USING ACTION LEARNING APPROACHES TO ENHANCE PEDAGOGIC PRACTICES IN CIVIL ENGINEERING AND CONSTRUCTION STUDIES AT TECHNICAL VOCATIONAL EDUCATION AND TRAINING COLLEGES IN FREE STATE PROVINCE

by

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DECLARATION

I, MOKHOTHU KHOJANE GEOFFREY, student number: _________, hereby declare that the study thesis titled**: "Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training Colleges in Free State Province"**, which I submit for the Degree of Doctor of Education at the Central University of Technology, Free State is my own work and has never been submitted by me for a degree at this or any other tertiary institution. I further, declare that all sources used and cited in this thesis have been stated and acknowledged in the reference list.

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MOKHOTHU Khojane Geoffrey Date

DEDICATION

This study is dedicated to my mother, Mashibe, and my children, Kganya, Keketso, Keletso, Kutloano, Teboho, and Thabo, for their patience and understanding throughout my research. Also dedicated to my late, beloved grandparents, Fine and Cecilia Matsekane, for their efforts and encouragement in my pursuit of the best education. In addition, I owe my first educational anchor to my uncle, Khooe Matsekane.

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CERTIFICATION

I, Khojane Geoffrey Mokhothu, hereby officially confirm that I applied for ethical clearance from the Central University of Technology in Free State, that I applied for permission from the Department of Higher Education (TVET colleges), and that I submitted consent forms to the participants at the TVET colleges to follow Doctor of Education degree studies under the promotor Dr CS Masoabi and co-promotor Professor AH Makura. My thesis is titled: "*Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training Colleges in Free State Province" (*see attached annexures C& D)

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MOKHOTHU Khojane Geoffrey Date

ABSTRACT

This study focused on reviewing an equational formulae and models that shall promulgate effective implementation of action learning approach as the main teaching method in Civil Engineering and Construction at TVET colleges in South Africa. Whereas the objectives are to: 1) determine the teaching approaches used at TVET Civil Engineering Construction Studies Curriculum, 2) assess the extent to which action learning approaches are employed in teaching content knowledge and practical work in Civil Engineering Construction Studies at TVET, 3) evaluate the sequence/procedure lecturers use to assess content knowledge and practical work at TVET colleges, 4) determines the challenges that TVET lecturers may experience during the implementation of action learning approach, 5) review for equational formulae and models for capacitating TVET lecturers in action learning approach to produce good quality work at TVET colleges - regarding the integration of content knowledge and practical work. While the research aim was to explore the use of action learning as a teaching approach with reference to content knowledge and practical work in Civil Engineering Construction studies at TVET colleges and to review existing formulas.

The research used a mixed method approach comprised of quantitative as well as the qualitative methodology to collect data. Data collection tools used were questionnaires and semi-structured interview. In the case of data analysis for quantitative data, Cronbach's Alpha was employed for reliability and confirmed by One-sample test t-test for significance. In addition, for qualitative data, thematic analysis was used to saturate the facts of the responses. The sample-size participants of the study consisted of N=26 lecturers who are both males, n=20 and females, n=6 responsible for content knowledge (theory) and practical work of NCV and NATED 191 programmes for Civil Engineering and Construction subjects from four public TVET colleges in the following municipality districts (Thabo Mofutsanyane, Motheo Mangaung Metropolitan, Lejweleputswa and Fezile Dabi) in the Free State in South Africa.

The study findings indicated that the following dynamics/elements or aspects are problematic in the effective implementation of an action learning approach in Civil Engineering and Construction Studies at TVET colleges: to integrate content knowledge and practical work. The lack of consumable material and insufficient working equipment. The insufficient time allocated for practical work and prescribed measure types of assessments. Also, most lecturers' lack of professional qualifications in education. Therefore, the study proposed a reviewed action learning formula and has made recommendations on how to implement effective action learning approaches in Civil Engineering and Construction studies at TVET colleges and how to resolve challenges.

Keywords: Action learning, Civil Engineering and Construction, Technical Vocational Education and Training, Content knowledge, Practical work.

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ACRONYMS

ALA	Action Learning Approach
AS	Assessment Standard
C2005	Curriculum 2005
CAPS	Curriculum Assessment Policy Statement
CEC	Civil Engineering and Construction
CK	Content Knowledge
CT	Civil Technology
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DoE	Department of Education
DST	Department of Science and Technology
EMIS	Education Management Information Systems
FET	Further Education and Training
FETC	Further Education and Training Certificate
FSDoE	Free State Department of Education
GET	General Education and Training
HET	Higher Education and Training
HOD	Head of Department
ITEA	Internal Technology Education Association
LPG	Learning Programme Guideline
MET	Manufacturing Engineering and Technology
MSE	Micro and Small Enterprises
NATED	National Technical Education
NCS	National Curriculum Statement
NCV	National Certificate Vocational
NCVQ	National Council for Vocational Qualifications
NDE	National Department of Education
NQF	National Qualification Framework
OBE	Outcome Based Education
PAT	Practical Assessment Task
RNC	Revised National Curriculum Statement

SAG	Subject Assessment Guideline
SETA	Sector Education and Training Authorities
TVET	Technical Vocational Education Training
UNESCO	United Nations Education, Scientific and Cultural Organisation
VTE	Vocational Training Education

CHAPTER ONE: ORIENTATION

1.1 INTRODUCTION

Since 2009, the South African education system has been separated into two Departments of Education namely: The Department of Basic Education (DBE) and Department of Higher Education and Training (DHET) (education news biz community 2014:2). The DBE was comprised of: Foundation Phase, General Education and Training (GET) phase, and Further Education and Training (FET) phase, while the DHET comprised Technical Vocational Education Training (TVET) Colleges, Universities of Technology (UOT) and Universities. The Minister of Higher Education in 2014 promoted FET colleges from DBE to DHET and renamed them TVET colleges (education news biz community 2014:2).

The DHET vision and mission state: "*Our vision was of a South Africa in which we had a differentiated and fully-inclusive post-school system that allows South Africans to access relevant post-school education and training, in ordered to fulfil the economic and social goals of participation in an inclusive economy and society*" (DHET, 2013a:14).

"*The mission of the Department of Higher Education and Training to develop capable, well-educated and skilled citizens who are able to compete in a sustainable, diversified and knowledge-intensive international economy, which met the development goals of our country*" (DHET 2013a:14).

This mission would be accomplished by reducing skills bottlenecks, particularly in high-priority and scarce skills areas; increasing post-school participation rates; correcting distributions in the shape, size, and distribution of access to post-school education and training; and enhancing the quality and effectiveness of the system, its sub-systems, and its institutions.

The Valued Statement reads:

"The Department of Higher Education and Training (DHET) was committed to:

- Distinction and excellence in all our work efforts to develop a skilled and capable workforce for the country.

- Honesty, perseverance, and commitment in providing differentiated education and training opportunities for all the people of South Africa.
- Efficiency of worked habits and proficiency of all DHET employees in fulfilling the mandate of the department.
- Teamwork, cooperation and solidarity in working with our partners in higher education and training to achieve the shared goals.
- Transformation imperatives to addressed social inequality, race, gender, age, geography, HIV/Aids and disability issues in all our higher education and training institutions to normalise them" (DHET, 2013a:14).

1.2 BACKGROUND OF THE STUDY

1.2.1 Technical Vocational Education and Training (TVET) Spectrum in South Africa

The term TVET was used as the main operational word in this study. It was loaded with meaning. According to Mokhothu (2015), TVET is defined as "Education, which is mainly to lead participants to acquire the practical skills, know-how, and understanding, and necessary for employment in a particular occupation, trade or group of occupations" (Mokhothu, 2015:13; Atchoarena & Delluc, 2002). According to Nasir (2012), TVET is training and education that prepares students for employment. This suggests that TVET is the source of workforce manpower, which enables students to be more productive in their specialised field of work in order to effectively contribute to the economy's growth.

Establishing TVET was founded on the history of racial segregation policies that were informed by the Apprenticeship Act of 1922, which was racially aligned to the needs of the labour market that excluded the African majority population (Akoojee, Gewer & McGrath, 2005; Buthelezi, 2016). During the transitional period in the post-apartheid dispensation, the TVET colleges in South Africa underwent a transitional designed to operate liked businesses to meet the demanded of the business community (Kraak & Hall, 1999; Makole, 2015). However, most black South Africans seem to engage in undermining the TVET sector education system (Mokhothu, 2015). They perceive it as the school for the dropouts, where students learned only handed worked with no better future, unlike the white-collar job market career (Mokhothu, 2015).

According to Serumu (2015), TVET was a concept involving the study of engineering, technical technologies, mathematics, and related sciences to gain practical skills, attitudes, understanding, and knowledge contributing to different employment sectors in economic and social life. Furthermore, the objectives of TVET are stated as follows: (Serumu, 2015):

- to provide trained personnel in applied science, technology, and business, especially at the sub-professional level.
- to provide people who could apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man.
- to provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial, and economic development.
- to introduce professional studies in engineering and other technologies.
- to provide training and impart the necessary skills in order to produce enterprising and self-employed craftsmen, technicians, and other skilled personnel.
- to enable our young men and women to have an intelligent understanding of the increasing complexity of technology (Serumu, 2015).

Buthelezi (2016) highlights that the second international conference on TVET in 1999 held in Seoul, Republic of Korea, took a unanimous vote to adopt the term TVET to describe the process of education and training integration that distinguishes employment as their direct objective. (UNESCO, 2002:1). However, South Africa did not adopt the term immediately because of the long changes: in 1994, in this stream, the Department of Education and Training split between the Ministry of Labour (responsible for skills development) and the Ministry of Education (responsible for schools, adult education, colleges, and universities), and in 1998, the Further Education and Training Act allowed for technical colleges to become FET colleges, under provincial authority (DoE, 2018:90). In 2015, the FET) colleges were renamed to TVET colleges.

In South Africa, TVET is the process of enhancing the industrial workforce's skills. It was also defined as an economically relevant and marketable education for individuals. Technical education consists of postsecondary coursework and on-the-job training designed to prepare technicians for supervisory positions. Vocational training is lower-level education and training for the preparation of skilled or semi-skilled workers in a variety of trades, but it does not enhance their level relative to general education (Makole, 2015; Akoojee, 2016).

Makole (2015) mentioned that TVET is a learning activity focused on imparting knowledge and skills that are applicable for employment or self-employment. TVET encompasses all types of formal, non-formal, and informal training and is acquired wherever it takes place—in institutions, schools, training centres, or the workplace or production site (Papier, 2011; Makole, 2015; Akoojee, 2016). Thus, the focus of the implementation was on jobs and localised supervision of provincial TVET centres. The objective of these TVET Centres was to "facilitate access to a variety of targeted skills training and business development services consistent with provincial economic development priorities". The TVET Centres have now been formally integrated under the Department of Education and Training to ensure a coordinated and decentralised approach to the delivery of skill development services within the national TVET sector. (Papier, 2011; Makole, 2015; Akoojee, 2016; Buthelezi, 2016).

TVET colleges aim to provide vocational training, according to Akoojee (2016). TVET is a globally used term for the portion of the education system that combines education, training, and skill development. This was to provide students with all the necessary skills for future employment (Buthelezi, 2016; Akoojee, 2016). TVET colleges educate students in a particular vocation or profession, preparing them for employment or allowing them to continue their education at one of South Africa's prestigious universities of technology (Motheo TEVT college prospectus 2018/2019; Akoojee, 2016).

TVET colleges offer courses with both theoretical and practical components. The theoretical portion provided the knowledge necessary to pursue one's chosen profession. The course's practical component aids candidates and graduates by instilling this knowledge by allowing them to learn and instructing them on how to apply it to the practical aspect of their work (Papier, 2011; Makole, 2015).

According to Buthelezi (2016), a credential is vocational and relevant to a particular occupation. This means that if you pursued a qualification in engineering, you learned how to perform a specific job in the field, such as bricklayer or pipe fitter. The engineering qualifications offered by TVET were distinct from those offered by universities. Typically, university qualifications were designed to allow one to work as a professional engineer, whereas TVET qualifications taught the skills required for specific engineering occupations. A candidate with engineering-related TVET credentials may be eligible to pursue a national diploma in engineering and, eventually, a BTech or advanced diploma. This indicates they met the requirements to become a professional engineering technician. This is applicable to the various practical areas of vocational courses (Buthelezi, 2016).

1.2.2 Qualifications Approach Offered at TVET

1.2.2.1 NATED 191 (Civil Engineering N1-N6)

TVET colleges delivered NATED/Report 191 programmes under the backing of the DHET, with Umalusi ensuring their quality (DHET: White Paper, 2013). The programmes include 18 months of college-level theoretical study and 18 months of relevant work experience. The business and service disciplines were categorised into different levels, namely N4 to N6, together with engineering studies (Umalusi, 2017; Kheza, 2018:39).

These engineering-focused programmes allowed students to pursue a national diploma in engineering or pursue a variety of careers in the engineering profession. These courses were not equivalent to the degrees offered by South African universities, but they did qualify students to pursue a national diploma in engineering, after which they could pursue a BTech or advanced diploma in engineering (Makole, 2015; Akoojee, 2016; Buthelezi, 2018).

Table 1.1: Civil Engineering N1-N6 Subjects

N1	**N2**	**N3**
o Building Science o Building Drawing o Mathematics	o Building Science o Building Drawing o Mathematics	o Building Science o Building Drawing o Mathematics o Building and Civil Technology

o Bricklaying and Plastering Trade Theory (choice subject) o Plumbing Theory o Woodworkers Theory (choice subject)	o Bricklaying and Plastering Trade Theory o Plumbing Theory o Carpentry and Roofing Theory	
N4	**N5**	**N6**
o Building & Structural Surveying o Building & Structural Construction o Quantity Surveying o Mathematics o Building & Structural Surveying o Building administration	o Building & Structural Surveying o Building & Structural Construction o Quantity Surveying o Mathematics o Building administration	o Building & Structural Surveying o Building & Structural Construction o Quantity Surveying o Mathematics o Building administration

Source: Motheo TVET college prospectus (2018/2019)

The above Table 1.1 of NATED 191 (N1-N6) was more associated with adults, as most students were sent and registered by their employers. Therefore, the teaching method and approach that was commonly used was andragogy.

Andragogy as a practice in NATED stream

Andragogy is described as an approach to adult learning that is grounded in problem-solving, and supported by the fact that adult education was a process where adult students became aware of and assessed their experiences (Greene & Larsen, 2018). Furthermore, Greene and Larsen (2018) asserted that andragogy is a learned process of theory and practise. It concludes as a single process in which theoretical and practical knowledge collaborated to resolve the creative experience. Hence, andragogy regards the adult (student) as the loaded bank of experience. Therefore, the lecturer plays the role of facilitator to ensure achievement and knowledge construction.

According to Greene and Larsen (2018), the art and science of assisting adults to learn, andragogy, is based on four assumptions:

- It is effective once individuals start maturing,
- The adult's self-perception changed from dependent to independent.
- They amass a growing pool of experience that becomes a more and more valuable learning resource.
- Their eagerness to learn became increasingly focused on the developmental responsibilities of their social roles.

Greene and Larsen (2018) moved the interval perspective from delayed to immediate application of knowledge, and therefore their approach toward learning switches from subject-centred to performance-centred. Adults that were socialised have been passive recipients of imparted knowledge via their early education experiences (based on a pedagogical model) and therefore needed assistance in becoming self-directed (Greene & Larsen, 2018). Adults experience a sense of liberation and exhilaration, however, when they realise they can be accountable for their own learning, just as they are for other aspects of their lives. A comfortable learning environment, student participation in identifying their own learning needs, an emphasis on the mutual responsibility of students and lecturers, a process of self-evaluation, and an emphasis on experiential techniques and practical application are some of the practical ramifications of adult education. As adult learners pursue education primarily as a result of pressure from their current life circumstances, their problem-oriented perspective must be incorporated into the curriculum's design (Greene & Larsen, 2018).

Alexander Kapp, a German grammar schoolteacher, coined the term andragogy in 1833 (Greene & Larsen, 2018). Bloemkolk, Defares, Van Enckevort and Van Gelderen (1971) posit that Plato's educational paradigm was reportedly described by Kapp using this term. Only 1926 did Eduard C. Lindeman write extensively about andragogy, resulting in the term being widely used (Gessner, 1956). In describing his theory of adult learning, Lindeman (1926) stated that problem-solving, as opposed to subjects, had been the approach to adult learning. I perceived adult education as a new method by which the adult learner became conscious of and evaluated his experience.

Pew (2007) also defines andragogy as student-directed, knowledge acquisition based on performance standards, and student-initiated learning. The central tenet of andragogy was that learning should be valued for its own sake. In other words, andragogy encourages the measurement of satisfaction and student-determined outcomes (Pew, 2007; Seward, 2016).

In Civil Engineering and Construction NATED 191 courses, students were prepared for and responded positively to the world of work. Therefore, andragogy should be promoted, as one of its main elements is application (experiential techniques). Hence, action learning emphasises that students should know what, how, and when to learn, thereby developing critical minds. Also, it allows students to integrate non-academic experiences with academic work (Seward, 2016).

1.2.2.2 National Curriculum Vocational (Civil and Construction Engineering L1-4)

National Curriculum Vocational (NCV) programmes begin after Grade 9, as this is the first level after high school, and are typically three-year programmes that lead from a NQF Level 2 qualification (Grade 10) to a NQF Level 4 qualification (Grade 12). This was equivalent to a traditional matriculation certificate, allowing applicants to apply to most universities of technology and some university programmes (DHET, 2010; Papier, 2010; Makole, 2015).

Subjects offered:

This programme covers construction, masonry building and woodworking, design, drainage, and sanitation in a management and design environment that is both practical and theoretical. By integrating academic knowledge and theory with practical skills and values, one could literally learn to build a better future (Maluti TVET prospectus, 2018–2019).

Table 1.2: NCV course and combination

Compulsory and Optional	Level 2-4
Compulsory	English first additional language
	Mathematics
	Life Orientation
Generic core and Compulsory	Construction Planning
	Plant and Equipment
	Materials
Optional	Plumbing or
	Masonry or
	Roads

Source: Maluti TVET college prospectus (2018/2019)

Pedagogy as a practice in NATED stream

Pedagogy derives from two Greek words: pedagogos, which means teacher, and agogus, which means leader of. According to the preceding definition, pedagogy is the art and science of educating children (Ozuah, 2005:83). Pedagogy can be tracked back to 7th century Europe, when monastic schools, also known as cathedral schools, introduced organised education (Knowles, Holton & Swanson, 1998). In this time, the pedagogical model emerged, which was founded on several student-related assumptions. These assumptions were to significantly influence the design of the educational model.

In a similar view, Pew (2007) referred to pedagogy as a, “schoolteacher who instructs in a pedantic and dogmatic manner”. Moreover, the pedagogical model encourages lecturers to take responsibility to decide what is to be learned, how to learn it, and when to learn it (Pew, 2007; Shulman & Shulman, 2004; Brantley-Dias, Kinuthia, Shoffner, de Castro, & Rigole, 2007; Seward, 2016). Hence, Memon and Alhashmi (2018) conclude with the single explanation that pedagogy is a methodology of teaching.

However, in the NCV stream, it seems that both andragogy and pedagogy were required to be used in parallel to cover technical and critical competence, with reference to action learning goals. Table 1.3 below shows the differences in key elements between andragogy and pedagogy.

Table 1.3: Andragogy and Pedagogy

Andragogy	**Pedagogy**
Students move from dependence to self-directed.	Students are dependent.
Students are important resources for learning	Limited validity in learner's previous experience
Uses experiential techniques, such as discussion and problem solving	Principal techniques include lectures and other passive methods of instruction.
Students are ready to learn when they experience the need	Everyone is prepared to learn a standard curriculum.
Learning is performance-centred	Learning is subject-centred

Source: Seward (2016:28). Adapted from Knowles (1980)

1.2.2.3 Occupational Skill Training (Construction, Carpentry and Plumbing)

According to White Paper (65/6) for Post-School Education and Training, the establishment of occupational teams represents a significant innovation in the management of strategic infrastructure projects. The primary objective of these teams was to bring together the various stakeholders' representatives. Employers, providers of education and training, professional organisations, and others such as trade testers and licence issuers are examples of such entities. On a national scale, stakeholders were tasked with addressing curriculum relevance and alignment issues between academic (theoretical) and workplace (practical) learning, in addition to work placement issues White Paper: 65/6; SIPs: 2012:55; Makole, 2015; Akoojee, 2016).

The students must be 18 to 35 years old, and must be residents of South Africa. They should be in possession of a Grade 10 (Standard 8) school qualification at least, or equivalent Recognition of Prior Learning (RPL) (DHET, 2018:15). In addition, they must be willing to voluntarily enrol for one year in the National Youth Service Programme, which includes youth development activities, technical training, and on-the-job practical training. Experience in a construction-related trade, such as bricklaying, plumbing, plastering, or carpentry, is desirable. One was placed on construction-related projects as part of their training to develop their skills and expand their knowledge in a particular trade. Two to three months of theoretical training are followed by six months of practical training with a host employer (Department of Transport and Public Works, 2010; Buthelezi, 2016).

1.2.2.4 Learnerships (Construction, Carpentry/Joining and Plumbing) Occupational

According to SIPs (2012), the Skills Development Act was enacted by the Department of Labor in 1998, followed by the Skills Development Levies Act the following year. Under the supervision of the South African Qualifications Authority, these laws established Sector Education and Training Authorities (SETAs) to oversee the development of standards for all sector-specific training (SAQA). By introducing learnerships modelled after the apprenticeship system, the SETAs fulfilled the majority of their mandate: First, whereas traditional apprenticeship required a period of college study followed by a lengthy period of structured on-the-job training, leadership integrated these two components into a single whole without prescribing when they should occur. Second, leadership was designed with the industrial workforce in mind (SIPs, 2012:164; DHET, 2011; Buthelezi, 2016).

Since Taylorization (manpower skill and technical colleges) started in South Africa at the beginning of the 1930s, the manufacturing of whole products has been subdivided into the performance of component tasks, and simpler tasks have been assigned to less-skilled individuals at lower pay rates (Buthelezi, 2016). This caused machine operators to become the majority of the industrial workforce. Learnerships were designed to provide these workers with the opportunity to acquire trade or trade-equivalent skills incrementally by completing a series of qualifications (SIPs, 2012:164; DHET, 2011; Buthelezi, 2016).

In addition, leadership was intended to enable workers to acquire trade or trade-equivalent skills incrementally by ascending a ladder of qualifications. According to a 2012 study conducted independently by the Human Sciences Research Council (HSRC), leadership was effective in terms of students obtaining employment. The study found that 86 percent of those who completed a leadership programme were employed, with the majority securing employment immediately after programme completion (SIP, 2012:164).

However, not everything was well. Those who acquired skills through this leadership system did not always receive national recognition for their abilities; frequently, they were limited to the industry in which they had acquired their skills. In terms of apprenticeship conditions, there were 17 sector-specific pathways to becoming an electrician, for example. Not recognising craftspeople who learned their trade in the local government sector, such as in the mining industry, is unacceptable. Consequently, the National Qualifications Framework (NQF) registered a surplus of sectoral learnerships. Due to disagreements between the Departments of Education and Labour, the private sector assumed responsibility for the theoretical component of studentships. Frequently, procedural learning supplanted more theoretical learning, resulting in a leadership deficient in theory. Employers have progressively demanded a return to the conventional apprenticeship model (SIP, 2012:164; DHET, 2011; Buthelezi, 2016).

The Table 1.4 below, outlines the entails of Occupational subjects in both Skill Training and Studentships:

Table 1.4: Studentships and Occupational Modules

OCCUPATIONAL DESCRIPTION	Modules for the training courses
Bricklayer: Constructs and repairs walls, partitions, arches, and other structures by setting bricks, pre-cut stone, and other building blocks in mortar.	• Chapter 1: Bricklaying tools • Chapter 2: Brick Cut Shapes • Chapter 3: Mortar Mixes • Chapter 4: Plumbing, levelling and gauging • Chapter 5: Setting out a Basic Wall • Chapter 6: Brickwork bonding • Chapter 7: Pointing and finishing

Carpenter and Joiner: Constructs and installs wood, plywood, and wallboard structures and fittings, as well as cuts, shapes, and instals timber components to form structures and fittings. **Carpenter**: Constructs, erects, installs, renovates, and repairs wood, plywood, wallboard, and other material structures and fixtures.	• Anatomy of a house. • Basic projects • Finishing walls and ceiling. • Enlarging opening and removing walls. • Framing and installing doors. • Framing and installing windows. • Adding shelves. • Adding cabinets. • Choosing countertops.
Plumber: Installs and repairs water, sewage, and drainage systems and pipes.	• Basic plumbing • Hydraulic Principles • Backflow • Pathogens • Plumbing Fittings • Plumbing Repairs • Drain & Vents • Water Distribution

Source: Adapted from SIP (2012:174)

SETAs Associated with the above courses

Construction Education and Training Authority (CETA)

The objective of CETA was to provide and drive skills development services for the construction industry, to implement the objectives of the National Skills Development Strategy (NSDS III), and to ensure that people obtain the critical skills necessary to build the construction industry's capacity to become economically sustainable and globally competitive. One of their core functions was to improve and better understand the education and training needs in their area by embarking on research to find out what the needs of employers were in terms of skills. Also, to find out what the provider’s offer was and to identify mismatches that would create a skills gap. Then CETA was responsible for filling the skills gap by providing adequate education and training and skills development programmes that are responding to the needs (CETA, 2018–2019).

According to CETA (2018/2019), the five sectors covered by apprenticeship, internship, and leadership in the building environment are as follows: Building The largest sector of construction is construction, which includes civil engineering, builders, steel, structural, and mechanical contractors, as well as residential and non-residential contractors. Roads and Civil Construction encompasses all outdoor activities associated with building construction, including road maintenance and repair, runaways, bridges, tunnels, and related structures, as well as drainage and road services. There are a variety of wooden fixtures, tiles, sanitary ware, ceramic products, concrete and cement products, tombstones, and roof trusses used in the manufacturing process. Architects, engineers, quantity surveyors, landscape architects, land surveyors, town and regional planners, and project and construction managers are included in this subfield. Electrical Construction: Students assemble, install, and wire electrical systems in newly constructed homes and buildings (CETA, 2018–2019).

CETA plays a pivotal and critical role in skill development, which indicates that it provides a clear action learning approach (ALA) during teaching and learning, of which it could be used in N1-6 courses and NCV levels during the juncture of teaching and learning at college with simulation. Then it could be followed by work-integrated learning at the end of their studies.

Services SETA

Services, in line with the Skills Development Act of 1998, SETA was established and registered in 2000, with the main role on distributing training levies paid by all employers. SETA also recognises and enhances the existing workforce's skills.

Manufacturing, Engineering, and Related Services Sector Education and Training Authority (merSETA)

According to merSETA (2019), its mission continues to be to promote skill development in accordance with the Skills Development Act of 1998. MerSETA encompasses manufacturing engineering and associated services, including the five chambers listed below: metal engineering, automobile manufacturing, motor retail and component manufacturing, tyre manufacturing, and plastic industrial. MerSETA does not collect levies, but the DHET does.

merSETA (2019) maintains that it does not train but rather facilitates the training process by providing grants, registering moderators and assessors, identifying scarce skills, accrediting providers, monitoring the quality of training, and implementing projects to close the skills gap. Consequently, their vision was *Leaders in closing the skills gap,* and their mission was to increase access to high-quality and relevant skills development and training opportunities to reduce inequalities and unemployment and to promote employability and economic participation (merSETA, 2019). The literature above purports that MERSA should be a visible agent that links the community, TVET colleges, universities, and the world of work to respond to skill shortages.

Education, Training, and Development Practices (ETDP)

According to the ETDP SETA (2018–2019), their main purpose is to encourage and facilitate the provision of education, training, and development that advance the skills profile of the education, training, and development (ETD) sector. Also, to play a major role in creating job opportunities for people who have been disadvantaged in the past.

The ETDP SETA was guided by the following strategic objectives:

- The identification of skill gaps and training requirements in the industry,
- Developing qualifications and learning pathways for practitioners in education, training, and development,
- a rise in the level of investment in education, training, and development in the sector, as well as an improvement in the return on investment.
- the development of the skills for workers at all levels in the sector, by
- a higher quality of life for workers, employment opportunities for formerly disadvantaged individuals, and labour mobility.
- productivity in the workplace and healthy competition among employers,
- self-employment, and
- redressing imbalances caused by a separate and unequal education and training system (EDTP SETA 2018/2019).

Therefore, all the above SETA sectors had different mandates to serve, but the most common and significant mandate was to identify the shortage of skills and provide skills development. And that should be a potential economic boost in South Africa if it can be properly managed. Moreover, it reflects the possibility of being cast into the lower level of pure technical high schools.

All the qualifications in South Africa are designed according to the National Qualification Framework to assure the quality and value of the curriculum. The qualifications are presented according to the following levels:

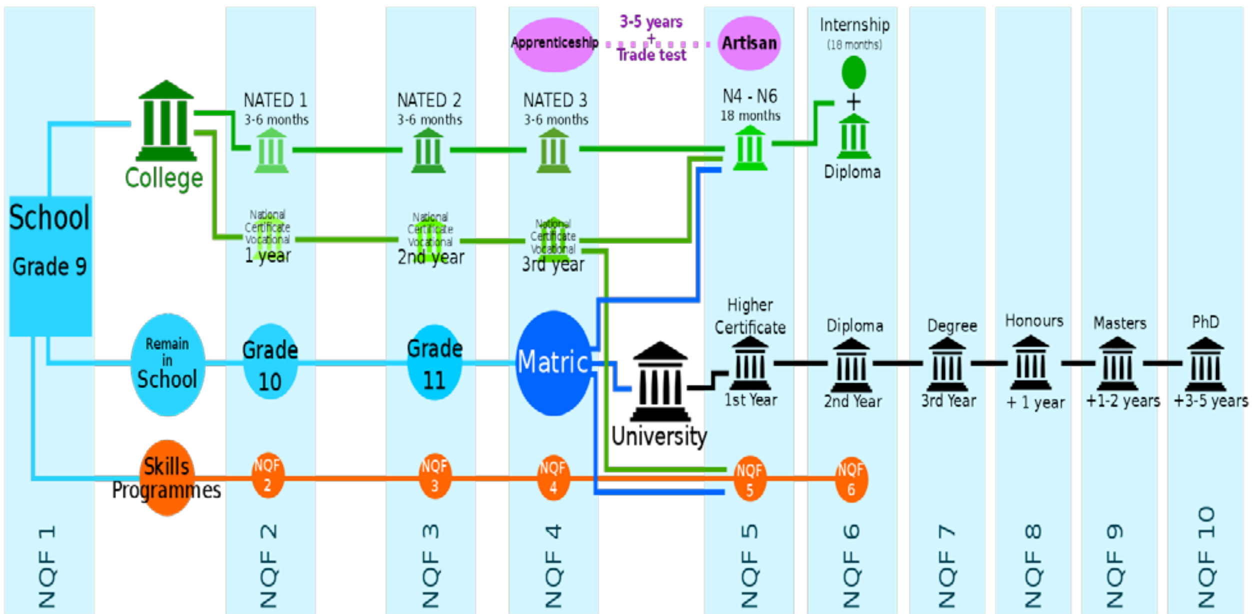

Figure 1.1: South African National Framework

Source: NQF South Africa (2017) explanation

The above Figure 1.1 graphically explains how the South African school system was organised. It fairly indicates that school level has two exit points, the first of which was Grade 9 (NQF 1), which serves as a prerequisite for TVET and skills programmes (NQF 2). The second was Grade 12 or Matriculation (NQF 4), a prerequisite for universities and TVET (NQF 5). Graphically, it also shows that TVET has two streams of learning, as mentioned previously in the study, which are NATED (N), which start from N1 (NQF 2) to N6 (NQF 5). Another stream was NCV, which begins in the first year (NQF 2) and continues through the third year (NQF 4). It further indicates that an apprenticeship of three to five years plus a trade test qualifies an artisan. Also, an N6 certificate plus eighteen months of internship gives an N-Diploma (NQF 6). It was also noticeable that skill programmes maintained a straight line from NQF 2 to NQF 6 (diploma). The only stream with a variety of options was NCV after NQF 4; there was an option to pursue NATED or the Skills Programme from NQF 5 to NQF 6. (NQF South Africa Educational System, 2017).

However, Buthelezi (2016) articulates that in South Africa (SA), to become a qualified artisan, students had two options. The first option was between the completion of N2 to N6 plus three to five years of registered apprenticeship, called Section 13. The second option was ample relevant work experience to test for, called Section 38. Both sections 13 and 38 are prescribed in the Training of Artisans Act, 1951 (Act No. 38 of 1951) [S. 28 substituted by s. 25 of Act 39/90]. Therefore, to become an artist requires a complete skill set of theory and practical work, where the integration of theory and practical work are emphasised through action learning that develops experience.

1.3 TVET INTERNATIONAL SPECTRUM

1.3.1 TVET in Lesotho

In Lesotho, the TVET education system was introduced to respond to human needs (Mosebekoa, 2019). Furthermore, the TVET system in Lesotho comprises of two streams: “occupational" and "empowerment-based" education. Hence, it has been planned to equip the student for specialised trade, craft, and careers by enforcing practical work and theory, both of which enable them to operate in the world of work (Lerotholi Polytechnic, 2019; Mosebekoa, 2019).

