



Journal of Education, Teaching, and Learning is licensed under
A [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/).

COLLEGE MANAGERS' VIEWS ON THE EMPLOYABILITY OF VOCATIONAL ENGINEERING GRADUATES: A CASE OF THE SOUTH AFRICAN TVET COLLEGE SECTOR

Nicholas Ndlovu¹⁾, Micheal M van Wyk²⁾

¹⁾ *University of South Africa, South Africa*

E-mail: ndlovunicholas10@yahoo.com

²⁾ *University of South Africa. South Africa*

E-mail: vwykmm@unisa.ac.za

Abstract. This study investigated the required competencies that TVET college engineering graduates need to be employable and become successful entrepreneurs after completing their studies. The study used a qualitative design and semi-structured interviews to collect the data. Purposive sampling was used to select the participants from three public TVET colleges in Gauteng. The study reported that National Certificate Vocational college engineering graduates need relevant engineering content knowledge, authentic practical engineering workplace experience, soft skills, technical skills and their application in the real world. It was also found that the engineering sector has a negative attitude towards TVET engineering graduates and that there is a lack of lecturers with engineering industry experience. We relied on a small sample; hence, the results of this study may not be generalisable, but moving forward, a cross-national study including all TVET programmes may be required; and, most probably, different results will be generated. We concluded by advocating the review of the TVET engineering curriculum and a paradigm shift to an intense formally supervised and examined industry-oriented workplace component that would boost the technical expertise of graduates. A widespread advocacy campaign in the engineering sector could also help to raise their awareness of TVET programmes.

Keywords: Graduate Employability; Technical And Vocational Education And Training (Tvet) Colleges; Engineering Knowledge And Skills

I. INTRODUCTION

The term “employability” embodies many concepts, and its meaning varies from one individual to another. Scholars view employability as having a set of skills, knowledge, understanding and personal characteristics that aid a person to secure a suitable job and succeed in his or her career (Chen, 2017; Mabunda & Frick, 2020; Bae, Polmear & Simmons, 2022). Furthermore, expanding on this notion employability can also be influenced by broader interior and outside elements (Sin & Amaral, 2017; Reid, 2016; Guilbert et al, 2016) explain that internal factors may include personal knowledge and soft skills. Moreover, external variables may encompass the labour market conditions such as social, institutional and economic issues (Harten, et al, 2022; Tholen, 2014). A positive attitude and adaptability are also key in determining one’s employability (Mello, Tregilgas, Cowley, Gupta, Makki, Jhutti &

Shanmugasundram, 2017; Moumen & Mejjad, 2021). The authors concur that employability refers to technical or non-technical competence attributes and one’s traits that can increase his or her employment potential and also enable them to successfully perform desirable job requirements. Because the definition of employability varies among scholars, this study embraced the definition of Mello, et al (2017) which focuses on the technical and non-technical competence traits that can help a graduate to secure and keep a job. As argued by scholars, this definition is useful for the study because it encompasses all the attributes that a 21-Century graduate should have (Mello et al., 2017; Badenhorst and Radile, 2018).

In the past decade, global views on the employability of technical and vocational education and training (TVET) college graduates have been a major interesting research subject due to the unemployment rates, specifically in South Africa and other developing countries in southern Africa. In

South Africa, public technical colleges were converted into further education and training colleges (FETs) through a merger process in 2006 and started offering FET college learning programmes in 2007 (FET Act 98 of 98). That was before they were rebranded again into technical and vocational education and training (TVET) colleges in 2013 (DHET, 2017). Besides previous scientific studies on TVET students' enrolment issues (Powell and McGrath, 2013; Human Resource Development Council, 2014); student learning experiences (Wedekind and Watson 2016); and leadership and management challenges (Badenhorst and Radile, 2018), there is a general lack of research on the employability of TVET engineering graduates in South Africa. Recent developments in the employability of engineering graduates have heightened the need for an investigation into the reasons why so many engineering graduates from public TVET colleges are struggling with employment (Sibiya & Nyembezi 2018; Badenhorst and Radile, 2018 Du Plooy & Du Preez, 2022).

Recently, researchers have shown an increased interest in the employability and entrepreneurship challenges of TVET graduates in South Africa and globally due to high unemployment, crime rate and poverty in South Africa (Paterson, Keevy & Boka 2017). The employability and entrepreneurship challenges of engineering graduates from public TVET colleges have been a nagging challenge in South Africa for a considerable period (Sibiya & Nyembezi, 2018). The major concern is the inability of qualified engineering graduates to secure employment and become entrepreneurs in an industry that are hard hit by the shortage of artisans and technicians (Statistics South Africa, 2017). The latter view highlights that the situation is more pronounced in the South African TVET system. This is not expected in a country where there is a shortage of plumbers, mechanics and other engineering trades. This challenge of shortage of skilled graduates has also been repeatedly highlighted by the Manufacturing Engineering and Related Sector Education and Training Authority (MerSETA) in particular the print and electronic media sector (Madibogo, 2016).

