student after they are completed with the apprenticeship” (Appendix D1.4). Apprentices who enrolled as an apprentice via a company indicated the willingness of companies to make investments in the apprentice programme. Bolli et al. (2021) posit that the education system where apprentices spend a lot of time in companies requires a high degree of cooperation between the educator and the employer. Actors such as apprentices work better than systems where education takes place only within educational institutions. Performance includes factors such as labour market

outcomes, from increased employment opportunities to fewer young people without education, employment or training. Businesses see this investment as a future benefit for the business. In some countries, apprenticeships are an important channel for companies to recruit new workers and to develop the necessary skills through work-based learning (Grollmann & Markowitsch, 2021). PT4 further explained by saying that: “what is needed is a link or connection between industry and colleges where some of the elements of workplace are addressed in order to save companies from retraining new artisans, which they will also save on training costs on the new systems they are using” (Appendix ET1.4).

The theme covers RSQ 1.5, which shows that TVETs comply with some elements when it comes to needs of the industry and that there are still improvements that need to be made. The problem is that low or a lack of employer participation in most TVET colleges creates a perfect mismatch between the skills and competencies that TVET schools offer and the skills and competencies required by the labour market (Darvas & Palmer, 2014). Some apprentices are still unemployed after passing the trade test, highlighting the challenges of getting employed because of the limited experience of the apprentices. Terblanche (2017) states that the contributing reasons for the high redundancy rates include the slowdown in the economy, non-responsiveness of syllabuses to industry requirements and the absence of TVET colleges’ capability to train industry-ready apprentices.

5.2.4 Curriculum alignment

There is constant change in the world and, as a result, curriculums need to meet the current needs (Kimario & Otieno, 2022). In most countries, curriculum planning priorities emphasise the importance of establishing a connection between education and the economy, especially in the context of small business economics and lifelong learning. The aim is achieved by adapting the training content not only to specific jobs of importance, but also to work clusters. Furthermore, moving workers from relevant fields of business and industry is needed, while aligning the needs of industry and market in order to achieve long-term cohesion at national, regional and global levels, as well as by improving the TVET curriculum (Musyimi et al., 2018). The research has found that the syllabus used by the TVET colleges is outdated.

PL2 stated that: “we still using the old syllabus, there are factories which assist TTCs in giving exposure on the new technology” (Appendix CT1). TVETs do not offer what is required by the industries, which supports the claims made by previous researchers. Responses received from a South African TVET college TTC indicate that many college programmes do not meet their expectations for hands-on training. There is a lack of coherence between colleges and industry as much as a theoretically dominated syllabus. The TVET industry still faces a number of challenges, including a lack of learning materials, large numbers of learners in classrooms and insufficient teaching staff (merSETA, 2020). There has been deterioration in the training of

artisans, and it is only now starting to pick up again, while colleges are still providing an outdated theoretical component of apprenticeship programmes (Terblanche, 2017). PC1 stated: “Industry are [sic] running short of artisans all the older artisans are retiring so the flow of new blood is slow” (Appendix ET1.1). PL1 supports Terblanche’s (2017) statement that syllabuses are outdated by stating that: “not all the material taught is relevant some of it is outdated” (Appendix CT1.1).

The Department of Higher Education and Training (DHET) (DHET, 2013a:1) deals with learning or development in a narrow range. They have limited learning of job skills and on-the-job training, and sometimes in a wide range. A programme of learning and teaching, according to Wotring et al. (2021), includes selected content, course organisation, assessment and tasks. Curriculum alignment refers to aligning instruction and assessment to programme goals (Kim et al., 2021). Much has been written about the curriculum for training people for the workplace at TVET colleges. Bringing together the interlocking elements of knowledge, skills, attributes, and behaviours for practice in the workplace presents issues for curriculation (Fuzzard, 2021). According to Fuzzard (2021:43), CBT (apprentice curriculum) often limit apprentices to those from working class backgrounds, leading to knowledge isolation, and “this simultaneously denies them epistemic access to the structures of knowledge relevant to their field.” The CBT approach requires the apprentice’s ability to develop in collaboration with the industry during the apprenticeship period in order to increase its relevance to the industry (Kanyonga et al., 2019). CBT is explained in Chapter 2, sections 2.5 and 2.6.

PC2 said that: “the syllabus does not relate, for example, we are using the recent technology even though we have the old machines and we do not use them on our new projects” (Appendix DT1.2). TVET curriculum development should include the participation of all stakeholders, including industry and employers, for an effective linkage between TVET curriculum and workplace behaviour and skills (Woldetsadik, 2012). PC4 explained how companies use the latest laser gauges whereas colleges are still using Vernier’s and ruler measuring techniques. PC5 mentioned that the training is related to the latest technology: “as we provide training if there are new machines or programmes” (Appendix DT1.5). According to Obwoge and Kibor (2016:23), “TVET curricula must focus on outcomes in terms of the skills, knowledge and attitudes required industry”. In other words, the supply of TVET training must meet the needs of the industry.

The theme addresses RSQ 1.5, which assess whether the skills provided in TVETs comply with the needs of the industries after the successful completion of the trade test. P5 said that: “apprentices must be tested on practical work problem-solving taught on industry which will be relevant to the companies and apprentices will be easily employed” (Appendix BT1.5). Okon (2020) argues that the reality is the need for assessment by interested groups in order to reveal

skill gaps among graduates in correlation with the industry demand. This argument is supported by the research, where it is clear that there is still a skill gap between the produced student and the expectations of the industry.

5.2.5 Funding

Funding is an important input into any educational system. Funding comes from the SETAs and the National Skills Fund for carrying occupational programmes such as learnerships, apprenticeships and short skills programmes (DHET, 2013b:7). It provides the essential purchasing power with which education acquires its human and material resources (Oviawe, 2018). TVETs offer skill-oriented programmes that require facilities for effective implementation, which involves huge amounts of money. TVET colleges are further hindered by a lack of admission to subsidised occupational qualifications from SETAs, which further restricts their capacity to reply to the moving labour market and student demands (Terblanche, 2017).