Therefore, Lesotho pronouncing one of their TVET groups as Polytechnic, which was offering several schools, including a Built Environment school (Mosebekoa, 2019). Polytechnic School of the Built Environment offers two types of qualifications with a variety of courses or programmes:

Table 1.5: Polytechnic Built Environment Programmes

Programme	Course	Duration	Career Path
Diploma (Technician)	Architectural Technology	3 Years (continued)	Engineer,
	Civil Engineering		

	Construction Management		Assistant engineer, Technician, Workshop Manager, and Entrepreneur
	Water and Environmental Engineering		
Certificate (Craft)	Bricklaying and Plastering	3 Years	
	Carpentry and Joinery		
	Plumbing and Metal Work		

Source: Lerotholi Polytechnic prospectus (2019/2020)

All qualifications in Lesotho are designed by the National Qualification Lesotho NQL like other countries. The Table 1.6 below that illustrate the level of NQL:

Table 1.6: Qualification Framework for Lesotho

TVET System	QFL				General (Academic) Education System
Doctoral Degree	10			D	Doctoral Degree
Master's Degree	9			E	Master's Degree
Honours Bachelor's Degree Post-Graduate Diploma Post Graduate Certificate	8	C E R T	D I P L	G R E E	Honours Bachelor's Degree Post-Graduate Diploma Post Graduate Certificate
Ordinary Bachelor's Degree	7	I F I	O M A		Ordinary Bachelor's Degree Graduate Diploma Graduate Certificate
National Diploma	6	C			National Diploma
National Craft Certificate Trade Test A	5	A T			National Certificate A-Levels
VET Certificate Trade Test B	4	E			COSC (O-Levels
Basic Vocational Trade Test C	3				

Trade Test: Operatives	2				Junior Certificate
Sub-Junior Certificate Training	1				Primary School Leaving Certificate

Source: High Education Policy from the Kingdom of Lesotho and CHE (2013:44)

1.3.2 TVET in Malaysia

In Malaysia, TVET was introduced with the aim of creating enough manpower in the workforce with competent skills to close the scarce and pivotal critical skills problem. Hence, a series of training courses and programme curriculum in TVET were developed according to the existing requires current needs of the job market so that the students could respond with their semi-professional knowledge (Hadi, Hassan, Razzaq & Mustafa, 2015).

Therefore, Hadi, Hassan, Razzaq and Mustafa (2015) in their finding proclaimed that TVET curriculum was achievable, as surfaced by the Ministry of Urban Wellbeing, Housing, and Local Government (MUWHLG) (2015) when dividing engineering syllabus into two competencies, which are generic and functional. Generic competence ensures that students are prepared to manage and administrate the workplace, which requires knowledge and skills to achieve the organisational mission and vision as set out. While functional competence promotes the students' acquired vocational work, knowledge, and skills in the civil engineering and construction fields (Hadi, Hassan, Razzaq, & Mustafa, 2015),

In some logic, Hashim, Utami, Rahman, Jumaat, and Phon (2019) concurred with the above statement when emphasising that the TVET education system in Malaysia was the main producer and supplier of the workforce that has maintained sustainability challenges (Hashim et al., 2019). It concludes that Malaysia has designed a strategy for generator supply.

1.3.3 TVET in Botswana

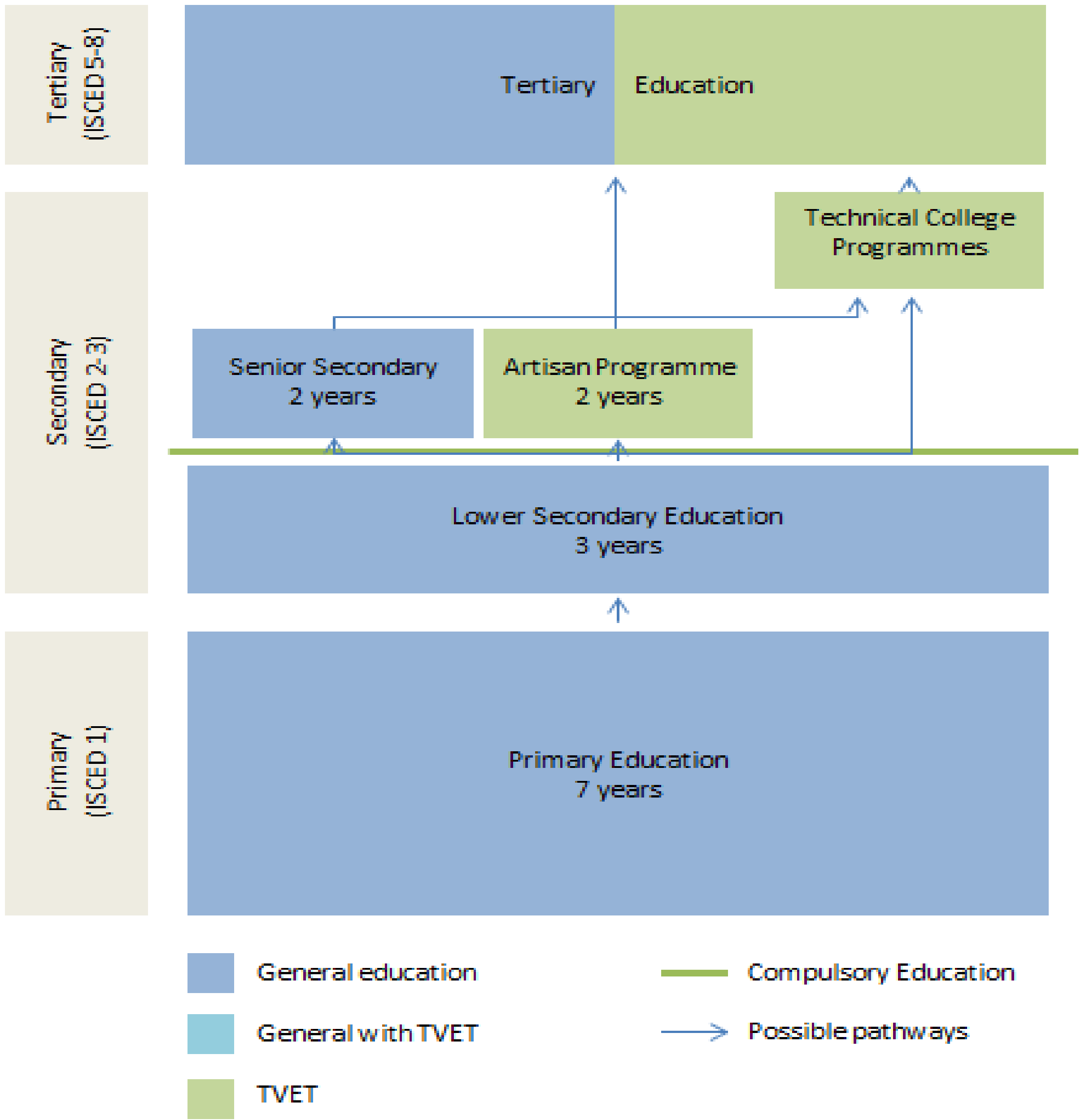

Figure 1.2: Botswana TVET structure

Source: UNESCO (2017:7)

In Botswana, the TVET system was divided into two ways where, after compulsory 10 years of schooling, learners had to choose their pathway, either general with TVET or artisan, which are both two-year programmes that end up in tertiary institutions (UNESCO, 2017:7).

1.3.4 TVET in Brazil

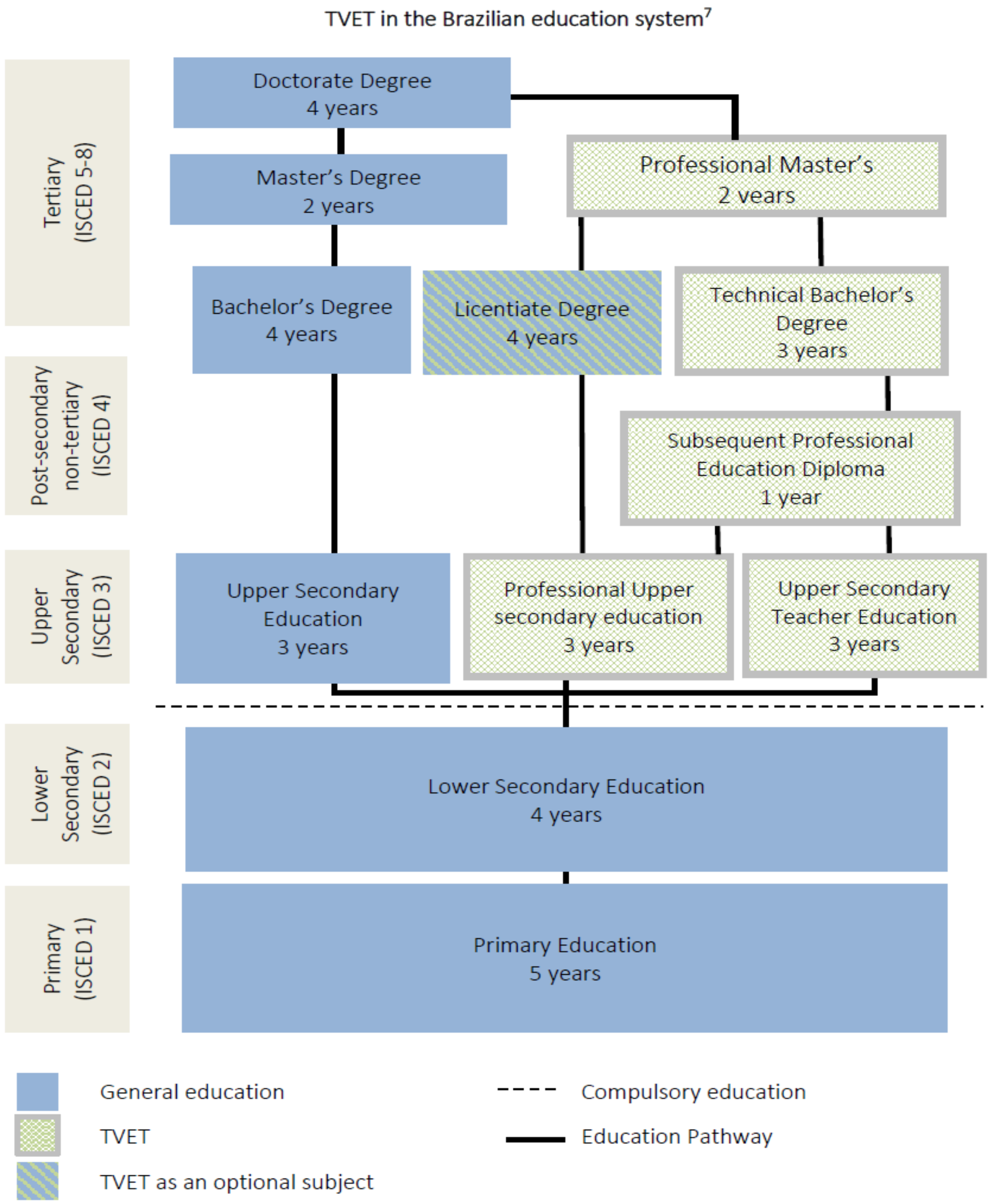

Figure 1.3: Brazil TVET structure

Source: TVET Profile Brazil (2018:5)

According to UNESCO (2017:5), the Brazilian education system has five stages, namely "primary, lower secondary, upper secondary, post-secondary, non-tertiary, and tertiary". On the technical side, they were divided into three systems:

Integrated: This is offered at the same institution to students who wish to take both general education and vocational courses.

Concomitant: This study direction is for students who enrolled in a general education course elsewhere, but who wants to complete a technical course; and

Sequential: This is offered only to high school graduates (Souza, Lima, Arabage, Camargo de Lucena & Soares, 2015).

Moreover, in Brazil, TVET education was primarily geared toward preparing youth for the workforce, boosting economic growth, and reducing poverty. The incorporation of postsecondary education into TVET could serve as a bridge between education and the labour market. Integration between secondary education and professional and technical education had recently begun in twenty of Brazil's twenty-seven federative units, particularly in the country's northern and north-eastern regions.

In Brazil, it was emphasised that TVET colleges is a critical part in the development of work-related skills. It facilitates the transition from secondary school into the adult world of work through VET programmes that increase worker productivity and respond to the labour market's specific skilled demand (Souza et al., 2015).

1.4 RATIONALE OF THE STUDY

According to Matea (2013), the government assisted in identifying the public FET college sector as an important institution to address South Africa's skills gap, especially in the area of intermediate skills, and committed to provide financial and structural support to strengthen the capacity of colleges in skill development. According to the Green Paper for Post-School Education and Training (DHET, 2012a:10), the public FET college sector remains weak and small despite the government's support since 2001. (Matea, 2013).

Mabale (2012) notes that within South Africa, the issue with TVETs was identical to that of other developing nations. The policy formulation and implementation gap remains significant. This disparity was attributed by studies to poor implementation (Curriculum Implementation, 2011). Since the advent of democracy in 1994, it was widely believed that South Africa had undergone unprecedented change. When there is a change in government, it is unavoidable that policy modifications will also be made (Graven, 2014).

Mbingo (2006) add that the 2007 implementation of the National Certificate Vocational (NCV) posed significant challenges for policymakers at both national and provincial level, and it impacted the implementation of policy at college level. With the introduction of the NCV curriculum, it was difficult for the lecturers to immediately accept the change, as they were accustomed to the notion of a know-it-all process (Mabale, 2012).

According to Makgato (2000), the current technical teacher education programmes needed to be evaluated in light of international technology teacher education practises. In schools, qualified educators were required to supervise the construction of a functional solar vehicle (Makgato 2000). This means that technology teachers' pre-service education have to comprise of exposure to all major industrial processes in the fields of mechanics, electronics, computing, and other engineering disciplines. There was a need for educators with expertise in the development, application, and maintenance of technological products (Lewis, 1994). However, technological concepts and processes must be balanced (Cajas, 2000).

Papier (2011) also note that, at this level of the curriculum, university education departments must design programmes that address and meet the requirements of the technical and vocational teachers. At a sociocultural level, national policy advocates the development of a professional identity incorporating the role and responsibility of each technical and vocational teacher (Government Gazette, 2013:3).

According to Mabela (2012), curriculum re-conceptualisation does not occur in a social vacuum; it should reflect the pressure for change from various educational constituencies and even interested groups. All factors should be taken into consideration when there is a plan to modify the educational policy.

Professionalising the vocational workforce by requiring higher qualifications would likely improve the morale of vocational educators. The other policy documents in South Africa (FET Act 2006, National Plan for 2008, and JVET Oxford 2010) demonstrate the candidate's relevant practical work experience. Therefore, a triple competence comprised of subject-specific knowledge, pedagogical knowledge, and practical work/experience knowledge is necessary (Papier, 2011).

Nonetheless, the aim of this research was to investigate the use of action learning as a teaching strategy in terms of content knowledge and practical work in technical subjects at TVET colleges. Papier (2011) asserts that lecturers require pedagogical training in teaching and assessment skills in order to devise innovative methods of assessment appropriate to practical work and to develop classroom management strategies for a diverse student body (Papier, 2011).

According to Papier (2010), in South Africa, higher education institutions that offers college lecturer credentials are limited, which are largely reconstituted schoolteacher credentials, with little agreement on the content of curricula (Papier, 2008). Universities that previously presented qualifications for college lecturers under now-obsolete frameworks, tend to emphasise the generic pedagogical component of lecturer qualifications over didactics in all the technical subjects that vocational lecturers teach across the spectrum of college programmes. Where applicable, subject methodologies had not been adequately addressed, nor had university programmes adequately considered the vocational context in which college lecturers teach or the audiences to whom they deliver education and training. According to Barnett (2006), the incorporation of a vocational pedagogy that looks both ways (towards disciplinary and workplace knowledge) into current higher education offerings for vocational teachers is not yet complete (Papier, 2010).

1.5 SIGNIFICANCE OF THE STUDY

The study's significance was to contribute to:

- changes to TVET practises,
- TVET colleges' available literature that would bridge the gap between content knowledge and practical work,
- Action learning is suggested as a teaching formula between content knowledge and practical work in engineering studies at TVET institutions.

1.6 STATEMENT OF THE PROBLEM

Civil Engineering and Construction is a programme that comprises both theory and practise. Students that graduate from this programme should be competent in theory and practice. In theory, students learn principles of mathematics, science, and design (engineering drawing), while in practise they translate their acquired knowledge through the application of actual hands-on or action-based practise. Lecturers at TVET colleges should integrate theory and practice work in teaching and learning in class. But from the researcher's personal experience, he observed that lecturers at TVET colleges were only teaching the theory part of the programme, and they shifted the practical work to work-integrated learning (WIL), which is left until the end. Yet at TVET colleges, students are expected to gain integrated generic knowledge and skills that paved a clear path to specific work-based learning. Buthelezi (2016) argued that TVET colleges in this country were designed to generate skilled artisans, apprentices, and entrepreneurs to achieve growth in the economic that can be sustained for years. The problem that this study was to investigate was using ALAs to enhance pedagogic practise to integrate theory and practical work, which was discarded during the restructuring of TVET colleges. The abandonment of practical work had caused a generic skills deficit.

Makole (2015) argues that the NCV programme in South Africa required lecturers in the FET and TVET college sector to have both theoretical and practical experience. During the implementation of the new NCV programme, it was discovered that the vast majority of TVET college instructors lacked the required credentials for their respective fields. The new NCV programme was implemented without a skills audit for lecturers in the FET college sector to align their job requirements with the NCV programme's requirements. This led to poor classroom performance, as evidenced by low learner output in the South African FET college sector (Makole, 2015). TVET colleges are marked as the institutions responsible for skill development and technical knowledge. But the problem was that lecturers from TVET colleges teach content knowledge only instead of teaching both content knowledge (CK) and practical work (PW), which seals a gap by integrating CK and PW through an application-based ALA.

According to Papier (2010), significant changes were made to college programmes in 2006, and a new curriculum, the NCV in eleven occupational fields, was implemented at the first FET level, Level 2 in 2007, Level 3 in 2008, and Level 4 in 2009. The new official curriculum represented a significant departure from what colleges had previously offered in accordance with the previous list of required college courses, known as NATED 191. First, the NCV incorporated foundational subjects such as language, mathematics or mathematical literacy, and life skills into all required programmes. Second, the new programmes in eleven vocational fields included four "core" courses with more stringent disciplinary and skill requirements than previous college courses. Thirdly, formative and external summative assessments were incorporated into the evaluation and advancement criteria for the seven subjects comprising each programme. Formerly-trained college professors were unfamiliar with the outcomes-based orientation necessary for delivering and assessing the new programmes. As a result, they required extensive training. In addition, colleges were frequently urged to accommodate with courses required by the local community and industry (DoE, 2008b:11). Many colleges offer, in addition to the state-funded NCV programmes, a number of other courses and programmes (Papier, 2010).

1.7 THEORETICAL FRAMEWORK OF THE STUDY

The study was guided by social and cognitive constructivism theories.

1.7.1 Cognitive constructivism in teaching and learning theory and practical work

Integration of conceptual knowledge from other academic disciplines was crucial for technology education. Learning areas that include science, mathematics, arts and culture, can provide the necessary knowledge, skills, and attitudes for solving technological problems. This, however, did not occur spontaneously, and for successful knowledge transfer, learners require intensive guidance from educators (Engelbrecht, Ankiewicz & de Swardt, 2006).

1.7.2 Social constructivism in teaching and learning theory and practical work

Individuals had no choice, according to Kiraly (2000) from a social constructivist viewpoint, other than to create meaning and knowledge via participation in interpersonal, intersubjective interactions. Due to the idiosyncratic nature of experience, our personal meanings and understandings of the world will never be identical to those of any other individual; however, language makes communication possible for all.

Harkness, Harris, Jones and Vaccaro (2009) and Masoabi (2015) stated that in social constructivist classrooms, students were able to raise different views from those of the teacher or textbook by indicating how they see things. Technical students also needed to link textbook material to the reality of their existence, like the well-known old debates on the shape of the earth, whether the earth was flat or spherical, and secondly, whether the earth is revolving or the sun is orbiting around the earth. Withdrawing from the existing knowledge about reality to construct one's own knowledge was imperative to learning as it developed inquiry skills, reasoning, critical thinking, and competencies among students as they got to sense the ownership of their knowledge (Masoabi, 2015).

Thorndike (1906) argues that learning occurs via the differential strengthening of ties between situations and actions. Teaching consisted of shaping the learner's responses through instructional techniques such as modelling, demonstration, and reinforcement of closer approximations of the desired response.

1.8 CONCEPTUAL FRAMEWORK

The conceptual framework would discuss the fundamental concepts underlying the teaching and learning action approaches in the study. According to Jabareen (2009), the conceptual framework links the different concepts to provide an all-encompassing understanding of a phenomenon.

Action learning as approach for Teaching and learning

An ALA is the method where students learn by doing, and it has become the main approach of any good learning design that requires practical work in addition to content knowledge (O’Neil & Marsick, 2007).

Action Learning based Approaches (ALA):

- Case Study
- Simulation
- Projects

- Research

Teaching Methods:

- Demonstration
- Problem Solving (Technological Process)

1.9 AIM AND OBJECTIVES

Aim:

This study aims to explore the use of action learning as a teaching approach with reference to content knowledge and practical work in Eivil Engineering Construction Studies at TVET colleges and to review existing formulas.

Objectives:

The study objectives are formulated as to:

- determine the teaching approaches used at TVET Civil Engineering Construction studies Curriculum.
- assess the extent to which action learning approach was employed in teaching content knowledge and practical work in Civil Engineering Construction studies at TVET.
- evaluate the sequence/procedure lecturers used to assess content knowledge and practical work at TVET colleges.
- determine the challenges that TVET lecturers may experience during the implementation of action learning approach.
- develop a formula for capacitating TVET lecturers in action learning approach to produce good quality work at TVET colleges - regarding the integration of content knowledge and practical work.

1.10 RESEARCH QUESTIONS

“How were action learning approaches used to promote and enhance the pedagogic practices in Civil Engineering and Construction studies at TVET colleges?” is the main research question to be answered.

The main question has the following sub-questions:

- What teaching approaches were used in TVET colleges engineering studies curriculum?
- To what extent were lecturers using action learning approaches in Civil Engineering and Construction studies at TVET colleges?
- What sequence lecturers used to assess content knowledge and practical work at TVET colleges?
- What challenges did TVET lecturers experience during application of ALA?
- How could lecturers be capacitated to use ALA to produce and integrate quality work at TVET colleges?

1.11 ASSUMPTION OF THE STUDY

It was assumed that if TVET lecturers applied different action-learning-based approaches and methodologies of teaching, they could practise effective teaching and learning, which can produce an effective integration of content knowledge and practical work.

1.12 METHODOLOGY

1.12.1 Research Design

For data collection, a mixed-methods approach was selected, with a qualitative and quantitative methodology. The research methodology includes a literature review and employing semi-structured purposive sampling interviews and questionnaires as qualitative and quantitative methods, respectively. McMillan (2000) states that both research methods could be used in the same study as both qualitative and quantitative approaches adhere to the same research paradigms. Most authors concur, according to Matea (2013) and De Vos, De Hauw and Willemse (2011), that social science researchers in the real world employ quantitative and qualitative methodologies, consciously or unconsciously.

In this mixed-method, according to Green, Creswell, Shope and Clark (2007), "quantitative and qualitative data were collected and analysed separately on the same phenomenon, and then the disparate results converged during interpretations".

According to Creswell (2003:81), a "mixed methods design was useful to capture the advantages of both quantitative and qualitative approaches". A mixed methods study can be described as the procedure for collecting, analysing, and combining data within a single study to gain a comprehensive understanding of a research problem (Creswell & Creswell, 2005). In a mixed-methods study, numerical data is collected and analysed to look at multiple facets of the same overarching research problem and provide a deeper understanding (Maree, 2009).

1.12.2 Population and sampling

Population

It is impractical to study the entire population; therefore, a researcher can draw conclusions from using a representative sample (Sharp, Peters & Howard, 2017; Maeko, 2013). The population for this study includes all lecturers who are teaching civil engineering and construction studies in NATED 191 and NCV programmes in TVET colleges in the Free State province of South Africa. The researcher would select some of the lecturers based on their characteristics that are relevant to the study.

Purposive Sampling

Cohen, Manion and Morrison (2011:4) posit that sampling is conducted for a variety of research purposes such as representation, enabling comparisons and putting focus on issues or cases that are new or unique, to generate theory "through the gradual accumulation of data from various sources". The respondents of the study consist of 26 lecturers who were both male and female and responsible for the content knowledge (theory) and practical work of NCV Technical and NATED 191 for Civil Engineering and Construction subjects from 4 TVET colleges, namely Maluti, Motheo, Goldfields, and Flavius Mareka in the Free State in South Africa.

1.13 DATA COLLECTION

Quantitative Design

The instrument for this study was a questionnaire.

Questionnaire

Bless and Smith (2000) describe a questionnaire as a data collection instrument using a series of standard questions that relate to the concepts of the study, and respondents answer these questions in writing. McMillan and Schumacher (2006) view the benefit of a questionnaire in that respondents can answer with confidence and anonymity. The questionnaires were administered by the researcher to the respondents, and the questionnaires were collected four days later.

Qualitative Design

Face-to-face interviews were conducted for this phase of data collection.

Interview

Babbie (2007) states that an interview is another method of data collection where the participants are interviewed individually, and their responses recorded, either in writing or by making a voice or video recording. In contrast to casual interviews, face-to-face interviews conducted for research purposes are a highly disciplined endeavour, according to Anderson (2004). According to Anderson (2004), it is a dynamic process in which an interviewer and interviewee converse in person, typically in accordance with a set of rules or a protocol.

Semi-structured interviews with open-ended questions were conducted with 13 participants using face-to-face or digital visual platforms. The participants were asked interview questions orally, and their responses were recorded using a tape recorder. Krathwohl and Smith (2005) state that qualitative research enables better comprehension of human behaviour and improves data interpretation.

1.13.1 Data Analysis

Quantitative (Questionnaires)

Quantitative research aims to collect and ascertain facts, that can be used statistically to describe a phenomenon, explain and predict, and show relationships between variables (Gall, Gall & Borg, 2007). Quantitative research designs are typically structured and prescriptive, and the data derived from these studies are frequently characterised as hard, empirical, or statistical (Bogdan & Biklen, 1997). Most of the data was expressed numerically, and interpretations were based on comparisons and partitioning of those numbers (Gall, Gall & Borg, 2007). The researcher arranged the data and sent it to the professional statistician employed by the researcher, who analysed the data gathered using SSPS software and provided a clear guide on how to interpret and discuss it.

Qualitative (Interview)

Descriptive qualitative research represents an approach that emphasises research processes. It is holistic, as studies had to be viewed in a broader social context, and it required intensive immersion in the data and familiarity with the research environment. In general, research designs were also less structured and flexible (Bogdan & Biklen, 1997). According to Creswell (1994), data analysis should be done at the same time, or close to data collection. The data from the tape recordings was transcribed, whereafter the researcher read those transcripts and developed codes and themes. Thereafter, the data was interpreted and discussed.

1.14 ETHICAL CONSIDERATION

The researcher requested an ethical clearance certificate from the ethics committee at the Faculty of Humanities as permission to apply to DHET and relevant TVET colleges. Permission was requested first from DHET, then DHET provided the researcher with the relevant form to fill out and submit to the principals of the TVET colleges targeted for collect data. The researcher presented participants with a consent form requesting their participation without promising any compensation afterward. Ethical consideration of the confidentiality of the participant's information has clearly been highly practised. The researcher adhered to all elements stipulated in the POPI Act emanating from Section 14 of the Constitution of the Republic of South Africa, 1996, which provides that everyone has the right to privacy; the right to privacy includes a right to protect against the unlawful collection, dissemination, and use of personal information (Government Gazette 2013:3). The study data would be used exclusively for or contribute to the body of knowledge.

1.15 LIMITATIONS AND DELIMITATIONS OF THE STUDY

- The study was limited to lecturers who were responsible for construction planning, carpentry, roofing, plumbing, masonry, carpentry and roofing theory, building and civil technology, quantity surveying, building and structural construction and surveying.

- Only Free State public TVET colleges were involved, which were Maluti, Motheo, Goldfields, and Flavius Mareka.
- Therefore, the main limitation was that findings from the study could not be generalised owing to the small sample based on the size of the sample, and it was done in Free State TVET colleges only.

1.16 DEFINITION OF TERMS

Pedagogy

Alexander (2001) contends that pedagogy is both an act and a discourse which includes the performance of teaching theories, beliefs, policies, and controversies that inform and shape it.

Subject Methodology

The subject methodology was described as a module that centred on the school subjects or learning areas that the student would teach and introduced pedagogical content knowledge, or how to teach that subject or learning area. (Bertram, Mthiyane & Mukeredzi, 2013).

Teaching Approaches

Teaching approaches were how the process of instruction took place. It was the philosophy that provided direction and set the spectrum in teaching and learning. In addition, an approach establishes the general rule or principle that makes learning possible. It is an approach that imparts a comprehensive understanding of teaching.

Content Knowledge

Content knowledge is defined by Koehler and Mishra (2009) as the actual subject matter learned or taught, such as middle school science. Knowledge and the nature of inquiry vary significantly across subject areas, and it is crucial that teachers understand this about their subject (Mokhothu, 2015).

Practical Work

Practical work is defined by Vilaythong (2011) as a teaching and learning activity where students or learners observe or manipulate real items and materials, and the creation of learning experiences in which students interact with material phenomena in a practical workshop (Maeko, 2013).

Technical Subjects

Technical education is the part of education that allows students to acquire practical skills and fundamental scientific knowledge (Nigerian Policy on Education, 1981; Mokhothu, 2015).

National Certificate Vocational (NCV)

NCV was implemented in South African FET, which is now changed to TVET colleges in 2007 as comprehensive response to the identified skills shortage (Kanyane, 2016). It was a new qualification at the NQF Levels 2 to 4. The NCV curriculum was introduced at FET colleges at NQF Levels 2, 3, and 4 from 2007 to 2009, respectively. The NCV provides Grade 9 students with an alternative to academic education in Grades 10 to 12 by offering industry-focused training at NQF Levels 2 to 4 (Mabale, 2012).

TVET and Further Education and Training (FET) College

A FET college was formally known as a technical college and provides apprentices with L2 to L4 NCV courses, as well as NATED courses on National N Diploma level (DHET, 2012a: 20).

1.17 CHAPTERS OUTLINE

The study was divided into the following chapters:

Chapter 1: Orientation of the study

Chapter 2: Literature Review: Theoretical framework: Historical perspective

Chapter 3: Literature Review: Conceptual framework: Current practices

Chapter 4: Research Methodology

Chapter 5: Data Collection, Analysis, Interpretation and Discussion

Chapter 6: Summary, Conclusion and Recommendation

1.18 CONCLUSION

In conclusion, ALAs are teaching and learning methods and strategies developed to strengthen and enhance TVET lecturers' pedagogical ability to apply various teaching approaches during teaching and learning. It also makes teaching technical subjects more effective, with an emphasis on integrated content knowledge and practical work approaches. This chapter's objective was to provide an overview of the study based on its significance and aim. It also covered the objectives and problem statement of the study. The next Chapter 2 explains the approach's theoretical foundation, as well as its nature and scope.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 INTRODUCTION

The previous chapter highlighted the study's context, problem statement, purpose, objectives, and significance. oriented about the Technical, Vocational, and Training Education (TVET) lecturer teaching and learning approaches that emphasise content knowledge and ignore practical work.

This Chapter therefore focuses on the theoretical framework that underpins this study, which is constructivism, which consists of social and cognitive components. Then there is also the theory of experiential learning by Kolb that will guide and signify the processes of understanding. It further explores the nature and scope of action-learning approaches.

2.1.1 Constructivism as Theory in Teaching and Learning

Constructivism theory is assumed to have been created by psychologists Piaget, John Dewey, and Vygotsky in the early 20th century (Kuany, 2012). Doolittle (2014) defines constructivism as the widely accepted theory that people construct their own knowledge by their interpretation of their individual experience in the real world. Doolittle went further to explain that constructivism highlights the outer nature of knowledge. Hence, Doolittle (2014) mentions the three pillars of constructivism theory as follows:

- Knowledge creation is a socially and individually active process.
- The end result of the active process of the construction of knowledge is to make own thoughts and behaviours more effective in terms of achieving one's goals.
- Individual and social interpretations of a person's experience contribute to his or her comprehension.

Expounding on the three constructivist pillars above, Dewey (1938) argued that knowledge is never a depiction of reality from an explanatory perspective. Individual and social experiences shape how knowledge and reality relate to one another (Dewey, 1998). Moreover, knowing is a process of being a part of reality rather than the students seeking out and recording reality (Montessori, 1912; 1997; Vygotsky, 1987; Piaget, 1971). As a result, knowledge is a process that involves the activity itself rather than an external, objective reality (Dewey, 1998). Constructing the right and wrong of the world through interpretations based on experiences. Broader and deeper experiences alter how individuals perceive what is acceptable (Dewey, 1998; Vygotsky, 1987).

While Vygotsky (1978) and Vollenhoven (2016) assert that students use daily experiences to understand the scientific concepts in the curriculum, the findings of this study contradict these claims. Vollenhoven (2016) assumes that this occurs during students' "interaction with others in various situations", However, it recognises that students also need assistance in understanding the more in-depth conceptual knowledge which reinforces practise or when generating innovative ideas, thus introducing others to the concept of the expert.

Hence, Seward (2016) contends that action learning (AL) is predominantly humanistic in its philosophy; its nature promotes social constructivism, where students are architects of their own reality, which influences their own experiences in life. In addition, the purpose of social action learning groups (set members) is to reflect on their education with the assistance of their peers and their lecturers (Vollenhoven, 2016). Therefore, the study will consider explaining more in terms of two types of constructivism, which are social and cognitive constructivism, as they underpin action learning theory. The below model (the K schema) by Kayes (2001) guides the study by indicating the relation of interdependence between social and personal knowledge (cognitive) by illustrating experiential learning.