One major theoretical issue that has dominated the field for many years is the general negative perception of employers in South Africa that public TVET colleges do not prepare students well (Manufacturing Engineering and Related Sector Education and Training Authority (MerSETA) 2014). The South African TVET curriculum, its inflexibility, delivery aspects, relevance and assessment practices have been repeatedly condemned by many education stakeholders, inter-alia Umalusi (2011-2015 Quality Assurance of Examinations and Assessment Reports), the Department of Higher Education (DHET), research task teams and the Human Resource Development Council of South Africa (HRDC, 2017). Critics argue that the curriculum offered at TVET colleges is not in sync with some demands and expectations of the labour market (DHET, 2010). According to Umalusi (2014; 2015), Internal Continuous Assessment (ICASS) reports, only 66% of the internal assessments given to National Certificate Vocational (NCV) engineering

students in 2013 and 2014 were found to be relevant and appropriate. The practical components of the engineering TVET curriculum are mostly improperly administered at many public TVET colleges (Umalusi, 2015; Du Plooy & Du Preez, 2022). This paper explored TVET college managers' perceptions of the competencies needed by vocational engineering training programme graduates to meet the expectations of employers. To achieve this objective, the following research questions were formulated:

- What specific competencies do vocational engineering graduates need to be employable?
- What are the experiences and challenges encountered by TVET college managers when preparing vocational engineering graduates for employment within the South African labour market?

By employing a qualitative mode of enquiry with semi-structured interviews we attempted to capture and illuminate the views and verbatim perspectives of the participants. This paper provides an opportunity to advance an understanding of the vocational engineering training received by graduates to become employable in Southern Africa and globally. This document is a template. An electronic copy can be downloaded from the conference website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website. The manuscript is delivered using the following components: introduction, methodology, results and discussion, and conclusions.

II. LITERATURE REVIEW

A. *Theoretical Lens for The Study*

This article is based on the revised theory of transformative learning by Jack Mezirow (2000) that "learning new frames of reference, and transforming habits of mind, learning can occur by transforming points of view" (p. 21). This theory has undergone modifications and incorporated new constructs as they are debated, empirically verified and recurrently influence adult pedagogy across contexts, subjects and methodologies. The latter statement informed our understanding of TVET college managers' perception that the required competencies attained by graduates in vocational engineering training are imperative to meet the expectations of employers. This view is supported by a recent study by Tien, Namasivayam and Ponniah (2020) which reported factors that promoted transformative learning in vocational engineering graduates. In this study, the theory assists in examining how institutions of higher learning, like public TVET colleges, can enhance their training and learning environments to promote holistic transformative learning to their graduates.

B. Global view of TVET college vocational engineering training

TVET engineering training experienced several challenges globally because of structural inequalities, inadequate vocational training, workplace skills training, insufficient government funding and a lack of private-public partnerships to strengthen this sector (Picard, Hardebolle, Tormey & Schiffmann, 2021; Atkins, 2020). Furthermore, these challenges are not being resolved to respond to the needs of the global labour market. In addition, the high unemployment rate among the youth creates another layer of challenges for job-seekers to ultimately find employment. Several African studies reported the status of the TVET college sector related to vocational engineering studies. Studies in Kenya reported on the importance of sustainable development through vocational training.

The TVET sector could in the long run be the driver to curb the challenges of dealing with the skills shortage gap through vocational training initiatives (Gichuki, Mwaura & Kiprop, 2019; Bae, Polmear & Simmons, 2022). From a Botswana perspective, Chitema (2020) concur that the TVET college sector in the country is facing the same challenge related to reducing the skills shortage. Furthermore, this technical skills shortage gap could be dealt with through competency-based training to meet employer expectations. Finally, a Ghanaian study by Quarshie, Akadzic and Mensah (2020) concurs with the latter and highlighted the critical issue related to competency-based training in vocational engineering to achieve sustainable goals for economic development. Ultimately, these initiatives by employers, governments and the TVET college sector may resolve the challenge of skills shortage.

C. South African TVET college sector-related engineering training

Since the restructuring of the TVET college sector to increase the pool of qualified engineering graduates, in particular, engineering training to address the skills shortage in the country remains a challenge. There are 50 public TVET colleges in South Africa spread over 264 campuses. (DHET, 2019). The colleges offer a three-year National Certificate Vocational Engineering programme, among other programmes. It is important to highlight that the South African NC (V) offered at TVET colleges had originally been designed with their practical components meant to be taught in colleges without any requirement for work placement (DHET, 2020 Du Plooy & Du Preez, 2022).

African scholars regard the TVET college sector model as ineffective because it does not prepare students in particular engineering students for the job market (Mabunda & Frick, 2020; Mesuwini, Singh-Pillay & Bomani, 2020; Quarshie, Akadzic, & Mensah, 2020). Moreover, Wedekind (2018) argues that vocational training with a workplace element is more likely to lead to better job opportunities. The authors posit that the NC(V) engineering training programme needs to be integrated with employer expectations related to competent graduates and the required skills to be employed

on completion of the programme. Added to this view, Mitchell, Nyamapfene, Roach and Tilley (2021) suggest that effective engineering learning programmes promote and reinforce practical workplace experience developed in the natural world of work. They continue to argue that an engineering curriculum prioritises communication elements, teamwork as well as critical thinking and problem-solving. Cruz, Saunders-Smiths, and Groen (2020) proffer that present-day engineers require abilities such as the capacity to scope, plan and find solutions to complex challenges and to communicate and apply ethical reflection in their work. Besides the latter characteristics, engineers are frequently confronted with complex challenges that cannot be solved by a single field; hence, multidisciplinary and inter-professional collaboration is becoming increasingly vital (Latuca et al., 2017; Klassen, 2018). Such ideas have also been considered by recent literature on the development of professional skills of engineers which advance that teamwork abilities are also understood to be a strong catalyst for student motivation and retention (Picard, Hardebolle, Tormey & Schiffmann, 2021; Du Plooy & Du Preez, 2022).