“Competency-based training is viewed as an expensive form of education to implement due to the fact that it needs a lot of materials for teaching and learning; hence, most of the colleges do not have enough training materials as required due to large intake of apprentices” (Anane, 2013; Kanyonga et al., 2019). Apprentices have highlighted insufficient resources in workshops and also shared concerns over the lack of support for them in their second attempt at the test as they lack funds. P11 said: “If the college can have working machines, buying more material for practical’s and use the funding in also extending the workshops” (Appendix BT1.11). Because of an inadequate subsidy, few lecturers can afford to update and equip their training workshops with the modern infrastructure, technology and equipment (DHET, 2013b). PL6 indicated that: “colleges does [sic] not have all financial aid to buy new technology machines convenience basis” (Appendix CT1.6). The funding depends on SETAs to allocate funds towards various units that need to be covered, similar to training costs, allowance for apprentices, personal protective equipment costs and trade test budget, etc. Funding is one of crucial point highlighted by participants.

The theme focuses on RSQ 1.1, which highlights funding as one of challenges faced for the TTC to have practising equipment, material and application fees in order to trade.

5.2.6 Resource deficiency

The theme relates to RSQ 1.1, showing the challenges apprentices are facing when attempting to do the trade test. Throughout the research conducted, inefficient resources appeared to be major problem from the students’ point of view. The lack of adequate and appropriate infrastructure and equipment in the facilities is an additional problem. A very poor situation is presented for most TVET colleges; some of the issues affecting many TVET colleges include outdated machinery and difficulty in placing graduates into industries. Lack of trained trainers to

deliver competency-based curricula, coordination issues between different ministries implementing TVET programmes, and limited involvement of identified development partners identification are problems. The TVET college programme is resource-intensive, including full faculty commensurate with the number of apprentices (Kanyonga et al., 2019).

P7 stated: “My challenge for not being competent on fitting was caused by not having a lecture at the college while we were on practical phases” (Appendix BT1.7). According to Masoabi (2017), the majority of TVET colleges lack the proper equipment and machinery to facilitate successful teaching of engineering programmes. Equipment and machinery, libraries, audio-visual equipment, housing and means of transport are still lacking. Collectively, this shortfall results in the production of graduates who are poorly educated and therefore cannot compete in their respective industrial sectors (Mushwana & Chiromo, 2020). This supports and resonates well with the findings of the research done here.

From the lecturers’ point of view, it is difficult changing to the latest technology because of funds. PL6 said that: “colleges does [sic] not have all financial aid to buy new technology machines convenience basis” (Appendix CT1.6). Obwoge and Kibor (2016) found that most technical schools need a lot of capital investment to be able to provide the necessary services to their apprentices. Obwoge and Kibor explain that not enough funding is invested in laboratory equipment and other learning resources. This study found the same results. In developing countries, limited budgets are one of the major challenges facing TVET institutions.

The result is that TVET institutions are unable to hire qualified teachers, assessors and verifiers, and cannot help them improve and enhance their qualifications or buy the most appropriate training equipment, aids and practical training technologies (Okelo et al., 2021). Several challenges remain for the TVET industry, including a lack of learning materials, large number of TTCs in classrooms and insufficient staffing of teachers (merSETA, 2020).

5.2.7 Behaviour

Self-management is defined as an individual’s ability to take responsibility for their own actions and behaviour related to self-management (Steyn, 2018). Good behaviour is the most important thing that students must maintain in order to achieve their goals. Rabae (2014:64) states that: “a personality with an individual is born with characteristics of its own. Some of these features are similar to the characteristics of the external or internal, unique and vary from one individual with another individual”.

PL2 articulated that: “apprentices are different as you find fast leaners and others apprentices who take their time” (Appendix CT1.2). According to a TTC who passed the test on their first attempt, they were exposed to different tasks in the field and when preparing for trade, which

made them positive when they were assessed. Mentoring-based interventions are widely used and increasingly popular to improve academic, behavioural and health outcomes (Schenk et al., 2019). A TTC mentioned that they have limited time available to prepare for the trade tests. This leads to nerves starting to play a role, and panic when taking the tests, resulting in a change in negative attitudes, and subsequently, failure. P11 mentioned: “Nerves under pressure and careless mistake made me fail for the 1st attempt Isolating and second attempt current transformers were it failed due to not following instructions” (Appendix CT1.11). To some extent, people often rely on their emotional response to situations or tasks to determine whether they can cope with them and succeed (Tadele & Terefe, 2016). Behaviour is one of the main challenges TTCs face when attempting to do the trade test, which addresses SRQ 1.1. TTCs panic and have difficulties concentrating, which affects their performance. Student personality influences social interactions in a school or higher education institutes and this, in turn, affects educational outcomes and training performance (Rabae, 2014).

There are some types of behaviour that people display when under stress that can be cured by verbal persuasion, verbal persuasion and emotional arousal (Teane & Gombwe, 2022:3). In terms of verbal persuasion, Teane and Gombwe (2022) explain how people must perceive social persuasion in stressful situations, and that they must also be equipped with mechanisms to handle them when faced with difficulty. TTCs and teachers can either motivate or demotivate each other depending on their behaviour. Teane and Gombwe (2022) explain how stressed individuals may perceive themselves as being less capable of coping with threatening situations. An arousal level so high that it debilitates performance is known as aversive arousal. When individuals do not experience extreme arousal, such as tension and visceral restlessness, they are likely to succeed. The fear response generates additional anxiety about an impending stressful situation through anticipatory self-stimulation.

5.2.8 Mentorship

According to Golele (2016:16), mentorship is: “the relationship between the experienced person and a person with less experience in a specific field of expertise”. In mentoring, mentees act as important friends who can speak openly about their experiences, fears and desires. Shandu (2016:10) posits that, “mentoring is a collaborative relationship where a skilled and professional person willingly gives their time to teach, support, and encourage a novice lecturer”. According to the Employer Mentoring Handbook (Plymouth University, 2016:9), mentoring is a one-to-one, long-term relationship between a professional (mentor) with experience, knowledge and understanding and students (mentees). Informal mentoring also takes place and includes informal knowledge transmission and psychosocial support perceived by the recipient as relevant to their job or profession (Cleary & Horsfall, 2015).