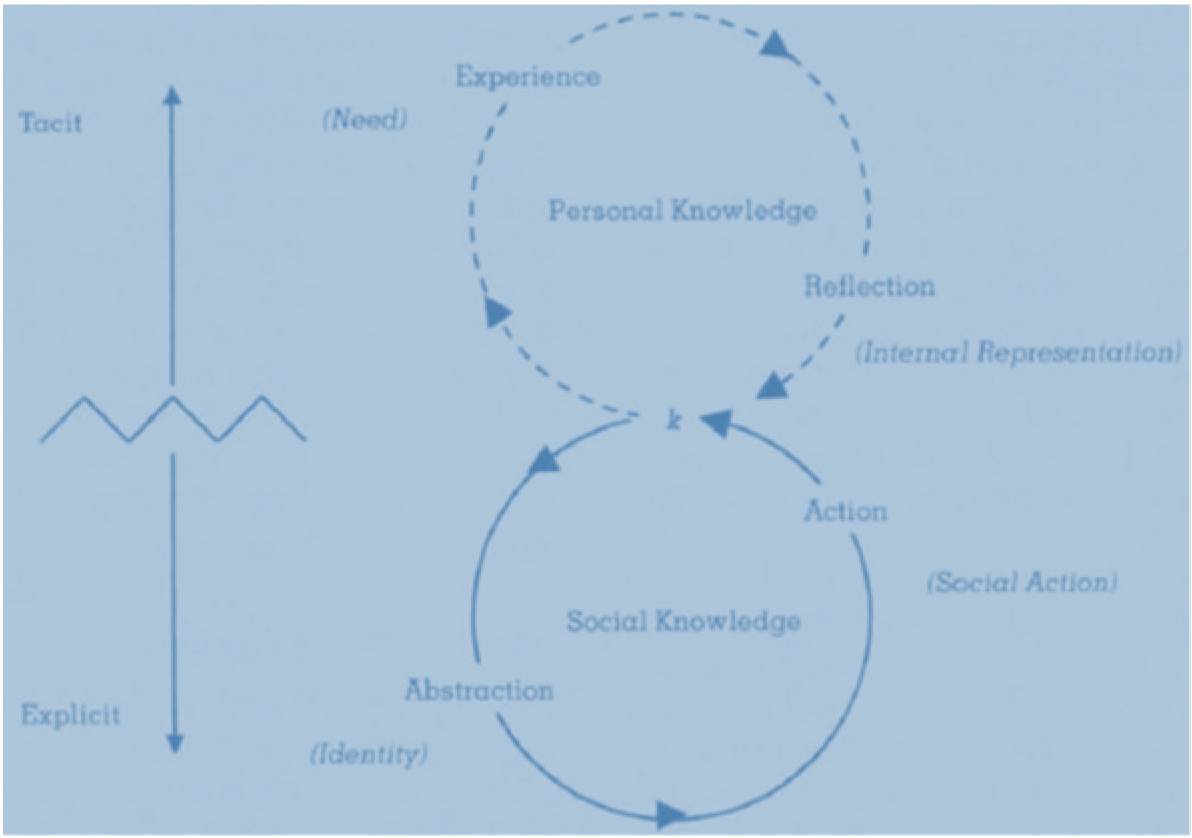

Figure 2.1: The K Schema

Source: Adapted from Kayes (2001:145) K Schema "Twist"

According to Kayes (2002), the K-Schema graphically shows the accurate ideology between personal and social knowledge in experiential learning theory. Furthermore, Kayes (2001) clarified that in the learning cycle, concrete experience or need revealed the emotional stage that will convert into reflective observation (known as internalised representation). While abstract conceptualisation indicates identity, it operates as an integrating instrument that makes for an organised experience. When active/action experimentation or social interaction operates as a symbolic heterogeneous blender, producing the raw material needed from which experience ascends, However, the central interaction between personal and social knowledge is highlighted by Kayes (2002), Powell and Kalina (2009), and Maeko (2016).

Therefore, Masoabi (2015) postulates that students are anticipated to integrate their daily knowledge to assist them in interpreting the new knowledge in the classroom and workshops, which will assist them in becoming critical thinkers during their action learning process.

2.1.2 Cognitive Constructivism in Teaching and Learning at TVET

Cognitive constructivism, according to Doolittle and Camp (1999), emphasises the accurate mental construction of reality. They continued to assert that cognitive theory accepts that each student constructs unique mental models based on different experiences. Students' intellectual growth is stimulated when they could use critical thinking in trying to do problem-solving and to explore and discover. As the world is made up of symbols that we encounter daily and in the classroom, students must develop their symbolic thinking (Nowak-Fabrykowski, 2018).

Cognitive constructivism encompasses each of the five career-technical education concepts listed previously in its entirety. Thus, cognitive constructivists advocate and support:

1 the function of prior knowledge in cognitive processing,
2 the advantage of domain-specific, expert-based problem-solving strategies,
3 domain-general problem-solving strategies and their adaptability,
4 the significance of acknowledging the impact of individual differences, and
5 The objective of an independent lifelong learner (Doolittle & Camp, 1999:14).

As the first concept of prior knowledge above is pronounced, as stated by Doolittle (2014), it indicates that the student gives an experience significance by connecting it to the regularities in or around that environment (Eisenhart & Broko, 1991; Martin, 1999). According to the second concept, it is the responsibility of the student construction process to help them internalise their culture and comprehend their surroundings (Doolittle, 2014). In addition, students create mental models based on their experiences, which function as complicated agents that entail the active search for regularities in understanding and making meaning (Cobb, 1989). The organisation of students' internal models is solely the responsibility of the student, regardless of the source of the model. Cowan, Pines and Meltzer (1994) define the third concept, domain-general problem-solving strategies, as constructivism and complexity. Both authors emphasise that this is a student-driven process, regardless of the source.

Furthermore, these processes happen as students are engaging with one another all the time (Cowan, Pines, & Meltzer, 1994; Doolittle, 2014).

The fourth concept, which appears to be difficult to control, is that students' internal models and rational understanding are observable outcomes of experience gained (Holland, 1998; Doolittle, 2014). Due to students' participation in and contributions to local community practises, Cobb and Yackel (1996) contend that this fifth concept epitomises individual learning as a constructive activity. The most challenging goal for connecting the accomplishments of individual consciousness is, thus, according to Singer (1995), the task of understanding students' developing minds (Vygotsky, 1987; Ernst, 1995; Yackel, 1995).

Vygotsky (1978:86) defines the Zone of Proximal Development (ZPD) as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Dixon-Krauss, 1996:18). Furthermore, the researcher considered ZPD one of the study's grounds based on its main ideal purpose, which is that a lecturer with more knowledge can significantly improve a student's learning by advising them through an activity moderately above their competency. As students acquire knowledge and skills, the lecturer gradually reduces expert advice until students can independently solve problems (Wood, Bruner & Ross, 1976; Vygotsky, 1978; Dixon-Krauss, 1996).

Jones and Araje (2002) concur that, in the ZPD, lecturers and students should work in brigades on a task that students cannot complete independently due to its level of difficulty. It also reflects the concept of collective activity, in which those who know more or are more skilled share their knowledge and skill with those who know less to complete a task. Working in the ZPD requires a significant amount of guided participation, where students contribute their own meaning and understanding of social interactions when integrating it with the context (Jones & Araje, 2002).

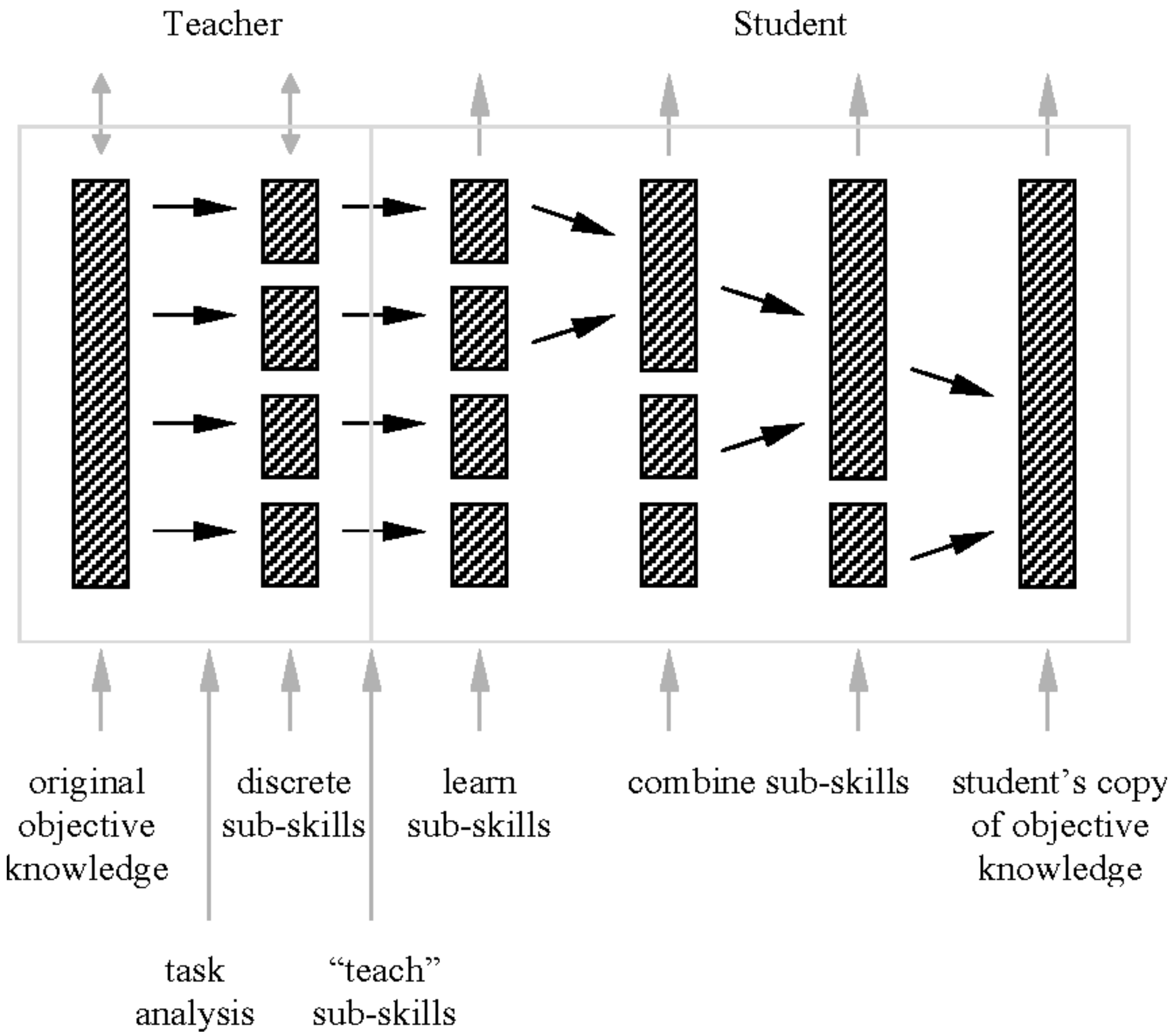

Figure 2.2: Cognitive Constructivism

Source: Adapted from Doolittle (2014:487)

Moreover, in TVET colleges, apprenticeship programmes are the cultural practise of skill transfer and cognitive development. However, Jones and Araje (2002) echo the same sentiment that, within the job sphere, apprentice work is according to ZPD because their work mainly goes above their present understandings. In Civil Engineering and Construction, where AL is used as a teaching and learning approach, each student is presented with the theory and practical work, and the importance to their daily lives as a "psychological experience" (Masoabi, 2015). While students are engaging each other in a social state, various perspectives will be lined up. Then, each student would take advantage of the chance to think carefully about what they had learned and build their own knowledge.

Doolittle (2014) agrees with Piaget (1973), who defined cognitive development as the effect of unchanged internal mental structures, a continuous sequence of diverse skills to reason with, and the influence of integrating and extending previous cognitive development levels into new knowledge or cognitive levels. Through the influence of Piaget (1970, 1973, 1977) and Glasersfeld (1995), the model in Figure 2.2 graphically depicts an individual's experience and their desire to comprehend what they already know (assimilation) and experienced (re-presentation). "This process of event interpretation-cognitive action-expected or unexpected results-verify/reorganize understanding" (Doolittle & Inkpen, 2018:487) is an adaptive process designed to improve a person's understanding and subsequent actions.

2.1.3 Social Constructivism in Teaching and Learning at TVET

Social constructivism culture and the environment for comprehending what occurs in society and constructing knowledge are grounded in the understanding of these intellectually situating and learning mechanisms and perspectives (Palincsar, 1998). These perspectives are linked to many different contemporary theories, such as the developmental theories of Vygotsky and Bruner, and the social cognitive theory of Bandura (Shunk, 2000). Social constructivism is based on certain assumptions about the nature of reality: “believe that reality is constructed through human activity; knowledge is socially and culturally constructed and influenced by the group and its environment; and learning is social activity” (Clerigo & Sario, 2014:9). To understand and implement social constructivist-based instructional models, it is necessary to be familiar with their underlying premises (Kim, 2006; Palincsar, 1998).

However, Vygotsky (1978) states that children learn easier when they are in social situations or from social relationships they require others to develop. Bruner (1960) concurs that children are active learners and construct new ideas when they can combine it with existing concepts, and proposes that intuitive and analytic thought be stimulated in children. While Robinson (2001) used the American school system as an example of how a focus on standardised test preparation stifles children's creativity and inquisitiveness, the school system should be held accountable (Nowak-Fabrykowski, 2018).

In the same vein, Masoabi (2015) suggests that students begin experiencing social interaction during action-learning set discussions, which would shed light on their own understanding, knowledge, and existing knowledge.

Moreover, Vygotsky (1978) emphasises that students and lecturers are active agents in teaching and learning of a student's development. The lecturer's involvement in the learning of a student is required, but the focus should be on the quality of the lecturer-student interaction (Jones & Araje, 2002; Maimane, 2019).

Therefore, Jonassen and Murphy (1999) also concur when they explain that social constructivism is based on the interaction between a student's activity or action and sociocultural activities that construct learning through environmental action around them. Therefore, social constructivism affords students the opportunity to design their own learning process by interacting with the world. Boyd's (2002) findings synthesised the idea that by directing their own learning process, students will understand concepts better.

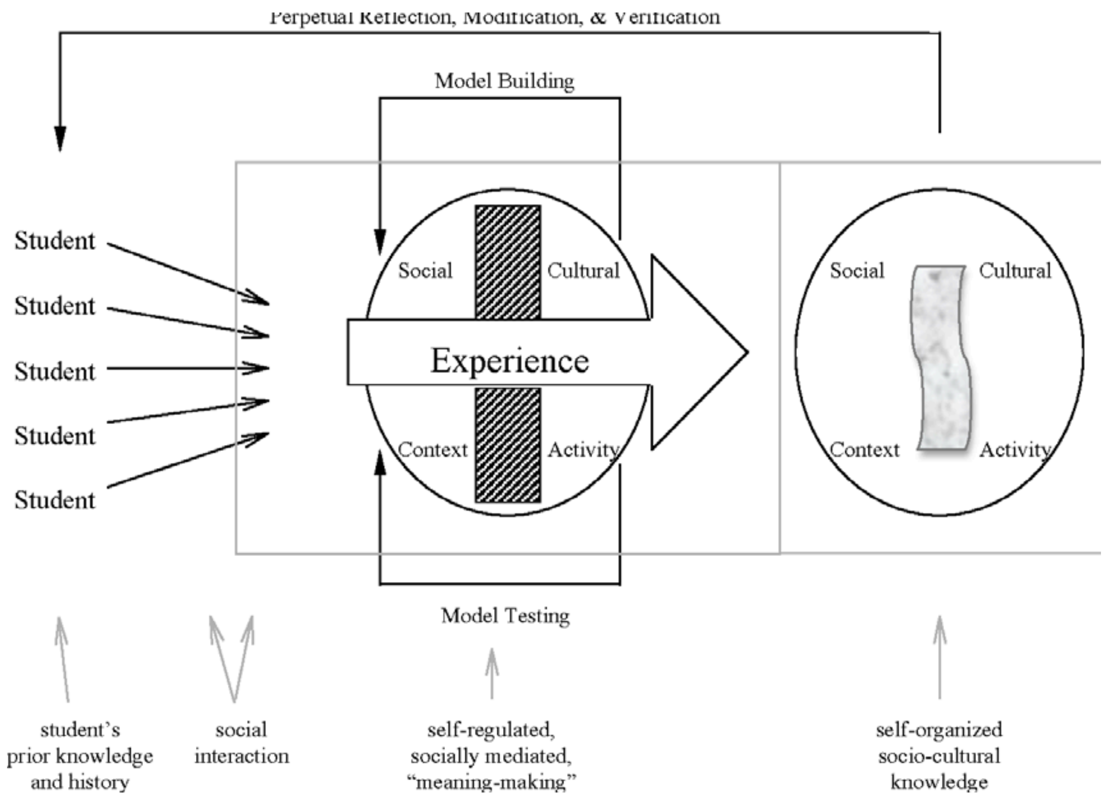

Figure 2.3: Perpetual Reflection, Modification, Verification

Source: Adapted from Doolittle (2014)

In Figure 2.3, a dark rectangle illustrates the students' interaction with knowledge in a socio-cultural environment. Whereas the development of the internal mental structure is influenced by the external social experience (social, cultural, contextual, and activity-based factors), However, in the light rectangle, students do not receive direct knowledge but depend on their personal interpretation of knowledge from external sources (Doolittle, 2014).

2.1.4 Theory of Learning Kolb's (Experiential)

The researcher chose to incorporate David Kolb's Experiential Learning Theory (ELT) (1984) to provide a clear guide to the teaching and learning process through action. Furthermore, ELT teaches an open model and a multi-linear model of adult competency, and are based on Kolb's theories regarding how people learn and develop (Maeko, 2016). Nonetheless, ELT theory indicates the study's relevance, as it aimed to improve TVET pedagogical practise through action learning. In addition, Kolb's model is appropriate because it attempts to capture the nature of learning through action. Therefore, it has also influenced the selection of ELT theory based on the integration of theory and practical knowledge through an ALA in the field of civil engineering and construction education. According to Kolb (1984), it is important to strike a balance between the content and process involved in the acquisition of knowledge and skills (Maeko, 2016).

Learning is the process of constructing meaning from one's experiences and making sense of them. According to Rahaman (2013), theorists including Dewey, Candy, Piaget, Vygotsky, Weick, Kolb, Lave, and Mezirow previously stated that learning takes place experience. Distinct learning occurs when a student adapts to his or her environment by expanding on what he or she already knows and altering future behaviour.

In a similar vein, Berg, Page, and Lou's (ibid.) findings advocate that ELT is an active tool that unlocks the conversation channel between both lecturer and student about their experiences, ideas, and interchangeable learning of new things (Berg, Page & Lou, ibid.:10).

Moreover, Seward (2016) promulgates that action learning (AL) assimilates characteristics of experiential learning through the grounds of Kolb's (1984) learning cycle (action, reflection, generalisation, and testing), which is a learning process that is experience-bound and involves understanding, planning, and action. Learning is subjected to a process where other students re-learn how to learn from others. Hence, Seward (2016) concurs that "the concept of learning to learn has become prominent for its potential to underpin lifelong learning". Furthermore, Maimane (2019) backs up the above statement by alluding to the fact that learning in social constructivism is comprehended as a social process. Significant learning happens during social activities because it does not occur in the alienated space of the individual (Maimane, 2019). Therefore, it uses critical reflection to consider and evaluate the practical or practice-based assumptions and beliefs (Seward, 2016).

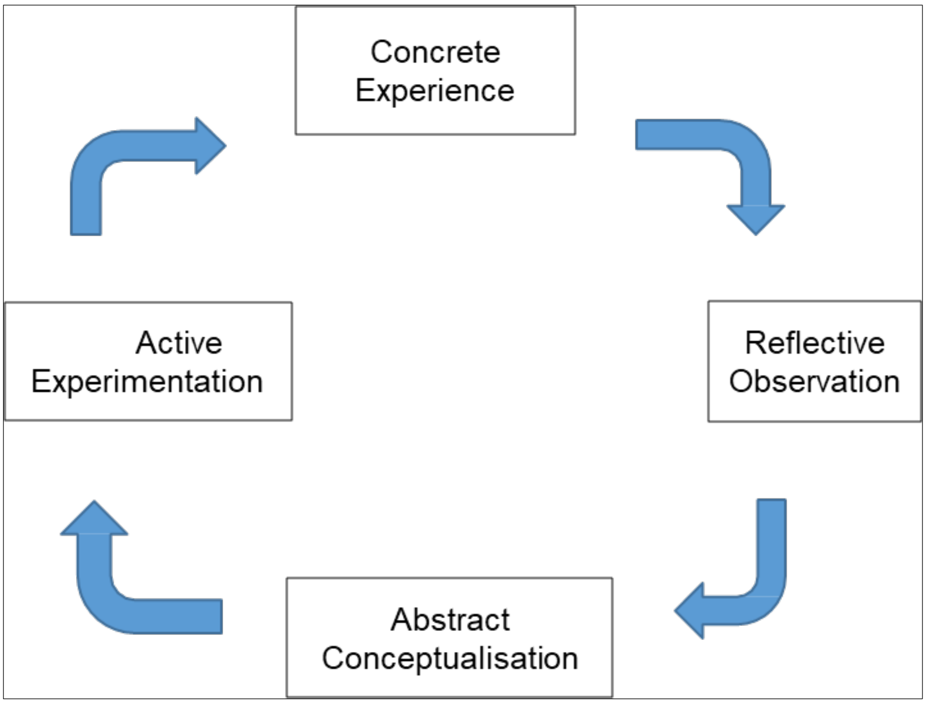

Figure 2.4: Experiential Learning Cycle

Source: Adapted from Kolb and Kolb (2018)

The model above by Kolb and Kolb (2018) postulates that new knowledge and skills are gained by means of alignment and laminating four styles of experiential learning.

Kolb (1984) states that students require four different types of abilities to be successful in practical learning, which are: concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualisation abilities (AC), and active experimentation abilities (AE). Furthermore, Kolb (1984) echoes that students should not fear new experiences, as they will bring new clarity and experiences (Maeko, 2016). It is ironically assorted with action approach as types concisely elucidated below:

- **The Concrete Experience (CE)**

Concrete experience is the first step of the Kolb learning cycle. At this step, students learn more by touch than by thinking. In this study, this step was applied during ALAs pertaining to practical work in civil engineering and construction class, because concrete experience is the foundation for observation and reflection (Kolb & Kolb, 2018; Maeko, 2016). Hence, Rhoda (2011) in Maeko (2016:49) alluded that "concrete experience must be an active, interactive event that involves all the students in the activity". Moreover, they emphasised that the chosen event may not exactly be part of learning objectives, but eventually it will give its own direction to the relationship (Maeko, 2016).

During the concrete experience, students in Civil Engineering and Construction (CEC) are placed in sets to solve an existing problem practically without any lead but only the problem. However, Maeko (2016) is of the opinion that those specifications from the sets would be complemented by the lecturers' or lab technicians' demonstrations and illustrations on the equipment and tools required to complete the task. In the same sense, Kolb (1984) uttered those instructions and demonstrations that lead to better acquisition of hands-on experience. Hence, this study encourages simulation as part of ALAs to allow a clear observation of how teaching and learning of practical work take place in a civil engineering and construction class or workshop. Therefore, the researcher was able to determine a clear path for the practical lesson that will impart an understanding of learning by doing.

According to Maeko (2016), the initial stage for introducing new concepts to be learned is through concrete experience. He further asserts that observation is regarded as an eye-opening process that stimulates students' interest in technical education through practical work. The pathway of Civil Engineering and Construction (CEC) also promotes that students should observe how tools, equipment, and machinery are used in multiple functions during project illustration. such as the construction of a domestic dwelling. which insight is known as manipulatives, which means identification, touch, and movement of tools, equipment, machinery, and materials by the students (Maeko, 2013; Maeko, 2016; Mokhothu, 2018). What you see and touch, you will never forget.

Maeko (2016) is of the opinion that other students have studied civil engineering at a high level and have accumulated more knowledge and basic skills. Those with such technical educational experience should be appointed as the set leaders, which should assist as a morale boost in the sets. which would help them reflect on the basics when they acquire more experience. While the functions of the lecturers should be to facilitate, demonstrate, and illustrate, they should also be more focused on those who do not have any experience in technical education. Therefore, it could be deduced that concrete experience is an observation stage for lecturers and students to observe the teaching and learning of practical work during action teaching and learning in the civil engineering and construction sphere.

The Reflective Observation (RO)

At this step of reflective observation, students begin to develop their own descriptions for the concrete experiences of illustration and demonstration that have been assumed. According to Kolb (1984), instruction and demonstrations are the main impetus for enhanced attainment of hands-on experience. While Jackson (2017) argues that through observation, students learn new components of information and close the knowledge gap by executing the new skill, which contend that this is not the case (Maeko, 2016). Hence, Rhoda (2011) attests that in the reflective and observation step, students' learning objectives are covered through observation rather than action to digest the sense of what they observed (Rhoda, 2011; Maeko, 2016). Therefore, students who observed well during the demonstration might understand the crucial features in the practical work sphere.

Reflective observation in civil engineering and construction (CEC) is used as a part of ALAs, where students apply sense to what they have observed. Students would then use these observations in their planning for a problem-solving situation where they discuss possible solutions within their sets. For example, students can be asked to select construction materials for the project to simulate material surveying for the real project.

The Abstract Conceptualisation (AC*)*

At this level, students endeavour to conceptualise the principles through the perspective of intellectual understanding (cognitive domain) (Rhoda, 2011). According to Dieleman and Huisingh (2006), the student's attention is based on comprehension via conceptual interpretation, analysis, and symbolic representation (Dieleman & Huisingh, 2006; Maeko, 2016). From the two previous steps, students developed ideas about how things operate, which can be tested through simulation and further manipulation of equipment to create a unique concept (Korn, 2015; Maeko, 2016; Dongkun, 2018). These steps confirm that students can integrate theory and basic practical work skills into new models through action learning. However, in this study, the lecturers and students would be in the Civil Engineering and Construction class. The lecturers would let the students set out to develop their own ideas on how to conduct material surveying for the project. Students can make a proposal for a domestic dwelling with all the specifications. Acquired theory and basic practical skills assist students with what to prepare and where to start with the given project. Therefore, Kolb and Kolb (2018, 2014), and Maeko (2016) attest that those students find practical work more active in their technical and vocational careers.

Active Experimentation (AE)

In active experimentation, ALAs are applied and tested fully by the students under the lecturers' supervision. Students are expected to implement their theories by putting them into practise to solve the problem assigned to them. In addition, it allows students to advance their learning past the immediate learning objective and try to experiment with their new knowledge or skills with another application or environment (Maeko, 2016:53). This is a doing step where students would experiment with the final simulation in a laboratory and attend the final practical application in a workshop (Kolb & Kolb, 2018). The manipulation of equipment, materials, and tools is applied at this active experimentation stage. This is the step where the assessment will reveal if the observation was well conducted, depending on the proper functioning of the project. However, if the project fails to operate as expected, it is likely that students did not pay the required attention during the observation period.

In civil engineering and construction, this is the step where the making, manufacturing, or modelling process takes place based on the specifications and experience. Moreover, the originality of active experimentation is to address practical application principles rather than theoretical principles (Maeko, 2013; Maeko, 2016). Keeping in mind that TVETs are the main impetus of the economy through skills development, which makes practical skills critical and pivotal to obtaining trade skills. Hence, in civil engineering and construction, students should regularly be hands-on during the teaching and learning process to advance their hands-on skills (Korn, 2015; Dongkun, 2018). Therefore, the researcher concludes and regards active experimentation as a making or creation step because students are building final projects.

- **Justifying the adaption of Kolb's cycle**

With the teaching and learning of civil engineering and construction theory as practical concepts, Kolb's learning cycle in all steps was understood as giving NATED 191 and NCV Civil Engineering and Construction students, who have a background in civil engineering from secondary school grades 10–12, a straightforward transition to furthering their technical skills and knowledge. Furthermore, Maeko (2016) and Dongkun (2018) emphasised that lecturers should put more concentration on those students without any building environment or specific Civil Technology background to boost their knowledge and technical skills. Therefore, illustrations, demonstrations, and application should be the main components of the integration of theory and practical skill concepts. Hence, Kolb and Kolb (2018:11) asset that "Learning is the best facilitated by a process that draws out the students' beliefs and ideas about a topic so that they can be examined, tested and integrated with new and more refined ideas".

Civil engineering and construction (CEC) subjects require and train students to apply drawing, mathematics, physical sciences, and technical or practical skills. The virtual skill is imperative as it serves as communication in the field because students should be able to interpret drawings and translate them into practical. In the same sense, Maeko (2016) echoes that in technical education, students are visual, sensing, inductive, active, and creative global thinkers. While technical teaching is auditory, intuitive, deductive, passive, and sequential, which suggests that civil engineering and construction should integrate theory and practical work through action learning (learning by doing).

2.3 THE NATURE AND SCOPE OF ACTION LEARNING APPROACH

"There is no learning without action and no (sober and deliberate) action without learning" (Revans, 1907-2003).

2.3.1 Action learning approach

According to action learning founder Reginald Revans (1980), the action learning method or approach does not have a single clear definition. further asserts that it cannot be used as a single generalising instrument. But in a simple articulation, Revans pronounced action learning as learning by doing and learning through the aid of others in solving the real problem. Furthermore, he continues expressing that action learning creates "development, intellectual, emotional, or physical that requires its subject" via responsible engagement in a real problem to attain anticipated advancement that will expand their learning skill and "observable behaviour" in the future field of civil engineering and construction (Revans, 1982; McNiff, 2013).

Action learning, according to Pedler (1991), is an approach to assist with the development of lecturers and learners in TVET that uses tasks to encourage learning. Action learning is founded on the tenet of "there is no learning without action and there is no deliberate action without learning". Moreover, Pedler (1991) advocates that method consists of three main components, which are: lecturers execute duty to students, who then assume the responsibility for working on a certain topic; the task they have set themselves; and a group of six or so peers who encourage and push each other to make progress on the current task (Pedler, 1991; McNiff, 2013).

While Mumford (1996:2006) claims that the strength of action learning depends on or emanates from the sets, where ideas and actions can be interpreted and produce a vivid common understanding in relation to content knowledge learned in theory class. Mumford continues to opine that lecturers' and students' actions are generated from individuals' ideas rather than diffuse categorisation, such as schools (Mumford, 2006:69). In addition, Marsick and O'Neil (1999) argue that action learning is a strategy for working with and developing people on a real-world problem or project to learn. In small groups, participants take action to solve their problem and learn how to learn from that action (Marsick & O'Neil, 1999).

In addition, McGill and Beaty (2013) define action learning as a continuous process of learning and reflection, supported by colleagues, with the goal of achieving results". Individuals learn with and from one another via action learning and group work on real problems that reflect from previous experiences (McGill & Beaty, 2013). Makura and Nkonki (2017) sustain the argument when they proclaim that working together by a group of individuals to solve a particular problem can have positive outcomes. This study concludes that an action-learning approach is a social learning process (set) for critical inquiry of deliberations that formulate ideas that develop action, reflection, evaluation, and execution.

2.3.2 Theories and Formulas Reinforcing ALA

2.3.2.1 Revan's Formula:

L= P + Q

L: Learning

P: Programming

Q: Questioning

The learning equation above was established by Reginald Revans in 1982 and 1989 and named the Revans formula, in which he describes L as learning and P as programme knowledge, which is expected knowledge from the book. Because this is where we must do it exactly as it has been for many years and Q as questioning insight, Revans overemphasises that question as the main drive of action learning. Bear in mind that, at times, a set question serves as a conversation opener. Questions such as "What are we trying to do? What can we do about it?" (McNiff, 2013; Marsick & O'Neil, 1999). The equation is also congruent with Kolb experiential learning when allowing questions as reflections on the theory-based AE part.

2.3.2.2 Inglis (1994) Formula:

L = P + Q + I

L: Learning

P: Programme Knowledge

Q: Questioning, and

I: Implementation

Inglis (1994) identified a gap left by Revans' equation where it communicates programmed knowledge and questioning. Inglis, who highlights that the type of learning that has been acquired should be implemented, has decided not to change but to add "I" for implementation of developed learning (McNiff, 2013; Marsick & O'Neil, 1999; Inglis, 1994). Therefore, one can conclude that Inglis's (1994) belief that all skills and knowledge should be used to bring clear evidence of problem solving is true.

2.3.2.3 Mumford (1995) Formula:

Q (1) + P + Q (2) = L

Q (1): Questioning

P: Programmed Knowledge

Q (2): Questioning

L: Learning

Mumford (1995) appeared to be the third person to revise Revans' equation, arguing that Q should come first, then P, of which he postulates that beginning with Q (1) should promote an interactive process of learning, as it should be the question that identifies the need to resolve the existing problem. Where P should not promote one streamed programmed knowledge but represent relevant acquired knowledge, then Q (2) should question to identify further opportunities for effectiveness (McNiff, 2013; Marsick & O'Neil, 1999; Mumford, 1995). Furthermore, Koo, Lee, Yilmaz, Farsad, Eckford, and Chae (1999) concur with Mumford when clarifying the equation that Q1 needs the resolution of the existing problem, P refers to acquiring the relevant knowledge, and Q2 is to identify further opportunities. This equation supports Kolbs' theory (RO) above that Civil Engineering and Construction students will apply sense to what they have observed for the planning of problem-solving situations present within their sets.

2.3.2.4 Volpert (1999) Cyclic Unit model:

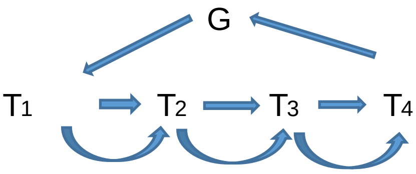

Figure 2.5: Cyclic Unit model

Source: Bunning (2007:19), adapted from Volpert and Volpert (1999:41)

G: Goal (the action goal)

T_n: Total of transformations to reach a goal

T_1: Initial transformation

T_2, T_3: Conciliatory transformations

T_4: Accomplished transformations.

Volpert and Volpert (1999) believes confidently that every action is driven by a goal. The model in Figure 2.5 illustrates cyclic units of action between the acting student and environment, which are changed within the transformations above. Transformation One (T_1) is step one of the initial state in the aimed direction, trying to identify the problem. T_2 and T_3 are the conciliatory transformations, which are developing the path to attaining the goal, while T_4 is called the act of consumption, where the goal was achieved, and it is the student's final solution implementation stage. The Civil Engineering and Construction field depends on problem solving through the technological process, which consists of six steps to complete a project.

2.3.2.5 McGill and Brockbank (2004); Rimanoczy (2009,2008):

L= P + Q + R

L: Learning

P: Programme Knowledge

Q: Questioning

R: Reflection

Rimanoczy (2009, 2008) has developed a similar formula, which he calls Action-Reflective Learning (L = P + Q + R). This formula sprang from the Revans original. In addition, Rimanoczy (2009, 2008) and McGill and Brockbank (2004) advanced the formula by adding R, where R represents the reflection. Wagner, Castaeda, Bohman, and Sterr (2019) reasoned that the grounds of action learning are anchored by the relationship between "reflection and action". They further emphasised that the action-learning approach inspires students to develop, apply, and reflect on the problem-solving skills, their creative thinking, and innovation. Similarly, Buthelezi (2016) declares that it is unmanageable to fathom and deem students' actions and their ambitions to be attained, but only if the analysis of their interdependence with each other is performed. Hence, this study promotes action learning in civil engineering and construction (CEC) based on the type of learning expected from TVET, which is mainly skills production. Therefore, it is paramount to develop effective CEC classes that can think deeply, apply, question, and reflect.