From a South African perspective, Paterson, Keevy and Boka (2017), as well as the DHET (2019), acknowledge that the NC(V) engineering programme was originally designed to prepare its graduates for employment in the South African economy. For example, a competency-based skills analysis was conducted among engineering graduates by Statistics South Africa (2017). The report questions the ability and capacity of the South African public TVET institutions in the context of the National Development Plan 2030 to close the skills shortage gap. Based on this report, it was revealed that engineering graduates from TVET colleges in South Africa are the hardest hit by unemployment amidst a critical shortage of electricians, plumbers and artisans in the country. From this analysis, recommendations were formulated to deal with the skills shortage, specifically in the field of engineering. The evidence examined here implies that engineering graduates require a combination of practical workplace abilities and a wide range of soft skills.

III. METHODOLOGY

A. Research paradigm and design

In this article, the researchers' approach was influenced by the ideology of constructivist-interpretivism; hence, its design was qualitative by nature (Creswell, 2014; Neuman, 2014;). TVET college managers were chosen for this qualitative research study because of their lived experiences in the vocational engineering training programme. Therefore, the constructivist-interpretivism paradigm focuses on the lived experiences of people and is informed by the meaning-making of people in their context. Building on this idea, Neuman (2014) contends that as human beings ceaselessly strive to make meaning of the world around them, they interpret and give constructive meaning and rationalise their ideas which are socially constructed.

B. Sampling, data collection and process

Only eight TVET college managers were purposively selected for this study to explore their views of vocational engineering training in the South African context (see Table 1.) Semi-structured interviews were used to collect the data. The purpose of the interviews was to explore participants' views about the competency requirements of engineering graduates as well as the challenges they face when preparing themselves for the world of work. For the data collection process, the researchers communicated with the participants via emails or telephone calls. The emails were used to inform the participants about the purpose of the study and to request their consent (see 3.4 ethical considerations). After receiving consent, specific dates and times were arranged and the interviews were recorded.

C. Data analysis and trustworthiness-related credibility

The interviews were audio-recorded, transcribed and analysed. A constant comparison analysis method was selected to identify themes and sub-themes, as reported in the results of this article (Glaser & Strauss 1967; Strauss & Corbin 1998). This data analysis method was applied manually, using three main steps: *open coding, axial coding and selective coding*. Firstly, the researchers conducted open coding manually whereby recurring data collected were organised into categories of units (themes and subthemes) and labelled with codes. Secondly, axial coding was conducted whereby similar codes were grouped into categories that aligned with the research study. Lastly, the main thematic constructs were systematically developed and interpreted from the data sets of categories.

For any qualitative research study to be regarded as trustworthy, credibility is the scientific acid test (Guba, 1981). In qualitative research, credibility is perceived as the extent to which the data, its analysis and conclusions are correct, congruent and trustworthy (McMillan, 2012). Furthermore, Richards, (2015) suggests that participants in the study need to receive data sets to check whether the transcripts from digital audio interview recordings and interview questions are a "correct version"; and if discrepancies are found, corrections need to be made. Therefore, member checking is the most significant technique to validate and confirm data. In this context, participants were allowed to confirm and validate whether the data captured by the researchers correctly reflect their views. To further ascertain the validity and correctness of the captured data, the verbatim accounts of participants' experiences were simultaneously recorded mechanically by using a digital audio recorder. The final process to ensure the credibility of the data sets related to the digital audio recordings, transcribed data and the identified themes was sent to a professor who specialises in qualitative data analysis to verify and validate the data (Padgett, 2008; Creswell, 2014).

D. Ethical considerations

This study was subjected to a series of basic ethical standards and procedures which included a comprehensive application that was tendered to the Ethics Review Committee of the University of South Africa, seeking its assessment and due approval to conduct the research and approval. Permission was also sought from the Department of Higher Education and Training, the principals of the three public TVET colleges in Gauteng; and the respective campus managers where the study was to be conducted. The researchers also ensured that the study participants stayed anonymous by using pseudonyms were used.

IV. RESULT AND DISCUSSION

A. Biographical data

As part of the study, the biographical information of the participants is captured in Table 1:

TABLE 1
 BIOGRAPHICAL INFORMATION OF THE PARTICIPANTS

Pseudonyms	Designation	Highest Qualification	Experience with NC(V) Programme
Vincent	Manager: NC (V) and Report 191 Curriculum Manager Provincial level. TVET college	B.Ed. (Hon.) Senior Phase.	13 years
Luke	Deputy Principal: Academic TVET college	B. Ed. Hons. Senior phase.	12 years
Thomas	Deputy Principal: Academic Manager:	B. Ed Senior phase	13 years
Peter	Engineering Programme Manager:	B. Tech.	12 years
Mathew	Engineering Programme. Campus Level	BSc, PGCE Senior phase	13 years
Jacob	Manager: SETA Work placement	Diploma Secondary	4 years
Linda	Officer: College level	School Teaching Diploma	6 years
Sophie	Work placement Officer: College level	Diploma in Marketing	4 years

Table 1 provides the majority of participants as male dominated TVET college managers who were qualified and experienced in their roles and responsibilities. Overall

management experience with NC (V) college programmes is noted.

B. Quantitative data

Specific competencies needed for successful job placement

TVET college managers raised sentiments about specific competencies required of graduates for suitable placement in the South African engineering field. It also emerged that specific competencies are technical and soft skills such as computer literacy skills, entrepreneurship knowledge and interpersonal communicative skills, which may be an advantage for successful employment (jobseekers) in the South African job market or starting a new business to job creators. On analysing the data, the thematic analysis revealed the following themes and sub-themes concerning the above question.