Mentoring in a TVET college is between lecturer/assigned workplace supervisor and a student, where a lecturer teaches a student how to read the work and motivates a student. Mentors in formal mentoring programmes are assumed to have rich and transferrable skills, trainees or apprentices, however, often have skill gaps that must be filled by their mentors (Woldetsadik, 2012). PC3 said that: “the exposure given to apprentices task assigned which they have to tackle on their own without supervising them” (Appendix BT1.12). Advice and positive suggestions from others can help regulate performance in areas that need improvement, which produce unsuccessful results (Tadele & Terefe, 2016). When apprentices are placed in industry, they are assigned mentors in industry, who are able to induct them into the work area and give guidance on problem solving. PC4 said that: “apprentices are exposed at the plant when working with mentors who guided them on tasks, explaining and making sure that apprentices understand fully” (Appendix DT1.4). For apprentices, on-site instruction is more important, which varies in quality depending on the type of organisation, size, sector, intangible culture and standards (Billett, 2014). Mentors assign tasks to the TTCs and, when they are trained, they are able to work alone. PC1 specified that: “with the exposure we have given them we can assign task that they can tackle on their own without supervising them” (Appendix DT1.1).

An apprenticeship programme is an essential training system based on a training agreement between an apprentice and a mentor or coach (Bass, 2017). Role model mentors are effective in enabling and influencing TTCs, allowing seamless integration of curriculum and workplace (Rowe, 2018). Based on the companies’ responses, PC2 mentor found that not all the apprentices placed by the college have the basic knowledge in order to the job, and that the apprentices need to be trained before they can perform any task. PC2 said: “I have noted that apprentices coming from the public colleges start from scratch with the basics” (Appendix DT1.2).

5.2.9 TVET and Industry 4.0

TVET colleges are gaining popularity in global debates and government priorities in education and national development (Marope et al., 2016). Specific industrial methods are changing rapidly in the face of emerging technologies (Okon, 2020). Industry 4.0 has fast-tracked the coordination between the information technology world and tertiary institutions with various industrial relations to reshape industries (Deloitte, 2018). The theme relates to RSQ 1.2, where the TVET curriculum is aligned to industry needs. According to PL2 and PL6, TVET colleges do not teach the current technology companies’ expect. To ensure a demand-driven transition in TVET education systems, the introduction of employer-demand-based curricula to meet labour market needs in similar African economies should be considered. Response remains an essential strategic and priority challenge. Therefore, TVET institutions need to establish partnerships with the business sector to help TTCs gain practical experience. This needs to be

done through internships, apprenticeships and job placements. and enables TVET institutions to identify emerging labour market needs and prepare TTCs to fill these gaps (Vaughan, 2017).

PT4 suggested that what is needed is a link or connection between industry and colleges where some of the elements of workplace are addressed in order to save companies from retraining new artisans, meaning that they will also save on training costs on the new systems they are using (Appendix ET1.4). PL2 stated that: “apprentices can only be able to apply the new technology machines if the company takes the apprentices for advance training on the machine. Some of the motors used at the college do not have the variable speed used on the latest technology” (Appendix CT1.2). PL6 also said that: “we only have 6 months with the apprentices at the college and the lack of technology advanced machine does not help” (Appendix CT1.6). During the Fourth Industrial Revolution (4IR), TVETs face the challenge of adapting to rapidly changing labour skills (Nurjanah, 2021). Three PCs (PC2, PC5 & PL2) provided their input of the technology that they work with and that is not provided by the colleges. PC2 posited that: “we are using recent technology we do have old machines we do not use them on the new projects” (Appendix DT1.2). PC 5 agreed with PL2 stating that: “the training is related to the latest technology we provide training for the apprentices if there are new machines or programmes” (Appendix CT1.2).

Currently, the TVET workforce lacks the skills necessary to compete in a progressively work-based economy (Thlomedi, 2018). University–industry collaboration can increase the pool of intermediate-level skills to a measurable level, especially among craftsmen, technicians and related professions (Kauppila & Mursula, 2015). Across South Africa, there is a mismatch between the skills that job applicants possess and the skill sets employers require. As Industry 4.0 technologies are adopted, the demand–supply gap will widen unless educational authorities increase the supply of science, technology, engineering and mathematics (STEM) graduates (Rasool & Rasool, 2020). According to the participant contributions, the participants are in line with the literature that indicates that there is a need for industry to collaborate with the TVET colleges.

4IR has changed the outlook for educational innovation. The rapid revolution in innovation has created another educational model for the future, Education 4.0 (Shahroom & Hussin, 2018). The possible new revolution goals are to produce openings for new roles that allowing people to partner their strengths with knowledge for better revolution, alternative environments and institutions (Deloitte, 2018). Industry 4.0 is expressively attracting a place in the higher education system (Wan Chik & Arokiasamy, 2019). The empirical TVET model appears to be the most consistent contributor to supporting Industry 4.0’s highly efficient and effective talent development (Gennrich & Dison, 2018). This guarantees professional skills related to the latest technology and facilitates the transition to employment.

5.2.10 Monitoring and evaluation

Monitoring and evaluation (M&E) assists TVET colleges to improve in order to prepare competent artisans and ensure a higher pass rates in trade test. PL3 said that: “they are doing monthly company monitoring visits” (Appendix CT1.3). By monitoring, lecturers are able see work related task they doing and can introduce in classrooms in order to align the curriculum.

The M&E system is a management toolkit that allows decision makers to track progress and show the impact of a particular programme project (Chebet, 2021). Globally, the implementation of M&E has not been entirely successful in bringing about the desired outcome of projects (Tengan et al., 2021). The theme *M&E* addresses RSQ 1.5 regarding to the skills compliance in terms of the alignment to industry’s needs. In the TVET system, M&E can focus on the services, plans and resources allocated, along with the outcomes expected from each TVET institution (Woldetsadik, 2012). Three PLs (PL3, PL4 & PL5) shared that most of the time, monitoring of companies is conducted, which assists in spotting the problems that occur in the industry and communicate that back to what apprentices need to be exposed to. In order for TVET colleges to have compliant candidates with skills and knowledge to meet industrial demands, TVET colleges need to use the system, which will assist in improving their performance. PT3 said that: “TVET colleges must monitor apprentices from company side making sure what is done at the college is implemented and for working apprentices there’s a centre of specialisation were lecturers communicate with companies and do check-ups on work that is being done industry is implemented at colleges” (Appendix ET1.3). The TVET colleges have the system in place to align industry’s needs where they can implement M&E.