2.3.3 Principles of Action Learning Approach

Action Learning Principles

Like every theory, ALAs are grounded in principles and guided by beliefs. Therefore, Tables 2.1 and 2.2 below portray two congruent principles of action learning practises by two different organisations.

Table 2.1: The five principles of action Learning enforced by facilitator

Airtime	Every individual member of the group should be given the opportunity to speak, and no one individual should be permitted to dominate the discussion.
Timed	Each stage session is given an agreed-upon time so that each cast member knows when it will begin and end. This has the benefit of

	preventing excessive time from being spent on a single-issue holder and aiding the set members in maximising their time usage.
Structure	Each set has an agreed-upon structure to which all members adhere. During the process review, if members agree, this can be modified for the subsequent session.
Focus	Each session focuses on assisting one member in presenting their problem and finding a solution.
Learning	Each session provides learning opportunities for all set members, not just the issue holder. Both the issue itself and the process of learning impart knowledge.

Source: https://www.personal-coaching-information.com/action-learning-principles.html *[accessed: 2020/01/16]*

Table 2.1 above clearly demonstrates the principles of action learning, according to which it is the responsibility of a civil engineering and construction lecturer to facilitate the process and make sure that all students adhere to it. All five principles embrace that students must respect each other, respect time, learn to think differently to agree, assist one another, and learn new things from the process itself. Hence, it is the responsibility of the lecturer to assist students but not to interfere with or influence the process.

Table 2.2: Underlying beliefs and principles of action learning

Beliefs	**Principles**
Belief 1: Learning starts with not knowing	• We only become open to learning when we admit what we do not know • There are no specialists in situations where there are no correct responses. • Where there are no right answers, you must act to learn
Belief 2: People who assume responsibility in each circumstance have the best opportunity to take actions that will make a difference.	• Work out what really matters to you, what it is you really want to do • Make choices and take actions and then learn from this • Keep it alive and moving

Belief 3: Learning requires both programmed knowledge (what is taught and read) and questioning insight.	• Learning is not just about the acquisition of programmed knowledge • Learning entails posing pertinent and discriminating questions under conditions of ambiguity. • Learning is about trying out unfamiliar ideas • Learning involves risk and taking actions which might not work
Belief 4: Learning should be greater than the rate of change	• An organisation that continues to only express ideas from the past is not learning. • Training programmes maintain our proficiency in techniques from the past. They do not instruct us on how to approach new opportunities.

Source: INTRAC Guide to Action Learning Sets 260511(2017:7)

The above Table 2.2 elucidates the beliefs and principles of action learning that emanate from Professor Reg Revans' writings and teachings. It starts by highlighting the critical statement that "learning begins with not knowing". Hence, in civil engineering and construction classes, students need to learn in totality and must be competent in both theoretical content and practical skills. Lecturers need to allow students to learn on their own, then they can master the skill of working together to solve issues or problems. According to Pedler (2011:21)., action learning is therefore a method for the organisation to transform or reform, thereby liberating the human vision within the organisation (2011:21).

2.3.4 The Fundamentals of Set in Action Learning Approach

The action learning set and participants

Six to eight individuals who meet more frequently to assist one another and learn from their experiences constitute an action learning set or group. These are methods designed to enable small groups to address complex issues through regular meetings and collaboration. This tool is especially designed for student and teacher learning and personal growth (Morrison, 2017; Pedler, 1991).

Morrison (2017) argues further that experience has demonstrated that teams perform better when members have comparable levels of expertise. A set adviser is appointed to assist with process management. The group adviser is a member of the group, but is also responsible for fostering a learning environment by motivating, challenging, and focusing on education. Some action learning modules are self-facilitated. In Civil Engineering and Construction class, a group that focuses on the actions of its members rather than on a shared set of work objectives should not be considered a team (Morrison, 2017; Pedler, 1991).

A Set Meeting process

According to Morrison (2017), the group should develop its own style of working during their meeting. The meeting should guarantee a time slot for all participants to present their project challenges and issues. A meeting programme usually addresses the following:

- an update of progress on actions from the last meeting,
- a presentation of current issues/problems,
- an agreement on actions for the future (Morrison, 2017; Pedler, 1991).

In addition, Morrison (2017:4) proposes that other participants will collaborate with the presenter (by listening and asking questions) to assist them in determining the appropriate actions. In a group meeting, time is always a limited resource, and the group adviser must ensure that all participants receive their full allocation (it is not a free discussion). Some groups develop a fixed agenda to expedite the start of the meeting, but regardless, all participants must arrive well-prepared.

Planning for a group meeting:

In addition, Morrison (2017), Maharaj (2016), and Mason (2016) argue that it is essential to ascertain from the participants if they have any additional information to add to the focus of their group. However, participants may experiment with various behaviours in a controlled setting. If participants are typically very talkative, the group may be a place where they can experiment with unusual behaviours, such as consciously asking more questions or being more reflective. Therefore, presenters should prepare for meetings, organise their time, be clear about what they want or what they want the group to focus on, learn to ask for what they want, listen, and generate action points for themselves. With the above-mentioned, the group can constantly meet their unpredictable objectives.

2.4 CONCLUSION

In conclusion, this chapter has elucidated the theories (constructivism, which consists of social, cognitive, and Kolb's theory of experiential learning) that are grounding and guiding the study. It even clarifies the theories through the graphical model to provide a rigid understanding, as drawing is the main mode of communication in this field. This chapter further explains the history of action learning and its theories. Furthermore, it has highlighted some reviews around the original theory or formula, which conveyed different approaches to the scope of action learning. Chapter 3 provides an in-depth clarification of the related literature regarding ALAs.

CHAPTER 3: REVIEW OF RELATED LITERATURE

3.1 INTRODUCTION

In Chapter 2, a theoretical framework that underpins this study was introduced. The theories comprise social constructivism, cognitive constructivism, and experiential learning, all which works well and establish the grounding of the study through the main theory of action learning and its scope.

Chapter 3 explores the related literature to address different teaching approaches used in TVET colleges engineering studies curriculum, measuring the utilisation of ALAs in Civil Engineering and Construction studies at TVET colleges, sequence use to assess content knowledge and practical work at TVET colleges, challenges experienced during application of ALA at TVET colleges, developmental support to use ALA to produce and integrate quality work at TVET colleges. Hence, the related literature used to advance understanding of teaching and learning approaches to achieve the main objective such as content knowledge and practical work which it produces blended comprehensive skills, knowledge and value.

3.2 NATURE AND THE SCOPE OF CIVIL ENGINEERING

The Civil Engineering and Building Construction course covers construction, masonry construction and woodworking, design, drainage, and sanitation in a practical, theoretical, management, and design setting. This course integrates theoretical and academic knowledge with practical skills and values (DHET, 2018:12). Civil engineering is a profession that uses fundamental scientific concepts in combination with mathematical and computational approaches to solve problems related to the development and maintenance of civilised life in the world (DHET, 2018:12; Kheza, 2018:39). Civil engineering projects are often one-of-a-kind; they are frequently large in scope; and they regularly need collaboration among experts from a variety of different disciplines. Completing a civil engineering project entails resolving technical issues that require input from a variety of sources and consideration of a plethora of non-technical variables (Kheza, 2018:39; DHET, 2018:12). In addition to bridges, buildings, dams, airports, ports, and harbours, civil engineering projects include roads, tunnels, towers, and water distribution systems. Civil engineers are also focused on flood management, landslide prevention, air and water pollution control, and earthquake-resistant structure design (Maluti TVET prospectus, 2018/2019; DHET, 2018:12). Civil engineering is one of the most diverse engineering specialties, both in terms of the issues it covers and the expertise required to address them.

3.3 DIFFERENT TEACHING APPROACHES USED IN TVET COLLEGES FOR ENGINEERING STUDIES CURRICULUM

Common learning methods, including teaching methods, discussion methods, case studies, structured lessons, role-playing, presentations, experiments, and field trips, are offered to lecturers in the technical vocational colleges and indeed to various TVET institutions (Ahmad, Nordin, Ali & Nabil, 2015). In addition, Lucas, Spencer, and Claxton (2012) contend that in TVET, most lecturers use learning-by-doing or experience-based, although others incorporate reflection, feedback, and theory. Extensive research suggests, for instance, that technical vocational education and training may be successful when employing the approaches and methods listed in Table 3.1.

Table 3.1: Teaching approaches in TVET colleges

Learning through:	Learning by:
simulation and role play	watching
virtual environments	reflecting
drafting and sketching	playing games
real-world problem-solving	competing
practising (‘trial and error’)	enquiring
conversation	imitating
teaching and helping	Obtaining feedback
listening, transcribing and remembering	working
thinking critically and producing knowledge	being coached

Source: Lucas, Spencer and Claxton (2012)

3.2.1 Learning through simulation and role play

According to Yusti, Ganefri, and Ridwan (2017), simulation is a software programme that is developed to replicate real-world events. The software for simulation is a computer programme that can use widely used programming languages like Visual Basic, C++, Delphi, or Java. In addition, Rutherford-Hemming (2012) defines simulation as a "set of conditions" that endeavours to present education and assess problems authentically. Through TVET, simulation-based education, in which students engage in a learning experience, is frequently employed to enhance empathy and empathic behaviours.

In professional engineering education, simulation methods include a variety of approaches, including simulated or consistent mini-project methodologies, mannequin-based methodologies, role-playing, games, and virtual reality (Bearman, Palermo, Allen, NutrDiet & Williams, 2015). Moreover, Yusti, Ganefri and Ridwan (2017) and Rutherford-Hemming (2012) further stress that simulation provides a secure, reassuring educational site that allows students to practise a variety of tasks to improve knowledge, skills, and decision-making in a genuine, lifelike environment. The study, therefore, views simulation as a teaching and learning method of ALA in civil engineering construction that develops students' self-confidence to practise application of knowledge, practical skills, critical thinking, and creativity in an actual life-like environment.

3.2.2 Learning through games

The constructivists Jean Piaget (1973) and Lev Vygotsky (1978) introduced a didactic approach to game-based learning at the university level in the 1970s, according to Olsson, Mozelius and Collin (2015,1978). According to Yachin and Barak (2019), educational games or game-based learning (GBL) refers to any learning environments or activities that use games to support teaching and learning (Yachin & Barak, 2019; Chang, Liang, Chou & Lin, 2017; Vu & Feinstein, 2017), using the advantage of game playing to engage students with learning assignments, in which learning and winning are both important (Yachin & Barak, 2019; Whitton, 2012).

Playing educational games provides students with opportunities to assume responsibility for their own education (Slade, Riutta, Roslin & Tuomisto, 2016), and further, advocates say that with educational games, it is conceivable to perform a "social constructivist" way of learning. However, it remains the responsibility of a lecturer to select a suitable game for an activity or task, phenomenon, skill, and knowledge to be learned (Slade, Riutta, Roslin & Tuomisto, 2016). This study concludes that learning through games as a teaching and learning method offers diverse opportunities that expose Civil Engineering and Construction students to flexible responsibility and focus on learning as action learning takes place by doing. Figure 3.1 below show the types of learning games available.

Figure 3.1: Learn through Gaming Examples of Gaming in Building

Source: Lets built www//http./Vodytech.com.

3.2.3 Learning by thinking critically and producing knowledge

Ennis (1987) defines critical thinking as pragmatic and reflective thinking abilities that are centred on deciding what to believe or do. Further, he argues that critical thinking skills could be acquired independently of specific subjects and transferred from one domain to another. Importantly, Scriven and Paul (2004) assert that critical thinking is an intellectually disciplined, active, and knowledgeable process of conceptualization, application, analysis, synthesis, and evaluation of information. Some studies argue that critical thinking can be accomplished by successful cognitive groups for learners. They also contain the idea that higher-order thinking can be induced to develop a logical reasoning capability for the learners by raising questions and engaging in concept explanation (Masoabi, 2015; Lombard & Grosser, 2008).

Masoabi (2015) describes critical thinking as a cognitive capacity for knowledge, experience, and environmental factors; the knowledge that is present in the current sequences and systems can be modified, expanded, accepted, supported, verified, and disagreed with. But on the other hands, critical thinking is perceived as sound thinking, logical thinking, and careful thinking, and it is one of the key requirements for civil engineering construction students and lecturers at TVET colleges to enforce the integration of theory and practical implementation through action learning. In addition, Allen and Rott (1969) view critical thinking as an act of evaluation or judgment. further advocate that it is a process of evaluation and categorisation in terms of some previously accepted standards. It is a logical examination of information that avoids fallacies and judgments made on an emotional basis only. Therefore, this study views critical thinking as a core aspect of reflective thinking and problem solving, which means there is no reflective thinking or problem solving without critical thinking.

Marvakis and Schraube (2019) argue that activist learning (solidarity in action learning) is a prime area for reflection on those topics that are not recognised in the sphere of existing educational practises or structures and thus cannot become topics of abstract theorization or intervention, which also do not allow questions about the what and why of learning by doing. However, Marvakis and Petritsi (2014) and Marvakis and Schraube (2019) advocate that concrete outcomes and the prerequisites for learning by theory are obtained by appropriating social significances as they are put and dispersed into a variety of socially generated instruments: mental tools (for example, concepts), social tools (for example, relations), and objective instruments (for example, external objects, events, and artifacts) that direct our actions rather than define them. Through this context, learning involves taking part in the action opportunities that are, so to speak, found and transmitted in these instruments (Marvakis & Schraube, 2019).

3.2.4 Learning by real-world (Contextual) problem-solving

The most critical aim in Civil Engineering Construction is problem-solving capability through action learning. Han, Turns, Cook, Mason and Shuman (2022) view problem solving as an integral part of engineering curricula and a critical skill for students to develop. According to Khotimah and Masduki (2016) and MAA (1998), students of civil engineering construction are expected to apply knowledge, concepts, ideals, and procedures to resolve actual or contextual problems. The students must be able to solve problems externally to Civil Engineering and Construction (CEC) using their own CEC knowledge. The ability to use knowledge or to relate mathematical principles they possess to solve problems occurring in the real world is the problem-solving potential of mathematics. This suggests that problems appear complex, non-routine, open-ended, and difficult to solve.

Contextual learning (CTL) is one of the learning approaches used to bring to light societal problems or problems that affect students. Contextual problems, commonly referred to as real-world problems, are based upon the experiences of students (Gravemeijer & Doorman, 1999). Students need to understand, symbolise, manipulate, and solve problems by applying civil engineering construction procedures or optional methodology to solve the problem (Chia, Huang, Koo & Fung, 2020). According to Watson, Johnson and Zgourides (2002), CTL is a process of learning that helps students see how academic subjects and real-life contexts in their daily lives are connected to the meaning they have learned, which is the context of their personal, social, and cultural condition. To ensure success for contextual learning purposes, Watson, Johnson and Zgourides (2002) formulate eight important components. They are: connection, meaningful work, self-regulation, cooperation, the critical and creative thinking of the work, the development and improvement of people, and the search for a high standard and authentic assessment.

Khotimah and Masduki (2016); Sulastri (2016, 2020) laid out seven principles for the development of contextual learning. They are:

1) Constructivism: The condition in which students construct their knowledge based on their experiences.
2) Inquiry: A learning process based on seeking and discovering via a methodically planned procedure.
3) Questioning: Learning is basically a process of asking and answering questions.
4) Learning community: Communication with others contributes to an individual's knowledge and comprehension.
5) Modeling: In contextual learning, the instructor is not the only learning model.
6) Reflection: Is the deposition of the experiences that students have encountered through the reorganisation of learning events or occurrences.

7) Authentic assessment: The success of the learning process is not solely determined by the development of intellectual ability; it should also include the development of all aspects (Khotimah & Masduki, 2016:2; Sulastri, 2020:50).

3.2.5 Learning through enquiry/inquiry (Problem Based Learning)

Enquiry-based learning, also known as problem-based learning, refers to a method of education in which students acquire knowledge or skills through active inquiry as opposed to direct instruction. It was first introduced in medical training at McMaster University in 1969 and has since gained momentum in other health education programmes and associated health education programmes throughout the world (Byrne, McNeill, Rogers & Porter, 2018). According to Botha (2019), PBL has been sustained through the use of inquiry as a tool to improve teaching and learning in schools. To simply clarify the difference between enquiry and inquiry, where enquiry means to ask a question, while inquiry states the formal investigation of something.

According to Yew and Goh (2016), problem-based learning (PBL) has been widely adopted to promote critical thinking and problem-solving in real-world learning situations in a variety of fields and educational contexts. In addition, according to Yew and Goh (2016), the fundamental philosophy of PBL is that learning should be viewed as a constructive, self-directed, collaborative, and contextual action. Constructivism posits that students are active knowledge explorers and co-creators who organise new relevant experiences into personal mental representations or schemas using prior knowledge.

However, Botha (2019) argues that inquiry-based learning (IBL) not only encourages student participation in the teaching and learning process, but also necessitates that the student knows more from his or her perspective. IBL entails the pursuit of knowledge through open-ended questions and is driven by students' inquiries (Botha, 2019). Students learn to continually ask questions and conduct open-ended research during the IBL process (Ertmer & Newby, 2013). This involves an intricate thinking process in which the learner tries to convert the teacher’s submitted information into useful and relevant knowledge.

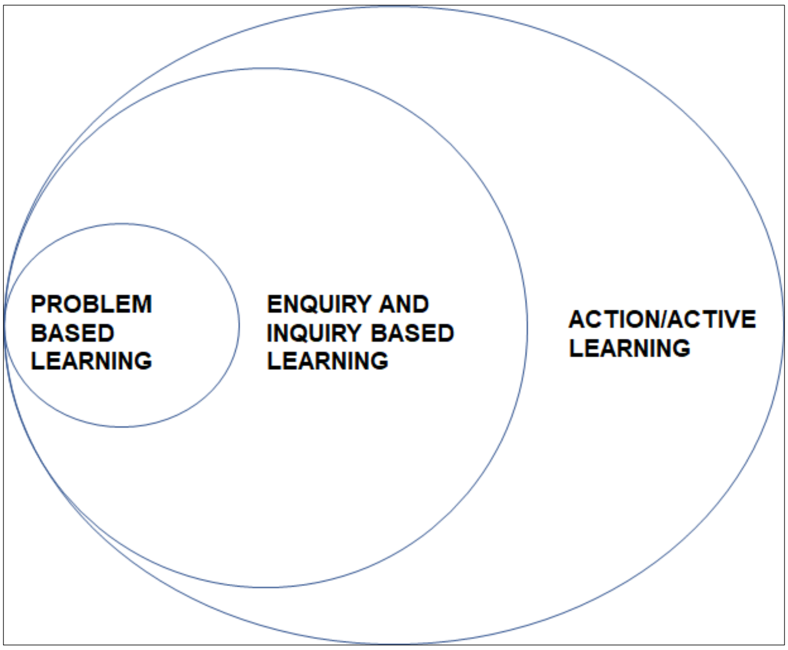

Figure 3.2: Action learning verses problem-based learning

Source: Botha (2017:39)

Figure 3.2 above illustrates the relationship between problem-based learning (enquiry and inquiry) and active/action learning. Therefore, from the above-mentioned information, this research concludes that PBL is one of the most effective approaches to action learning as it revolves around and embraces constructivism, which connects experiential learning through the implementation of action learning.

3.2.6 Learning by practising ('trial and error')

When a student is confronted with a novel and challenging situation—a dilemma—learning starts. Most educational bodies counter errors and reduce errors through repeated trials (Truskanov & Lotem, 2017). The phenomenon is, in a simple sense, called trial-and-error learning. Trial and error in behavioural psychology is only one of the theories of learning. Lucubrate Magazine (2019:1) and Lucas, Spencer, and Claxton (2012:63) Other types of education include:

Insight Learning

It is the instantaneous recognition of the components of a problem that reveals the solution (Lucubrate Magazine, 2019:1; Lucas, Spencer & Claxton, 2012:63).

Latent Learning

This refers to learning that is not reinforced or demonstrated until the desire to do so exists. Latent learning is a term used in psychology to describe information that only manifests when a person is motivated to demonstrate it (Truskanov & Lotem, 2017). A student may, for instance, learn how to solve a math problem in class, but this learning is not immediately apparent. Only when the student is provided some sort of reinforcement for finishing the challenge does this learning become apparent (Lucas, Spence, & Claxton, 2012).

Observational Learning

This method came about because of seeing the actions of others, and Thorndike's (1898) study of Animal Intelligence produced the first small trial-and-error learning system of the approach. This type of learning is classified as S-R learning theory and is also known as constructivism. The term “trial-and-error learning” was subsequently coined since increasing the number of trials led to a decrease in the number of errors.

Basic Conditions for Trial-and-Error Learning

Drive is a crucial element that sets in motion the numerous circumstances that led to this occurrence. In the previous experiment, the cat's motivation was hunger, which drove it to try numerous solutions until it eventually mastered the trick. People are motivated to study, and this makes students more active in their pursuit of knowledge (Truskanov & Lotem, 2017:1).

Blockade/barrier in satisfaction of drive

Only when there is a blockage or barrier between hunger and food do trials and errors occur. In the previous experiment, the only way to satisfy hunger was to consume food, but obtaining the food was difficult. To obtain sustenance, it was necessary to overcome the obstacle. Attempts to resolve the issue resulted in trial-and-error measures (Truskanov & Lotem, 2017:1; Lucubrate Magazine, 2019:1).

Random Activities

When the solution is not immediately available, students tend to act erratically in their attempts to solve the problem. It is all due to a lack of knowledge (Lucas, Spencer & Claxton, 2012).

Accidental Success

After multiple attempts, the first time a student gets something correct is always by accident, hence the term accidental success. For instance, the cat's initial successful pull of the lever was unintentional. Accidental success is not the only means of problem resolution. The creature repeats its previous random attempts until it discovers the correct response. The answer can be isolated by trial and error (Lucas, Spencer & Claxton, 2001; Lucubrate Magazine, 2019:1).

Fixation of the Right Response

It is the final phase of education. Once the student has chosen the correct response, he or she maintains focus on it, allowing the organism to act immediately when faced with the same situation. After the cat had learned the trick or reached the final level of trial-and-error learning, for instance, it was able to quickly draw the loop (Lucas, Spencer & Claxton, 2012; Lucubrate Magazine, 2019:1).

3.2.7 Learning by reflecting

Reflection is a structured evaluation process for every lecturer that enables you to connect experiences to make maximum progress for your students. Therefore, reflection is an important part of teaching and learning, as defined in Finlay and Gough (2008). The aim of the study is to raise awareness of your expertise and actions by “challenging everyday assumptions of practise and making a critical assessment of individual partitions” (Finlay & Gough, 2008; Harvey, Coulson & McMaugh, 2016). It also encourages teachers and students to work in sets to support each other's best practises. The following model shows a reflective teaching and learning design.

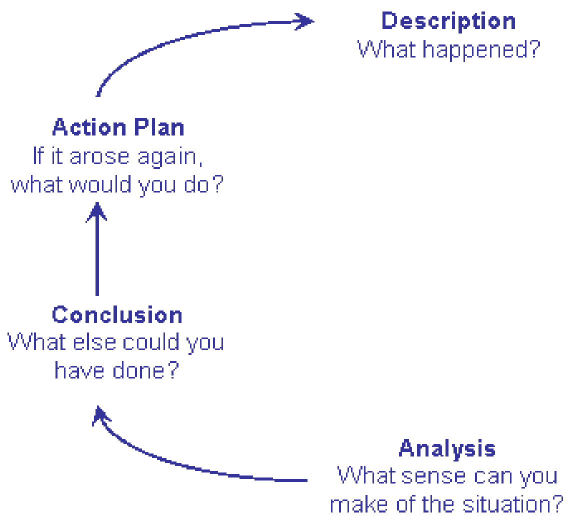

Figure 3.3: Reflective learning model

Source: Adapted from Gibbs (1988).

The model above was summarised by Gibbs in 1988 when pronouncing six stages of reflection as follows:

- **Description** of the experience
- **Feelings** and thoughts about the experience
- **Evaluation** of the experience, both good and bad
- **Analysis** to make sense of the situation
- **Conclusion** about what you learned and what you could have done differently
- **Action plan** for how you would deal with similar situations in the future, or general changes you might find appropriate.

Moreover, the information of the reflective stages above also works like the technological process and Kolbs' model of experiential learning, where the main purpose is to achieve a certain goal to solve a problem through action learning (hands-on). However, Donaghy and Morss (2000:7) argued that reflective learning consists of two key types of reflection, which are "reflection in action" and "reflection on action". They further emphasised that the most absolute variance is in terms of "when they happen". The table further tabulated the explanation of the two mentioned above as follows:

Table 3.2: Two key types of reflection learning

Types	Explanation
Reflection-in-action	This is the reflection that occurs during participation in a situation, typically a student interaction. Reflection in action entails the application of analysis derived from observation, listening, and/or touch to the resolution of problems. Reflection differs from clinical reasoning in that the problem-solving leads to a shift in the practitioner's perspective of self, values, and beliefs (Donaghy & Morss, 2000:7).
Reflection-on-action	This type of reflection involves gaining distance from the situation, so it occurs after the situation has occurred. Therefore, it requires a time commitment, which is not always easy. Despite this, it is essential for professional development (Donaghy & Morss, 2000:7).

3.2.8 Learning through virtual environments

Learning, especially in a virtual environment, could be effective and practical as a method of education. Virtual environments refer to interactive multimedia classrooms that provide full interactivity (Banek, Zorica & Lujanac, 2002). Stimulating children in the virtual world not only improves spatial awareness but also creativity, and because of the online contact with people, emotional intelligence is growing, which is now much appreciated by the formerly common IQ. Figure 3.4 below presents a multimedia learning environment.

Figure 3.4: Virtual classrooms should be connected

Source: Banek, Zorica and Lujanac (2002:559)

Moreover, Banek, Zorica, and Lujanac (2002) report that multimedia classrooms are typically outfitted with a television, speakers, and an LCD projector, thereby creating a basic multimedia environment that attempts to meet the needs of students.

To create a virtual classroom, the following is important:

- With the aid of cutting-edge technology, a team of experts generates virtual reality for each teaching scenario and stores it in the educational information system so that it is accessible to all users.
- The teacher selects an appropriate situation based on the lesson plan and sets up an educational environment (computer, audio-visual helmet, and sensor gloves) that allows him to create a learning programme.
- students interact with the system.
- High-quality virtual learning environments and intense perceptual organ activity create a reality in which students generate cognitive and experiential effects during the learning process.

The figure below shows virtual reality as other part of multimedia learning environment

Figure 3.5: Civil Engineering and Construction virtual reality learning lab

Source: news.asce.org

In many areas, immersive virtual reality is also extensively used as an educational tool. Due to common complications with spatial visualisation, there is evidence that interactive simulation in engineering programmes can improve student learning and engineering education. (Vergara, Rubio, Prieto & Lorenzo, 2016). Figure 3.6 below illustrates augmented reality.

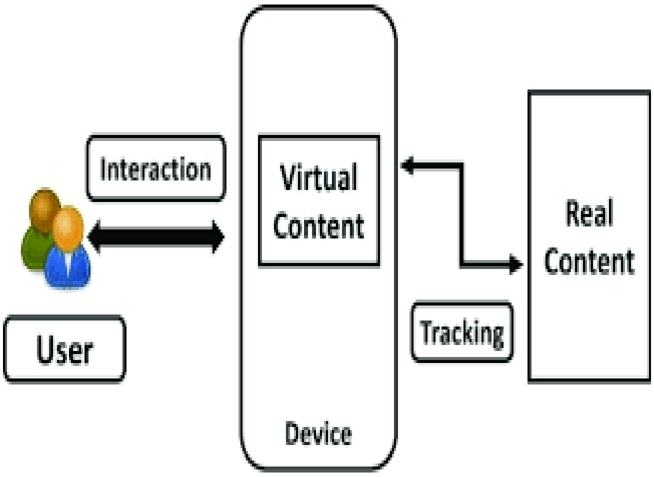

Figure 3.6: Augmented reality (AR) technology

Sources: researchgate.net; thinkmobiles.com

Skaar (2019) argues that in vocational education, augmented reality (AR) is a useful tool. The educational tool kit expands your options. It allows a wider audience to feel haptic sensations while using occupational tools and to see the tool's effects in a virtual, vocation-contextualised environment. The students benefited practically from self-paced learning, self-evaluation, and flexible scheduling. Consequently, this should be one of the strongest incentives for enrolling in a vocational course. The educational kit is intended to reinforce student comprehension and technical curiosity regarding fundamental concepts of vocational tools (Skaar, 2019). It will make constructing the educational tool enjoyable for the student and promote action learning as it is more interactive and challenging for students.

3.2.9 Learning by drafting and sketching

Drawing something prompts a person to recall that they have long known it. Drawing is superior to reading and writing, according to Fernandes, Wammes, and Meade (2018), because it forces a person to process information in multiple ways: visually, kinaesthetically, and semantically. Researchers discovered that drawing information through a series of tests was an effective method for enhancing memory by nearly doubling its recall (Terada, 2019).

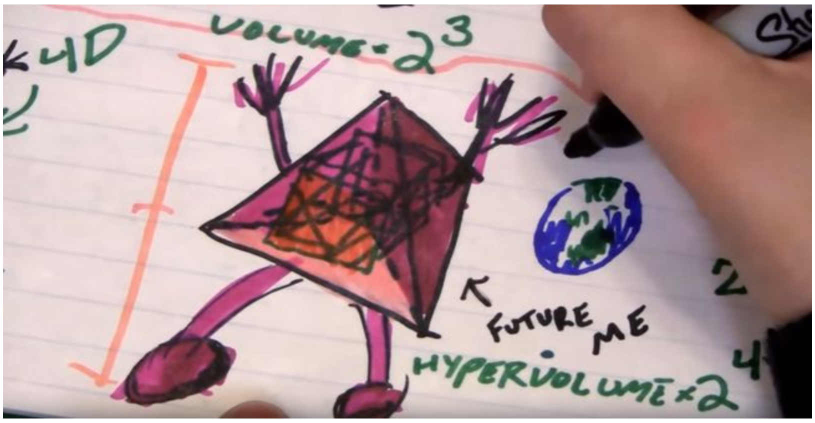

Figure 3.7: Learning by drafting and sketching

Source: Terada, (2019)

In addition, Martin-Erro, Dominguez, and Espinosa (2016) concur with the above information when they say that sketching enables information to be represented in different forms and to work at different levels of abstraction. It is used before the detailed design phase to start analysing a design problem and to refine ideas. Many drawings are produced for the own use of the designer: "to capture ideas, externalise thoughts, and build visual understanding." In other cases, drawings are developed mainly for communication or group solutions. In conclusion, they also pointed out that sketches can be classified based on the purpose for which they were drawn. Martin-Erro, Dominguez, and Espinosa (2016) Ferguson (1994), in Martin-Erro, Dominguez, and Espinosa (2016), present categories of sketches as follows: “who identifies thinking sketches (to support individual thinking processes), talking sketches (to communicate with others), and prescriptive sketches (to represent the sketched idea)”. Another is storing sketches, which mentions “sketches drawn to keep valuable ideas” (Ferguson, 1994; Martin-Erro, Dominguez & Espinosa, 2016).

Therefore, sketches or sketching are regarded as the key basic skills of communication (engineering graphics design) in civil engineering construction and show the significance of action learning as both students and the lecturer are hands-on or practically doing to achieve a solid common goal.

3.2.10 Learning through conversation

Learning via conversation is another technique that allows students to identify specific groups that are similar or match anything in your lecture. Students may need to find others who agree with them on a topic or who have a similar understanding of the immigration policy lesson they are working through. Justus (2020) emphasises that one of the most important skills humans learn early in life is how to talk or have a conversation. For the most part, most people learn this early in life through natural means. Further, when we learn naturally, we have an intrinsic motivation to learn. The desire to learn comes from within us rather than from someone else who wants us to learn (Justus, 2020). Therefore, Okeke and Van der Westhuizen (2020) define professional conversations in the context of teaching and learning as instructors working together in a specific environment to frame and address education and classroom-based issues by creating their own robust learning opportunities. Therefore, action-learning methods in civil engineering and construction studies are based on the creation of sets, as illustrated in the figure below, which depicts learning through conversation in TVET.

Figure 3.8: Learning Through Conversation

Source: Lucubrate Magazine (2019)

The above figure provides a clear perspective on teamwork (sets) in a TVET plumbing workshop or workplace and illustrates the effectiveness of learning through conversation. Moreover, conversation in the workshop or workplace, often known as watercooler chatter, is a critical component of learning. Lecturers and students have demonstrated exactly how a management team understands the varied things it experiences and learns via different types of discussion. Therefore, the aforementioned information grounds learning by conversation as one of the appropriate ALAs in civil engineering and construction studies.

3.2.11 Learning by teaching and helping

Lucubrate Magazine (2019:1) asserts that learning by teaching and helping (Peer Learning) is a set of teaching and learning strategies in which students learn from one another without the need for immediate instructor involvement. Although there are pedagogical challenges to its formal application, peer learning (and other collective forms of learning) is said to better suit some students. In addition, there are advantages to establishing peer leadership:

- Formation of learning outcomes pertaining to collaboration, teamwork, and membership in a learning community;
- Increased opportunities for students to engage in inquiry and reflection, given the absence of a teacher to directly respond to questions;
- More practise communicating subject matter to others, more experience receiving feedback from peers on the same learning path, and
- Individuals are better able to identify their own learning needs and develop the ability to plan how to address them.(Lucubrate Magazine 2019:1; Njabili. 2004:37)

3.2.12 Learning through feedback

A student's key tool for tracking progress is feedback. Feedback is an important part of formative evaluation. In education, there are four components to feedback:

- Information on a measured attribute's actual level.
- Information on the attribute's reference level.
- A method for comparing the two levels and providing data on the difference between them.
- A method for using information to close the gap (Lucubrate Magazine 2019:1; Lucas, Spencer & Claxton, 2012:20).

3.2.13 Learning by listening, transcribing and remembering

According to Lucusbrate Magazine (2019:2), the methods of delivery include learning by listening, transcribing, and remembering. When learning content is delivered effectively via an auditory delivery method: Using verbal instructions and explanations, complementing learning with appropriate music, and encouraging debate, discussion, and analysis. Talking in a positive manner, using word patterns such as rhyme, rhythm, or mnemonics to learn information, reading aloud, encouraging students to ask each other questions, and using audio recordings of pertinent material.