- 1) *Required vocational engineering competencies for graduates' employability:* Modern engineering knowledge and specialised hard and soft skills are the hallmarks of a work-ready graduate; thus, these characteristics should never be overlooked. It is a requirement of the engineering sector that vocational engineering graduates have specific competencies to compete in the labour market for placement. To meet the requirements, relevant engineering content, knowledge and skills are needed and the ability to apply these competencies in the workplace. Furthermore, graduates should have hands-on work-integrated learning (WIL) and practical experiences required by the engineering industry.

The NC (V) curriculum prepares students for the world of work in various ways; students do theory in TVET colleges and their practices in the form of ISAT as well as going to the industry for work-integrated learning (Matthew).

- 2) *Relevant engineering content knowledge and its application:* The extracts below are those of the TVET college managers who deal with NC (V) engineering graduates in various capacities. The experiences of some of these managers emanate from lecture rooms, and work placement duties to college and provincial department management responsibilities, as already indicated. The extracts highlight their perspectives on what employers look forward to regarding the relevant engineering content knowledge and its application.

Employers want knowledge relevant to their industry and not just mere knowledge but its application in the environment where it is needed. (Peter)

Eehh, employers need those that can apply the knowledge. Students must be productive the employer is in business and has got no time to teach. Employers want students to do the job,

there are no textbooks there in the industry, and it is busy throughout the day. Remember, the industry is profit-oriented, they can't waste time teaching students at the workplace because they have targets to meet, so these graduates should be work-ready ... that is what the employer wants (Linda)

The participants felt that employers are looking for graduates with relevant competency-based subject knowledge, appropriate skills and values in the engineering sector. Furthermore, the learned engineering skills must be applicable for suitable placement.

- 3) *Soft skills contextualised:* Soft skills can be conceptualised as personality attributes encompassing social and emotional intelligence essential for developing one's career. The NC(V) engineering programme managers seem to be conscious of the importance of integrating soft skills into the engineering syllabus. The following extract reveals one view on this issue.

At this college, we do teach and have specific programmes for soft skills. I now realize that students benefitted a lot in equipping them with such skills. (Matthew)

Based on the participants' views, the TVET college managers indicated specific competencies that are a requirement for suitable placement in the engineering field. The participants mentioned that computer literacy skills, entrepreneurship knowledge and interpersonal communicative skills would be to their advantage for successful employment in the job market or starting a new business to create employment for others.

- 4) *Computer literacy skills, entrepreneurship knowledge and interpersonal communicative skills:* According to NC(V) engineering programme managers, students were equipped with computer knowledge and application skills with are important with other soft skills in the engineering syllabus.

Students are taught computer skills, communication and business skills in the Life Orientation course. Lecturers teach also other soft skills like etiquette and punctuality (Luke)

Experiences and challenges encountered by TVET college managers when preparing vocational engineering graduates for employment

It emerged that TVET college managers experienced and faced challenges in preparing engineering graduates for employment. Issues such as training in foundational knowledge and skills; insufficient funding in the form of bursaries; a lack of placement for apprenticeship; and the attitude by employers in the engineering industry towards TVET college graduates remain major challenges and need to be dealt with through relevant policy amendment to correct these negative views.

- 1) *TVET college managers' experiences in preparing graduates for employability in the South African engineering sector:* In analysing the managers' narratives from the collected data, experiences and challenges were highlighted concerning the perceptions of the engineering sector related to the preparation of engineering graduates in the South African economy.

The subject content knowledge of the engineering programme needs to be reviewed because some subject guidelines still talk about carburettors when most cars now use fuel injectors (Luke)

Participants in this study alluded that engineering lecturers in the TVET college had inadequate technical and industry experience of what is required to prepare graduates for successful employment, as reported by DHET (2014). This was not investigated in the study, but some participants mentioned it. Other issues that emerged from the narratives were inadequate student funding, the use of outdated workshop equipment and large classes.

The funding we get is not enough, we need quipment similar to the one used in the industry but because of insufficient funding we cannot afford to buy that type of equipment, so we are still stuck with some of the old-outdated equipment (Luke)

- 2) *Attitude of the engineering industry market towards TVET programmes:* TVET college managers were positive about the engineering programme which is recognised by the engineering industry. Linda, a college work placement manager at one of the TVET colleges, gave her perspective:

The major challenge is that the TVET programmes are currently not popular with the South African industry or workplace. The industry is our major stakeholder, but they don't seem to co-operate fully and that affects our placement of students for practical experience. Even when they advertise posts, they hardly mention TVET qualifications.

A TVET college work placement manager from another college echoed Linda's sentiments about the experiences and challenges she encounters when soliciting work placement opportunities for engineering graduates in the engineering industry market:

The majority of the employers in the industry are not familiar with TVET programmes. They seem to favour those that have done similar courses at universities. Engineering qualifications obtained from TVET colleges are relatively unknown to some of them. (Sophie)

As the statements above attest, some engineering employers do not seem to know much about TVET engineering programmes. A manager from the Provincial Department of Higher Education and Training commented on the same note:

Employers depend on and differ from industry to industry, some of them are positive but the majority need more information about TVET college programmes which they claim that they know nothing about. (Matthew)

- 3) *Inadequate engineering industry sector experience and technical competence:* The following extracts highlight the approximate percentage of engineering lecturers with experience in the engineering sector and the impact of the scenario on TVET education. When asked about the latter, engineering programme managers, some of whom perform lecturing duties to a few engineering classes made the following statement:

...the number is very small, about 25% of the lecturers in the engineering division have industry experience. (Peter)

A lot of things have changed with time, and so is the industry's equipment. One needs that technical industry experience so that they will be able to teach students how certain machinery is operated. (Luke)

