International Journal of Learning, Teaching and Educational Research
Vol. 22, No. 5, pp. 674-687, May 2023
https://doi.org/10.26803/ijlter.22.5.35
Received Mar 15, 2023; Revised Apr 15, 2023; Accepted May 25, 2023

Understanding the Demand for Industrial skills through the National Certificate (Vocational) Building and Civil Engineering Programme

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Abstract. The Ministry of Higher Education and Training has significantly transformed the technical and vocational education and training sector to respond to socio-economic ills such as poverty, unemployment and inequalities. With the mission of the White Paper for Post-School Education and Training, TVET programmes are prioritised as a significance in responding to societal challenges by offering skills that are aligned to industry to enable youth and young adults to successfully enter the industry for their sustainable livelihoods. This study provides a critical analysis on alignment of the National Certificate (Vocational): Building and Civil Engineering programme) offered by TVET Colleges. This article is based on a case study of two vocational training institutions in Mpumalanga Province, South Africa. A qualitative research approach was followed. The article used interviews and observations as data collection tools. The population for the study consisted of ten TVET teachers. The data were analysed by transcribing the data, coding, and thematic discussion using thematic analysis. The study's findings show that the NCV: Building and Civil Engineering programme is not aligned with the industry, as the workshop's practical training is given inadequate time. The NCV: Building and Civil Engineering programme contains too many theoretical sections. The theoretical part is mainly offered to the students rather than hands-on practical training. The study concludes that the TVET sector faces challenges to meet the demand for industrial skills. This study recommends that the NCV program be evaluated urgently to address this issue and to ensure that it remains aligned with industry.

Keywords: inadequate exposure**;** insufficient resources**;** curriculum review; alignment

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1. Introduction

One of a number of technical and vocational education and training-based programmes, the National Certificate Vocational (NCV) is designed to meet the modern economy's priority skill needs. This programme offers a range of skills including engineering, information technology, commerce and hospitality. The NCV Building and Civil Engineering is one of the few programmes that has made a substantial contribution to the domains of design, craftsmanship, and production (Schmidt, 2017). It has also promoted growth in developing countries for many years. Against this backdrop, the NCV: Building and Civil Engineering programme has had a major impact in the past, making life and work more effective and efficient. Therefore, the alignment of NCV: Building and Civil Engineering is especially important, and the TVET colleges programmes must adapt to the needs of the industry.

Upon introduction of the NCV programme, the South African department of higher education and training (DHET) envisaged that NCV: Building and Civil Engineering would make a huge contribution to the country's economy by supplying relevant skills that are aligned with industry in the priority trades like carpentry, bricklaying and plumbing. On the one hand, this is not happening as DHET had envisaged. For instance, research studies revealed that TVET colleges fail in their quest to supply the industry with an adequately qualified labour force to enter the industry (Windapo, 2016). It is not surprising to see such trends, as Ismail & Abiddin (2014) declared that a lack of skilled labour has become a worldwide issue.

Another point worth noting is that of scholars such as Makgato and Moila (2019) who argue that South Africa's TVET programme fails to align with the changing needs of the industry. This reasoning justifies the present study, which seeks to understand the demand for industrial skills through the National Certificate (Vocational) Building and Civil Engineering Programme. Most studies have been somewhat short-sighted in this approach when trying to understand the alignment of TVET colleges with industry demand. For example, Olowoyo et al. (2020) concluded that there were discrepancies between the consistency of the curriculum and their research focusing on hospitality studies at TVET colleges. Also, Mtshali and Ramaligela (2020) submitted that not only is the programme for civil engineering at TVET colleges skewed towards the provision of industrial contemporary skills, but even training tools and equipment are also, to a great extent, unresponsive to the current industrial era. It is clear from these findings that no TVET teachers' inputs were taken into consideration. In order to boost economic growth, emerging nations must work to grow and improve their technical vocational education and training sector. In light of this, the TVET college sector ought to make an effort to provide the appropriate skills that are in line with the requirements of the industry (Okwelle et al., 2017). For this reason, this study was guided by the following research question:

How does the NCV: Building and Civil Engineering programme remain aligned with the demand of the industry?