PL6 shared a different point of view: “Very seldom we don’t have enough time to spend in industry to see what problem occur”. The lack of adequate monitoring and evaluation systems makes it impossible for trainees to provide feedback on the quality of training they have received. This can hamper the implementation of TVET strategies and programmes (Woldetsadik, 2012).

5.11 Summary

The aim of the research was to explore the factors that affect the high failure rates of TTC at TVET institutions. The research questions, results and discussion of the observed data were related to the themes, specifically: i) career development; ii) resource deficiency; iii) skills development; iv) behaviour; v) funding; vi) mentorship; vii) curriculum alignment; viii) M&E; ix) TVET and Industry 4.0; and x) employment opportunities. Themes have been developed in assist with answering the RQ and RSQs.

The theme *career development* addresses research objective 1.2. TVET colleges need improve preparing competent artisans and ensure a higher pass rate in trade test. According to Finding

23, all the PLs agreed that apprentices have the basic knowledge to do the job, and apprentices have not been exposed to all aspects they need for artisanship when placed in industry. The findings show that more knowledge is gained during work-base experience, while colleges give the apprentices basic training. Apprentices reported inefficient resources to be a major problem from the students' point of view, which is called *resource deficiency*. This theme relates with RSQ 1.1 and has shown the challenges apprentices are facing when attempting to do the trade test. One of the issues faced by apprentices is a lack of resources. The findings show that lecturers are available to assist apprentices with preparing for the trade tests. Another research finding revealed a lack of material, equipment and adequate infrastructure in the workshops for trade test training and preparation, which is seen as a key cause of apprentice failure.

The theme *skills development* addresses the challenges TVETs are facing to ensure that they prepare a fully compliant candidate with skills and knowledge to meet industrial demands. The research revealed that apprentices placed by TVETs do not have the basic knowledge to do the job; however, the 18 months practical knowledge given in the workplace prepares them sufficiently to be qualified artisans. Despite the gained knowledge at TVETs, there is still a gap in the training at TVETs and what is needed in industry. The theme *behaviour* addresses RSQ 1.1, which is all about self-control. Based on the study findings, apprentices become nervous, panic and ignore assessment instructions. The theme *funding* addresses RSQ 1.1, the challenges apprentices are facing when attempting to do the trade test. On funding, apprentices have highlighted insufficient resources in workshops and shared concerns over the lack of support that they receive for their second attempt because they lack funds. The findings for the theme *mentorship* indicate that apprentices are placed in the industry and assigned to a mentor, who exposes and guides them in all areas of the workplace.

The *curriculum alignment* theme addresses RSQ 1.5, which assesses whether the skills provided in TVETs comply with the needs of the industries after the successful completion of the trade test. Study findings show that TVET colleges use outdated syllabuses. The theme *monitoring and evaluation* addresses RSQ 1.5, the skills compliance in terms of the alignment to industry's needs. According to the study, the TVETs have a monitoring system that allows them to track student performance. The theme *TVET and Industry 4.0* relates to RSQ 1.2, where TVETs' curriculum is aligned to industry needs. The research shows that TVET colleges lack modern machines and technology. The *employment opportunities* theme relates to RSQ 1.4, employability of the TTC. Companies see this investment as a future benefit for the company. Research has shown that most TTCs are being employed after passing their trade tests.

Chapter 6 addresses the conclusions and recommendations from the research.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

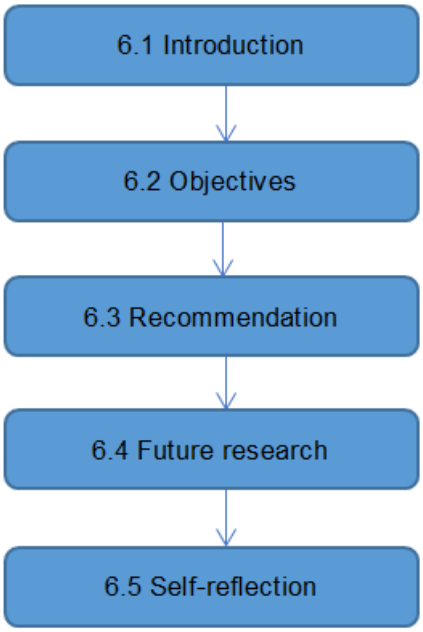


Figure 6.1: Layout of Chapter 6

6.1 Introduction

In this chapter, the researcher presents the conclusions and recommendations of the study. The relevance to the research aim and research questions, as well as the benefits and contribution, will also be addressed. Opportunities for future research will be identified, along with a self-reflection.

The aim of the research was to explore the factors that affect the high failure rates of trade test candidates (TTCs) at technical and vocational education (TVET) institutions. There is a high failure rate of trade tests by TTCs, which is causing damage to the country's skills development initiatives. The processes of training at TVET colleges explored the technical operations that the TTCs undergo before becoming qualified.

6.2 Conclusions

i) Before artisans can undergo a trade test, they need to be fully prepared in terms of practising and knowing all the techniques needed for the test. Unfortunately, the results show that the TTCs need more practise, focus and preparation for the trade test.

ii) Skills development reports show that during the early years of TVET, the system was unable to produce sufficient numbers of qualified artisans to meet the National Artisan strategy plan, which stands at 30,000 per annum. As a result, the skilled artisan positions are filled by people coming from other countries. There has been a misalignment

between the supply and demand of the required skills; what the TVET colleges teach is different from the industry.

iii) Resource deficiency, such as the unavailability of instructors in the artisan programmes and a shortage of material, are challenges faced by the test candidates when preparing for the trade tests. A shortage of senior artisans to act as mentors and lecturers is also contributing to the shortage of skilled artisans. Seniors employees in the industry are retiring and leaving the trade, taking their knowledge and experience with them.

iv) Only five (5) of 12 artisans passed the trade test at their first attempt. One of the reasons for this low pass rate lies with human behaviour, where the TTCs become nervous and under the high pressure, because they do not have the skills to cope in this environment. As a result, they make careless mistakes and fail. More focus should be placed on this aspect of the training.

v) Funding is a challenge for TTCs. It is concluded that preparations for artisans for assessment and re-assessment is lacking. TTCs who have failed shared their experiences about having to pay for reassessments, which they cannot afford. The training machines at the TVETs are different from those being used in the trade test environment. This is basically because of a lack of funding at the TVET institutions. The TTCs are not given enough preparation time at the centre as they need to align machines to what they are used to. To do this, they also need to pay for the preparations at the centre before trade testing in order to familiarise themselves with the machines.