The excerpt below was derived from a telephonic interview with one of the managers from the national Department of Higher Education and Training, explaining the policy on the qualifications of TVET lecturers:

Yes, the policy is there: It is about the TVET lecturer qualification. It was gazetted in 2013 and talks about TVET lecturer qualifications but only a few universities have expressed willingness to offer the programme but...only a few universities are offering that qualification for TVET lecturers ... the current majority of TVET lecturers are from high schools in the basic education department. (Vincent)

- 4) *Insufficient funding and class size hindered effective learning:* The participants expressed divergent views on the issue of funding, and the following extracts encapsulate their voices:

Students are well-funded, about 80% of them are adequately covered. (Vincent)

The funding we get is not enough, we need equipment similar to the one used in the industry but because of insufficient funding we cannot afford to buy that type of equipment, so we are still stuck with some of the old equipment. (Thomas)

The participants seemed to understand how large classes affect the quality of teaching and learning as well as the infrastructure (computer labs) used for engineering education.

I think the issue of having large groups also affects the quality of our teaching and learning, for instance, I have 40 students in a class and the workshop is not large enough to accommodate all of them... that affects effective teaching Large classes affect the quality of graduates we produce. (Peter)

In the next section, the findings will be discussed with appropriate literature critically argued to answer the research questions.

C. Discussion

The findings indicated that TVET college managers are of the view that engineering graduates attained their competencies through the vocational engineering training programme, but do not know whether they meet the expectations and job requirements of employers in the South African engineering industry. At the time of this research, vocational engineering students in South African TVET colleges were exposed to the workplace environment only through workplace-based experience (WBE) sessions which lasted for one week at most, but the National Qualification Framework (DHET, 2018) stipulated that workplace practical experience should be incorporated into the degree programme as work-integrated learning of ten weeks (fifty days).

The TVET college managers agreed that specific competencies such as soft skills, computer literacy, entrepreneurship knowledge and interpersonal communicative skills are important for the employment of engineering graduates within the South African engineering sector. This finding is supported by research studies on equipping vocational engineering students with relevant knowledge, skills in particular computer literacy skills, and soft skills for the global market (Gichuki, Mwaura & Kiprop, 2019; Mitchell, Nyamapfene, Roach, & Tilley,

2021; Masoabi & Alexander, 2021; Du Plooy & Du Preez, 2022). Furthermore, TVET college managers highlighted that the engineering sector requires that graduates must have specific competencies to compete with science graduates. Mitchell, Nyamapfene, Roach, and Tilley (2021) concur that to meet the requirements, relevant engineering content, knowledge and practical technical skills are needed as the ability to apply these competencies in the workplace.

Currently, the National Qualification Framework stipulates that work-integrated learning (WIL) should be included in the National Certificate Vocational programmes offered at public TVET colleges (DHET, 2018). However, the nature and quality of the WIL remain questionable. Engineering graduates need to be 'work-ready' with authentic practical work experience and the relevant theoretical subject knowledge which they acquire in their institutions of learning. These findings appear to be consistent with the views of Mitchell, Nyamapfene, Roach, and Tilley (2021) who argue that a successful engineering learning programme focuses on and prioritises a natural and authentic industry experience for its graduates. This study established the importance of an increased association between engineering graduates and the workplace for them to acquire new knowledge and skills that can enhance their employment prospects.

These findings are further corroborated by Wedekind (2018) as well as Du Plooy and Du Preez (2022) that employers are more receptive to graduates from vocational training contexts that are largely integrated into the workplace environment. Similarly, Masoabi and Alexander (2021) argue that to promote suitable placement in the engineering field, computer literacy skills, entrepreneurship knowledge and interpersonal communicative skills are important attributes of graduates. This sentiment is consistent with recent studies which conceptualise the employability of engineering graduates broadly as embracing even non-technical skills, like the ability to communicate effectively, think critically, being able to work effectively in a team and reflect and apply ethical standards (Mello, et al 2017; Cruz, Saunders-Smiths, and Groen 2020; Picard, Hardebolle, Tormey & Schiffmann, 2021; Makgato, 2021).

The findings on the second research question revealed that TVET college managers face a variety of challenges when preparing vocational engineering graduates for the South African labour market. Issues such as training in foundational knowledge and skills; insufficient funding in the form of bursaries; the lack of placement for apprenticeship and the attitude of employers in the engineering industry towards TVET college graduates remain major challenges. Six of the TVET college managers (75%) decry the lecturers' inadequate technical engineering industry experience which is required to prepare graduates for successful placement. The managers stressed the importance of developing the technical abilities of lecturers for them to be technically and procedurally compliant with the latest technological developments that are taking place in the industry. Again, these findings seem to corroborate

previous research that emphasises the essence of multidisciplinary and inter-professional collaboration in learning institutions and workplaces (Latuca et al., 2017; Klassen, 2018; Du Plooy & Du Preez, 2022).

Such developments promote an interface of what students learn in class (theory) with what is done at the workplace (practice). In response to the interview question on whether there was a policy as a requisite of qualifications for one to qualify as a TVET lecturer, all the participants responded that there was but raised a concern that it was applied unfairly for appointments within the TVET College sector. It was further evident from the participants' responses that some graduates are undisciplined, are absent during lectures and fail to take ownership of their learning. This concern is supported by recent studies conducted at TVET colleges which highlighted factors like immaturity, poor discipline and negative attitudes of students which contributed to poor academic performance (Ngwato, 2020; Kanyangale & Sibanda, 2021; Bae, et al., 2022). During the interview sessions, TVET college managers lamented that some students were absent without any valid reasons when simulated practical activities were demonstrated by the lecturers. Several studies reported that student absenteeism is a major impediment to student's academic performance (Geda, 2016; Buthelezi, 2018; Dean, 2019; Ngwato, 2020).