2. Literature review

2.1 Background

The South African Ministry of Higher Education and Training introduced the National Certificate Vocational Program in 2007. The NCV programme was initially seen as an ideal replacement for previous qualifications (National Technical Education Diploma N1-N3) (Wedekind, 2016). The three-year NCV programme was introduced primarily to address the issues of prior qualification such as misalignment with the industry demand (DHET, 2014). In this regard, Badenhorst and Radile (2018) claim that the NCV program was specifically designed to address issues such as the unresponsiveness of skills and the mismatch with industry demand. This programme has been considered a new qualification aimed at providing students with a professional qualification that corresponds to the current needs of the industry (Buthelezi, 2018). As a result, the NCV has been recognized as a much-needed new curriculum to address the economy's skills gap.

This programme consists of twenty career fields including areas such as marketing, office administration, finance, engineering and related design, electrical infrastructure, building and civil engineering. The Building and Civil Engineering qualification is part of the NCV curriculum, which was introduced to address skill shortages in occupations such as bricklaying, plumbing and carpentry (DHET, 2014). When enrolling in NCV: Building and Civil Engineering, students have to choose a curriculum that consists of compulsory subjects such as construction planning, carpentry and roofing, plumbing or brickwork (Papier, 2017). Theoretical subjects and hands-on training in college workshops make up the Building and Civil Engineering curriculum.

The practical component is one of the most important aspects for the acquisition of hands-on practical skills for meeting the demands of the industry. This hands-on element of learning ensures that students acquire skills relevant to the job market. However, the NCV: Building and Civil Engineering programme tends to focus too much on theoretical content (Van der Bijl & Lawrence, 2019). Papier (2017) agrees with this view that TVET neglects to provide hands-on practical training in workshops as so much attention is paid to theoretical learning in the classroom. As a result, the offering of practical training in the workshop is neglected.

2.2 Significance of technical and vocational education and training

The TVET's significance to the industry is crucial for expanding the economy and providing youth and young adults with essential skills. Vocational training is seen around the world as the key to acquiring the skills that prepare young people and youth for entry into industry. Skills and knowledge acquired from the TVET enable the youth and young adults to enter the job market successfully and improve the productivity of the economy. For this reason, developed nations have improved their TVET education systems to meet industry demand (Kuczera & Jeon, 2019). Hence, developed nations regularly review their TVET programmes to maintain relevancy and alignment with the demand of the industry.

Developing nations such as South Africa have invested a lot in the provision of TVET system. The Ministry of Higher Education and Training stated in the white paper on post-school education that TVET must provide young people with the skills and knowledge they need to transition to industry (DHET, 2014). This is in line with the call of the Sustainable Development Goals to ensure that quality TVET is accessible to all, so that TVET students can acquire relevant skills and knowledge. However, studies have shown that TVET programmes in developing nations do not meet the needs of the industry as they are not aligned properly with industry demands (Albashiry et al., 2015).

2.3 Skills training in TVET

The TVET sector plays a vital role in providing key skills for economic development and industry (Lee et al., 2018). A majority of countries around the world consider the TVET sector essential to gaining skills and improving the productivity of their economies. Developed European countries have responsive TVET systems that match industry demands (Abrassart et al., 2017). However, most of the theoretical literature believes that TVET institutions still face the challenge of providing students with modern industrial skills for today's (and tomorrow's) world of work (Amran et al., 2020). Poor workplace learning environments and the inability of TVET teachers to apply different teaching and learning strategies and set clear learning outcomes have been identified as major concerns (Zulu & Mutereko, 2020). However, these scholars simply followed established trends, and amplified discoveries advanced by Ayentimi et al. (2018), Nyerere (2018), and Dempsey (2013), among others. For example, Dempsey (2013) investigated the impact of changing the nature of the TVET system on TVET educators in Australia. The study found that skills training is adversely affected by unclear government policies on TVET colleges, pressure from management to produce results rather than skilled graduates, and the challenge of keeping up with and training students in new technologies.

Nyerere (2018), who looked into and documented youth unemployment in Kenya, emphasised the importance of entrepreneurship and transferable skills in educational programs. In his research, he emphasised the need to teach TVET students entrepreneurial skills to encourage self-employment, as well as the need for TVET educators to teach these skills. As Ayentimi et al. (2018) have shown, these findings are not new to the TVET field when looking into the education and training system's skills gap. According to these researchers, economic instability and a lack of workshop equipment and skilled workers were the primary barriers to qualification. Yet, the study is not entirely conclusive, particularly with regard to the extent to which the country's education and apprenticeship systems are meeting the needs of the modern industry for skilled workers, including civil engineering. Dempsey (2013) argues that there are too many unresolved issues in TVET, supporting this viewpoint.