vi) The curriculum alignment between the TVETs and Industry 4.0 is misaligned and a major factor affecting the pass rates. Industry training and requirements differ from what is offered in TVETs. The gap is even worse as the TTCs are taught one thing at work and assessed on something else at the trade test centres. The research has shown that the TVET college curriculum is not aligned to industry, because the system used by TVET colleges is outdated. The curriculum falls short of exposing TTCs to all the aspects they need to pass the trade test in order to be placed in industry.

vii) The companies do not offer what is indicated in the logbook and what they are doing on a daily basis, showing that TVETs need to restructure what they do to be of relevance to current trends in the industry. Despite having basic knowledge from college, artisans must be retrained by the industry mentor. The industry trains TTCs for 18 months, but the outdated syllabus makes the gap too large. The TVET colleges are still using the old machinery, whereas industry has updated technology. Artisans are provided with training on the latest technology by mentors from the companies. The introduction of new technologies also created misalignment in that the trainers are not being exposed to the technology and are then not able to train the TTCs in the technology used by the trade at large.

viii) Artisans are being assigned to supervisors (mentors) who train students by giving them exposure to the work environment. The artisans are also mentored by lecturers showing them tools and the basics of operating machines in practicals.

ix) When artisans are placed in industry, they are being monitored by lecturers who check on the exposure they are given.

x) Most of the TCCs who passed the trade test are being employed by some of the companies into the trade tested field, while, in some cases, companies have stopped employment because of the recession.

6.3 Aim of the research

The aim of the research was to explore the factors that affect the high failure rates of TTCs at TVET institutions. The research posed the following main question: What are the factors that affect the failure rate of TTCs in TVET colleges? The challenges and factors affecting the TTCs when attempting the trade test, as revealed by this research, are summarised as findings in Chapter 4, section 4.3, Table 4.6.

6.4 The objectives of the research

i) *Examine the challenges TTCs face when they attempt to do the trade test:* The research has revealed the challenges when TTCs attempt trade tests, which originates from the learning processes, i.e., some of the aspects of the trade test are not covered by the TVET colleges, and there is a shortage of resources needed by the students to prepare for the trade. Some of the challenges are based on the TTCs' behaviour.

ii) *Assess whether the curriculum provided by TVET complies with the needs of the manufacturing and service industries:* The research has shown that the curriculum provided by the TVET colleges is outdated. It does not comply with the needs of industry.

iii) *Determine the learning processes to assist TTCs in passing their trade test:* Through the learning processes, the research has identified: i) a lack of resources and lecturers; ii) in preparation of trade tests, the TCCs need to fill the gaps that they were not taught in industry; and iii) the TCCs must try to familiarise themselves with the equipment at the centre, which differs from the TVET college and work environment. According to the research, most of the TTCs are being employed after qualifying for the trade test, but they still need more exposure in the field so that they can be competent and able to solve problems according to the field processes.

iv) *Assess whether the skills provided by the TVETs comply with the needs of industry after TTCs successfully completed their trade test:* The research has shown that the skills and knowledge provided by the TVETS do not relate to industry's needs as it is outdated. Despite the knowledge gained at TVETs, there is still a gap in the training

TVETs offer. What is needed by industry is not supplied by TVET institutions. The TVET colleges need to take into consideration the current methods and machines that industry is using and align it to the curriculum the offer. In the economic climate that is prevailing, funding is becoming scarcer and this places stress on TVET colleges, preventing them from keeping up with new technology developments. As a result of the lack of funding, test candidates are underprepared, or even worse, they are incorrectly prepared for the trade tests.

6.5 Recommendations

Based on the findings, the following recommendations are made:

i) A TVET and private sector partnership should be encouraged to ensure effective development of the training programmes necessary for TVET artisans to gain exposure of new technologies. By having a partnership, the sharing of tools and equipment between TVET institutions and industries will help keep TVETs up-to-dated with the changes taking place in industry.
ii) The curriculum needs to be revisited with all the stakeholders involved.
iii) More capital needs to be raised. Capital should be raised from government and industry. The capital should be allocated for the latest technology and training needs.
iv) More time needs to be allocated to prepare TTCs for the trade tests.
v) A mentoring programme needs to be developed and implemented.
vi) Artisans' emotional needs must be taken care of.
vii) TVET lecturers must be trained on the latest technology.
viii) There must be workshops between TVETs and industry to benchmark what industry uses and relate the trade test to what TTCs learn in the workplace.

6.6 Future research

More research is needed on the partnership between TVET colleges and industry. Additionally, the emotional and behavioural aspects of the TTCs need to be explored.

6.7 Self-reflection

With time management, I was focused from the start. During the data collection process, I faced challenges due to COVID, and had to postpone some of the interviews while waiting for the country to normalise COVID regulations so I could continue collecting data. In most cases, the participants approached were willing to share their experience in trade tests and the processes used when undergoing a trade test, from which I have learned a lot. Another challenge I encountered was that there were but a few journals that discussed TVET colleges and artisan jobs, which made it difficult to relate to them. Throughout my research study, I was guided and motivated by my supervisor.

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Appendix A: Consent letters

WEST COAST COLLEGE
WESKUS KOLLEGE

Date: 10.07.2019

I Nomathemba Dapula in my capacity as Deputy Principal Academic at West Coast College give consent in principle to allow Vuyiseka Sityoshwana no 208158243 a student at the Cape Peninsula University of Technology (CPUT), to collect data in this company as part of his/her Master of Technology research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate).

	Thesis	Conference paper	Journal article	Research poster
Yes	✓			
No				

Nomathemba Dapula

10.07.2019

Northlink College
The Education Connection

I Xola Lennon Ncate, in my capacity as Acting Program Manager at Northlink College give consent in principle to allow Vuyiseka Sityoshwana, a student at the Cape Peninsula University of Technology, to collect data as part of her M Tech Business Administration research. The student has explained to me the nature of her research and the nature of the data to be collected. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No	✓	✓	✓	✓

Xola Ncate

05/08/2020

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

INFORMAL SETTLEMENT, WATER & WASTE SERVICES
WATER & SANITATION

Siyabonga Manyamalala
Professional Officer

T: +27 21 400 6673 F: 021 918 7480 M: 067 6188938
E: Siyabonga.manyamalala@capetown.gov.za

Date: 17/07/2019

I **Siyabonga Manyamalala**, in my capacity as **Professional Officer** at City of Cape Town give consent in principle to allow **Vuyiseka Vuyokazi Sityoshwana,** a student at the Cape Peninsula University of Technology (CPUT), to collect data in this company as part of his/her Master of Technology research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate).