Another issue raised by TVET college managers was funding for vocational engineering students which plays a central role in the completion of their studies. TVET college managers expressed grave concern about insufficient funding; and claimed that some students do not have enough money to pay for their studies and they, therefore, dropped out of the vocational engineering programme. Moreover, recent South African studies conducted by Yende (2021) and Mabuza (2020) concur with TVET college managers' concern that several student protests and drop-outs were caused by insufficient student funding. These student protests over insufficient funding were recorded at institutions of higher learning, including TVET colleges locally and globally. The lack of funding is a majority drawback of drop-out, as well fuelled by the ineffectiveness and mismanagement of the National Student Funding Aid Scheme (Mabuza, 2020; Ngonda, Shaw, & Kloot, 2022; Mapaling, Webb & du Plooy, 2023). In a technologically-driven world, engineering students need to become acquainted with modern technology that is relevant to the engineering industry (Mabunda & Frick, 2020; Bhat, et al 2020; Vodovozov, Raud & Petlenkov, 2021). Inadequate funding would certainly hamper any efforts of acquiring a relevant modern digital infrastructure that can promote effective teaching and learning during engineering workshops.

In this research, managers mentioned that large classes harm the quality of teaching and learning and the quality of instructional delivery of the vocational engineering programme. Class size plays a major role in the quality and equal learning experiences (Maringe & Sin, 2014). Notably, it is undeniable that class size can also be informed by the nature of the course or subject and the resources available.

Consistent with this thought, Bai and Chang, (2016) as well as Wang and Calvano (2022) contend that class sizes affect student performance; and that compared to smaller groups, large classes have lower levels of class participation and student preparedness hence small classes tend to benefit more and are likely to perform better than large classes. Given the above assertions, one may conclude that a large class is one with more students than the available facilities and resources can support. Therefore, the participants' perspectives reflect a TVET college teaching and learning environment in which engineering students outnumber the available facilities and equipment, harming instructional delivery and the quality of graduates produced by that system.

VI. CONCLUSION

This study was designed to explore TVET college managers' perceptions of the competencies needed by vocational engineering graduates to be employable in the engineering sector. It is confirmed that engineering industry employers need graduates to be work-ready with relevant technical competencies to be employed successfully. Managers agreed that specific competencies such as computer literacy, entrepreneurship knowledge and interpersonal communicative skills are important for the employment of engineering graduates. It is, therefore, imperative that the competencies stipulated in the National Certificate Vocational programmes are offered at public TVET colleges and that the colleges meet the requirements of the National Qualification Framework (NQF). The findings further showed that TVET college managers involved in preparing engineering graduates for the workplace have had a variety of teaching experiences as revealed in the biographical data. Also, managers echoed the sentiments of the industry stakeholders were expressed negative attitudes towards the employment of TVET engineering graduates as compared to university graduates.

The findings of this study are significant since they add to the ever-growing body of knowledge and understanding of the skills and other facets engineering graduates need to secure employment. These findings have certain limitations in terms of generalisability. For example, not all programmes were included, which resulted in a limited sample size. Again, the views of the engineering sector were represented through the lens of work placement managers and engineering programme managers who engage with them regularly. In this context and moving forward, a cross-national study including all TVET programmes and the engineering sector may be required.

Based on the findings, several significant implications emerged for policy and practice. From a policy perspective, it is suggested that policymakers and curriculum planners review TVET college engineering curricula to be aligned with the requirements of the engineering sector. A substantial formally supervised and examined workplace component for TVET programmes would also boost the

technical expertise of graduates. We conclude by advocating the review of the TVET engineering curriculum and a paradigm shift to an intense formally supervised and examined industry-oriented workplace component that would boost the technical expertise of graduates. From a practical stance, TVET College lecturers must be empowered with digital literacy skills, technological skills, innovative pedagogical strategies and work-integrated learning opportunities. To increase the practical component of the TVET engineering programme, industry-study-related digital game-based simulations for effective learning must be included in the programme. Finally, to increase engineering student enrolments, a progressive advocacy campaign could be implemented to raise awareness about TVET college programmes.

ACKNOWLEDGEMENTS

We sincerely appreciate the support and collaboration of the University of South Africa (UNISA), the Department of Higher Education and Training, management of the TVET colleges involved and the participants (Certificate Ref.# 2018/06/13/48174947/27/MC).