Other research studies conducted on the South African TVET sector have focused on issues such as structural, institutional and curriculum changes (Buthelezi, 2018). Also, Van der Bijl and Lawrence (2018) examined factors influencing the retention and turnover rates for state-certified and professional students in civil

service and construction at TVET colleges in South Africa. Furthermore, Van der Bijl and Taylor (2018) studied work-integrated learning (WIL) for TVET teachers and explored opportunities for integration between industry and academic practice. However, Van der Bijl and Taylor (2018) do not examine the skills required by the industry to realize the potential of 4IR, especially in the NCV program.

2.4 The need to respond to industrial skills demands

The white paper for post-school education claims that its goal is to improve the relevance of the TVET curriculum and to meet industry demands (DHET, 2014). Therefore, the TVET programme is expected to meet industry demand. Contrary to this, various studies from the literature indicate that TVET programmes offered have not kept pace with or adapted to modern changes in industry (Nkwanyane et al., 2022). Similarly, a study by Papier (2017) conducted in South Africa's TVET sector has shown that the NCV: Building and Civil Engineering programme does not align with industry requirements.

The misalignment between TVET and the industry create negative implications for TVET graduates as they are not able to enter the industry successful. To address this issue of misalignment, the TVET sector in South Africa requires a curriculum that produces skilled young people who are adaptable to the industry. On the other hand, it is revealed that most TVET graduates cannot be employed in industry due to misalignment of TVET programmes with industry demands (Mtshali & Ramaligela, 2020). In this context, there is a need for TVET programmes that produce professionally qualified youth for all subsectors of mining, electricians, welders, plumbers and carpenters. The Building and Civil Engineering programme needs to be aligned quickly in response to industry demands. If these issues are not addressed, TVET may provide students with out-of-date and ineffective training.

2.5 Provision of teaching and learning resources in TVET

The TVET sector in developing countries such as Africa is faced with enormous challenges to provide adequate teaching and learning resources. For this reason, the state of teaching and learning resources is very poor and inadequately provided for in developing countries. Hence, developing countries encounter several challenges with the provision of teaching and learning resources such as machinery, tools and equipment for training students. The lack of machinery, tools and equipment as well as a lack of workshops for training of students make TVET teachers resort to theoretical teaching. Badenhorst and Radile (2018) found that inadequate machinery, tools and equipment compel students to overcrowd machines during the practical training.

Sephokgole et al. (2022) also revealed that the lack of resources, equipment, and infrastructure has a negative implication on the provision of quality TVET programmes as lecturers are being prevented from exposing students adequately to hands-on practical skills. Therefore, effective teaching and learning is not stimulated due to the lack of machinery, equipment and tools for practical training. The enhancement of TVET to be aligned with industry demand cannot be achieved as necessary machinery, tools and equipment are inadequately

provided in TVET. The TVET sector must be improved in terms of modern equipment and machinery to adequately prepare students in line with the technological advancement of industry (Pongo & Obinnim, 2015). To enhance the alignment of TVET with industry is essential and requires provision of functional workshops equipped with the latest machinery, adequate tools and equipment. The necessary resources such as training, equipment, workspaces and machinery must be made available for practical training to meet the industry demand (Odoom et al., 2016). Yet, inadequate teaching and learning resources persist in the TVET colleges as students are trained with outdated machinery, tools and equipment that are not comparable with current changes in the industry.

3. Research method

This research study used an exploratory case study design to understand the demand for industrial skills within the National Certificate (Vocational) Building and Civil Engineering programme. A case study design is an investigation that studies people in their location and is intended to find out the views of the participants about the issue that is being investigated (Cohen et al., 2018). Patten and Newhart (2018) state that a case study design is seen as an ideal research design as it focuses on one or more cases. Hence, a case study research design was used to provide detailed characteristics of a group of TVET teachers involved in the NCV: Building and Civil Engineering programme. This type of research design was more appropriate for this study as it helped to identify participants who have experience with the phenomenon being studied (Ahrens, 2022). According to Creswell and Creswell (2018), qualitative research is a type of strategy aimed at identifying and understanding people within their location. For this reason, this study took a qualitative research approach to support an inductive technique.