	Thesis	Conference paper	Journal article	Research poster
Yes	√	√		
No				

Siyabonga Manyamalala

17/07/2019

DELTA REWINDS

SPECIALIZING IN AC/DC, FORKLIFT MOTOR REPAIR AND SUBMERSIBLE PUMPS

I Stephen Jacobs , in my capacity as Director at Delta Rewinds give consent in principle to allow Vuyiseka Sityoshwana, a student at the Cape Peninsula University of Technology, to collect data in this company as part of his MTech (Business Administration) research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

Research will be done on the time and dates as agreed with the student.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No				

Stephen Jacobs

24/04/2020

35 Glenhurst
Beaconvale

Parow

Telephone: 021 931 4597 or 7160
Fax: 021 931 3669
Web: www.apeengineering.co.za

AFRICAN PRESSING EXPERTS

ENGINEERING SERVICES

To: Cape Peninsula University of Technology

From: Clive Barnes (Director: African Pressing Experts)

Subject: Consent Letter

Date: 26 May 2020

I Clive Barnes, in my capacity as Director at African Pressing Experts give consent in principle to allow Vuyiseka Sityoshwana, a student at the Cape Peninsula University of Technology, to collect data in this company as part of his MTech (Business Administration) research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

Research will be done on the time and dates as agreed with the student.

In addition, the company's name may or may not be used as indicated below.

(Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No				

26.05.2020

Clive Barnes

I Elijah Mhlongo in my capacity as Technical Manager at Transnet give consent in principle to allow Vuyiseka Sityoshwana, a student at the Cape Peninsula University of Technology, to collect data in this company as part of his MTech (Business Administration) research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

Research will be done on the time and dates as agreed with the student.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No				

Elijah Mhlongo 2020/06/03

Appendix B: Trade Test Candidate Interview Questions

Semi-structured-Interview Guide

Interview schedule:

In South Africa, artisan skills are very scarce which has resulted in the government to implement target for artisan needed which about more than 30 000 artisans must qualify every year. Through those processes of producing artisan, there are challenges that occur before the target can be reached most artisan candidates fail the trade and have to repeat before they qualify in becoming a fully qualified artisan. The study will be investigating the Factors effecting the failure rate of trade test candidates in Technical Vocational Educational Training colleges.

The aim: The aim of the research to explore the factors that affect the high failure rates of TTC of TVET institutions. The research also explores how artisans can improve their competency and be better qualified to do the work.

We are kindly requesting answers to the questions listed below in your good faith. Your answers will be used specifically for this study purposes only and they will be treated with the highest degree of confidentiality and privacy. Also, participation in this interview is voluntary and allows anonymity as well as autonomy.

Section A: participant's details

Year of Trade:_____ Trade: _____	Date:_____ Work occupation:_____

RQ1: What are the main factors that affect the failure rate of the engineering trade test in TVET colleges?		
SQ1.1 What are the challenges students are facing when attempting to do the trade test?		
IQ 1.1 .1 Have you received enough training, to prepare you for the trade test. Comment: If yes, why? If no, why not?	Yes	No
IQ 1.1.2 How many times have you taken the trade test? Comment: Please mention the tests that you have failed. Please mentions how many times have attempted to pass the specific tests.	1st attempt	2nd Attempt
	3rd Attempt	4 or More Attempts
IQ 1.1.3 Which task did you struggle with and why? Comment:	Drawing Analysis	Calculations
	Practical	
IQ 1.1.4 Why do you think you struggled with the task? Comments:		
IQ 1.1. 5 Is material used at the trade test centre differs from the one that the college trains you on? If yes Explain how? Comments: If yes, why? If no, why not?	Yes	No
IQ 1.1.6 How would you describe the mentor/ facilitator support you have received in preparation for your test?	Excellent	Good
Comment: Explain why you give the chosen answer	Fair	Poor

IQ 1.1.7 Do you think you're getting enough information before your training on what to expect? Comments: If yes, why? If no, why not?	Yes	No
IQ 1.1.8 Is there any support after failing the trade test? Comments: If yes, why? If no, why not?	Yes	No
IQ 1.1.9 What support do you think should be given to trade test candidates after failing initially? Comment:		

RQ 1.4 How is the employability of the trade test candidate graduates?(Student)		
IQ 1.4.1 Are you currently employed? **Comment:** If yes, why? If no, why not?	Yes	No
IQ 1.4.2 Is the worked that you are employed for related to the trade you have qualified in? **Comment:** If yes, why? If no, why not?	Yes	No
IQ 1.4.3 How many years/months did you take to get a job after you qualified? **Comment:** Explain your answer.	Less than 1 year	More than 1year

Thank you for your time and patience in answering these questions. Your contribution is highly appreciated.

Appendix C: Lecturer Interview Questions

Semi-structured- interview guide

Interview schedule:

Introductory remarks:

In South Africa, artisan skills are very scarce which has resulted in the government to implement target for artisan needed which about more than 30 000 artisans must qualify every year. Through those processes of producing artisan, there are challenges that occur before the target can be reached most artisan candidates fail the trade and have to repeat before they qualify in becoming a fully qualified artisan. The study will be investigating the Factors effecting the failure rate of trade test candidates in Technical Vocational Educational Training colleges.

The aim: The aim of the research to explore the factors that affect the high failure rates of TTC of TVET institutions. The research also explores how artisans can improve their competency and be better qualified to do the work.

We are kindly requesting answers to the questions listed below in your good faith. Your answers will be used specifically for this study purposes only and they will be treated with the highest degree of confidentiality and privacy. Also, participation in this interview is voluntary and allows anonymity as well as autonomy.