FUNDING

This investigation was not funded

REFERENCES

- Atkins, L. (2020). Researching Technical and Vocational Education and Training in a UK context: classic works and contemporary concerns. In Michael RM Ward and Sara Delamont (eds.) *Handbook of Qualitative Research in Education*. Edward Elgar Publishing.
- Badenhorst, J. W., & Radile, R. S. (2018). Poor performance at TVET colleges. Conceptualising a distributed Instructional leadership approach as a solution. *Africa Education Review*. 15 (3) 91-112. <https://doi.org/10.1080/18146627.1352452>
- Bae, H., Polmear, M., & Simmons, D. R. (2022). Bridging the gap between industry expectations and academic preparation: civil engineering students' employability. *Journal of Civil Engineering Education*, 148(3), 04022003.
- Bai, Y. & Chang, T (2016) Effects of class size and attendance policy on university classroom interaction in Taiwan. *Innovations in Education and Teaching International*, 53 (3), 245-246
- Bhat, S., Raju, R., Bhat, S & D'Souza, R. (2020) Redefining Quality in Engineering Education through the Flipped Classroom Model. *Procedia Computer Science*, 172. 906-914.
- Buthelezi, Z. (2018). Lecturer experiences of TVET College challenges in the post-apartheid era: a case of unintended consequences of educational reform in South Africa. *Journal of Vocational Education & Training*, 70(3), 364-383.
- Chen, Y. (2017). "Graduate employability: the perspective of social network learning" *Journal of Mathematics Science and Technology Education*, 13 (6) 2567-2580.
- Chitema, D. D. (2020). Technical and Vocational Education and Training (TVET) in Botswana: Implications for Graduate Employability. *The Education Systems of Africa*, 1-19.
- Cohen, L., Manion, L., & Morrison, K. C. (2011). Research methods in education. (7th Ed.) New York: Routledge.
<https://www.appam.cnfex.com/...cortesMoussa>
Westein-Behaviour.
- Creswell, J. W. (2014) Research design: Qualitative, Quantitative and Mixed Methods Approaches. London: SAGE Publications Limited.
- Cruz, M. L., Saunders-Smiths, G. N., & Groen, P. (2020). "Evaluation of Competency Methods in Engineering Education: A Systematic Review" *European Journal of Engineering Education*. 45 (5), 729-757
- Dean, A. S. (2019). Soft skills for the 21st Century workforce. *International Journal of Applied Management and Technology*. 18 (1) 17-32 <https://doi.org/10.5590/IJMT.2019.18.1.02>
- Department of Higher Education and Training (2020). Annual Report 2019-2020. <https://www.nationalgovernment.co.za/department-annual/320/2020>
- Department of Higher Education and Training. (2019). Annual Reports, 2018-2019. <https://www.gov.za/sites/default/files>
- Department of Higher Education and Training. (2018). Radically transforming TVET colleges through empirical research. Pretoria. Department of Higher Education and Training
- Department of Higher Education and Training. (2017). *Best practices in TVET systems: BMS and LMS for colleges in South Africa*. Pretoria: Department of Higher Education and Training
- Department of Higher Education and Training. (2012). Green Paper for Post School Education and Training. Pretoria: Department of Higher Education and Training.
- Department of Higher Education and Training, (2010). *Report on the Further Education and Training Summit*. Pretoria: Department of Higher Education and Training
- Department of Higher Education and Training (2014). *Technical and Vocational Education and Training (TVET)*. Pretoria: Department of Higher Education and Training
- Du Plooy, B., & Du Preez, K. (2022). Perceptions of staff and students about the NC (V) model of workplace engineering artisan training offered by south african

- tvect colleges. *South African Journal of Higher Education*, 36(1), 98-114.
- Geda, T. B. (2016). The Implementation of Cooperative Training in Technical and Vocational Education and Training Colleges of Oromia. *Education Journal*, 5(4), 43-48.
- Gephart, R. (1999). Paradigms and research methods: <https://www.division.org.com/RMD> retrieved 11 June 2018.
- Gichuki, K., Mwaura, P., & Kiprop, S. (2019). The Influence Of Competition On Market Performance Of Privately Owned TVET Colleges In Kenya.
- Glasser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research. Chicago: Aldine.
- Guba, E. (1981). ERIC/ECTJ Annual Review Paper: Criteria for Assessing the Trustworthiness of Naturalistic Inquiries. *Educational Communication and Technology*, 29(2), 75-91. Retrieved January 20, 2021, from <http://www.jstor.org/stable/302119811>
- Guilbert, L., Bernaud, J., Gouvernet, B and Rossier, J. (2016) "Employability: review and research prospects", *International Journal for Education and Vocational Guidance*, 16 (1), 69-89
- Harten, J., Cuyper, N, Knies., E and Forrier., A (2022) Taking the temperature of employability research: A systematic review of interrelationships across and within conceptual strands. *European Journal of Work and organisational psychology*, 31 (1), 145-159.
- Kanyangale, M., & Sibanda, R. (2021). Recipe of Poor Performance: Case of a Misaligned Organisational Architecture of a TVET Campus. *Academic Journal of Interdisciplinary Studies*, 10(1), 83. <https://doi.org/10.36941/ajis-2021-0008>
- Klassen, R. G. (2018). "Interdisciplinary Education: A Case Study." *European Journal of Engineering Education*. 43 (6), 842-859
- Mabunda, N. O., & Frick, L. (2020). Factors that influence the employability of National Certificate (Vocational) graduates: The case of a rural TVET college in the Eastern Cape province, South Africa. *Journal of Vocational, Adult and Continuing Education and Training*, 3(1), 89-108. <https://hdl.handle.net/10520/ejc-jovacet-v3-n1-a8>
- Madibogo, J. (2016). Graduates search for work on street corners. *Sowetan*. 04 June 1
- Makgato, M. (2021). "Challenges Experienced by TVET Colleges in Producing Skilled Workforces: Implications for Continuous Professional Development." *New Models for Technical and Vocational Education and Training*, edited by Moses Makgato and George Afeti, IGI Global, 2021. 1-13. <http://doi:10.4018/978-1-7998-2607-1.ch001>
- Manufacturing Engineering and Related Services (MerSETA) (2014). Sector skills plan update 2014/15-2018/19. Promoting artisan development for employability. http://www.mobicareerhelp.org.za/download.files/scarce-skills/MerSETA_scarce_skills.pdf Retrieved 19 April 2020.
- Mapaling, C., Webb, P., & du Plooy, B. (2023). "I would help the lecturer with marking": Entrepreneurial Education Insights on Academic Resilience from the Perspectives of Engineering Students in South Africa. *Transforming Entrepreneurship Education*, 177.
- Maringe, F & Sing, N (2014) Teaching large classes in an increasingly internationalising higher education environment. Pedagogical, quality and equity issues. *Higher Education*, 67, (6) 761-782. doi. 10.1007/s100734-013-9710-0
- Masoabi, C. S., & Alexander, G. (2021). Possible Merger, Entrepreneurship Education In TVET Engineering Studies: A Case For South Africa. *Journal of Entrepreneurship Education*, 24(2), 1-20.
- McMillan, H. J. (2012). Educational research: fundamentals for the consumer. (6th ed.). New York: Pearson
- Mello, L. V., Tregilgas, L., Cowley, G., Gupta, A., Makki, F., Jhutti, A., & Shanmugasundram, A. (2017). The 'Students-As-Partners' scheme enhances postgraduate students' employability skills while addressing gaps in bioinformatics education. *Higher Education Pedagogies* 2(1), 43-57. <https://doi.10.1080/23752696.2017.1339287>
- Mesuwini, J., Singh-Pillay, A., & Bomani, M. (2020). Perceptions of engineering lecturers and graduates on employability skills: A case of a TVET college in Kwazulu-Natal, South Africa. *International Journal of Social Sciences and Humanity Studies*, 12(2), 416-432.
- Mezirow, J. (2000). Learning as transformation: Critical perspectives on a theory in progress. San Francisco: Jossey-Bass.
- Moumen, A & Mejjad, N (2021) Graduate employability: An exploratory literature review. <https://www.researchgate.net>.
- Neuman, W. L. (2014). Social research methods: Qualitative and quantitative approaches. 7th ed. Essex: Pearson Education Limited.
- Ngonda, T., Shaw, C., & Kloot, B. (2022). The pitfalls of work placement learning: perceptions of mechanical engineering students from a South African university. *Australasian Journal of Engineering Education*, 27(1), 38-46.
- Ngwato, S. E. (2020). *Factors which contribute to poor academic achievement in TVET colleges: a case study* (Doctoral dissertation). <https://core.ac.uk/download/pdf/334609814.pdf>
- Padgett, D. K. (2008). Qualitative methods in social research. Los Angeles: Sage Publications.
- Paterson, A., Keevy, J., & Boka, K. (2017). Exploring a Work-Based Values Approach in South African TVET Colleges to Improve Employability of Youth: Johannesburg. JET Education Services.