3.1. Research participants

The focus of this study was on two TVET colleges in Mpumalanga Province, South Africa. The two vocational colleges were selected for the reason that they offer the programme for NCV: Building and Civil Engineering. In order to achieve the aim of this study, purposive and convenience sampling was used. A convenience sampling technique was used to facilitate access to the premises of the two TVET colleges. The rationale for using a purposive and convenience sample was based on the fact that a case study research design often requires a smaller sample (Ahrens, 2022). For this study, the sample was smaller and more manageable. Participants for this study were selected based on their availability, qualifications and experience, and their willingness to participate in the study. The total number of participants in this study consisted of ten TVET teachers. The researcher selected five of the TVET teachers to take part in the study. Due to the busy teaching schedule of the TVET teachers, the researcher managed to set appointments for interview sessions and observation with only five TVET teachers. The other five TVET teachers indicated that they were not available to take part in the interview session and observation as they were attending the departmental workshops.

3.2. Sample size and research instrument

A qualitative research instrument consisting of semi-structured interviews was used as the data collection method. The semi-structured interviews consisted of open-ended questions. I chose to use interviews as they are powerful tools to unpack the problem in more detail. The semi-structured interviews provided the researcher with an opportunity to ask questions of the participants and to explore the participants' views further if necessary (Creswell & Creswell, 2018). The interview with the TVET teachers took place face-to-face on the college premises and lasted about 40 minutes. Each session was tape-recorded and the researcher took additional notes during the interview.

An observation schedule was used as an additional data collection tool. The researcher took the part of a non-participant observer to observe TVET teachers when they carry out hands-on practical training in the workshop. The reason for observing TVET teachers was to obtain rich and detailed information directly from the participants at their location. Table 1 below shows the TVET teachers' biographical data.

Table 1: Teachers' biographical data

Participants code	Gender	Qualification	Teaching experience
Teacher 1 (R1)	Male	National Diploma in Building Construction	11 years
Teacher 2 (R2)	Male	National Technical Education Diploma	15 years
Teacher 3 (R3)	Male	Professional Teacher's Diploma	14 years
Teacher 4 (R4)	Female	Professional Teacher's Diploma	10 years
Teacher 5 (R5)	Female	Bachelor of Education (Technical)	12 years

3.3. Data analysis

Analysing data in qualitative studies is about making sense of the data collected by disassembling and merging the data (Cohen et al., 2018). According to McIntosh and Morse (2015), thematic analysis involves identifying, analysing, and interpreting patterns of meaning in qualitative data. This study used thematic analysis within qualitative research as suggested by Braun and Clarke (2006). The six phases of data analysis proposed by Braun and Clarke (2006) were used to analyse the transcripts of the interviews. The interviews were transcribed and analysed using arranged coded statements, audio recordings and verbatim quotations. The data collected was cleaned and double checked to ensure there were no errors. The interview session transcripts were sent to the participants to verify and confirm that they reflected their original views expressed during the interview session.

3.4 Ethical considerations

The researcher ensured compliance with the research ethics that govern the conduct of social sciences studies (Cohen et al., 2018). Ethical clearance was obtained from the institution where the researcher is affiliated. The Research Office of the Department of Higher Education and Training (DHET) was contacted before the start of the study. In addition, permission to conduct the research was sought from the two identified TVET College principals, and a letter of formal notice was sent to the TVET College rectors requesting permission to conduct the study. Data collection began immediately after the study was approved. Informed consent forms were distributed and the research goals were explained to the participants. Then, the participants were informed about the purpose of the study and their rights, such as voluntary participation and the right to withdraw from the study at any time.

4. Results and discussion

The research results are presented by themes, which were developed from semi-structured interviews with the TVET teachers and the observation tool. The three themes identified are: 1) Inadequate exposure to hands-on practical training, 2) Curricula review, and 3) Insufficient machines, tools, and equipment for practical training.