Section A: participant's details

Name: _____ surname:_____ Position: _____	Date:_____ Contact No:_____

Section B: Questions

SRQ1.2 How is the TVETs curriculum aligned with industry needs?	Lecture
IQ 1.2.1 Are the students that are placed by the college having the basic knowledge in order to do the job? Comment: If yes, why? If no, why not?	
IQ 1.2.2. Is the practical knowledge for 18months given to the trade test candidate at the workplace enough to be a qualified artisan? Comment: If yes, why? If no, why not?	
IQ 1.2.3 Is the current syllabus taught at colleges relevant to the latest technology used by industry? Comment: If yes, why? If no, why not?	
IQ 1.2.4 Will the students be able to apply the knowledge gained at the college to the latest technology provided by industry? Comment: If yes, why? If no, why not?	

IQ 1.2.5 Are the students capable to work under pressure and complete work on time when solving problems? Comments:
SRQ 1.3 How can TVET institutes improve preparing competent artisans and ensure a higher pass rates in trade test?
IQ 1.3.1 How often does the college benchmark with the industry by involving problem solving done by industry in activities given to students? Comment:
IQ 1.3.2 Are there any workshops conducted by the industry, or student's exposure given in order to align the syllabus with the latest technology? Comment: If yes, why? If no, why not?

Thank you for your time and patience in answering the questions. Your contribution is highly appreciated.

Appendix D: Company Interview Questions

Semi-structured-Interview Guide

Interview schedule:

Introductory remarks:

In South Africa, artisan skills are very scarce which has resulted in the government to implement target for artisan needed which about more than 30 000 artisans must qualify every year. Through those processes of producing artisan, there are challenges that occur before the target can be reached most artisan candidates fail the trade and have to repeat before they qualify in becoming a fully qualified artisan. The study will be investigating Factors effecting the failure rate of trade test candidates in Technical Vocational Educational Training colleges.

The aim: The aim of the research to explore the factors that affect the high failure rates of TTC of TVET institutions. The research also explores how artisans can improve their competency and be better qualified to do the work.

We are kindly requesting answers to the questions listed below in your good faith. Your answers will be used specifically for this study purposes only and they will be treated with the highest degree of confidentiality and privacy. Also, participation in this interview is voluntary and allows anonymity as well as autonomy.

Section A: participant's details

Name: _____ surname:_____ Position: _____	Date:_____ Contact No:_____

Section B: Questions

RQ 1.4 How is the employability of the TTC graduates?		
	Yes	**No**
IQ 1.4.4 Are there any apprentice TTC employed by the company? Comment: If yes, why? If no, why not?		
IQ 1.4.5. How do you find the knowledge they have gained; can they work on a task without being supervised ? Comment:		
SRQ 1.5 What are the possible challenges TVET's are facing to ensure they prepare a fully compliant candidate with skills and knowledge to meet industrial demands?		
IQ 1.5.1 Do the students that is placed by the college have the basic knowledge in order to do the job? *Comment:*		

IQ 1.5.2 Is the practical knowledge of 18 months given to the TTC at the workplace enough to be a qualified artisan? Comment:
IQ 1.5.3 Does the syllabus of the TVETs relate to the latest technology used by industry? *Comment:*
IQ 1.5.4 On the newly qualified artisan, what is your opinion on the exposure they have gained and is it enough? *Comment:*

Thank you for your time and patience in answering the questions. Your contribution is highly appreciated.

Appendix D: Trade test Practitioner Interview Questions

Semi-structured-Interview Guide

Interview schedule:

Introductory remarks:

In South Africa, artisan skills are very scarce which has resulted in the government to implement target for artisan needed which about more than 30 000 artisans must qualify every year. Through those processes of producing artisan, there are challenges that occur before the target can be reached most artisan candidates fail the trade and have to repeat before they qualify in becoming a fully qualified artisan. The study will be investigating Factors effecting the failure rate of trade test candidates in Technical Vocational Educational Training colleges.

The aim: The aim of the research to explore the factors that affect the high failure rates of TTC of TVET institutions. The research also explores how artisans can improve their competency and be better qualified to do the work.

We are kindly requesting answers to the questions listed below in your good faith. Your answers will be used specifically for this study purposes only and they will be treated with the highest degree of confidentiality and privacy. Also, participation in this interview is voluntary and allows anonymity as well as autonomy.

Section A: participant's details

Name: _____ surname:_____ Position: _____	Date:_____ Contact No:_____

Section B: Questions

RQ1: How can the failure rate of trade test candidate's affect Technical and Vocational Education and Training (TVET) colleges and economy of the country		
	Yes	**No**
IQ 1.10 Do you think there's a high failure rate for trade test candidate? Comment: If yes, why? If no, why not?		
IQ 1.1. 11 What is the cause of the high rate failure in your opinion? Comment:		
SRQ 1.3 How can TVET institutes improve in preparing competent artisans and ensure a higher rate in trade test pass?		
IQ 1.3.1 *Do you think colleges are capable of producing qualified candidates based on the performance?*	Yes	No

Comment: If yes, why? If no, why not?
IQ 1.3.2 How can colleges prepare the students to do better? Comment: If yes, why? If no, why not?
SRQ 1.5 What are the possible challenges TVET's are facing to ensure they prepare a fully compliant candidate with skills and knowledge to meet industrial demands?
IQ 1.5.5 How does the failure rate of students affect the industry?

Thank you for your time and patience in answering the questions. Your contribution is highly appreciated.

Appendix E: Ethical Clearance

Cape Peninsula University of Technology

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 4603291 • Email: fbmsethics@cput.ac.za
Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	Faculty: **BUSINESS AND MANAGEMENT SCIENCES**

The Faculty's Research Ethics Committee (FREC) on **12 September 2019**, ethics **Approval** was granted to **Vuyiseka Sityoshwana (208158243)** for research activities of **M Tech: Business Administration** at Cape Peninsula University of Technology.

Title of dissertation/thesis/project:	FACTORS EFFECTING THE FAILURE RATE OF TRADE TEST CANDIDATES IN TECHNICAL VOCATIONAL EDUCATIONAL TRAINING COLLEGES Lead Supervisor (s): Dr A de le Harpe

Comments:

Decision: Approved

Signed: Chairperson: Research Ethics Committee	**12 September 2019** **Date**

Appendix F: Memorandum of Understanding (MOU)

Cape Peninsula University of Technology

MEMORANDUM OF UNDERSTANDING BETWEEN POSTGRADUATE STUDENT AND SUPERVISOR

We, the undersigned, have read and agree to the general terms of the CPUT Memorandum of Understanding (MoU)* between research students and supervisors, and submit the following additional points of agreement in relation to the details of the intended work.