- <https://www.heacademy.ac.uk/systems/files/resources/pedagogyforemployability>.
- Picard, C., Hardebolle, C., Tormey, R., & Schiffmann, J. (2021). Which professional skills do students learn in engineering team-based projects? *European Journal of Engineering Education*. <https://doi.org/10.1080/03043797.2021.1920890>
- Powell, L., & McGrath, S. (2013). *Why students enrol in TVET-The voices of South African FET college students*, *Journal of Vocational Education and Training (TVET) International Conference: Oxford, 20 in Higher Education* 3(0) <https://doi.org/10.4102/the.v3i0.33>
- Quarshie, R., Akadzie, D., & Mensah, H. (2020). Critical Competency-Based Skills Requirements For TVET In Ghanaian Construction Industry Empirical Perspectives From Craftsmen/Artisans. *International Journal of Construction Project Management*, 12(1), 61-80.
- Reid, J. (2016) "Redefining employability" as something to be achieved: utilising Tronto's conceptual framework of care to refocus the debate", *Higher Education, Skills and Work-Based Learning*, 6 (1), 55-68
- Richards, L. (2015). *Handling Qualitative Data: A Practical Guide* 3rd Ed. London, Sage Publications.
- Sibiya, A. T., & Nyembezi, N. (2018). 'Examining factors that shape Technical Vocational Education and Training engineering students' understanding of their career choices, *Transformation* 2(8), 1-14.
- Sin, C and Amaral, A (2017) "Academics and employers' perceptions about responsibilities for employability and their initiatives towards its development", *Higher Education*, 73 (1), 97-111.
- Strauss, A. C., & Corbin, J. (1998). *Basics of qualitative research. Technics and procedures for developing grounded theory*. Thousand Oaks: Sage publications
- Tholen, G. (2014) "Graduate employability and educational context: a comparison between Great Britain and The Netherlands", *British Educational Research Journal*, 40 (1), 1-17
- Tien, D. T. K., Namasivayam, S. N., & Ponniah, L. S. (2020). Addressing global sustainability challenges: a qualitative study on factors that promote transformative learning in engineering students. *SN Applied Sciences*, 13. Academia Education
- Umalusi. (2014). *Report on the quality assurance of examinations and assessment of the national certificate (vocational) and NATED (N1-N3)* Pretoria: Umalusi
- Umalusi. (2015). *Report on the quality assurance of the examinations and assessment of the national certificate (vocational) and NATED (N2- N4)* Pretoria: Umalusi
- Vodovozov, V., Raud, Z & Petlenkov, E (2021) Challenges of Active Learning in a view of Integrated Engineering Education. *Education Sciences*, 11, (43) 1-14.
- Wang, L & Calvano, L (2022) Class size, student behaviours and educational outcomes. *Organisational Management Journal* 19 (4), 126-142. doi.org/10.1108/OMJ-01-2021-1139
- Wedekind, V. (2018). Vocational Versus Occupational Qualifications: Is there a difference, and a difference? <https://www.saqa.org.za/events-and-conference-proceedings> Retrieved 25 May 2021
- Yende, S. J. (2021). Funding Opportunities and Challenges: A Case of South African Institutions of Higher Learning. *Journal of Public Administration*, 56(1), 70-79.