4.1. Inadequate exposure for hands-on practical training

With regard to this theme, it has been found that the programme for NCV: Building and Civil Engineering is not geared to the needs of the industry due to the inadequate exposure to hands-on practical training in the workshop. The TVET teachers interviewed for this study indicated that students spend most of their time learning theoretical content in the classroom. Furthermore, the TVET teachers noted that the workshop practical training is inadequate as students spend most of their time learning theoretical work rather than doing hands-on practical training in the workshop. This assertion is further supported by observation results, which show that too little time is planned for practical training in the workshops. Observing the workshops, I observe that the NCV: Building and Civil Engineering students spend less time on hands-on practical training in the workshop. This is not in line with the required practice for any vocational qualification. Observational results showed that students spend most of their time in the classroom, where they are taught theoretical content of the programme. The teachers mentioned that they are aware of this situation and that it needs to be addressed urgently so that the students can acquire the relevant skills that match the needs of the industry.

The observation results are also consistent with the teachers' interview results, as the teachers indicated that they spend most of their time in the classroom teaching the students theoretical content, rather than focusing on hands-on practical training. From the teachers' point of view, more attention is paid to the offering of theoretical content than to the acquisition of hands-on practical training in the workshops. Some of the excerpts from the teachers' remarks during the interviews are as follows:

Teacher 1: ''*The NCV: Building and Civil Engineering Programme focuses too much on learning the theory than on the practical part of learning*''. Teacher 2 made a similar statement: ''*In the programme NCV: Building and Civil Engineering, we concentrate too much on theoretical work and not on offering practical training for the students*''. Teacher 3 also expressed supporting views, pointing out that ''*The practice-oriented training in the programme NCV: Building and Civil Engineering is not given enough time.* Similarly, teacher 4 also maintained that ''*This program of Building and Civil Engineering was intended to focus more on practical training in the workshop, but we do not do that as most of the time we spend is in the theory class.*

The interview and observation findings show that the teachers complained that the programme of NCV: Building and Civil Engineering was too much geared towards learning theoretical content. The statements made by the teachers above confirm that the program for NCV: Building and Civil Engineering does not advance the range of hand-on practical training offered in the workshops. As a result, these inequalities have a serious negative impact on the students, as they are not offered the opportunity to acquire important practical training in the workshops, which is important in preparing the students for the industry.

The above results are consistent with study by Nkwanyane et al. (2022) who in their probe focused on finding out students' perceptions regarding the programme of Civil and Building construction. This study revealed that students find the Civil and Building curricula too focused on theory content. Researchers such as Van der Bijl and Lawrence (2018) also support this claim, having previously pointed out that the course content in the Building and Civil Engineering program is geared towards offering theoretical content and ignoring the offering of practical training in the workshops. As a result, students complete the NCV: Building and Civil Engineering without acquiring full practical training in the workshop.

4.2. Curriculum review

The findings on this theme generally indicate that the programme for NCV: Building and Civil Engineering urgently requires immediate evaluation. From the teachers' point of view, it is important to evaluate the program in line with the changes that are happening in the industry. This is to ensure that the programme keeps up with technological changes in the industry. However, the teachers noted that, while the industry is constantly changing, the NCV: Building and Civil Engineering programme does not address the rapid changes in the industry. During the interviews, the TVET teachers indicated that the NCV: Building and Civil Engineering programme consists of too much theoretical content rather than hands-on practical training. Therefore, it is essential to maintain a good balance between the provision of theoretical and hands-on practical work in order to rectify these disparities.

Students would be provided with sufficient exposure to acquire industry-relevant critical skills by maintaining a balance between theory and practical training.
The following are the excerpts of the interviews that show points raised by the teachers during the interviews: Teacher 1: ''*It is necessary to examine building and civil engineering in order to strike a balance between theoretical and hands-on training*''.

Another point was raised by teacher 2 as follows: ''*A curriculum revision for NCV: Building and Civil Engineering is urgently needed so that we can be able to meet the technological changes in the job market*''. Teacher 3 also indicated similar views by indicating that ''*The industry is experiencing rapid changes. It is important that NCV: Building and Civil Engineering be evaluated in line with the changes of industry.*"

These findings correspond with the observation results. The observation results discovered that the content of the programme for Building and Civil Engineering does not address the technological advances that are taking place in the industry. During my observation, I observed that the program for NCV: Building and Civil Engineering use the old outdated manual ways of doing things. The NCV: Building and Civil Engineering programme is still based on old approaches and methods of doing things. For example, in the course content there is reference to the old method of erecting structures, measuring structures and performing cube tests. Also, some part of the curriculum content still relates to machines that are no longer relevant or used in industry. There is an urgent need to evaluate the programme for NCV: Building and Civil Engineering to ensure that it is aligned to the current industry demands. Assessing curriculum content will ensure that industry demand is met and reflected in the Building and Civil Engineering programme.