**Notes on MoU provided on page 5 of this document*

Research programme:

Post-doctoral	Doctoral	100% Masters	50% Masters

1. STUDENT DETAILS:

Full name of student:	**Vuyiseka Vuyokazi Sityoshwana**
Student number:	208158243
Full-time or part-time:	**Part-Time**
Dissertation/ thesis title: ***Factors effecting the failure rate of trade test candidates in Technical Vocational Training Colleges***	
Email:	sityoshwanav@gmail.com
Telephone no:	073 028 0204
Faculty:	Business and Management Science

2. SUPERVISOR DETAILS:

Title, Initials, Surname:	DR .de la Harpe
Staff no:	30003224
Telephone no:	0824481058
Faculty:	Graduate Centre of Management
Department or Unit:	

3. SUPERVISOR'S EXPECTATIONS AND ARRANGEMENTS

Supervisor's expectations:
After discussion, the supervisor should set out what he/she expects of the student in terms of reaching certain milestones or goals during the course of the research.
Expected date of submission of HDC 1.2 to FRC which should be within 6 months of initial registration: 13.09.2019
Other expected milestones or goals: Complete thesis by December 2020

1

Supervisor's plans and commitments:
The supervisor should record his/her plans for providing supervision, including the pattern and intended frequency of meetings, contributions from other researchers etc:
To meet with student once weekly if needed.
Supervision arrangements:
(a) Expected absence of supervisor(s) on leave/ sabbaticals/ conferences (giving arrangements for supervision if away for more than 2 months in any one year)
No leave planned for period. If absent will use skype and email
(b) Field work: Outline arrangements for field work:
Visits will be co-ordinated with well planned activities with industry as and when needed.
(c) Laboratory work:
None
(d) Outline lab arrangements (if any) and supervision arrangements for lab work:
None
(e) Estimated timing of formal seminars:
Once every quarter if needed.
(f) Access to computers and software:
None
(g) Responsibility for payment of costs (printing, stationary, copying, etc):
For students
(h) Any departmental commitments by the student and details of remuneration:
None
(i) Courses and classes: List any class, workshop or course that the student must attend as a pre-requisite and costs associated with this. Clarify the responsibility for costs associated with these (if any).
As when needed

Co-Supervisory roles (if applicable): The role of co-supervisors should be clarified. It should be noted that any co-supervisory suggestions and proposals by the student should be discussed with the supervisor.
None

Funding plans: Specify any approved financial assistance to be provided, or organized, by the supervisor(s) to support this study (e.g. bursaries, teaching allowance etc.).
None
If, on withdrawing or being refused re-registration, the student becomes contractually obliged to repay any of the above, **this should be noted.** Funding from external agencies may stipulate such a provision.
None

4. EXPECTATIONS AND PLANS OF THE STUDENT

After discussion, the student should set out any expectations and requests to the supervisor and the department	
I expect to complete my research at the agreed time frame with my supervisor. I will require assistance in selecting and securing the consent and participation of required organisations for the study. I will also require financial assistance to cover the cost of case study if available.	
Comment by the supervisor on this:	
Approved	
The student and supervisor should record their agreed plan and broad timetable for the completion of the thesis/ dissertation. The candidate should be informed on the Faculty's maximum time limits for completion.	
Done	
Agreed intended date of completion:	**December 2020**

5. INTELLECTUAL PROPERTY ISSUES AND ETHICS

Intellectual property: CPUT policy on intellectual property (IP) is available on request. Students and supervisors should make themselves aware of University policies relating to both ethics and IP.
(a) Authorship: Points on authorship must be noted here by the supervisor, including arrangements about the order of listing of co-authors:

Student first author, supervisor second and co supervisor third. If supervisor writes be article his name will be first
(b) Ownership of intellectual property rights developed in the course of the research: The IP emanating from research conducted at CPUT is (in general) owned by the University but additional points on this to be noted below:
Correct
(c) Patents: Should any patents emanate from this study, in whose name(s) will this be registered.
Correct

Assessment of ethics in research: The supervisor and student should discuss the ethical issues involved in the research project and record their conclusions here. The student should confirm here that she/ he is aware of the requirement to complete and submit an ethics form prior to collecting or analysing data.
I Vuyiseka Vuyokazi Sityoshwana aware of the requirement to complete and submit an ethics form prior to collecting or analysing data.

6. SIGNATURES:

Student signature:		Date: 13-09-2019
Supervisor signature:		Date: 06 / 11 / 2019

7. CONFIRMATION BY THE HoD

I have reviewed this completed MoU and am satisfied that it reflects the shared understanding of the supervisor and the student and that the department is able to meet the obligations to candidates set out in this MoU:

Name:	Prof Stephen Hosking
Signed:	
Date:	6/11/19

Appendix B

Appendix B Code Analysis Students.xlsx

Appendix C

Appendix C Lectures.xlsx

Appendix D

Appendix D Code Analysis Company....xl

Appendix E

Appendix E Code Analysis Trade Test p

Appendix F

Appendix F RQ and Themes.xlsx

Appendix G: Editing Certificate

11 November 2022

VUYISEKA VUYOKAZI SITYOSHWANA
Faculty of Business and Management Sciences
Cape Peninsula University of Technology
Cape Town Campus, Cape Town

CERTIFICATE - EDITING OF MASTER'S THESIS

I, the undersigned, herewith confirm that the editing of the Master's thesis of Vuyiseka Vuyokazi Sityoshwana, *"FACTORS THAT AFFECT THE FAILURE RATE OF TRADE TEST CANDIDATES IN TECHNICAL AND VOCATIONAL AND TRAINING COLLEGES IN CAPE TOWN, SOUTH AFRICA",* has been conducted and concluded.

The finalised thesis was submitted to Vuyiseka Sityoshwana and cc'd to Dr de la Harpe on 11 November 2022.

Sincerely

Professor Annelie Jordaan
DTech: Information Technology
Ph: 065 990 3713

Member: SATI 1003347

South African Translators' Institute (SATI)