Undoubtedly, some vocational lecturers deliver content by talking more than necessary, when other learning facilitation techniques would be more appropriate (Njabili, 2004). Although talking in and of itself is not a bad idea, teachers must be aware of when it is most and least advantageous for learning (Lucusbrate Magazine, 2019:2; Lucas, Spencer & Claxton, 2012).

3.2.14 Learning by watching

When learning by watching, our goal is to leverage demonstrations provided by others, such as Zhang and Ohn-Bar (2002). While Lucusbrate Magazine (2016:4) attests that the value of watching others to learn is equally important for skilled lecturers, Nevertheless, Woodruff (2017:1) specifies the actual process in different areas of the brain during watching of other people: “the striatum is a key component of dopamine-mediated reward learning”, which emphasises that watching can activate reward circuits. Another section of the brain, the anterior cingulate cortex (ACC), appears to be crucial for differentiating oneself from others. The prefrontal cortex appears to be engaged in communicating error prediction, with distinct sub-regions indicating mistakes in anticipating the actions of others and mistakes in providing a better understanding of those actions (Woodruff, 2017). This method compensates for one of the key methods used in civil engineering construction known as “demonstration”, where the students observe the lecturer and do what the lecturer has shown them.

3.2.15 Learning by competing

Competition is an excellent approach for students to learn subjects while using the project-based learning (PBL) paradigm, since students learn while competing and compete while learning (Karia, Rucmenya, Krishna & Kavi, 2018). Bennett, Roche, Dymond, Baeyens, Vervliet and Hermans (2020) argue that reinforcing competing and incompatible behaviours might be one operant-based method to reduce avoidance. Shifting the delivery of incentives to favour competing classes of behaviour has been shown to reduce the likelihood of another appropriate result. That is, as new classes of competing behaviours are strengthened, there is a decrease in problematic behaviours. However, the above statement provides a clear picture of how to regulate and balance the strength of the civil engineering construction set of actions.

3.2.16 Learning by imitating

Imitative learning is a kind of social learning in which new behaviours are learned through the practise of others. Humans and students both have the capacity to match their actions to those seen in others; imitative learning is essential to human cultural development (Lucubrate Magazine, 2019:4; Timire & Teis, 2019). In addition, Torabi, Warnell and Stone (2019) define imitation learning as the situation where the expert gives examples of task performance that the imitator tries to replicate. Ordinarily, techniques developed within this paradigm have required demonstration datasets to contain not only the expert's states but also its actions (Torabi, Warnell & Stone, 2019).

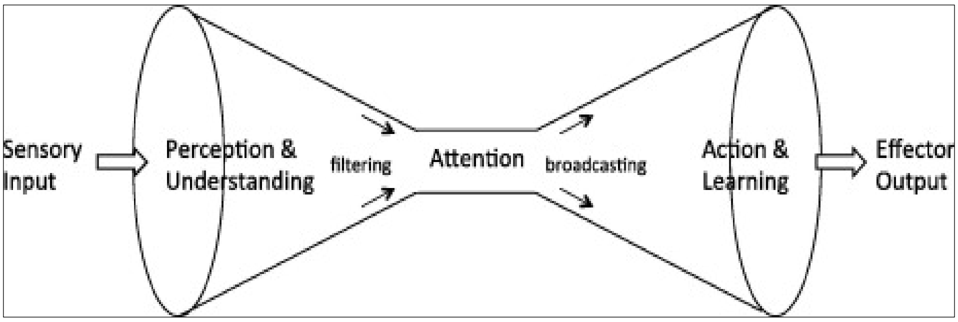

Figure 3.9: LIDA Cognitive Model

Source: Franklin et al. (2016:107)

The model above illustrates the cognitive model of imitative learning and its processes from observation. The model can also be classified or tautologised as a mind process, which indicates that the volume input is equal to the volume output. Hence, Torabi, Warnell and Stone (2019) promote that imitation learning from observation comprises of two main problem components, which are perception and control. In perception, multiple approaches can be applied, but the dominant approach is where the students should record the lecturer's movement using sensors placed during the demonstration (copy exactly what the lecturer is doing). While control is more in an inverse dynamic where students, during the imitating process, learn by themselves (Torabi, Warnell & Stone, 2019). Therefore, in Civil Engineering and Construction studies, imitation can be applied during small project periods where students need to learn a specific, standardised skill.

3.2.17 Learning on the fly

Learning on the fly is not a single approach or method, but rather a collection of approaches that, by their very nature, cannot be scheduled (Woodruff, 2017; Lucubrate Magazine, 2019:4). While formal learning strategies may include mentoring, shadowing, or coaching, informal learning involves consultation and collaboration within the learner's sphere of influence, which is frequently more ephemeral than implicitly shared knowledge (Skule, 2004). Observation and imitation are used frequently. In frequently it does involve the use of written materials such as manuals (Skule, 2004; Lucubrate Magazine, 2019:4).

3.2.18 Learning by being coached

Learning by being coached is a crucial aspect of an effective career development programme. Coaching can help build the will, skill, and ability, as it can go where there has not been any further professional development: into a lecturer's intellect and behaviours. Coaching establishes the relationship between a student and lecturer, thus enabling a student to access and implement new knowledge (Aguilar, 2013; Blumke, 2021). The cycle below illustrates the three stages of how coaching impacts learning.

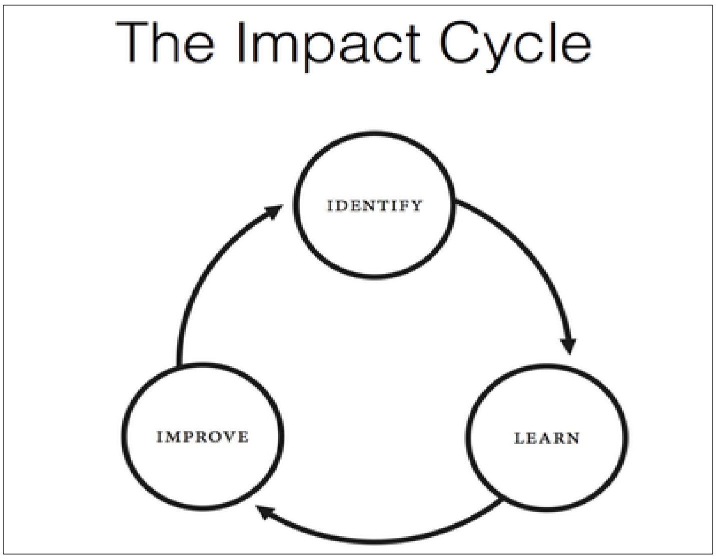

Figure 3.10: The Impact Cycle

Source: Knight (2018:50)

The impact cycle presented above assists the lecturer in creating a positive environment in the classroom. There are three phases in the impact cycle: identification, learning, and improvement. This is how it functions:

Identify: To establish a clear picture of the reality in the lecturer's classroom, the lecturer coaches a student with other lecturers during this stage of development: observation, interview, and videotaping (Knight, Hock, Skrtic, Bradley & Knight, 2018).

Learning: During the stage of learning, the instructor and student collaborate to determine how to implement the new strategy. Typically, lecturers give students the opportunity to observe the practises by simulating them in the lecturer's classroom, sharing a video, or delivering a lecture, so that students can observe another student employing the same learning strategy (Knight, 2019).

Improve: During the improving stage, the lecturer and students make changes in this stage until the objective is fulfilled. Adaptations may involve changing or implementing the strategy itself. It may involve changing the goal or measuring progress towards the goal. Or it could mean nothing at all and just wait until the goal is achieved (Knight, 2019).

3.3 MEASURING THE USE OF ACTION LEARNING APPROACHES IN CIVIL ENGINEERING AND CONSTRUCTION STUDIES AT TVET COLLEGES

3.3.1 Measuring the effectiveness of action learning

When it comes to measuring performance, key performance indicators that are not usually used in conventional teaching techniques may be required, since people and teams construct their own workplace realities via continuous reflection and evaluation. However, traditional assessment techniques (survey and evaluation/examination) may still be used depending on the training or course learning objectives. Inman and Vernon (1997) recommend using narrative and dialogical methods for assessments, such as scenarios, to integrate learning via consensus-building processes.
Table 3.3 stipulates the teaching and learning methods of the ALA that are commonly used in civil engineering and construction studies at TVET colleges:

Table 3.3: AL Teaching methods in CEC at TVET colleges

Demonstration
Discussion
Simulation
Project
Inquiry
Lecture
Questioning
Guided discovery
Field trips
Individualised instruction

The table above indicates teaching methods that are key in teaching and learning during the utilisation of action learning:

3.3.1.1 Demonstration

In accordance with Mokhothu's (2018) pronouncement, the demonstration method may be separated into two types: step-by-step and the whole process. He goes on to clarify the following two points: In step-by-step demonstrations, the method is introduced and shown in an inter-space situation that is part of the lesson. In the whole process type, the lecturer demonstrates the whole procedure from stem to stern without interruption from the students (Mokhothu, 2018; Chingombe, 2013).

3.3.1.2 Discussion

In the discussion of Civil Engineering and Construction Studies, is used as one of the fundamental teaching methods for teaching and learning to promote an ALA. The discussion method is divided into three types, which are:

3.3.1.2.1. Structured group discussion

During these types of group discussions, the students are pitted against one another in the roles that they must perform within a certain context. Participants are charged with addressing the problems that are inherent in the provided scenario within the limits of their allocated responsibilities (Xu, Chen & Chen, 2020:2; Shi, Luo & He, 2017).

3.3.1.2.2 Unstructured group discussion

Unstructured group discussion, as opposed to scheduled group discussion, provides students the opportunity to choose the subject of discussion with their peers. This formal technique of group deliberation is seldom used lately (Xu, Chen & Chen, 2020; Shi, Luo & He, 2017).

3.3.1.2.3 Role play

Students are given specific roles to play within the framework of a certain scenario while participating in this kind of group discussion (Hawes & Hawes 1982). As part of their work, the participants must deal with the problems that are inherent in the scenario that has been given to them (Xu, Chen & Chen, 2020:2; Shi, Luo & He, 2017; Cherif, 1995).

3.3.1.3 Simulation

The replication of real-world activities and processes in a safe setting is referred to as simulation. Simulations strive to offer an experience that is as like the “real thing” as possible; nevertheless, a simulated activity has the added benefit of enabling learners to "reset" the situation and attempt other tactics and approaches. This enables students to get experience in particular circumstances by applying their broader learning and expertise. (Heitzmannet al., 2019).

The method (simulation) is often used in fields where students need to acquire skills and expertise but are unable to do so due to safety concerns or financial constraints (Chernikova, Heitzmann, Stadler, Holzberger, Seidel & Fischer, 2020:501). Civil Engineering and Construction Simulators, for example, allow students to practise brick joints by using dry packing of bricks that can react in sophisticated and realistic ways, whereas Architectural Simulators enable trainee architects (engineering students) to learn how to conduct foundation laying out in a range of situations without ever touching the ground (Chernikova et al., 2020:501). While the application of simulation is evident and well-established in these fields, it also exists in others, such as the virtual courtroom in the legal field, and may be utilised in a great number of others. In some fields, the distinction between a simulation and a role-play exercise may be inconsequential, particularly when the exercise focuses on interpersonal relationships (Heitzmann et al., 2019).

Moreover, Chernikova et al. (2020:500) claim that simulations are increasingly often used in higher education settings. They are used in STEM (science, technology, engineering, and mathematics) education to expedite a deeper understanding of concepts and their relationships, as well as to advance inquiry, problem solving, and decision making (Hegland, Aarlie, Strmme & Jamtvedt, 2017; Chernikova et al., 2020). Therefore, simulation is used to advance the analytic competences, motor skills, and technical skills of prospective civil and construction engineers, as well as teacher educators, action learning promotes the principles of teaching and learning.

3.3.1.4 Project

Projects are regarded as one of the pivotal and critical teaching methods or strategies that integrates content knowledge (theory) and practical work, as students shall travel the route of learning alone, following the six steps of the technological process in civil engineering and construction studies to solve a particular problem (Mokhothu 2020; Van der Walt, 2008; Van der Walt, 2007); the six steps are identification, investigation, design, making, evaluation, and communication. Furthermore, Gumbo, Toit, Khumalo, Maluleke, Mapotse, Ngetu, Sibanda, and Thompson (2019) argue that using projects as a teaching strategy promotes action and active learning rather than passive learning because action learning encourages learners to solve problems in their field as well as develop products to solve problems, resulting in a comprehensive gain of new knowledge and skills. Projects in Civil Engineering and Construction Studies are divided into different categories, which are:

3.3.1.4.1 Small project (a scale model of real project of PAT)

Sonar (2021:1) asserts that critical theory courses and typical practicals are small projects. The effectiveness of teaching the contents and the essential skills through a small project based on the design process: investigation skills, making skills, evaluation skills, and communication skills (Curriculum and Assessment Policy Statement, 2011:30) Ntshaba (2012:4) also emphasised the significance of small projects as a component of summative evaluation for the maintenance of students' competency (Curriculum and Assessment Policy Statement, 2011:30; Ntshaba, 2012:4). Ntshaba (2012:4) and Sonar (2021:1) further assert that small projects give students the chance to participate in design activities and comprehend how internal constraints and processes affect designs. First-hand information is provided via brainstorming, visualising, scale modelling, testing, and fine-tuning designs. Therefore, as a result, students acquire skills in dealing with actual projects, communicating design information, and reporting results (Department of Education, 2002b:5; Ntshaba, 2012).

3.3.1.4.2 Practical Assessment Task (PAT) (Actual/Main project)

A project should require the student to plan, prepare, investigate, and conduct research to solve the identified problem or task; complete the task or follow the instructions (according to the criteria provided); develop the project in accordance with the criteria provided; and demonstrate some innovation and creativity. To begin, the teacher should: determine the content, skills, and knowledge to be addressed; establish clear criteria; provide clear instructions to guide the learner (the learner should understand exactly what is expected of him or her); keep the project's scope manageable; and identify the resources necessary to complete the project. Ensure that these resources are accessible to students (CAPS, 2011:26; Mtshali, 2020).

Mtshali (2020:238), on the other hand, defines PAT as cognitive skills and dispositions, and his findings confirm his accuracy when he states, “Clearly, according to the student teachers, the Civil Technology practical assessment task does not promote critical thinking skills” (Mtshali, 2020:240).

3.3.1.5 Inquiry

Sondlo and Ramnarain (2021:502) claim that there are two types of inquiry learning approaches that are more student-centered, which are:

- Guided Inquiry: a teacher designs an activity in which students investigate a phenomenon, and then guides them to develop the desired scientific concept.
- Open-ended inquiry orientation: students investigate a phenomenon independently, conceiving means to do so with minimal guidance, and then report their findings.

Further, inquiry-based learning is defined as a teaching strategy in which students engage with data, using evidence and logic to make sense of a given event or phenomenon in a social, collaborative setting (National Research Council, 1996; 2000; NRC, 2012). National Research Council (NRC) defines inquiry as an activity that teaches students about scientific concepts and how scientists investigate the natural world on a daily basis.

The table below characterises the philosophy of learning in the application of various teaching and learning methods at various stages and ages of students and lecturers during the process of implementing the ALA.

Table 3.4: Pedagogy, Andragogy and Heutagogy philosophy of learning

	Pedagogy	**Andragogy**	**Heutagogy**
Locus of Control	Teacher	Teacher/Learner	Learner
Skill Learning/Education Sector	School	Adult education	Self-Direction/ Research
Cognition Level	Cognitive	Meta-cognitive	Epistemic Cognition

Source: Adapted from: Chawla and Singh (2019:3)

Philosophy of learning (philosophy of learning): pedagogy, sciences, and education, especially instructional theory covering diverse systems of formal education, education for adults, alternative education (to main) education, and clubbing of special (to disabled) training with accessibility of ICT and mobile technology (Bizami, Tasir & Kew, 2022). The teacher provided the teacher's resources, which believe the teacher knows best, even when the teacher does not regularly change the philosophy of pedagogy. The teacher also learns to teach a child. The teacher motivates the student and decides how to focus learning (supported by the child's parents), and so on.

Andragogy combines the learning of adults, who are (maybe less) self-motivated but who imbue learning to become more efficient. The teacher acts as a facilitator or enabler (Buthelezi, 2016). According to Meeder (2012:1), the opposite of pedagogy is andragogy, in which a curriculum is more instructor-directed than student-centred. Admired characteristics of andragogy include its adaptability, broad applicability, capacity to consider the perspectives of the learner, and coherence with theories (Roberts, 2007:20). The study literature has discovered that andragogy is more successful when addressing adult learners (Meeder, 2012:2). However, Sutherland (1998:2) counters that andragogy is incompatible since adult students remain dependent on their teachers even while they are educated on how to learn on their own. Therefore, this study concludes that andragogy is the best for the teaching and learning process for adults' learners, but only through the monitoring and supervision of the lecturer on the adults' learners as an expert in the field. In addition, according to Kearsley (2003:2), it is crucial for adult education to emphasise social context and experiential learning (Meeder, 2021).

The heutagogy is based on the learner's self-direction, where a teacher and learner exchange resources, and the learner goes beyond solving problems and embedding colleagues' or co-learners' experiences (Bizami, Tasir & Kew, 2022). The heutagogy philosophy is beneficial for LLL (lifelong learning) (Ismail, 2017:3). It is the combination of the three philosophies now operational (Hase, 2016:6). In 2000, Hase and Kenyon (2000) defined heutagogy in Greek as the self-determined study of learning. According to Eachempati, Komattil, and Ismail (2017), heutagogy is based on a holistic approach to building learning capacity, with learning as an action and active process in which learners play key roles in their own learning (Hase & Kenyon, 2007). Heutagogy resembles andragogy, and it is asserted that it is an extension of andragogy. Heutagogy, like andragogy, promotes the principle of providing guidance and resources to facilitate the learning process. In contrast to andragogy, where the teacher maintains control over the learning process, heutagogy gives up all control to the student, who negotiates the learned way and determines what is to be learned (Komattil & Ismail, 2017).

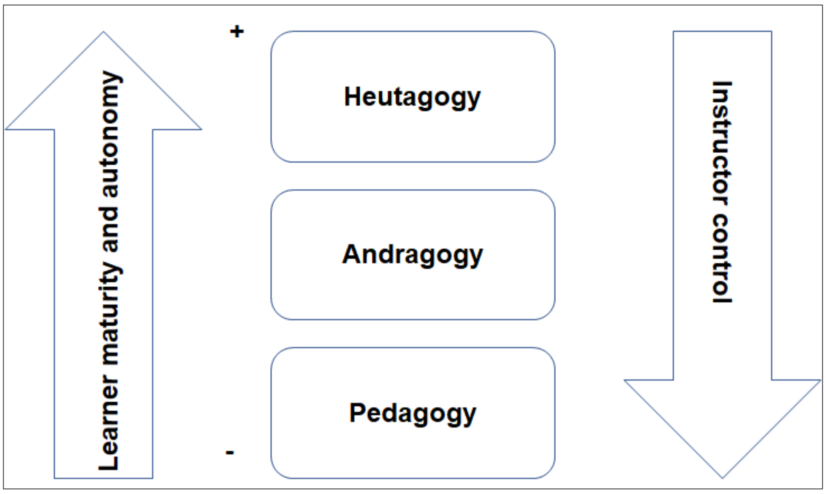

Figure 3.11: Paradigm shift from Pedagogy to Heutagogy

Source: Adapted from Eachempati, Komattil and Ismail, (2017:3)

Figure 3.11 above illustrates the evolution and main relationships between pedagogy, andragogy, and heutagogy. According to Eachempati, Komattil, and Ismail (2017), the paradigm shift revolves around the degree of state-induced interaction between the lecturer and the student. As a result, learner/student maturity and autonomy progress from negative below to positive above, indicating a progressive state of independence (Hase, 2016; Eachempati, Komattil, & Ismail, 2017). While at the instructional control points-down from negative above to positive below, that guarantees the independence state of implementation of teaching and learning through various ALAs with lecturer supervision and mentoring action (Eachempati, Komattil & Ismail, 2017).

3.4 ASSESSMENT OF CONTENT KNOWLEDGE AND PRACTICAL WORK AT TVET COLLEGES

In Civil Engineering and Construction Studies, assessment is focused not only on the result, such as a test or project completed and turned in, but also on the whole design process so that students appreciate its significance (Engelbrecht, Ankiewicz, & de Swardt, 2016). Values and attitudes that guide good decision-making in selecting suitable designs to solve a problem, achieve a need, or capitalise on an opportunity are also critical components of evaluation (van Niekerk, Ankiewicz & Swardt, 2010; Masoabi, 2015). Assessment in Civil Engineering and Construction Studies has characteristics that distinguish it from other forms of evaluation (Ankiewicz 1995; ITEA 1997:ii; Engelbrecht, Ankiewicz, & de Swardt, 2016). Although there is a distinction between conceptual and procedural knowledge in engineering (McCormick, 1997), conceptual and procedural knowledge are inextricably linked (Ropohl, 1999:69; McCormick, 1997).

Conceptual or descriptive knowledge focuses on the relationships between knowledge objects; to the extent that learners can recognise these relationships, which assert that they have conceptual understanding. "That taken from other disciplines, such as science, and that specific to engineering" are examples of conceptual knowledge important to technology (McCormick, 1997:153). Tactic, personal, and implicit knowledge are all terms used to describe procedural knowledge. "Technological procedural knowledge may be used for design, modelling, problem resolution, systems methods, project planning, quality assurance, and optimization" (McCormick, 1997:144). Procedural knowledge, unlike conceptual knowledge, cannot be taught. "Only extensive practise can provide technical know-how" (Ropohl, 1999:69).

In society, education is the production of the required life skills. To achieve a healthy education, such abilities must be transferred across the cognitive, affective, and psychomotor fields. Igborgbor (2006) states that cognitive abilities include:

- Usable knowledge of specific facts gained either directly or indirectly.
- Deeper understanding of phenomena in one's environment.
- Enhanced reasoning ability that facilitates a deeper comprehension of situations.

- Creativity and motivation.

Therefore, balanced education can be classified into the following domains as itemised by Kasilingam, Ramalingam & Chinnavan (2014).

Table 3.5: Assessment domains

Cognitive Domain	Affective Domain	Psychomotor Domain
Knowledge	Receiving	Imitation
Comprehension	Responding	Manipulation
Application	Valuing	Precision
Analysis	Organisation	Actualisation
Synthesis	Characterisation	Naturalisation
Evaluation		

Source: Kasilingam, Ramalingam & Chinnavan (2014:31-32)

According to Yulindar, Setiawan, and Liliawati (2018), there are five stages that must be scored to evaluate problem-solving skills. The following are the five stages:

Stage 1: Assisting students in focusing on the problem can be accomplished using images or words.

Stage 2: Linking the problem with the physics concept in terms of physical symbols and principles, students can simplify the problem by doing.

Stage 3: In order to plan a problem-solving solution (student the solution), students construct a framework of equations based on the proposed relationships from the previous stage.

Stage 4: Students can manipulate equations, enter known numbers, and solve algebraic problems if the plan is implemented.

Stage 5: The student must evaluate the answer and ensure that it is satisfactory when evaluating the solution.

While Mokhothu (2019) identifies technological process as the central principle of an ALA to assessment in civil engineering and construction, he reaffirms that the technological process affords students the opportunity to be innovative and creative and to develop a genuine, comprehensive skill set in the workplace. In addition, Mokhothu (2019), Masoabi (2015), DBE (2011b:10), and Van der Walt (2009:26) describe the technological process' six steps as follows:

Step 1: Identify: Create a summary of the problem from the given or created scenario.

Step 2: Investigation: The design brief describes a problem that must be solved with supplementary freehand drawings illustrating three potential solutions. Write constraints: scope, cost, and time, and requirements: standard, material, and quality.

Step 3: **Design**: Formal drawing plan with complete specifications, scale, and materials list.

Step 4.:**Make:** Physically constructing your project in accordance with a formal plan.

Step 5: **Evaluation and Test:** Compile a checklist for the project.

Step 6: **Communication:** Presentation of the project (portfolio, project exhibition, and flow-chart).

However, the above stages and steps of problem solving are deemed to address the main principle of action learning assessment in civil engineering and construction, but all these steps and stages should be practised in consideration of and in alignment with Bloom Taxonomy's levels of domains. The below examples in Figure 3.12 illustrate how civil engineering and construction should be practised in line with ALAs:

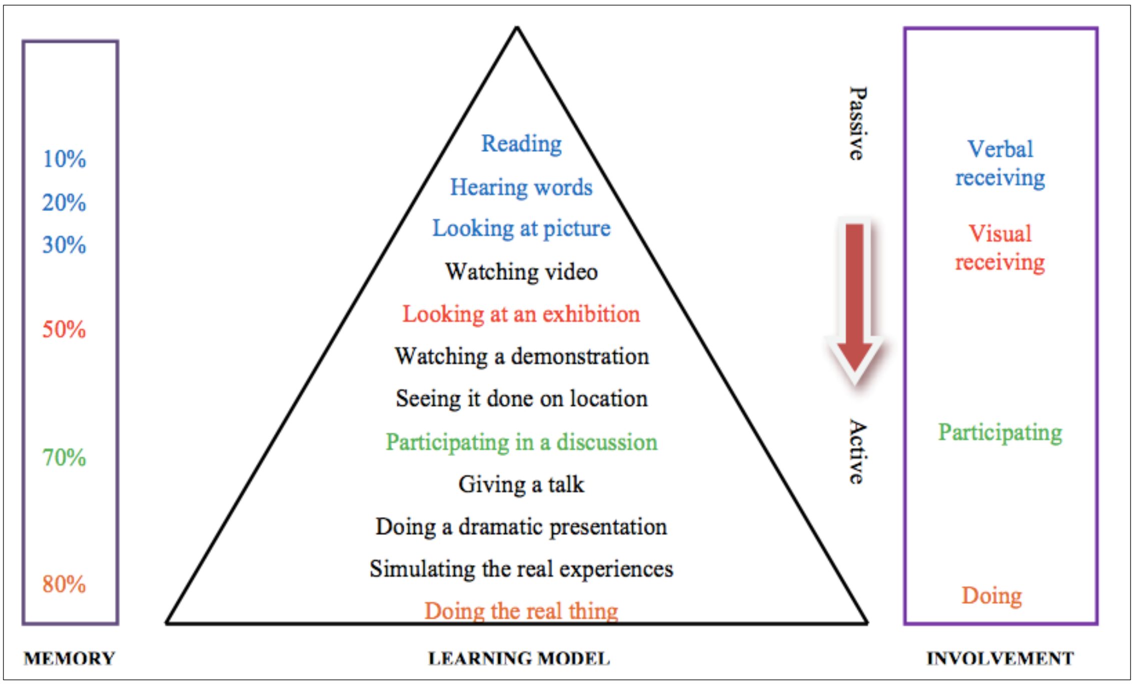

Figure 3.12: Learning and Assessment model in Civil Engineering and Construction at TVET college
Source: Ahmad et al. (2015:26)

The learning and assessment model in civil engineering and construction at TVET college outlined above indicates three aspects to be considered, which are memory, the learning model, and involvement. All these aspects are measured in percentages and controlled by the passive and active learning model, which shows that participating is 70% and doing is 80%. Therefore, it proves that in civil engineering and construction, action learning plays a key role. Narrowing down the argument, Mokhothu (2018), in his findings, has proven Joughin (2010) to be accurate when asserting that oral assessment is one of the most powerful tools and moments where the students can express knowledge without a restricted space of discussion between lecturer and student in a private assessment space. “Spoken word is written on the soul of the hearer with understanding, and the written word is only a pale shadow of the living and animate speech of a man with knowledge” (Mokhothu, 2018:324; Joughin, 2010; Kehm, 2001:27). Particularly, oral assessment portrays and promulgates the actual inculcated knowledge with assurance to explore other avenues of creativity and innovation. “Students must be assessed in all types of assessment before being declared competent or incompetent” (Mokhothu, 2018:324). As a result, the above quotations indicate that in this study, all student assessment methods should be scrutinised to determine student capacity and competency.

3.5 CHALLENGES EXPERIENCED DURING APPLICATION OF ALA AT TVET COLLEGES

Industry expects graduates to possess superior skills (Jones & Killick, 2013; Pitso, 2018). Magnus, Prinsloo, Bird, and Singh (2013) also highlight a graduate's adaptability and flexibility, his willingness to learn, his teamwork, his high level of skill, and his dedication to acquiring excellent skills. To achieve this, TVET colleges should focus on aligning their curricula with workplace requirements to maintain the employability of their graduates (Easa, 2013). Inadequacies in TVET necessitate constant renovation and the participation of various stakeholders in the conceptualization, evaluation, and design of programmes and their development (Afeti, 2017). Due to a lack of expertise in curriculum design, TVET institutions in developing countries appear to face difficulties in maintaining and enhancing the quality and relevance of their programmes to meet labour market needs and demands (Albashiry, Voogt & Pieters, 2015).

According to Booyens (2012), there is a disconnect between the fields of study for which lecturers are qualified and the outcomes they require curriculum content to generate. In addition, Booyens (2012) questions whether their prior work experience is in fact directly related to the skills required to deliver industrial and employment programmes today (Terblanche, Albertyn & van Coller-Peter, 2017). However, Mtshali, Ramaligela, and Makgato (2019) argue that the challenging aspect of teaching practical skills in Civil Technology, Civil Engineering, and Construction Studies is a result of lecturers lacking adequate pedagogical subject knowledge transmission and inadequate teaching materials and facilities. In their study, Han, Turns, Cook, Mason, and Shuman (2022) found that students relied on analogous examples or textbook equations during the problem-solving process rather than developing a conceptual understanding. Consequently, this study has investigated the challenges and develop a formula or model that promotes ALAs to problem-solving.

3.5.1 Facilities, Materials and Infrastructure

In TVET colleges, to achieve an accurate integration of content knowledge and practical work through an ALA, the college should be in a position of having appropriate classrooms and workshops with sufficient equipment and materials. Maeko (2016:30) confirms this, stating that high-quality skills training requires appropriate workshop equipment, an adequate supply of training materials, and student practise (Maeko, 2016:30; Yangben & Seniwoliba, 2014). Inadequate training equipment and a lack of instructional materials, on the other hand, are among the factors that reduce the effectiveness of training in achieving civil engineering construction knowledge and skills objectives.

The requirement for suitable facilities, tools, and equipment for efficient civil engineering construction has been shown by Chakamba, Jumo, Edziwa and Misozi (2013); Alaba and Adekomi (2012); and Maeko (2016). This demand is mirrored by Umunadi (2014) and Maeko (2016:30), who also highlighted the need for having enough equipment in the workshops for students' learning. In addition, Maeko (2013) and Mokhothu (2018) argue that Civil Engineering Construction students should be permitted to handle equipment and deal with various materials to draw the link between classroom learning and real-world circumstances. Moreover, Uzoagulu (1992), Alam (2008), and Maeko (2016) caution that low-quality technology education programs, particularly those lacking appropriate functioning equipment, may result in unskilled and unemployable graduates. However, according to Kennedy (2008) and Mtshali, Ramaligela and Makgato (2018), the training of students is hampered by a shortage of facilities such as workshops, laboratories, equipment, and materials. As a result of this circumstance, students in civil engineering construction graduate with just academic knowledge and no practical skills. As a result, the course is more theoretical than practical, with less focus on practise than theory (Mokhothu, Maimane & Rankhumise, 2015). Of which students will not meet the standard of being competed in totality.

3.6 DEVELOPMENTAL SUPPORT TO USE ALA TO PRODUCE AND INTEGRATE QUALITY WORK AT TVET COLLEGES

Staff development in the area of pedagogy should be a top priority for colleges that provide TVET in order to deliver high-quality programmes. This necessitates that instructors acquire all the necessary skills and knowledge to conduct relevant and responsive vocational education and training programmes (Mmako, 2015; Pitso, 2018). In addition, Hill, Walkington, and France (2016) highlight the high demand for graduates with disciplinary, professional, and technical expertise. TVET institutions must be aware of and adhere to quality, quantity, and equity imperatives (Pitso, 2018). Terblanche, Albertyn, and van Coller-Peter (2017) assert that training in specialised skills is more effective when it is built upon a solid foundation of general education. Education and training appear to be essential for productivity, but they are difficult to manage effectively within the same institutional structure. Therefore, training institutions with a degree of autonomy and flexibility, which is difficult to attain in formal and rigid systems, is more effective.

Buthelezi (2016) discovered in her research that the TVET college sector is complex, and that the associated issues necessitate holistic professional lecturer development, producing instructors with the appropriate knowledge, characteristics, and competencies. In addition, she suggested that future opportunities for college lecturer development in TVET include the development of a curriculum package that includes practical knowledge, disciplinary knowledge, workplace knowledge, tacit knowledge, knowledge of the heart in the form of values, attitudes, intuition, and situated learning, as well as competencies such as reflection, collegiality, teamwork, critical thinking, and problem-solving. All of the following are required: lifelong learning, the ability to integrate theory and practise, cross-disciplinary thinking, self-evaluation, and self-guidance (Buthelezi, 2016; Makole, 2015; Papier, 2011).

ALAs are highlighted or recommended as a strategy to be used to equip students with outstanding practical skills and subject knowledge in order to close the skills gap in the workplace and increase self-employment. According to Loynes (2017), TVET colleges should place a strong emphasis on employability, which would assist students in becoming more marketable to industry and maintaining their competitiveness. In support of the notion that employability is essential to the economies of many nations, it encompasses the entire spectrum of educational values, ranging from knowledge and information to skills and attributes (Maclean & Pavlova, 2013). TVET Colleges should offer competent lecturers with new advanced skills to face the difficulties of real time in their individual colleges to accomplish the assertion (Hamisu, Salleh, Sern, Adamu & Gambo, 2017). As a result, TVET lecturers are urged to get sufficient action learning methods training to develop students' totalities.

Anastasiou and Kyriakou (2017) stated in their findings that lecturers like to employ a variety of ALAs in TVET for engineering students. The design and delivery of lectures, which are improved by student engagement and action participation, are a successful and widely used teaching method. This has the potential to improve the key student-centric nature of the learning process by keeping and capturing the students' attention throughout the lesson.

3.7 CONCLUSION

This chapter addressed the general teaching methods employed in TVET institutions. In this instance, measuring the use of ALAs in specific civil engineering construction in colleges of technical and vocational education was also addressed. The chapter also addressed the evaluation of subject-matter knowledge and practical skills. This chapter also discussed the obstacles encountered throughout the action-learning methodology as well as the developmental supports available. In conclusion, this chapter has amassed a sufficient amount of literature concerning the aforementioned assertions. Chapter 4 describes the research methodology and justification for the researcher's selection.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

Chapter one provided the study's background, problem statement, and primary and secondary research questions, while Chapter two provided the theoretical framework that underpins and guides the study. Then, Chapter four supported the study with a critical review of the study's related literature.