4.3. Insufficient machines, tools, and equipment

In this section, the TVET teachers were required to indicate how the programme for NCV: Building and Civil Engineering is aligned with the needs of the industry. The study results show that the TVET teachers stated that they do not have adequate machines, tools and equipment to carry out hands-on practical training in the workshops. The majority of the teachers involved in this study stated that they find it difficult to carry out hands-on practical training due to insufficient equipment, machines and tools in the workshops. As a result, teachers claimed that the NCV: Building and Civil Engineering programme could not meet current industrial skill requirements due to issues such as the lack of machinery, tools and equipment to conduct the hands-on practical training required to acquire industry-critical skills . During the interview session, the teachers indicated the following: Teacher 1: ''*Here in our college there is no single machine, we struggle with resources for practical training*''. In support of this view, Teacher 2 stated: ''*We only have a few machines and we don't have all the necessary machines in the workshops*''. A similar view was also expressed by teacher 3 who pointed out that ''*No, we don't have all the machines needed to conduct practical training*''. To illustrate the urgency of this matter, Teacher 4 indicated that ''*We do not have a workshop on our campus to conduct practical training*''. Teacher 5 also echoed similar sentiments: ''*With the machines, tools and equipment, this is the challenge, as we do not have a workshop and machines that are needed for practical training*''.

From the above views, it is clear that the NCV: Building and Civil Engineering programme does not align to the demand for industrial skills due to the insufficient resources necessary to carry out the practical training. Findings showed that vocational colleges are failing in their attempts to provide training that addresses the demand for industrial skills. This is mainly due to the scarcity of resources such as machines, tools and equipment to carry out the hands-on

practical training. Therefore, TVET cannot align a programme such as NCV: Building and Civil Engineering with the demand of the industry. This has serious implications for the students as they are not properly trained with the essential industry skills to enter the industry.

Makgato (2021) has revealed in the study "Challenges of vocational colleges in developing a qualified workforce" that the state of teaching and learning resources in vocational colleges is very poor and not sufficiently provided. The author goes on to point out that this situation has a negative impact on TVET Colleges when it comes to producing a qualified workforce for industry. Similar views are held by Badenhorst and Radile (2018) who indicate that the lack of sufficient machines, tools and equipment forces the teachers to resort to theoretical teaching as the resources for practical training in the workshops are scarce.

5. Conclusion and recommendations

The objective of this study was to examine the alignment of the programme for Building and Civil Engineering to industry demand. The results of the study showed that the program for Building and Civil Engineering does not align with the needs of the industry. The study found that students in the Building and Civil Engineering programme do not get enough hands-on practical training in the workshops. The lack of time allocated for practical training in the workshops is to blame for the absence of sufficient practical training. This means that the students are not adequately trained for the industry as they do not receive adequate practical training. The study results also indicated that the programme for NCV: Building and Civil Engineering needs to be evaluated in order to align it with the needs of the industry. The evaluation of the NCV: Building and Civil Engineering programme should be addressed in order to enable more practical training in the workshop to be available to the students. This ensures that the vocational training programme remains aligned with industry demand.

Due to insufficient resources such as machines, tools and equipment in the workshops, students are not taught adequate skills. As a result, the programme does not provide sufficient industry-relevant skills. This study recommends that the evaluation of NCV: Building and Civil Engineering be implemented as a matter of urgency. The evaluation process should consider the provision of on-the-job training consistent with industry demand. In this way, the programme for NCV: Building and Civil Engineering will be geared towards the demands of the industry.

6. Limitation of the study

This study encountered limitations. Firstly, this study is about two TVET Colleges in Mpumalanga Province, South Africa and the results of this study cannot be generalised to the whole context of South Africa. The researcher intended to conduct the interviews and observe ten TVET teachers. However, due to the unavailability of five TVET teachers for interviews and observations, it was not possible to cover all ten TVET teachers. To overcome these limitations, only five

TVET teachers were interviewed and observed as part of the data collection. The five available TVET teachers were used to represent the entire population.

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