This chapter discusses the research paradigm, research design, and methodology employed in the study. This chapter also describes the study's population and sampling methodology. It elaborates on the data collection instruments and analysis, including ethical considerations and the study's reliability.

4.2 RESEARCH PARADIGM

The word paradigm is derived from the Greek word paradeigma, meaning pattern (Kuhn 1962). In the study by Kuhn in 1962, this term was first used to define a conceptual framework that is agreed upon by a group of researchers or scientists and that provides them with an in-depth guideline for conducting the study (Reading Craze, 2017:3; Kivunja & Kuyini, 2017). A research paradigm is the collection of common beliefs and agreements shared between scientists on how issues should be interpreted and solved (Kuhn, 1962). A research paradigm is an approach to conducting research that has long been confirmed by the research community and that has been in use for hundreds of years (Stephan, 2015). A research paradigm is an approach or research model. It is also a guide to providing the right direction for research as it offers an idea of the kind of resources required in terms of capital, effort, time, and manpower (Kivunja & Kuyini, 2017). Hance this study opted pragmatic paradigm.

4.2.1 Pragmatic

The pragmatic paradigm refers to a viewpoint that emphasises "what works" rather than what could be called "true or actual" objectively and completely. Early pragmatists rejected the notion that social inquiry could discover real-world truths through a single empirical process (Shannon-Baker, 2016). According to these pragmatists, reality should be measured by its consequences. The pragmatic paradigm is useful for guiding research design, particularly when a combination of different approaches is philosophically inconsistent. Since pragmatism as a scientific research paradigm acknowledges that knowledge can be socially created and that truth resides in this world, mixed methods research is associated with pragmatism (Masoabi, 2015; Creswell, 2011). Kanyane (2016:27) argues further that the pragmatist view is that people are change agents and are able to experience and test their ideas and beliefs through experimentation, which reveals practical development and teaches through consequence actions. Nevertheless, Terblanche, Albertyn and van Coller-Peter (2017) also assert that the pragmatic paradigm addresses the problematic matter of the need to integrate theory and practise through ALAs. Shannon-Baker (2016) concludes, therefore, that pragmatic emphasises a solid foundation for research questions, communication, and shared perceptions. During the combination phase of mixed methods, it was found to be useful for linking theory to collected data. Throughout the investigation, pragmatism advocates for a balance between subjectivity and objectivity (Shannon-Baker, 2016).

The adoption of pragmatism in the data collection and data analysis processes is directly related to the purpose and essence of the addressed research problem (Creswell, 2003). In pragmatism, the study issue is regarded as the most important concern, rather than the approach (Creswell, 2003). The adopted methods of data collection (interviews, questionnaires, observation, articulation, and documentation), narratives (qualitative and quantitative), and analysis (descriptive, factor, material, thematic, and discourse) are frequently regarded as the most likely factors that offer a profound understanding of the research problem (Creswell, 2003; Mackenzie & Knipe, 2006). Therefore, pragmatism is unquestionably the foundation for the mixed methods researcher.

4.3 METHODOLOGY

In contrast to epistemological considerations, methodology refers to a scientific theory and the examination of various abstract facts (Buthelezi, 2016). While Khosa, Croyle, Belage, LeBlanc, Haley, and Kelton (2019) assert that "research methodology" refers to a system by which researchers accomplish their study objectives, Mosebekoa (2019) defines it as a scientific and systematic approach to learning about behaviour, objects, and events, and Creswell (2012) defines it as a series of steps involving data collection and analysis to comprehend a problem. Definitions have the same meaning as the procedure for gathering information to fulfil the objectives of the study. Creswell (2012) concludes that the significance of submitting research is to contribute knowledge, advance practises, and inform policies. Furthermore, Creswell, Plano Clark, Gutmann, and Hanson (2003) argue that mixed-methods research should be considered a distinct research design in the social sciences for several reasons. Researchers mean by design a method for collecting, analysing, and reporting research, such as the moment designs of quantitative studies and surveys, as well as the qualitative approaches of studies in the field, grounded theory studies, and case studies (Creswell, Plano Clark, Gutmann & Hanson, 2003; Bless, Smith & Sithole, 2013).

The research employed a combination of methods to collect data. A mixed-methods research strategy is an independent research strategy. According to Creswell and Plano Clark (2011), a mixed-methods research design is a research design with its own distinct theories and investigation techniques. It utilises paradigms as a methodology to provide guidelines for the collection and analysis of data from multiple databases within a single study (Dawadi, Saraswati, Shrestha, Sagun, & Giri, 2021). According to Enosh, Tzafrir, and Stolovy (2014), researchers can answer research questions with sufficient depth and breadth by employing mixed methods. In addition, a mixed-methods design offers the best chance of answering research questions by combining two sets of capabilities while compensating for the weaknesses of each method (Johnson & Onwuegbuzie, 2004). Consequently, addressing impact through mixed methodological approaches increases the significance of study methods (Saville, 2012).

Moreover, Dawadi, Saraswati, Shrestha, Sagun, and Giri (2021) note that combining qualitative and quantitative methods could be advantageous compared to using a single method because it is anticipated to yield rich insights into the research data that cannot be fully comprehended by using either qualitative or quantitative methods alone. A mixed-methods design can integrate and collaborate on multiple data sources, thereby facilitating the investigation of complex problems (Bergman, 2008; Poth & Munce, 2020). Consequently, combining two methods produces a more complete picture and allows for a greater variety of divergent or complementary perspectives, which are valuable because they lead to additional reflection, strengthen our understanding of the concepts, and increase the scope of future research opportunities (Teddlie & Tashakkori, 2009; Dawadi, Saraswati, Shrestha, Sagun & Giri, 2021). Therefore, results from the mixed-methods study provide a comprehensive understanding of the data, which is helpful for generating substantive concepts and conclusions (Ventakesh, Brown & Bala, 2013).

4.4 RESEARCH DESIGN

Research design is the overall technique that researchers use in a consistent and logical way to investigate various components of a sample. Therefore, a research design directs the steps involved in the process of research, detailing the basic building blocks (Maeko, 2017:55; Myers, 2009:22). In addition, a research design is also described by Smith, Thorpe, and Jackson (2008) as a statement written, often before any data is collected, that describes and justifies what data is to be collected, how, and from where. Furthermore, Eriksson and Kovalainan (2015) argue that a research design often involves ideas and perspectives, a rough time schedule for the entire project and for the different parts of it, the modes of data collection that one may have accessible, and method choices that one may have accessible, provided the research issue, structure, and data that one intends to collect. This implies that a research design is a guide for conducting the analysis. However, Lekhu (2013) defines research design as explanations of the procedures for conducting the study, as well as when, from whom, and under what conditions the data will be collected. Therefore, the researcher views research design as an investigation flowchart to solve the research problem and achieve the study's objectives.

For data collection, a mixed-methods strategy involving quantitative and qualitative methodology was employed. The research methodology includes a literature review and an empirical study employing semi-structured purposive sampling interviews and questionnaires as qualitative and quantitative methods, respectively. According to McMillan (2000), both qualitative and quantitative approaches can be used in the same study because they both adhere to the same research paradigms. Matea (2013) cited De Vos, De Hauw, and Willemse (2011), indicated that most authors agree that in real life, social science researchers do use both quantitative and qualitative methodologies, sometimes consciously and sometimes unconsciously. In addition, Creswell (2003) identifies the following six models of mixed-method approaches:

Sequential Explanatory Design

Sequential explanatory design is when quantitative data results serve as the primary source for collecting qualitative data to support quantitative conclusions (Creswell, Plano Clark, Gutmann & Hanson, 2003). Consequently, it is anticipated that the qualitative findings will either provide a detailed explanation of the quantitative findings or expand their scope (Creswell, 2012; McMillan & Schumacher, 2006; Masoabi, 2015; Cohen, Manion & Morrison, 2011). In addition, the sequential explanatory design frequently employs qualitative results to support the explanation and interpretation of the results of a predominantly quantitative study (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Tashakkori & Teddlie, 2007:215).

Sequential Exploratory Design

Researchers using a sequential exploratory design start by collecting qualitative data to assess the surrounding circumstances (Creswell, 2012). They would then gather quantitative data to aid in elucidating the linkages between variables and the descriptive context of the qualitative data analysis (Cohen, Manion, & Morrison, 2011). Moreover, qualitative data would be more significant than quantitative data. Therefore, this method may be useful when developing and testing a new instrument (Creswell, 2012; Cohen, Manion, & Morrison, 2011).

Sequential Transformative Design

The sequential transformational design includes two distinct phases for data collection. Either the quantitative phase or the qualitative phase may be prioritised in this design; either method may be employed first (Creswell, Plano Clark, Gutmann & Hanson, 2003). The data from the two phases are also combined during the interpretation step. This design has been used more effectively when a theoretical perspective has been provided to direct the investigation than when methods are used alone (Creswell, Plano Clark, Gutmann & Hanson, 2003; Tashakkori & Teddlie, 2007).

Concurrent Embedded Design

The embedded design is a mixed-methods design in which one data set plays a supporting, supplementary role in a study that is primarily based on the other type of data (Creswell, Plano Clark, Gutmann & Hanson, 2003). This design is predicated on the assumptions that a single data set is insufficient, that multiple questions should also be addressed, and that multiple data types are required for various question types (Howe, 1988). When answering a research question in a predominantly quantitative or qualitative study, this design allows researchers to include qualitative or quantitative data (Tashakkori & Teddlie, 2007). Moreover, this design is especially convenient if a researcher wishes to incorporate a qualitative element into a quantitative design, as in the case of an experimental or correlational design approach that guides the study. (Creswell, 2012; Cohen, Manion, & Morrison, 2011); (Creswell, 2012; Cohen, Manion, & Morrison, 2011). Compared to the conventional triangulation design, nested or embedded designs are more prevalent (Creswell, Plano Clark, Gutmann & Hanson, 2003).

Concurrent Transformative Design

The method is used to influence all methodological choices by providing a theoretical perspective reflective of the objectives or research questions of the study (Creswell, Plano Clark, Gutmann & Hanson, 2003) to evaluate a theoretical perspective at multiple levels of analysis (Creswell, 2003). This viewpoint may be based on a conceptual or theoretical framework, advocacy, participatory research, critical theory, or other ideologies (Howe, 1988). In addition, it serves as the basis for all methodological approaches throughout the research process, including problem definition, determination of the design and data sources, analysis, interpretation, and reporting of results (Howe, 1988). The concurrent transformational design may incorporate triangulation or nested design elements. In other words, both types of data are collected concurrently (Creswell, 2003). Consequently, the two types of data are collected concurrently during a single phase of data collection and may be accorded equal or unequal priority. Although integration during the phase of interpretation becomes a potential variation (Creswell, Plano Clark, Gutmann & Hanson, 2003; Howe, 1988).

Concurrent Triangulation Design

The primary objective of this design is to collect diverse but complementary data on the same topic in order to gain a deeper understanding of the research problem (Morse, 1991). Denzin (1978:291) and Morse (1991) state that two methods are utilised to confirm, cross-validate, or corroborate study findings. The collection of data is concurrent. In general, these methods are employed to compensate for the shortcomings of one method with the advantages of another (Creswell, 2003). The triangulation design is a single-phase design in which quantitative and qualitative data are utilised. According to Creswell, Plano Clark, Gutmann, and Hanson (2003), concurrent triangulation design typically combines the results of the two methods during the phase of analysis and interpretation. This interpretation may either demonstrate the integration of the data or explain any potential lack of convergence to support the study's findings (Morse, 1991).

The study employed a concurrent triangulation design with a quantitative closed-ended questionnaire and a qualitative semi-structured interview. This mixed-method design has advantages since it generates findings that are well validated and corroborated (Jick, 1979). In addition, Morgan (1998) notes that, compared to sequential designs, concurrent data gathering yields higher quality and lower data collection times. Therefore, Jick (1979:605) emphasised that to properly analyse data using two different methodologies, concurrent triangulation demands a significant amount of effort and technical expertise (Creswell, 2003; Denzin, 1978; Morse, 1991).

Green, Creswell, Shope, and Clark (2007) assert that in this design, “quantitative and qualitative data are collected and analysed separately on the same phenomenon, and then the different results are converged during interpretations”. Creswell (2003) notes that a “mixed methods design is useful to capture the best of both quantitative and qualitative approaches”. Mixed-methods research is defined as a procedure for collecting, analysing, and combining quantitative and qualitative data at some point in the research process within a single study to gain a more comprehensive understanding of a research problem (Creswell & Creswell, 2005). In a mixed methods study, numerical and textual data are collected and analysed to address different facets of the same overarching research problem and provide a more comprehensive understanding of it (Maree, 2009).

Hence, Mosebekoa (2019) explains that the design of quantitative research enabled numbers in the study because of its existence. He also notes that the quantitative study design is a numerically calculated and statistically evaluated social issue survey. Moreover, Kanyane (2016) perceives a qualitative approach as an experience in the intricate nature of the context. In Addition, considering that the qualitative research approach is subjective in nature, it appears to focus on intangible aspects of the study. Therefore, Kumar (2005) and Lekhu (2013) explain the variance between quantitative and qualitative research in a simple table format below:

Table 4.1: Quantitative versus qualitative research method

DIFFERENCE WITH RESPECT TO	QUANTITATIVE RESEARCH	QUALITATIVE RESEARCH
Underpinning philosophy	Rationalism: Humans being achieve knowledge because of their capacity to reason.	Empiricism: The only knowledge that human beings acquire is from sensory experiences.
Approach to inquiry	Approach to inquiry Structured/rigid/predetermined methodology	Unstructured/flexible/open methodology
Main purpose of the investigation	To quantify extent of variation in a phenomenon, situation, issue, etc.	To describe variation in a phenomenon, situation, issue, etc.
Measurement of variables	Emphasis on some form of either measurement or classification of variables.	Emphasis on description of variables.
Sample size Emphasis on	Emphasis on greater sample size	Fewer cases
Focus of inquiry	Limits the scope of the investigation, but collects information from a larger number of respondents.	Covers multiple issues, but assembles required information from fewer respondents.
Dominant research value	Reliability and objectivity (value free)	Authenticity, but does not claim to be value free.

Dominant research topic	Explains the prevalence, incidence, scope, and nature of issues, perspectives, and attitudes; identifies patterns and formal theories.	Explores experiences, meanings, perceptions and feelings.
Analysis of data	Subject variables to frequency distributions, cross-tabulations or other statistical procedures.	Subject responses, narratives, or observational data are used to identify and describe themes.
Communication of findings	A more analytical organisation that draws inferences and conclusions and examines the magnitude and strength of relationships.	Organisation more descriptive and narrative in nature.

Source: Adapted from Lekhu (2013:92) and Kumar (2005:14)

4.5 POPULATION AND SAMPLING

This portion of the study describes the population and sample. In addition, it provides a concise explanation of population and sampling, followed by a description of how the sample was selected.

4.5.1 Population

Often, it is impractical to study an entire population, so it is necessary to draw broad conclusions based on a study of a representative sample (Sharp, Peters & Howard, 2017; Maree, 2009; Maeko, 2013). Whereas Maeko (2016) affirms that a population is an "aggregate or totality" of all staff members in a particular institution or organisation. Khosa, Croyle, Belage, LeBlanc, Haley and Kelton (2019) define a population as the collection of elements from which a sample is drawn. The population in this study comprises all the lecturers and laboratory technicians who are lecturing Engineering Studies in NATED 191 and NCV programmes at TVET colleges in the Free State Province of South Africa. The researcher has selected some of the lecturers based on their pertinent characteristics. This map of the municipality districts in the Free State Province is depicted in Table 4.2 as the population area under study.

4.5.2 Sampling

According to Khosa, Croyle, Belage, LeBlanc, Haley, and Kelton (2019), a sample is chosen from a large number or a group of people in an organisation with at least similar functions. To be able to generalise findings to the population, it is crucial, according to Maeko (2016), to select a sample that is representative of the population. Furthermore, Maree (2009), Creswell (2009), and Maeko (2016:57) to strengthen his argument, state that "in sampling for research purposes, the participants should be carefully chosen to suit the purpose of the study". However, from the abovementioned, the researcher is of the view that in the sampling process, all research elements such as significance, aim, and objectives of the study should play a pivotal role in choosing a proper sampling technique. Table 4.2 below presents different sampling techniques with a brief explanation:

Table 4.2: Sampling Techniques

Simple Random Sampling	Each subject in the population has an equal chance of being selected
Stratified Random Sampling	A representative number of subjects from various subgroups
Two Stage Cluster Random Sampling	Samples chosen from pre-existing groups
Systematic Sampling	Selection of every nth (i.e., 5th) subject in the population. Which means a specific interval from the random
Convenience Sampling	Subjects are easily accessible
Purposive Sampling/criterion-based sampling	Subjects are selected because of some characteristic

Source: *https://researchbasics.education.uconn.edu/sampling/#*

This study selected participants based on their characteristics and capacity for specific tasks using a sampling technique called purposive sampling. According to Cohen, Manion, and Morrison (2011), sampling is conducted for a variety of research purposes, including achieving representativeness, enabling comparisons, focusing on specific, unique issues or cases, and generating theory through the gradual accumulation of data from various sources. In addition, Ames, Glenton, and Lewin (2019) assert that purposive sampling is used to identify research participants who are directly related to the study's objective.

The participants of the study consist of 26 lecturers who are both male and female and responsible for content knowledge (theory) and practical work in NCV Technical and NATED 191 in Civil Engineering and Construction subjects from 4 TVET colleges (Maluti, Motheo, Goldfields, and Flavius Mareka) in the Free State in South Africa. In this case, all 26 participants mentioned above were the only total number available of all lecturers employed to teach (theory and practical) in Civil Engineering and Construction subjects at the 4 different TVET colleges in the Free State Province aforementioned. Table 4.3 below indicates clearly the pseudonymous names of the TVET colleges and the numbers of participants per TVET college:

Table 4.3: Specific TVET college names and number of the participants

College names	**Number of the participants**	**Total number = N (32)**
College A	13	13
College B	6	6
College C	3	3
College D	4	4

4.6 DATA COLLECTION INSTRUMENTS

4.6.1 Quantitative Design

The instruments that were used to collect data was a questionnaire. A closed-ended questionnaire was used as an instrument to collect quantitative data.

Questionnaire

According to Bless and Smith (2000), a questionnaire is a data collection instrument consisting of a standardised series of research-related questions to be answered by participants in writing. According to McMillan and Schumacher (2006), the benefit of questionnaires is that respondents can respond with confidence and anonymity is maintained. In addition, Mokhothu (2015:46) asserted that questionnaires were utilised to adequately cover the variables and gauge the breadth of potential responses. He then explains that a quantitative research method is used to test theories about reality and to look for cause and effect in gathering data to test questions (Mokhothu, 2015; Inankova, Creswell, & Clark, 2007).

In this study, a closed-ended questionnaire was developed to assess the perspectives of civil engineering and construction lecturers regarding the application of ALAs during the teaching and learning process to promote the full integration of theory and practise. The questionnaire played a vital role in attaining answers to the following research questions, from main to sub-questions: main question, "How does ALAs used to promote and enhance the pedagogic practices in Civil Engineering and Construction studies at TVET colleges?" Then sub-questions:

1) What teaching approaches are used in TVET colleges engineering studies curriculum?
2) To what extent are lecturers using action learning approaches in Civil Engineering and Construction studies at TVET colleges?
3) What sequence lecturers use to assess content knowledge and practical work at TVET colleges?
4) What challenges do TVET lecturers experience during application of ALA?
5) How can lecturers be capacitated to use ALA to produce and integrate quality work at TVET colleges?

However, the researcher developed a closed-ended questionnaire to obtain the degree of answers using rating scales 1 to 4, the "Likert scale" by Rensis Likert (1932). Where the rate starts from: strongly agree = 1, agree = 2, disagree = 3, strongly disagree = 4. It is preferable for quantitative ways to produce data, as it encompasses increasing degrees of opinion that cannot be considered in dichotomous and multiple-choice questions. According to Maeko (2019), questionnaires with closed questions are easier to administer and analyse than those with open questions. Through this method, Maeko sees a greater chance for respondents to generate completely completed questionnaires, to encode and analyse the responses more easily, to find fewer incorrect answers, and to promote comparisons and quantification. Thus, it is possible to statistically analyse the answers.

The questionnaires were distributed by hand, mail, and email to civil engineering and construction lecturers, along with a consent form and letter requesting respondents to fill out the questionnaire and tick or cross the appropriate boxes, as well as explaining all instructions. Respondents were given five days to complete and return the survey. Each of the 26 lecturers who participated in the survey teaches at a TVET college in a different district of South Africa's Free State Province. The placement of lecturers in their districts, the names of TVET colleges as pseudonyms to protect confidentiality, and the number of schools are depicted in Table 4.4 below.

Table 4.4: TVET college names and provincial districts of the participants

Districts	**College names**	**Number of Campuses**	**Number of the Lecturers**	**Number of TVET college**
Motheo	College A	2	13	1
Thabo Mofutsanyane	College B	1	6	1
Lejweleputswa	College C	1	3	1
Fezile Dabi	College D	2	4	1

The researcher administered the questionnaires to the sampled participants. After five days and the commencement of analysis, the researcher gathered responses and commenced with analysis. It was crucial to ensure the questionnaires were administered accurately and to know which districts participated in the survey. The following table (Table 4.5) was used to regulate the flow of questionnaires. The first column shows the college name, the second shows the number of campuses, the third shows the number of lecturers per college, and the fourth and fifth were used as the checklist for handing out and returning questionnaires for reliable auditing.

Table 4.5: Record list for questionnaire

RECORD LIST FOR QUESTIONNAIRE				
College name	number of campuses	number of lecturers	Out	In
College A	2	13	13	13
College B	1	6	6	6
College C	1	3	3	3
College D	2	4	4	4
Total	6	26	26	26

4.6.2 Qualitative Design

Face-to-face interviews were used as an instrument to collect qualitative data.

Interview

According to Babbie (2007), an interview is an alternative method for collecting survey data in which, instead of requiring respondents to read questionnaires and enter their own responses, researchers send interviewers to ask the questions orally and record respondents' responses. In contrast to casual interviews, face-to-face interviews conducted for research purposes are a highly disciplined endeavour, according to Anderson (2004). Anderson (2004) also says that it is a dynamic process in which an interviewer and interviewee talk to each other in person, usually following a set of rules or a protocol.

The researcher conducted 10 face-to-face interviews with semi-structured, open-ended questions. Interview questions were asked orally or virtually, and the participants' answers were recoded using a tape recorder or virtual video recorder. Makura and Shumba (2014) attest that the advantage of the use of a tape recorder was that participant responses could be listened to several times before concluding. According to Krathwohl and Smith (2005), a qualitative research orientation enables the researcher to comprehend human behaviour and improve the interpretation of collected data. Table 4.6 below illustrates a purposive sampling of the participants, who were selected based on reliability, specialisation, knowledgeability, and the establishment of civil engineering and construction staff.

Table 4.6: Information of participants' interview

College names	Number of Campuses	Total number of the Lecturers	Interview participants = 13	Responsibility: Lecturer NCV, NATED and Lab Technician
College A	2	13	4	Lecturer NCV, NATED and Lab Tech
College B	1	6	2	Lecturer NCV, NATED and Lab Tech
College C	1	3	2	Lecturer NCV and Lab Tech
College D	2	4	2	Lecturer NCV, NATED and Lab Tech

4.7 DATA ANALYSIS

4.7.1 Quantitative (Questionnaires)

The primary objective of quantitative research is to establish facts, statistically describe phenomena, explain and predict phenomena, and demonstrate relationships among variables (Gall, Gall & Borg, 2007). Quantitative research designs are typically structured and prescriptive, and the data derived from these studies are frequently characterised as hard, empirical, or statistical (Bogdan & Biklen, 1997). Most of the data is expressed numerically, and its interpretation is based on numerical comparisons and partitioning (Gall, Gall & Borg, 2007).

The results of the questionnaire were analysed using descriptive and inferential statistics. Rijuan (2009) cites Burns (2000) and notes that the statistics used in the questionnaire study are succinct and inferential, allowing the researcher to summarise the data using numerical methods. The researcher arranged the data and sent it to the professional statistician employed by the researcher to analyse the data gathered using SSPS software and Cronbach's alpha as a main option test to measure questionnaire accuracy and reliability. The statistician further provided a clear guide on how to interpret and discuss it. The analysis was created following the sections of the questionnaire:

- Section A:
  - Biographical data
- Section B:
  - Teaching approaches used in TVET colleges engineering studies curriculum
  - The extent to which lecturers in Civil Engineering and Construction studies at TVET colleges use action learning approaches
  - Sequence lecturers use to assess content knowledge and practical work at TVET colleges
  - Challenges that TVET lecturers experience during application of ALA
  - Lecturers capacitated to use ALA to produce quality work at TVET colleges – pertaining to the integration of content knowledge and practical work

Therefore, the statistician solely analysed and discussed section B with the researcher. The statistician also guided the researcher on how to interpret and report the collected data.

4.7.2 Qualitative (Interview)

Descriptive qualitative research represents an approach that emphasises research as a process. Holistic in the sense that studies must be viewed within a broader social context and require intensive immersion in the data and familiarity with the research environment. In addition, research designs are typically less rigid and flexible (Bogdan & Biklen, 1997). According to Creswell (1994), data analysis should occur concurrently with data collection and interpretation. The researcher gathered data through interviews and recorded the conversation. The researcher extracted the information from the tape and transcribed it. The researcher analysed these transcripts by developing codes and themes. Mokhothu (2015:49) outlines the following steps a researcher must take when interpreting interview data:

Step 1: Identify the themes

Step 2: Coding

Step 3: Draw a table

Step 4: Group the data according to themes; and write a report

Thereafter data was interpreted and discussed using above mentioned steps, to provide a clear perspective of the results.

4.8 RELIABILITY AND VALIDITY

In this section of the study, the researcher described the research's reliability and validity, as well as its function.

4.8.1 Reliability

Simply put, reliability is the degree to which a procedure for measuring and producing similar results when repeated is dependable. According to Cohen, Manion, and Morrison (2011), reliability is a synonym for dependability, consistency, and replicability across time, instruments, and respondent groups, and is concerned with precision and accuracy. Reliability refers to the consistency of achieving the same results when the problem is later duplicated or with similar samples (Joppe, 2000; Bird, 2009; Cohen, Manion, & Morrison, 2011). Cohen, Manion, and Morrison (2011) clarify in that regard when a reliable questionnaire test is performed. Two groups of students closely matched on significant characteristics, such as age or gender, should produce identical results or responses at approximately the same time.

According to Buthelezi (2016), instrument dependability implies dependability and consistency. To certify this, instruments were submitted to the study promoters for assessment. Then the pilot of the instrument was performed in a similar setting as TVET College. This practise allowed the researcher to test both instruments on those participants and allowed an opportunity to adjust the questions prior to the actual process of data collection. The table below explains types of reliability and how it can be estimated using various statistical methods:

Table 4.7: Types of reliability

Type of reliability	What does it assess?
Test-retest	The consistency of a measurement over time: obtaining the same results when a measurement is repeated.
Interrater	The consistency of a measurement across raters or observers: obtaining identical results when different individuals conduct the same measurement.
Internal consistency	Consistency of measurement: obtaining the same results from different parts of a test designed to measure the same thing.

Source: Adapted from Middleton (2020)

4.8.2 Validity

Validity refers to the extent to which evidence and theory support proposed test score interpretations and applications. Validity refers to the precision of a system's calculations. If a study's validity is high, its findings correspond to the actual properties, characteristics, and variations of the physical or social world. Manion, Cohen, and Morrison (2011). In addition, Salkind (2014) also states that the term validity refers to the results of a test, not the test itself.

The researcher submitted data instruments to the promoter and a few colleagues to review both instruments and make comments. The test work on the instrument was then performed, and the feedback was then analysed to ensure that the findings related directly to the research objectives. The following table illustrates the validity of a measurement that can be projected based on three significant types of evidence evaluated by expert judgement or the statistical method.

Table 4.8: Three types of validity

Type of validity	What does it assess?
Construct	Conformity of a measurement to existing theory and understanding of the concept being measured.
Content	The extent to which the measurement encompasses all aspects of the measured concept.

Criterion	The degree to which the result of a measurement corresponds to the results of other valid measurements of the same concept.
To assess the validity of a cause-and-effect relationship, you also need to consider internal validity (the design of the experiment) and external validity (the generalisability of the results)	

Source: Adapted from Middleton (2020)

As a result, construct validity was used to measure the instruments' linkage to the reviewed theories or those known in the study based on the related concepts demonstrated. While content validity was considered to measure the variables and its complexity, instruments had to be aligned to serve their actual purpose. Furthermore, to measure the instruments' purpose attainment, criterion validity was used to compare the data collected via those instruments and conclude that the instruments are valid (Bless, Smith, & Sithole, 2013).

4.9 PILOT STUDY

A pilot study is a small study that helps researchers test the effectiveness of their research instruments before using them on a larger scale, which should result in a comprehensive study (Van Teijlingen, 2001; Maeko, 2016). They attest that a preliminary small-scale observational study or experimental design was used to assess the feasibility and potential complications of the larger research study. In this study, a pilot study is referred to as a small-scale run trial to measure advantages and complications that can be experienced when using designed data collection instruments to prepare for a large-scale data collection. Therefore, the researcher used two technical skills centres in the Free State province to pilot quantitative and qualitative instruments. The characteristics of the participants were as follows:

Table 4.9: Pilot study participants

Centres	Male (n)	Female (n)
A	3	2
B	4	1
Total (N)	7	3

4.10 ETHICAL CONSIDERATION

According to the World Health Organization (2020:1), research ethics govern the conduct standards for scientists. To protect the dignity, rights, and welfare of research participants, it is essential to adhere to ethical principles.

An ethical clearance certificate was obtained from the Faculty of Humanities and used it to apply for permission from the principals of various TVET colleges to conduct research on their campuses. The research presented the participants with a consent form requesting their participation on a voluntary basis, not promising any compensation afterward. The theory or principle of informed consent is founded on the subject's right to liberty and autonomy (Cohen, Manion & Morrison, 2011). Clearly, ethical consideration of the confidentiality of participant information was prevalent. The study data will only be used to contribute to the researched body of knowledge.

4.11 CONCLUSION

In Chapter 4, the research design and methodology were discussed. The fourth chapter presented the methodology for data collection via semi-structured interviews, and questionnaires as instruments. The list and the location of the participants were presented. The data analysis methods and procedures have also been elucidated in detail. Chapter 5 below indicates data presentation, interpretation and discussion.

CHAPTER 5: PRESENTATION, ANALYSIS, AND DISCUSSION OF DATA

5.1 INTRODUCTION

This chapter presents, interprets, analyses, and discusses quantitative (a closed-ended questionnaire) and qualitative (an interview) data collected from four TVET colleges in the Free State Province of South Africa. The procedure was determined by the aims and objectives of the study, which were to assess the responses to research questions. The objective was to investigate the use of action learning as a teaching method in Civil Engineering Construction studies at TVET colleges, with an emphasis on content knowledge and practical work, and to review existing models.

5.2 PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA FROM THE QUESTIONNAIRES

The questionnaire was divided into two sections, where Section A was to gather biographical data for all participants (N = 26) and Section B was also to be answered by N = 26 participants based on five sub-sections:

- Teaching approaches used in TVET colleges engineering studies curriculum,
- To the extent lecturers use action learning approaches in civil engineering and construction studies at TVET colleges,
- Sequence lecturers use to assess content knowledge and practical work at TVET colleges,
- Challenges that TVET lecturers experience during application of ALA,
- Lecturers are capacitated to use ALA to produce quality work at TVET colleges, pertaining to the integration of content knowledge and practical work.

5.2.1 Section A presents the biography of the participants based presented in frequency and percent (%)

Table 5.1: Participants gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	20	76.9	76.9	76.9
	Female	6	23.1	23.1	100.0
	Total	26	100.0	100.0	

Table 5.1 above reports the results on gender, which show that males are in the majority (n = 20; 76.9%) and females are in the minority (n = 6; 23.1%). The result indicates that men dominate the Civil Engineering and Construction Studies at the TVET colleges in the Free State Province. The information presented confirms the finding of Mokhothu (2015:72) when he reported that TVET Civil Engineering and Construction Studies are still viewed as a hard labour career that is for males only.

Table 5.2: Participant's race

Race					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Black African	25	96.2	96.2	96.2
	Coloured	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

Table 5.2 above reveals the race dominance between the participants. Most participants are black Africans (n = 25; 96.2%), and coloured people are in the minority (n = 1; 3.8%). The results state clearly that most black Africans are available to teach Civil Engineering and Construction Studies at TVET College.

Table 5.3: Participants age

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25-35 years	13	50.0	50.0	50.0
	36-45 years	8	30.8	30.8	80.8
	46-55 years	4	15.4	15.4	96.2
	Above 55	1	3.8	3.8	100.0
	Total	26	100.0	100.0	

Table 5.3 above shows that most lecturers are in the age group between 25 and 35 years, where n = 13 (50%), followed by 36 and 45 years, where n = 8 (30%), while 46 to 55 years was n = 4 (15.4%), and the lowest age group was above 55 years, where n = 1 (3.8%). The findings mean that the 50% followed by 8% of participants are still at the age where they could easily embrace pedagogical development training.

Table 5.4: Participants years of work experience

Year of experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	under 3 years	5	19.2	19.2	19.2
	3-6 years	6	23.1	23.1	42.3
	7-10 years	5	19.2	19.2	61.5
	11 years and over	10	38.5	38.5	100.0
	Total	26	100.0	100.0	

Table 5.4 above indicates the results of the year of experience by the participants, which reveals that most of the lecturers do have at least 11 years of experience (n = 10; 38.5%), followed by 3 to 6 years (n = 6; 23.1%), while those with less than 3 years and 7 to 10 years of experience (n = 5) have less than that (19.2%). The results prove that most experienced lecturers are still available at TVET colleges to transfer their expertise to less experienced lecturers.

Table 5.5: Participants qualifications profile

BEd, Bed (Hons), MEd & DEd					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	12	46.2	46.2	46.2
	No	14	53.8	53.8	100.0
	Total	26	100.0	100.0	
NDip, BTech Eng					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	15.4	15.4	15.4
	No	22	84.6	84.6	100.0
	Total	26	100.0	100.0	
PGCE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	23.1	23.1	23.1
	No	20	76.9	76.9	100.0
	Total	26	100.0	100.0	
N. NDip					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	11	42.3	42.3	42.3
	No	15	57.7	57.7	100.0
	Total	26	100.0	100.0	
N1-6 plus VEOP or Artisan					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	23.1	23.1	23.1
	No	20	76.9	76.9	100.0
	Total	26	100.0	100.0	

Table 5.5 shows that the minority of the participants have professional teaching qualifications: n = 12 (46%), and n = 14 (53.8%) do not. followed by the N. Diploma, n = 11 (42.3%), while lecturers in positions of PGCE are only n = 16 (23.16%) and N1-6, VEOP, or artisans are n = 6 (23.1%). The participants in engineering qualifications from university are in the minority, n = 4 (15.4%). In general, the results confirm that lecturers are still lacking in their qualifications in the teaching profession, which is one of the main requirements to teach effectively, integration of content theory and practical work.

Table 5.6: Participant's major subjects or specialisation

Woodwork/Carpentry					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	9	34.6	34.6	34.6
	No	17	65.4	65.4	100.0
	Total	26	100.0	100.0	
Construction/bricklaying & plastering					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	23	88.5	88.5	88.5
	No	3	11.5	11.5	100.0
	Total	26	100.0	100.0	
Plumbing					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	15	57.7	57.7	57.7
	No	11	42.3	42.3	100.0
	Total	26	100.0	100.0	
Quantity Surveying					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	26	100.0	100.0	100.0
Civil Technology/Technical					

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	15	57.7	57.7	57.7
	No	11	42.3	42.3	100.0
	Total	26	100.0	100.0	

Table 5.6 above indicates the results of the participants in terms of their areas of specialisation in civil engineering and construction. The results show that all lecturers are specialists in quantity surveying, where n = 26 (100%). In second majors, most participants indicated that they had specialised in construction (n = 23; 88.6%) also. while plumbing and civil technology followed with an equal number of participants (n = 15; 57.7%). Woodwork has been indicated to be the minority of second majors (n = 9, or 34.6%). The results state that all civil engineering and construction students should have question 5 (Q5) as their major subject, although they can specialise in different subjects.

5.2.2 Section B of the questionnaire (1, 2, 3, 4, 5, M and SD)

Section B of the questionnaire shows the questions emanating from the objectives and research question using a four-point Likert scale, which are: (1) strongly agree, (2) agree, (3) disagree, and (5) strongly agree. This section also provided data based on the mean (M) and standard deviation (SD). According to Livingston (2004:120), the mean is the arithmetic average of the scores, which is determined by adding all the scores and dividing them by the total number of scores. While the standard deviation is significant as a measure of how evenly distributed the values are within a dataset, it is a single number that, in plain English, indicates the variability of a set of scores (Livingston, 2004:120; Cohen, Manion & Morrison, 2011). As a result, SD in this study contributed to clarifying how numerical data was distributed in a way that reflected the average (M).

Table 5.7: Teaching approaches used in TVET colleges engineering studies curriculum

Q1	**I know the concept, teaching and learning approaches**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	19	73.1	1.31	.549
	Agree	6	23.1		
	Disagree	1	3.8		
	Total	26	100.0		
Q2	**I understand different teaching and learning approaches**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	16	61.5	1.38	.496
	Agree	10	38.5		
	Total	26	100.0		
Q3	**I was trained how to apply different teaching and learning approaches**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	12	46.2	1.73	.874
	Agree	11	42.3		
	Disagree	1	3.8		
	Strongly Disagree	2	7.7		
	Total	26	100.0		
Q4	**I use student-centred approaches for teaching and learning**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	10	38.5	1.65	.562
	Agree	15	57.7		
	Disagree	1	3.8		
	Total	26	100.0		
Q5	**I only apply what is prescribed in the textbook or curriculum for teaching and learning in engineering studies**				

		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	5	19.2	2.46	.989
	Agree	8	30.8		
	Disagree	9	34.6		
	Strongly Disagree	4	15.4		
	Total	26	100.0		
Q6	**I prefer interactive approaches to teaching and learning**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	16	61.5	1.62	.941
	Agree	6	23.1		
	Disagree	2	7.7		
	Strongly Disagree	2	7.7		
	Total	26	100.0		
Q7	**I prefer to use lecturer-centred approach in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	7	26.9	2.31	1.050
	Agree	8	30.8		
	Disagree	7	26.9		
	Strongly Disagree	4	15.4		
	Total	26	100.0		
Q8	**I mostly use constructivist/Pragmatism Approach (means thinking of or dealing with problems in a practical way, rather than by using theory or abstract principles)**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	11	42.3	1.58	.504
	Agree	15	57.7		
	Total	26	100.0		
Q9	**I mostly use action learning approach in my class.**				

		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	10	38.5	1.65	.562
	Agree	15	57.7		
	Disagree	1	3.8		
	Total	26	100.0		

Table 5.7 above, teaching approaches used in TVET colleges' engineering studies curriculum, indicates the frequency, percentage, mean, and standard deviation of the nine items analysed in the questionnaire (Section B of Appendix A). The lowest score of Q1 "I know the concepts, teaching, and learning approaches" is mean (M = 1.31) and standard deviation (SD = 0.549) when n = 19 (73.1%), which shows the majority strongly agree. followed by the second high score, Q2, "I understand different teaching and learning approaches", with a mean (M = 1.38) and standard deviation (SD = 0.496) of n = 16 (61.5%), which indicate a majority strongly agree. While Q8 states that "I mostly use constructivist/pragmatist approach [which] means thinking of or dealing with problems in a practical way rather than by using theory or abstract principles", the mean (M = 1.58) and standard deviation (SD = 0.504 with n = 15 (57.7%) assert that participants in the majority agree and the minority (n = 11 (42.3%) are in strongly agreed with Q8. In Q6, "I prefer interactive approaches to teaching and learning" (M = 1.62) and (SD = 0.941) with n = 16 (61.5%), which indicates strongly agreeing. The two items Q4 ("I use student-centred approaches for teaching and learning") and Q9 ("I mostly use action learning approaches in my class") have an equal score (M = 1.65 and SD = 0.562) with n = 15 (57.7%), which indicates a majority agrees. Then Q3: "I was trained how to apply different teaching and learning approaches" (M = 1.73) and (SD = 0.874), with n = 12 (46.2%) strongly agreeing and n = 11 (42.3%), which highlights most participants strongly agreeing. Furthermore, in Q7, "I prefer to use a lecturer-centred approach in my class" (M = 2.31 and SD = 1.50), n = 8 (30.8%) and n = 7 (26.9%) strongly agree, which means most participants are in the affirmative. However, Q5: "I only apply what is prescribed in the textbook or curriculum for teaching and learning in engineering studies" (M = 2.46 and SD = 0.989) with n = 8 (30.8%) confirms most participants are more inclined to disagree. The results above imply that most of the lecturers understand the teaching and learning approaches used in TVET colleges for engineering studies.

Table 5.8: The extent lecturers use ALA in Civil Engineering and Construction studies at TVET colleges

Q10	**I understand the difference and relationship between approaches and methods of Action Learning**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	4	15.4	2.04	.662
	Agree	18	69.2		
	Disagree	3	11.5		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q11	**I use case studies as a teaching and learning technique frequently in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	4	15.4	2.08	.628
	Agree	16	61.5		
	Disagree	6	23.1		
	Total	26	100.0		
Q12	**I use simulations frequently as a teaching and learning technique in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	13	50.0	1.65	.745
	Agree	9	34.6		
	Disagree	4	15.4		
	Total	26	100.0		
Q13	**I use projects frequently as a technique to teach other aspect of the content**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	8	30.8	1.96	.824
	Agree	12	46.2		
	Disagree	5	19.2		

	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q14	**I use research as a teaching and learning technique frequently to promote critical thinking in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	11	42.3	1.77	.863
	Agree	12	46.2		
	Disagree	1	3.8		
	Strongly Disagree	2	7.7		
	Total	26	100.0		
Q15	**I use demonstration method as the main teaching method in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	17	65.4	1.42	.643
	Agree	7	26.9		
	Disagree	2	7.7		
	Total	26	100.0		
Q16	**I use problem solving method to teach integration of content knowledge and practical work in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	16	61.5	1.42	.578
	Agree	9	34.6		
	Disagree	1	3.8		
	Total	26	100.0		
Q17	**I use technological process method to teach integration of content knowledge and practical work in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	7	26.9	1.96	.824
	Agree	15	57.7		
	Disagree	2	7.7		
	Strongly Disagree	2	7.7		

	Total	26	100.0		

The extent to which lecturers use ALA in civil engineering and construction studies at TVET colleges is presented in the analysis from the questionnaire, interpreted in frequency (n), percentage (%), mean (M), and standard deviation (SD). The two lowest scores are Q15, "I use demonstration method as the main teaching method in my class" n = 17 (65.4%) with SD = 0.643, and Q16, "I use problem solving method to teach integration of content knowledge and practical work in my class" n = 16 (61.5%) with SD = 0.578, and both Q15 and Q16 have a M = 1.42, which means the majority score is more towards strongly agreeing. Followed by Q12, "I use simulations frequently as a teaching and learning technique in my class" (M = 1.65, SD = 0.745), with n = 13 (50%) which indicated most participants are more toward strongly agreeing. When two items, Q13, "I use projects frequently as a technique to teach other aspects of the content" and Q17, "I use technological process methods to teach integration of content knowledge and practical work in my class" (M = 1.96 and SD = 0.863), with n = 12 (46.2%), confirm that participants are more inclined to agree. Moreover, Q10: "I understand the difference and relationship between approaches and methods of action learning" (M = 2.04 and SD = 0.662) with n = 18 (69.2%) indicates that most participants are more inclined to agree with the statement. The highest scoring item was Q11, "I use case studies as a teaching and learning technique frequently in my class" (M = 2.08 and SD = 0.628), with n = 16 (61.5%), which indicates that most of the participants are more inclined to agree.

Table 5.9: Sequence lecturers use to assess content knowledge and practical work at TVET colleges

Q18	**I use Oral test as part of content knowledge formal assessment in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	8	30.8	2.04	.871
	Agree	10	38.5		
	Disagree	7	26.9		
	Strongly Disagree	1	3.8		
	Total	26	100.0		

Q19	Oral test reveal student content knowledge understanding without limits (freedom of expression than writing)				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	13	50.0	1.62	.752
	Agree	11	42.3		
	Disagree	1	3.8		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q20	**Oral test serves as report back and reflection after group discussions (separate the two) or lesson**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	14	53.8	1.62	.804
	Agree	9	34.6		
	Disagree	2	7.7		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q21	**I use written test to assess content knowledge in my class**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	18	69.2	1.31	.471
	Agree	8	30.8		
	Total	26	100.0		
Q22	**I use simulation to assess practical work readiness of the students**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	15	57.7	1.65	.846
	Agree	5	19.2		
	Disagree	6	23.1		
	Total	26	100.0		
Q23	**Simulation plays role of preparatory assessment toward the evaluation of authentic practical tasks**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	18	69.2	1.35	.562
	Agree	7	26.9		

	Disagree	1	3.8		
	Total	26	100.0		
Q24	**I use practical test to assess students' skills and values on authentic practical tasks**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	15	57.7	1.69	.970
	Agree	6	23.1		
	Disagree	3	11.5		
	Strongly Disagree	2	7.7		
	Total	26	100.0		
Q25	**Practical test helps me to recognise the level and quality of practical skills acquired by students**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	17	65.4	1.42	.703
	Agree	8	30.8		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q26	**I use projects to assess students' group work qualities and abilities**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	8	30.8	1.88	.766
	Agree	14	53.8		
	Disagree	3	11.5		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q27	**Project technique promotes team work and awareness of world of work in building environment**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	12	46.2	1.58	.578
	Agree	13	50.0		
	Disagree	1	3.8		
	Total	26	100.0		

Q28	I use practical assessment task to evaluate the integration (application) of content knowledge into authentic practical tasks				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	14	53.8	1.69	.884
	Agree	7	26.9		
	Disagree	4	15.4		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q29	**Practical assessment task gives a student freedom of creativity and critical thinking**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	13	50.0	1.50	.510
	Agree	13	50.0		
	Total	26	100.0		
Q30	**Student portfolio of learning process experience demonstrate student's fitness to practice.**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	14	53.8	1.50	.583
	Agree	11	42.3		
	Disagree	1	3.8		
	Total	26	100.0		

Sequence lecturers use to assess content knowledge and practical work at TVET colleges present the analysis from the questionnaire interpreted in frequency (n), percentage (%), mean (M), and standard deviation (SD). The lowest score (M) item Q21, "I use written tests to assess content knowledge in my class" (M = 1.31) and (SD = 0.471), with n = 15 (69.2%) strongly agreeing and n = 8 (30.8%) agreeing, the results show that most of the participants are more towards strongly agreeing. Followed by Q23, "Simulation plays the role of preparatory assessment toward the evaluation of authentic practical tasks" (M = 1.35 and SD = 0.562), the n = 18 (69.2%) majority of participants are more toward strongly agreeing. Q25: "Practical tests help me to recognise the level and quality of practical skills acquired by students" (M = 1.42) and (SD = 0.703), with n = 17 (65.4%), which shows most participants are more towards strongly agreeing. Two items Q29: "Practical assessment tasks give a student freedom of creativity and critical thinking" and Q30: "Student portfolios of learning process experiences demonstrate a student's fitness to practice" (M = 1.50 and SD = 0.583), with n = 14 (53.8%), reveal that the majority leans more towards strongly agreeing. Q27: "Project technique promotes teamwork and awareness of the world of work in a building environment" (M = 1.58) and (SD = 0.578), with n = 13 (50.0%), most participants lean more toward strongly agreeing. Two items, Q19 ("Oral test reveal student content knowledge and understanding without limits (freedom of expression than writing") and Q20 ("Oral test serves as report back and reflection after group discussions (separate the two) or lessons"), n = 14 (53.8%), and both Q19 and Q20 (M = 1.62) which aver that participants are more toward strongly agree. Q22: "Simulation plays the role of preparatory assessment toward the evaluation of authentic practical tasks" (M = 1.65 and SD = 0.846), with n = 15 (57.7%), which indicates that participants were more inclined to agree. Two items Q24: "I use practical tests to assess students' skills and values on authentic practical tasks" n = 15 (57.7%), SD = 0.970; Q28: "I use practical assessment tasks to evaluate the integration (application) of content knowledge into authentic practical tasks" n = 14 (53.8%); both Q24 and Q28 have a mean of 1.69, which designates that most participants agree with both statements above. Q26: "I use projects to assess students' group work qualities and abilities" (M = 1.88 and SD = 0.77), with n = 14 (53.8%), which means most participants strongly agree. Q18: "I use oral tests as part of formal content knowledge assessment in my class" (M = 2.04 and SD =.871) with n = 10 (38.5%), which shows that most of the participants agree with the statement above.

Table 5.10: Challenges that TVET lecturers experience during application of ALA

Q31	**Action learning approach requires me to study how to use it before I could implement it in my classroom**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	10	38.5	1.81	.749
	Agree	11	42.3		
	Disagree	5	19.2		
	Total	26	100.0		

Q32	Action learning approach techniques require long preparation periods. Secondly, ALA techniques require extended classroom time during implementation. Consuming				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	12	46.2	1.62	.637
	Agree	12	46.2		
	Disagree	2	7.7		
	Total	26	100.0		
Q33	TVET college curriculum and time table does not provide sufficient time to implement all ALA techniques				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	11	42.3	2.00	1.058
	Agree	7	26.9		
	Disagree	5	19.2		
	Strongly Disagree	3	11.5		
	Total	26	100.0		
Q34	My class is overcrowded to apply action learning approaches				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	6	23.1	2.54	1.104
	Agree	6	23.1		
	Disagree	8	30.8		
	Strongly Disagree	6	23.1		
	Total	26	100.0		
Q35	I have a fully equipped and functional workshop that can accommodate all my students				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	5	19.2	2.58	1.065
	Agree	7	26.9		
	Disagree	8	30.8		
	Strongly Disagree	6	23.1		
	Total	26	100.0		
Q36	I can demonstrate any civil engineering construction practical work to my class				

		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	6	23.1	2.23	.992
	Agree	12	46.2		
	Disagree	4	15.4		
	Strongly Disagree	4	15.4		
	Total	26	100.0		
Q37	**Students do not value college work they take it as bridging to university entrance**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	7	26.9	1.92	.744
	Agree	15	57.7		
	Disagree	3	11.5		
	Strongly Disagree	1	3.8		
	Total	26	100.0		
Q38	**Trade testing stations are few in the Free State province for us to collaborate with for the enhancement of practical skills and competencies of our students**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	14	53.8	1.50	.583
	Agree	11	42.3		
	Disagree	1	3.8		
	Total	26	100.0		
Q39					
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	14	53.8	1.65	.846
	Agree	8	30.8		
	Disagree	3	11.5		
	Strongly Disagree	1	3.8		
	Total	26	100.0		

Challenges that TVET lecturers experience during application of ALA are presented, along with the analysis from the questionnaire interpreted in frequency (n), percentage (%), mean (M), and standard deviation (SD). The lowest scoring (M) item Q38: "Trade testing stations are few in the Free State province for us to collaborate with for the enhancement of practical skills and competencies of our students" (M = 1.50) with an SD of 0.583 and n = 14 (53.8%), which indicates that most participants agree with the statement mentioned above. While Q32 "action learning approach" techniques require long preparation periods, Furthermore, ALA techniques require extended classroom time during implementation. Consuming (M = 1.62) with an SD of 0.637 and n = 12 (46.2%) strongly agree and n = 12 (46.2%) agree, which confirm that most participants agree with the statement above. Q39: "Trade testing stations are expensive, and that demotivates students' morale about learning" (M = 1.65) with an SD of 0.846 and n = 14 (53.8%), which indicates that most participants strongly agree. Q31: "Action learning approach requires me to study how to use it before I could implement it in my classroom" (M = 1.81) with an SD of 0.749 and n = 11 (42.3%), which indicates that more participants are more inclined to agree. Q37: "Students do not value college work; they take it as a bridge to university entrance" (M = 1.92; SD = 0.744; n = 15; 57.7%), which indicate that participants are more inclined to agree. In Q33, "TVET college curriculum and timetable do not provide sufficient time to implement all ALA techniques" (M = 2.00) with an SD of 1.058 and n = 11 (42.3%), which shows that more participants are inclined to strongly agree. Q36: "I can demonstrate any civil engineering construction practical work to my class" (M = 2.23; SD = 0.992); and n = 12 (46.2%), which allude to the fact that participants are more inclined to strongly agree. However, in Q34, "My class is overcrowded to apply action learning approaches" (M = 2.54; SD = 1.104), n = 8 (30.8%) disagree while n = 6 (23.1%) strongly disagree, which indicates that most participants are more inclined to disagree with the statement mentioned above. Similarly, in Q35, "I have a fully equipped and functional workshop that can accommodate all my students" (M = 2.58) with an SD of 1.065, n = 8 (30.8%) disagree while n = 6 (23.1%) strongly disagree, which asserts that most participants are more inclined to disagree with the statement.

Table 5.11: Lecturers capacitated to use ALA to produce quality work at TVET colleges – pertaining to the integration of content knowledge and practical work

Q40	**I would like to have Industrial exposure every term**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	19	73.1	1.35	.629

	Agree	5	19.2		
	Disagree	2	7.7		
	Total	26	100.0		
Q41	**I would like to attend practical refresher courses annually**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	18	69.2	1.42	.703
	Agree	5	19.2		
	Disagree	3	11.5		
	Total	26	100.0		
Q42	**I would like to register and further my studies in education**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	13	50.0	1.62	.697
	Agree	10	38.5		
	Disagree	3	11.5		
	Total	26	100.0		
Q43	**I need training in action learning approach techniques to enhance teaching and learning in Civil Engineering classes**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	13	50.0	1.50	.510
	Agree	13	50.0		
	Total	26	100.0		
Q44	**I recommend cluster subject group to assist each other**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	16	61.5	1.46	.647
	Agree	8	30.8		
	Disagree	2	7.7		
	Total	26	100.0		
Q45	**Theory classes and practical workshop should be well equipped**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	25	96.2	1.04	.196
	Agree	1	3.8		
	Total	26	100.0		

Q46	**Time tables should allow ample time for integration of Content Knowledge and Practical Work**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	20	76.9	1.23	.430
	Agree	6	23.1		
	Total	26	100.0		

Q47	**Qualified laboratory technicians should be employed on fulltime based contracts**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	17	65.4	1.38	.571
	Agree	8	30.8		
	Disagree	1	3.8		
	Total	26	100.0		

Q48	**Civil Engineering Construction NATED 191 courses academic duration should be changed from 3 months to 6 months or a year for the inclusion of practical work within the college**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	18	69.2	1.42	.758
	Agree	6	23.1		
	Disagree	1	3.8		
	Strongly Disagree	1	3.8		
	Total	26	100.0		

Q49	**To ensure quality work of integrating content knowledge and practical, I recommended ALA Civil Engineering Construction NCV subjects**				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	9	34.6	1.69	.549
	Agree	16	61.5		
	Disagree	1	3.8		
	Total	26	100.0		

The analysis from the questionnaire, interpreted in frequency (n), percentage (percent), mean (M), and standard deviation (SD), is presented by lecturers who are able to use ALA to produce quality work at TVET colleges (concerning the integration of content knowledge and practical work) and is presented in frequency (n), percentage (percent), mean (M), and standard deviation (SD) (SD). The lowest scoring (M) item Q45: “Theory classes and practical workshops should be well equipped” (M = 1.04, SD = 0.196), with n = 25 (96.2%), affirms that most participants are more inclined to strongly agree. Furthermore, Q46 indicates that "time tables should allow ample time for integration of content knowledge and practical work” (M = 1.23 and SD = 0.430), with n = 20 (76.9%), which indicates that most participants are more inclined to strongly agree. Q40: “I would like to have industrial exposure every term” (M = 1.35 and SD = 0.629) with n = 19 (73.1%), which shows that most participants are more toward strongly agreeing. Q47: “Qualified laboratory technicians should be employed on full-time basis” (M = 1.38) and (SD = 0.571) with n = 17 (65.4%), which asserts that most participants are more toward strongly agreeing. Moreover, two items Q41: “I would like to attend practical refresher courses annually” (n = 18; 69.2%); SD = 0.703; and Q48: “Civil Engineering and Construction NATED 191 courses academic duration should be changed from 3 months to 6 months or a year for the inclusion of practical work within the college” (n = 18; 69.2%); SD = 0.758; both Q41 and Q48 (M = 1.42) proclaim that most participants are more toward strongly agreeing. In addition, Q44: “I recommend cluster subject groups to assist each other” (M = 1.46 and SD = 0.647) with n = 16 (61.5%) asserts that most participants are more inclined to strongly agree. Q43: “I need training in action learning approach techniques to enhance teaching and learning in civil engineering classes” (M = 1.50) and (0.510), with n = 13 (50.0%) strongly agreeing and n = 13 (50.0%) agreeing, which shows that all participants are toward more agreement with the statement above. Q42: “I would like to register and further my studies in education” (M = 1.62) and (SD = 0.697), with n = 13 (50.0%) strongly agreeing and n = 10 (38.5%), which indicates that the majority is more inclined toward strongly agreeing. Q49: “To ensure quality work of integrating content knowledge and practical application, I recommended ALA Civil Engineering and Construction NCV subjects” (M = 1.69 and 0.549), with n = 16 (61.5%), which indicates that most participants are more inclined to agree.

Table 5.12: Reliability of the statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.841	.845	49

Table 5.12 above indicates the overall reliability of the statistics (Q1-Q49). The Cronbach's alpha is 0.845, which is higher than the alpha coefficient of 0.70. Therefore, the high Cronbach's alpha indicates that there is internal consistency between the questions. Pallant (2007) maintains that a level of 0.7 is considered acceptable to declare a question or questionnaire reliable but adds that with instruments containing fewer than ten items, lower values, even as low as 0.5, are common. In addition, according to Tavakol and Dennick (2011), higher values of 0.90-0.95 should be the ideal, yet a score of greater than 0.7 is generally regarded as acceptable. Field (2006) on the other hand, affirms that any value less than 0.7 should be regarded as unreliable.

Table 5.13: One-Sample Test

One-Sample Test						
	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Q1	12.143	25	.000	1.308	1.09	1.53
Q2	14.230	25	.000	1.385	1.18	1.59
Q3	10.093	25	.000	1.731	1.38	2.08
Q4	15.016	25	.000	1.654	1.43	1.88
Q5	12.689	25	.000	2.462	2.06	2.86
Q6	8.750	25	.000	1.615	1.24	2.00
Q7	11.212	25	.000	2.308	1.88	2.73
Q8	15.959	25	.000	1.577	1.37	1.78
Q9	15.016	25	.000	1.654	1.43	1.88
Q10	15.697	25	.000	2.038	1.77	2.31
Q11	16.875	25	.000	2.077	1.82	2.33
Q12	11.316	25	.000	1.654	1.35	1.95
Q13	12.143	25	.000	1.962	1.63	2.29

Q14	10.455	25	.000	1.769	1.42	2.12
Q15	11.280	25	.000	1.423	1.16	1.68
Q16	12.559	25	.000	1.423	1.19	1.66
Q17	12.143	25	.000	1.962	1.63	2.29
Q18	11.935	25	.000	2.038	1.69	2.39
Q19	10.947	25	.000	1.615	1.31	1.92
Q20	10.247	25	.000	1.615	1.29	1.94
Q21	14.167	25	.000	1.308	1.12	1.50
Q22	9.970	25	.000	1.654	1.31	2.00
Q23	12.223	25	.000	1.346	1.12	1.57
Q24	8.893	25	.000	1.692	1.30	2.08
Q25	10.326	25	.000	1.423	1.14	1.71
Q26	12.552	25	.000	1.885	1.58	2.19
Q27	13.916	25	.000	1.577	1.34	1.81
Q28	9.761	25	.000	1.692	1.34	2.05
Q29	15.000	25	.000	1.500	1.29	1.71
Q30	13.117	25	.000	1.500	1.26	1.74
Q31	12.300	25	.000	1.808	1.51	2.11
Q32	12.925	25	.000	1.615	1.36	1.87
Q33	9.636	25	.000	2.000	1.57	2.43
Q34	11.726	25	.000	2.538	2.09	2.98
Q35	12.340	25	.000	2.577	2.15	3.01
Q36	11.463	25	.000	2.231	1.83	2.63
Q37	13.176	25	.000	1.923	1.62	2.22
Q38	13.117	25	.000	1.500	1.26	1.74
Q39	9.970	25	.000	1.654	1.31	2.00
Q40	10.916	25	.000	1.346	1.09	1.60
Q41	10.326	25	.000	1.423	1.14	1.71
Q42	11.813	25	.000	1.615	1.33	1.90
Q43	15.000	25	.000	1.500	1.29	1.71
Q44	11.520	25	.000	1.462	1.20	1.72
Q45	27.000	25	.000	1.038	.96	1.12
Q46	14.606	25	.000	1.231	1.06	1.40
Q47	12.362	25	.000	1.385	1.15	1.62
Q48	9.579	25	.000	1.423	1.12	1.73
Q49	15.714	25	.000	1.692	1.47	1.91

Table 5.13 above shows the significance of the results for all 49 items using a one-sample t-test, with a p-value of.000 and narrow confidence intervals (CI) indicating a

high level of significance. Therefore, the above-mentioned information confirms the correctness and validity of the results. According to Ganesh and Cave (2018:55), the p-value, or probability value, tells how likely it is that the data could have occurred based on the statistical test to establish a precise correlation between variables. In addition, Fisher (1956) and Knaub (1987:246) state that p-value is employed to measure the significance of observational data. As a result, it is frequently employed to boost the study's credibility. Furthermore, Knaub (1987:246) confirms that a p-value between 0 and 1 is employed to denote the degree of statistical significance. In accordance with this, a p-value of less than 0.05 implies significance, and a p-value of less than 0.01 implies high significance. Therefore, p = 0.000 denotes high significance (Knaub, 1987:246; De Winter, 2013:6; Ganesh & Cave, 2018:55).

5.2.3 Presentation of Data from Interviews

This section presents, analyses, and discusses the semi-structured face-to-face interviews that the researcher conducted with ten participants from four distinct TVET colleges and campuses. The data obtained from the semi-structured interview questions were categorised into themes.

5.2.3.1 Theme 1: Action learning in CEC studies

Table 5.14: ALA in CEC

Q1	What is your view regarding the use of ALA in CEC studies at TVET college?
A	During my PGCE, my lecturer for Civil Technology methodology used ALA to comprehend integration of theory and practical work. Therefore, I found ALA more productive in teaching CEC at TVET as students are hand-on to integrate theory and practical.
B	Action learning should be applied as CEC because students must be competent in both theory and practical then action learning promote integration of both.
C	It is good so that students are exposed to new things, using AL techniques and resources.
D	It makes the learning outcomes to be more conducive in the classroom.

E	Even though I am not sure about the concept or term ALA, but in general understanding being an engineer action learning is imported because it allows students and lecturers to be hands-on.
F	You learn skills while you are on action and hands-on.
G	We might not be aware of the term/concept but I am using it. Because skill require a person to be a team player and be hands-on.
H	CEC require problem solving skill and practical skill therefore ALA should be the main approach.
I	It is the best approach to effective teaching and learning in CEC as it promotes hands-on and creativity.
J	To teach skill well you need to be hands on together with you students therefore, ALA is all about hand-on.

<u>Action learning View</u>

All participants mentioned that they like ALA because it contributes to clear interaction between students and lecturers as it allows both to be hands-on and opens the way for creativity, innovation, and problem solving through critical thinking.

5.2.3.2 Theme 2: Favourite techniques in ALA in CEC

Table 5.15: ALA Techniques in CEC

Q2	What are your favourite techniques when implementing ALA in CEC studies?
A	Demonstration (Step by Step or whole process), Project based and blended (hybrid)
B	Demonstration, simulation is the main and project based
C	Practical approach
D	Demonstration
E	Practical approach and demonstration
F	Demonstration and project based
G	Project based and demonstration
H	Project based and demonstration
I	Project based, demonstration and practical approach
J	Project based and demonstration

Techniques/methods

All participants in Table 5.15 expressed that their favourite techniques to implement ALA are demonstration and project-based. Participants C, E, and I indicated that they also favour the practical approach as a technique to implement ALA in CEC studies.

5.2.3.3 Theme 3: Makes of favourite techniques in ALA for CEC

Table 5.16: Makes of favourite

Q3	What makes them your favourite techniques of action learning in CEC studies?
A	Demonstration stimulates students' interest to learning, while project base allows students freedom of learning through different modes or channels
B	They allow students to be involve in their teaching and learning process they are hands on
C	Doing practical keeps one to understand quicker
D	Assist in planning relevant assessment and learning actives
E	Demonstration helps students to understand visual/see, practical simplifier learning by doing. When you do you learn better.
F	Because you learn while you are doing
G	Remember workshop is all about skill learning and problem solving: so they are all about action then action is when you do.
H	Construction is all about projects which require more practical. Therefore, project based and demonstration
I	Because it allows more integration of learning through demonstration step by step
J	These techniques promote skills development through hands-on as both students and lecturers have space to be involve in the process of teaching and learning

Reason for Favourite

The participants in Table 5.16 indicate that almost all of them share the same understanding that demonstrations allow students and lecturers to integrate and stimulate channels of teaching and learning. While project-based learning allows students to be hands-on as it upholds problem-solving skills, Furthermore, it proclaims that the project approach propels full-skills, knowledge, and values in the student's competence in totality (theory and practical work).

5.2.3.4 Theme 4: Use of favourite techniques of ALA in CEC

Table 5.17: Use of favourite techniques

Q4	Can you explain how do you use these favourite techniques of ALA in your CEC studies class?
A	I present my lesson using model to demonstrate then give a problem to solve applying knowledge gained from the lesson
B	I always bring some relevant objects to simulate what am I teaching and allow my students to critic and suggest a way forward, always, they lead the lesson
C	I always give them problem that requires us to discuss and plan then solve the problem practically
D	I summarise models and theories of students learning process and create a culture conducive of learning and teaching
E	Demonstration, I come with models explain through a model step by step. Practical I use blend it with step by step and whole process.
F	Demonstration: I show them how to do and solve the problem
G	I mix all the techniques as they are determined by the types of students at time, but demonstration and simulation when I teach them showing them.
H	I demonstrate to them how to perform practical work then a give them a project to complete
I	I first demonstrate to them how to use the tool or machines then I give them a chance to learn how to operate then I will guide them if they are straggling
J	I bring all the model or real equipment to demonstrate and allowed them to try until they get it well

<u>Use techniques</u>

The participants in Table 5.17 highlighted that they bring models into the class to demonstrate the lesson content of the day. Also, to stimulate critical thinking, as they can see what you are talking about physically as I demonstrate step by step or the whole process, allow them to apply what they observed to their own learning process. However, participant G mentioned that "I mix all the techniques as they are determined by the types of students at the time, but I use demonstration and simulation when I teach them by showing them". Therefore, participants should apply all mentioned techniques at once based on the situation at that moment.

5.2.3.5 Theme 5: Learning methods of techniques

Table 5.18: Learning methods or techniques of ALA in CEC

Q5	Which teaching and learning methods or techniques you use during application of ALA in CEC studies class?
A	Problem solving through project based and simulation
B	Simulation, Demonstration and inquiry to promote problem solving
C	Practical and self-discovery approach
D	I use integrated methods (blended)
E	Simulation and project based
F	Project based and simulation
G	Hybrid (blended) but project base is the key
H	I mix base on the student's background (blended)
I	Project based, simulation and self-discovery
J	Project based, simulation and trial and error

<u>Method or Techniques</u>

All participants in Table 5.18 indicated that they use project-based learning and simulation as teaching techniques, while participant H emphasises that "I mix based on the student's background (blended)". Participants C and I added self-discovery to their practices. Moreover, participant J uses trial and error as a method or technique. The above-mentioned data implies that project-based learning and simulation are the most effective key methods or techniques to implement ALA.

5.2.3.6 Theme 6: Assessment for ALA in CEC

Table 5.19: Types of assessment for ALA in CEC

Q6	How do you choose types of assessment for ALA in CEC studies?
A	All assessments are from DHET, but for expanded opportunity I use six steps technological process
B	I prefer a written test to assessment to show individual capacity or understanding
C	Types of assessment are given to us by DHET (Test, simulation, practical and Exam)
D	Assessment should be relevant to the topic, if it requires theory it will test, if practical it will be practical work or simulation.
E	All assessments are based on DHET stipulation. Both theory and practical. I recommend oral test and major practical only
F	40% theory and 60% practical as stipulated in the policy but is other way round 60% theory and 40% practical. All assessments are given from DHET
G	Test, simulations, practical and examination as stipulated from the policy. I recommend six steps of technological process as a main key assessment
H	Test, simulation, practical and Examination. As stated in the policy
I	Test, simulation, practical and Examination
J	I use all assessment provided: Test, simulation, practical and Exam. But I recommend Technological process

<u>Assessment</u>

All participants use assessments as prescribed by the policy from DHET, such as tests, simulations, practicals, and exams. However, Participant F highlights that 40% theory and 60% practise do not match the reality of practise based on constraints. In addition, participants A and J confirm that they use and recommend technological processes to strengthen fair practises in teaching, learning, and assessment.

5.2.3.7 Theme 7: Outcomes of assessment of ALA in CEC

Table 5.20: Impact of outcomes of assessment of ALA in CEC

Q7	How are the outcomes of assessment after the use of ALA in CEC studies?
A	Based on the standards of DHET out comes differ based on topics, but through technological process outcomes are excellent.
B	Most of my students are performing well
C	The outcomes are good even if some are not clear because at TVET we need practical not exam
D	They will depend on the topic but usually outcomes are good because students are always hand on (action action)
E	Based on my experience on size does not fit all, because students do differ cognitively other love practicals over theory. When I assess practical most students perform well
F	Because this is skills, ALA is giving the best results
G	We cannot measure the outcome because we are using unit standard, but if I use my old experience, I always measure specific outcomes and students do well
H	Based on test students are well, but practical work is outstanding
I	Through ALA I always reach my outcomes but not perfectly as I planed
J	Outcome are good but not as I prefer them

<u>Assessment outcomes</u>

As shown in Table 5.20, all participants shared the same experience about the outcome, which was strengthened by ALA, especially in the practical work. However, both participants' E "Based on my experience, size does not fit all" is because students do differ cognitively and some love practicals over theory. "When I assess practical, most students perform well" and "We cannot measure the outcome because we are using unit standards, but if I use my old experience, I always measure specific outcomes and students do well" offer a proximity of articulation in terms of old and current practises, which endeavour to promote the free role of assessment planning by the lecturers.

5.2.3.8 Theme 8: Challenges of ALA in CEC

Table 5.21: Challenges during the use of ALA in CEC

Q8	What are the challenges that you encounter during the use of ALA in CEC studies?
A	Insufficient material and time allocation for practical's
B	Most of my first years who don't have technical background are straggling with drawing due to time constrains/ insufficient time
C	Materials, time allocation also students are not exposed to the actual construction site
D	Materials, time allocation for practical
E	Time allocation, lack of materials
F	Time allocation, insufficient material for practical
G	Late receivable of working materials also time allocations
H	Time allocated to practical work is not enough
I	Time allocation for practical's in the time table it is no sufficient at all
J	Time allocation for practical's and not being allowed to design you own assessment measures

Time and material

All participants expressed their challenges during the use of ALA in CEC studies. Participants mentioned time allocation or time structure as a main challenge during the practice, as they highlighted that the time allocated for practical work is insufficient. Moreover, participant B points out that "most of my first-year students who don't have technical backgrounds are struggling with drawing due to time constraints or insufficient time". Therefore, lecturers need more structured time to teach and perform practicals. However, most participants A, C, D, F, and G cautioned that lack of material or late delivery of materials played second fiddle to excellent practise.

5.2.3.9 Theme 9: Solving challenges of ALA in CEC

Table 5.22: Solution to challenges of ALA in CEC

Q9	How do you solve these challenges as you experience them during the use of ALA in CEC studies?
A	I always improvise by scaling down real projects into models and simulations and re-use the material of which it compromises the quality of skills and knowledge
B	I am applying different of method but I am not achieving anything the time is insufficient 3 months
C	Re-use the material and performing simulations and small projects/task
D	Re-use material or scale down the project
E	Use small projects to cover time and materials
F	I real don't follow the schedule; I use may school experience as was a student here to improvise. I group them to make real project. For individual I give them small projects
G	I re-use the material and just models
H	I always group students for major practical and individual models or simulations for formal assessment.
I	As I state that time is major challenge I try my level best to compress my practical's in small projects
J	I group them and give theme project to work on or I give them a problem to solve

<u>Solutions</u>

All participants indicated that, to solve a problem, they improvise by scaling down models and reusing the available material. However, participant A cautioned that reusing material and scaling down the projects do "compromise the quality of skills and knowledge".

5.2.3.10 Theme 10: Recommendation on ALA in CEC

Table 5.23: Recommendations about the use of ALA in CEC

Q10	What are your recommendations/views about the use of ALA in CEC studies at TVET college?
A	ALA is the best teaching and learning approach for CEC studies a TVET as it promotes the integration of theory and practical. Time for practical's should be increased and theory should be reduced to the level of student's type.
B	I strongly recommend that we must move from 3 months to a year, or 6 months, so we can produce quality students
C	It will be good to use ALA so that students are exposed to new things, skills at the construction site, also allow them to get used to the new technology
D	Give lecturers freedom to order materials on their own also to increase time allocated to practical's.
E	I recommend ALA in CEC, but give lecturers freedom to assess as they view their student things like oral test
F	Mix theory with practical work: first trimester theory then second trimester practical NATED to solve time allocation problem
G	Integrate theory and practical two days' theory and three days' practical's then we will have a quality skills development through ALA
H	I recommend ALA for CEC to revive the main aim of TVET college as a skills hub, because ALA is about embracing learn by doing and innovation. Also allow lecturers to develop their own types of assessment. I personally prefer Technological process as a perfect assessment method for ALA in CEC.
I	ALA should be formalised as compulsory teaching and learning approach to use in CEC
J	I recommend that colleges must adapt ALA as the main teaching and learning approach in CEC

<u>Recommendations</u>

All participants highlighted that ALA should be used as a key approach in CEC studies as it allows integration of theory, practical work, and freedom of critical thinking. Furthermore, participant B suggested that NATED should move from a 3-month to a

6-month course. While participant H emphasised that technological processes should be used as the main final assessment in CEC studies at TVET colleges.

5.3 DISCUSSION OF THE FINDING

The preceding section described the data analysis, presentation, and interpretation. This section discusses the conclusions drawn from the data interpretation. The purpose, objectives, and research questions will be utilised to evaluate the results.

5.3.1 Biographical details of the participants/lecturers (section A)

5.3.1.1 Gender

Table 5.1 exposed that the course, Civil Engineering and Construction Studies, is dominated by 76.9% male lecturers. This insinuates that females in Civil Engineering and Construction Studies regard this field as the male's "man's world". Mtshali (2021:86) also has indicated that out of 6 participants (lecturers), 67% were males while 33% were females. Moreover, participants (students) totalled 250, which is 76% males and 24% females. Therefore, statements confirm the findings of Mokhothu (2015:72) that there is a false perception of technical/engineering studies being used when pointing at males and still viewed as a hard labour career. The study pronounces that there is a deficit in terms of gender transformation in civil engineering and construction studies at TVET colleges in the Free State province of South Africa.

5.3.1.2 Race

Table 5.2 revealed that Africans are dominating in civil engineering and construction studies with 96.2%, compared to 3.8% for non-Africans. This information implies that there is a drastic race transformation in the TVET sector, where Africans begin to develop sustained interest in TVET. However, the data above provide the opposite of the indoctrination in Africans, stating that: "In South Africa, the establishment of the technical and vocational education and training sector was founded on the history of racial segregation policies that were informed by the Apprenticeship Act of 1922, which was racially aligned to the needs of the labour market and excluded the African majority populace" (Akoojee, Gewer & McGrath, 2005; Buthelezi, 2016). The above information seems to answer one of the most significant points of the DHET value statement: “Transformation imperatives to address social inequality, race, gender, age, geography, HIV/AIDS, and disability issues in all our higher education and training institutions to normalise them” (DHET 2013a:14). Therefore, with confidence, the study claims that there is an evident progress in race transformation in civil engineering and construction studies at TVET colleges in the Free State province of South Africa.

5.3.1.3 Age, Year of experience and Qualifications profile

Tables 5.3, 5.4, and 5.5 present the results of age, year of experience, and qualification profiles. Table 5.3 expressed that lecturers between the ages of 25 and 35 were 50%, while those between 36 and 45 were 30.8%, and those between 46 and 55 were only in the minority at 15.4%. This implies that TVET colleges attract the young lecturers required for the sustainability of manpower in the system. Table 5.4 divulges that most lecturers have the highest number of years of experience, 11 or more, with 38.5%, indicating their continued interest in teaching at TVET colleges. Moreover, 3-6 years’ experience with 23.1% was highlighted as the second highest percentage. Table 5.5 revealed a high minority of 46.2% for lecturers with a professional qualification, while PGCE presented only 23.1%. However, the second highest minority is N. Diploma with 42.3%. The statements state that most lecturers do not have professional qualifications. Furthermore, a slight movement in the lectures toward improving their professional qualifications was indicated. In general conclusion, the above-mentioned information concurs with Buthelezi (2016) when she states that TVET colleges are complicated and their associated problems necessitate holistic professional lecturer development, generating lecturers with suitable knowledge, traits, and competencies. Furthermore, keeping in mind that lecturers have professional qualifications, lectures are equipped with professional knowledge. According to Mtshali, Ramaligela and Makgato (2018), professional knowledge is demonstrated through offering meaningful experiences that demonstrate an understanding of the curriculum, topic content, pedagogical knowledge, and developmental requirements of students.

5.3.2 Section B

The current section discusses the findings from Section B of the questionnaire, grounded on the following five question statements or themes:

- Teaching approaches used in TVET colleges engineering studies curriculum.
- The extent lecturers use action learning approaches in Civil Engineering and Construction studies at TVET colleges.
- Sequence lecturers use to assess content knowledge and practical work at TVET colleges.
- Challenges that TVET lecturers experience during application of ALA.
- Lecturers capacitated to use ALA to produce quality work at TVET colleges – pertaining to the integration of content knowledge and practical work.

5.3.2.1 Teaching approaches used in TVET colleges engineering studies curriculum

The lecturers were presented with the question statement to explore their understanding and views. Q1 was "I know the concept, teaching, and learning approaches" mean (M = 1.31) and standard deviation (SD = 0.549) when n = 19 (73.1%), which shows the majority strongly agree on their understanding of the concept, teaching, and learning approaches. While Q2 was "I understand different teaching and learning approaches," the mean (M = 1.38) and standard deviation (SD = 0.496) with n = 16 (61.5%) indicate a majority strongly agree. Q5 was "I only apply what is prescribed in the textbook or curriculum for teaching and learning in engineering studies" (M = 2.46 and SD = 0.989) with n = 8 (30.8%), which confirms most participants are more inclined to disagree. However, Q3 was "I was trained how to apply different teaching and learning approaches" (M = 1.73 and SD = 0.874), with n = 12 (46.2%) strongly agreeing and n = 11 (42.3%), which highlights most participants strongly agreeing. The findings indicate that lecturers strongly agree with Mabale (2012) when she attests that lecturers at TVET colleges are used to the notion of a know-it-all process, hence during the transition of FET and introduction of NCV, conditions were unconducive for new implementations. Thus, it confirms what Mabale (2012) attested when contrasted with the findings in the biography section, where it was found that most lecturers lacked professional qualifications but claimed to have formal training. The notion of a know-it-all process without formal pedagogical training relapsed.

The question statements were further explored regarding general teaching approaches and curriculum implementation in TVET colleges. The findings were: Q4 “I use student-centred approaches for teaching and learning” (M = 1.65) and (SD = 0.526), with n = 15 (57.7%), which is more toward agreeing. Q6 was “I prefer interactive approaches to teaching and learning” (M = 1.62) and (SD = 0.941), with n = 16 (61.5%), which indicates strongly agree. Q7 was “I prefer to use a lecturer-centred approach in my class” (M = 2.31 and SD = 1.50), when n = 8 (30.8%) agree and n = 7 (26.9%) strongly agree, which means most participants agree with Q7's statement. While Q8 states, “I mostly use the constructivist/pragmatist approach (which, for example, means thinking of or dealing with problems in a practical way rather than by using theory or abstract principles)” (M = 1.58) and (SD = 0.504), n = 15 (57.7%), which asserts that participants in the majority agree and the minority, n = 11 (42.3%), are in strong agreement with Q8.

The above findings concur with Makgato and Adelabu (2019:85) who found that lecturers at TVET colleges have good opinions and are aware of technical and vocational pedagogical practices. Nevertheless, good pedagogical practise should be acquired through formal professional qualification. Hence, Makgato and Adelabu (2019:85) further concluded that “above all, lectures should be upgraded professionally”. Therefore, the study claims that lecturers are keen to be upgraded with professional qualifications and to sound more relevant to the system. Moreover, Buthelezi (2016) concludes and affirms the study claim when she states that, based on her findings, most lecturers feel inadequate and have the aspiration to upgrade themselves professionally. In addition, it was highlighted that during the NCV introduction, those without teaching qualifications felt incompetent. The above statement maintains that pedagogical practise plays a critical role in effective teaching and learning processes at TVET colleges.

However, Q9 was used to introduce the investigation on ALAs as a part of point two of the themes above; therefore, the question was: “Q9: I mostly use action learning approaches in my class?” (M = 1.65 and SD = 0.562) with n = 15 (57.7%), which indicates most lecturers are more inclined to agree. The statement's aim was to establish if the lecturers are using action learning in their class, and the finding indicates that the lecturers agree that they are using action learning. The finding also proves that lecturers are aware of ALAs. The findings concur with Brook and Pedler (2020:2) who argue that action learning is not a single way of practising but multiple ways, and the term has been used to refer to a range of activities, or in other cases, the concept has been used to designate nearly any kind of group activity. Moreover, Wagner, Castaeda, Bohman and Sterr (2019) shared the same sense when they attested that the action-learning approach inspires students to develop, apply, and reflect on their problem-solving strategies, creativity, and innovations.

5.3.2.2 The extent lecturers use action learning approaches in Civil Engineering and Construction studies at TVET colleges

The question statements were used to investigate and confirm the extent to which lecturers use ALAs specifically in civil engineering and construction studies at TVET colleges. The question statements with findings were: Q10, “I understand the difference and relationship between approaches and methods of action learning” (M = 2.04 and SD = 0.662), with n = 18 (69.2%), which declares that most participants are more inclined to agree with the statement. Q11: “I use case studies as a teaching and learning technique frequently in my class” (M = 2.08 and SD = 0.628) with n = 16 (61.5%), which indicates that most of the participants are more inclined to agree. Q12: “I use simulations frequently as a teaching and learning technique in my class” (M = 1.65 and SD = 0.745), with n = 13 (50%), which indicated most participants are more toward strongly agreeing. Q15: “I use the demonstration method as the main teaching method in my class” n = 17 (65.4%) with an SD of 0.643, which indicated a majority that was more toward strongly agreeing.

The findings corroborate with Yusti, Ganefri and Ridwan (2017) and Rutherford-Hemming (2012:130) who add that simulation provides a secure and reassuring educational site that allows students to practise a variety of tasks to improve knowledge, skills, knowledge implementation, and decision-making in a genuine life-like environment. In addition, findings strengthen the study’s claim by naming simulation as a teaching and learning method of ALA in civil engineering construction that develops student self-confidence to practise application of knowledge, practical skills, critical thinking, and creativity in a real-life setting. While Chernikova et al. (2020)

acknowledge that the method (simulation) is frequently used in areas where students need to attain skills and experience but are unable to do so owing to safety concerns or cost limits.

The findings also coincide with Olsson, Mozelius and Collin (2015) when they conclude that the demonstration method is optimal for teaching a skill since it includes all required steps in the action learning order. Furthermore, the demonstration step allows students to "see and hear" the specifics of the skill being imparted. These details include foreknowledge, actions or procedures, nomenclature, and safety measures. As a result, the findings support Masoabi (2015) who states that critical thinking is a cognitive capacity for knowledge, experience, and environmental exposures—the knowledge that is present in the current action scenes and systems can be revised, expanded, approved, supported, validated, and disagreed with. On the other side, critical thinking is viewed as "sound, logical, and careful thinking", and it is one of the fundamental prerequisites in case studies. In this study, it was suggested that a case study be used to verify the imparted knowledge through critical thinking.

Furthermore, question statements with findings were placed to indicate the alignment of integration of theoretical content and practical skill in CEC studies at TVET colleges. Therefore, the question statements were: Q13 was "I use projects frequently as a technique to teach other aspects of the content" (M = 1.96 and SD = 0.863), with n = 12 (46.2%), which avers more towards agreeing. Q14: "I use research as a teaching and learning technique frequently to promote critical thinking in my class" (M = 1.77 and SD =.863) with n = 12 (46.2%) then n = 11 (42.3%), which means majority agree with Q14. while Q16 was "I use the problem-solving method to teach integration of content knowledge and practical work in my class" n = 16 (61.5%) with an SD of 0.578, which means toward strongly agree. Q17: "I use the technological process method to teach integration of content knowledge and practical work in my class" (M = 1.96 and SD = 0.863), with n = 12 (46.2%), which confirms that participants are more inclined to agree.

The findings above support Gumbo et al. (2019) in the argument that using projects as a teaching strategy promotes action and active learning rather than passive learning because action learning encourages learners to solve problems in their field as well as develop products to solve problems, resulting in a comprehensive gain of new knowledge and skills. In addition, DBE (2014:4) content states that the practical should be done in controlled conditions and based on real-life scenarios. Lecturers should schedule the various phases of the practical work. Furthermore, Maeko (2016:27) emphasised that the practical aspects of a field like civil engineering and construction are realised to be beneficial in developing a "skilled culture" and attitude toward physical work, as opposed to a pure academic culture and preference for white collar occupations.

Teis (2010:18) and Mokhothu (2015:34) contend, however, that a teaching strategy that emphasises open-ended problem solving is the most effective way to prepare students for the challenges they will face outside the classroom. In a problem-solving workplace, projects may not always be clearly defined, and standard processes and procedures may need to be adapted to meet the project's requirements. Involvement of students in open-ended problem solving should include practise in addressing issues they may encounter in real life. The findings also accord with Mokhothu (2019:118), who regard technological process as a major concept of ALA assessment in civil engineering and construction studies. Furthermore, technological processes provide students with the prospect to be innovative, creative, and create a true, complete skill set in their field of work.

5.3.2.3 Sequence lecturers use to assess content knowledge and practical work at TVET colleges

The question statements were used to confirm the above theme, derived from research objective number four. The question statements were as follows: Q18 was "I use oral tests as part of formal content knowledge assessment in my class" (M = 2.04 and SD =.871) with n = 10 (38.5%), which shows that most of the participants agree with the statement above. When Q19 was "Oral tests reveal student content knowledge and understanding without limits (freedom of expression than writing)" (M = 1.62) and (SD =.752), with n = 13 (50.0%), which indicates more towards strongly agreeing. Q20: "Oral test serves as report back and reflection after group discussions (separate the two) or lesson" (M = 1.62 and SD =.804) with n = 14 (53.8%), which means that participants are more inclined to strongly agree. The findings concur with Mokhothu (2018:324) when he shows that Joughin (2010) is correct in stating that oral assessment is one of the most powerful tools and opportunities for students to express their knowledge without a restricted discussion space between lecturer and student in a private assessment space. *"The spoken word is written on the soul of the hearer with comprehension"* and *"the written word is simply a faint ghost of a man's live and active speech".* Students must be evaluated across the board before being deemed competent or incompetent" (Mokhothu 2018:324).

Moreover, question statements and findings were provided to clarify the assessment process in action learning through the integration of theory and practical work. The findings and discussion were as follows: Q21 was "I use written tests to assess content knowledge in my class" (M = 1.31 and SD = 0.471). With n = 15 (69.2%) strongly agreeing and n = 8 (30.8%) agreeing, the results show that most of the participants lean more towards strongly agreeing. While Q22 was "Simulation plays a role in preparatory assessment toward the evaluation of authentic practical tasks" (M = 1.65 and SD = 0.846), n = 15 (57.7%), which indicates that participants were more inclined to agree. Q23: "Simulation plays a role in preparatory assessment toward the evaluation of authentic practical tasks" (M = 1.35 and SD = 0.562), with n = 18 (69.2%) participants, most participants lean more toward strongly agreeing. Q24: "I use practical tests to assess students' skills and values on authentic practical tasks" and (SD = 0.970) with n = 15 (57.7%), which indicates that the majority agrees. Q25: "Practical tests help me to recognise the level and quality of practical skills acquired by students" (M = 1.42) and (SD = 0.703), with n = 17 (65.4%), which shows most participants are more towards strongly agreeing. Q26: "I use projects to assess students' group work qualities and abilities" (M = 1.88 and SD = 0.77), with n = 14 (53.8%), which means most participants strongly agree. Q27: "Project technique promotes teamwork and awareness of the world of work in a building environment" (M = 1.58) and (SD = 0.578), with n = 13 (50.0%), most participants lean more toward strongly agreeing. Q28: "I use practical assessment tasks to evaluate the integration (application) of content knowledge into authentic practical tasks" (M = 1.69, SD =.884), n = 14 (53.8%), which confirms that the majority agrees. Q29 (M = 1.50, SD =.510) with n = 13 (50%) strongly agree, then n = 13 (50%) agree, which designates all participants totally agree with the statement. Q30: "Student portfolio of learning process experiences demonstrates student's fitness to practice" (M = 1.50, SD =

0.583), with n = 14 (53.8%), reveals that the majority is more towards strongly agreeing.

The above findings agree with Engelbrecht, Ankiewicz and de Swardt (2016) and McCormick (1997) when they argue that assessment in Civil Engineering and Construction studies has its own unique features that set it apart from other types of assessments. Although there is a difference in engineering between conceptual knowledge (knowing that) and procedural knowledge (knowing how), these two kinds of knowledge are inextricably linked. In addition, they further highlighted that conceptual or descriptive knowledge is concerned with the connections between knowledge objects to the degree that learners can recognise these connections. In a similar vein, Maeko (2016) contends that to integrate theory with practise and therefore bridge the gap, students must first be taught theory in the classroom and then provided with opportunities to apply skills and approaches in the workshop.

However, Mollo (2020) outlines two types of knowledge that students in higher education should gain during the teaching and learning process: declarative knowledge and functional knowledge. Furthermore, Mollo (2020) defines declarative knowledge as knowledge about objects that is largely represented verbally or symbolically. This type of knowledge is commonly obtained from textbooks available in libraries or on the Internet. Functional knowledge, on the other hand, is knowledge that guides action and puts theories into practise. This is the knowledge required for applying theory and solving problems in a professional setting. Nevertheless, all refer to action learning as a key approach that integrates theory and practise. Therefore, the civil engineering and construction curriculum should be assessed as integrated. Hence, Ndebele (2020) says that the integrated curriculum is defined generically as the curriculum that connects several areas of specialised knowledge. It is identical with transdisciplinary education, thematic education, and synergistic education.

5.3.2.4 Challenges that TVET lecturers experience during application of ALA

The question statements were used to measure the above theme four, derived from research objective number four. The question statements were as follows: Q31: “Action learning approach requires me to study how to use it before I could implement it in my classroom” (M = 1.81) with an SD of 0.749 and n = 11 (42.3%), which indicates that more participants are more inclined to agree. While Q32 “action learning approach” techniques require long preparation periods, Furthermore, ALA techniques require extended classroom time during implementation. Consuming” (M = 1.62) with an SD of 0.637 and n = 12 (46.2%) strongly agree and n = 12 (46.2%) agree, which confirm that most participants agree with the statement above. Q33 was “TVET college curriculum and timetable do not provide sufficient time to implement all ALA techniques” (M = 2.00) with an SD of 1.058 and n = 11 (42.3%), which shows that more participants are toward strongly agreeing. Q36: “I can demonstrate any civil engineering construction practical work to my class” (M = 2.23; SD = 0.992); and n = 12 (46.2%), which allude to the fact that participants are more inclined to strongly agree.

The findings support Terblanche, Albertyn and van Coller-(2017) Peter's contention that there is a disparity between the fields of study lecturers are qualified in and the outcomes required for curriculum content, as well as whether their work experience is directly related to what is currently required to deliver industrial and employment programmes. Whereas Mtshali, Ramaligela and Makgato (2019), on the other hand, argue that the precarious condition of teaching practical skills in Civil Technology, Civil Engineering, and Construction Studies is exacerbated by lecturers who lack adequate pedagogical subject knowledge conveyance and the inadequacy of teaching materials and facilities. Moreover, Han, Turns, Cook, Mason and Shuman (2022) discovered that students relied on comparable instances or formulae from textbooks during the problem-solving process rather than gaining conceptual knowledge in their study.

In addition, the research further explores the challenges through the following question statements: Q34 was “My class is overcrowded to apply action learning approaches” (M = 2.54; SD = 1.104) and n = 8 (30.8%) disagrees while n = 6 (23.1%) strongly disagrees, which indicates that most participants are more inclined to disagree with the statement mentioned above. While Q35: “I have a fully equipped and functional workshop that can accommodate all my students” (M = 2.58), SD = 1.065, and n = 8 (30.8%) disagree, n = 6 (23.1%) strongly disagree, which asserts that most participants are more inclined to disagree with the statement. Q37: “Students do not value college work; they take it as a bridge to university entrance” (M = 1.92; SD = 0.744; n = 15; 57.7%), which indicate that participants are more inclined to agree. Q38:

“Trade testing stations are few in the Free State province for us to collaborate with for the enhancement of practical skills and competencies of our students” (M = 1.50) with an SD of 0.583 and n = 14 (53.8%), which indicates that most participants agree with the statement mentioned above. Q39: “Trade testing stations are expensive, and that demotivates students' morale about learning” (M = 1.65) with an SD of 0.846 and n = 14 (53.8%), which indicates that most participants strongly agree.

Similarly, the findings concur with Maeko (2016:30) and Yangben and Seniwoliba (2014), who assert that high-quality skills training requires adequate workshop equipment, enough training materials, and student practise. In addition, they stated that inadequate training equipment and a lack of instructional materials are two factors that reduce the effectiveness of training in achieving the knowledge and skills objectives for civil engineering construction. However, according to Mtshali, Ramaligela and Makgato (2018), student training is limited by a lack of facilities such as workshops, labs, equipment, and supplies. As a result of this condition, civil engineering construction students graduate with only academic knowledge and no practical skills.

5.3.2.5 Lecturers capacitated to use ALA to produce quality work at TVET colleges – pertaining to the integration of content knowledge and practical work

The question statements were used to measure the above theme five, derived from research objective number five. The question statements were as follows: Q40 was “I would like to have industrial exposure every term” (M = 1.35 and SD = 0.629) with n = 19 (73.1%), which shows that most participants are more towards strongly agreeing. While in Q41, “I would like to attend practical refresher courses annually” (M = 1.42) and (SD = 0.703), n = 18 (69.2%) and (SD = 0.703), which indicates that the majority is more toward strongly agreeing, Q43: “I need training in action learning approach techniques to enhance teaching and learning in civil engineering classes” (M = 1.50, SD = 0.510), with n = 13 (50.0%) strongly agreeing and n = 13 (50.0%) agreeing, which shows that all participants are toward more agreement with the statement above. Q44: “I recommend that cluster subject groups assist each other” (M = 1.46 and SD = 0.647), with n = 16 (61.5%), which asserts that most participants are more inclined to strongly agree. Q47: “Qualified laboratory technicians should be employed on full-time basis" (M = 1.38) and (SD = 0.571) with n = 17 (65.4%), which asserts that most participants are more toward strongly agreeing.

Terblanche, Albertyn, and van Coller-Peter (2017) suggested that basic research skills should be incorporated into the curriculum leadership programme to enable leaders and lecturers to collect and analyse data pertinent to curriculum change and the broader scope of TVET college sector challenges to make crucial curriculum-related decisions and ensure effective implementation. Therefore, the above utterances by Terblanche, Albertyn and van Coller-Peter (2017) solicit the gravity of issues affecting a lecturer's development and professional support. Furthermore, Mosebekoa (2019) highlighted that lecturers are involved to first establish the students' prerequisite knowledge and then introduce new information. The lecturers then make space for pupils to demonstrate comprehension through activities. It is through this practise that students gain and improve both expected and unexpected skills, but all of that requires full professional knowledge. However, the aforesaid finding disagrees with Mosebekoa (2019) who found that when it mentions that the lecturers at TVET colleges had explained that their colleges had organised training in education courses with the following institutions: the NUL and CUT. Furthermore, Timire and Teis (2019) assert that an appropriately trained technical lecturer may confidently stand in front of a class and offer lessons. A lecturer who lacks the "requisite subject" pedagogical, and technical content knowledge and abilities, on the other hand, loses the students' respect and, as a result, has poor self-esteem.

In addition, the research further explores the lecturers' capacity to use ALA to produce quality work through the following question statements: Q45: "Theory classes and practical workshops should be well equipped" (M = 1.04, SD = 0.196), with n = 25 (96.2%), affirms that most participants are more inclined to strongly agree. Q46: "Timetables should allow ample time for integration of content knowledge and practical work" (M = 1.23 and SD = 0.430), with n = 20 (76.9%), indicates that most participants are more toward strongly agreeing. Q48: "Civil Engineering and Construction NATED 191 courses' academic duration should be changed from 3 months to 6 months or a year for the inclusion of practical work within the college" (M = 1.42) and (SD = 0.758), with n = 18 (69.2%), which pronounces that most participants are more towards strongly agreeing. Q49: "To ensure quality work of integrating content knowledge and practical application, I recommended ALA Civil Engineering and Construction NCV subjects" (M = 1.69) and (0.549) with n = 16 (61.5%), which designates that most participants are more inclined to agree.

The results were also consistent with Pitso's (2018) assertion that TVET institutions should prioritise staff development in order to provide high-quality programmes. This necessitates that professors acquire all the skills and knowledge necessary to deliver relevant and responsive vocational education and training programmes. Terblanche, Albertyn, and van Coller-Peter (2017) conclude that skill training is more effective when it is founded on a solid foundation of general knowledge. Education and training appear to be essential for productivity, but they are challenging to administer effectively within the same institutional structure. Consequently, it is more effective to educate institutions with a degree of autonomy and flexibility, which is difficult in formal and rigid systems. Therefore, the findings are consistent with those of Maeko (2016), who concluded that providing engineering and technical education in TVET concurrently with general education subjects is unlikely to be advantageous. According to the analysis, this is due to the fact that the practical component of engineering and technical technology education is too expensive for all TVET colleges to offer.

5.3.3 Semi Structured Face-To-Face Interview Discussion

The semi-structured interviews were scheduled with lecturers to find clarity on the missing points during quantitative data collection and analysis. The researcher developed ten semi-structured interview questions to lead the interview and discussion. In 5.3.3, the research discusses the findings based on the questions. Where Q1 was "What is your view regarding the use of ALA in CEC studies at TVET college?" The findings revealed that most lecturers are aware of and interested in using ALAs with reference to a student-centred approach at TVET. However, the lack of professional pedagogical practise makes implementing action learning ineffective, as it promotes creativity and innovation through hands-on experience. The aforementioned findings concur with Mosebekoa's (2019) statement that, in general, all lecturers have praised the use of a student-centered approach because it enables students to conduct independent research to better comprehend and apply their knowledge, which lecturing does not permit.

However, four questions were asked more interchangeably to establish the purpose, drives, and implementation of favourable techniques. The questions were Q2 *"What are your favourite techniques when implementing ALA in CEC studies?", Q3 "What makes them your favourite techniques of action learning in CEC studies? Q4* "*Can you explain how do you use these favourite techniques of ALA in your CEC studies class? Q5 Which teaching and learning methods or techniques you use during application of ALA in CEC studies class?* In this conversation, the findings expressed that most lecturers' favourite techniques to implement ALA are demonstration and project-based. The statement above concurs with Gumbo et al. (2019), who state that using project-based learning as a teaching strategy promotes action and active learning rather than passive learning because action learning encourages students to solve problems in their field as well as develop products to solve problems, resulting in a comprehensive gain of new knowledge and skills. Furthermore, Inuwa, Abdullah, and Hassan (2018) proposed that the demonstration technique be acceptable for teaching civil engineering and construction students at TVET institutions since it facilitates proper student engagement in the learning process. They also emphasised the demonstrative method as an educational strategy in which lecturers perform as role players while students observe with the goal of acting afterwards. In a demonstration approach class, teachers explain the lesson step by step or the entire process to the students and demonstrate all the methods (Inuwa, Abdullah & Hassan, 2018).

In the similar vein, questions of assessments were posed to clarify the sequence of assessment in content knowledge and practical work: Q6 was *"What sequence lecturers use to assess content knowledge and practical work at TVET colleges?* and Q7 "*How are the outcomes of assessment after the use of ALA in CEC studies?"* The findings regarding assessment and outcomes postulated that lectures adhered to the prescribed assessment of DHET, which is mentioned above. However, most lecturers are not pleased to be confined within the prescribed limits, as they claim to conceal students' individual experiences in totality. Hence, most lecturers are running up what is formally required and strengthening it with technological processes to accommodate all students' capacities, which shall promulgate creativity, innovation, and problem-solving skills.

Moreover, the findings surface in the guide of Yulindar, Setiawan and Liliawati (2018) when they pronounce that there are five stages to be scored to assess the problem-solving abilities. The five stages are as follows: Stage 1: “Focusing on the problem” can be developed using images or words that can help students. Stage 2: Describe the problem in terms of the physics concept. Students can simplify the problem by linking the problem with the physics concept in terms of principles and physical symbols. Stage 3: Planning a problem-solving solution (the student's solution), students create a framework of equations based on the relationships that have been proposed in the previous stage. Stage 4: Implementing the plan: students can manipulate equations, enter known numbers, and solve algebraic problems. Stage 5: Evaluating the Solution: The student must evaluate the answer and make sure that it is satisfactory.

In addition, Mokhothu (2015–2019) interprets technological processes as the crucial principle of ALA assessment in civil engineering and construction. Further, it reiterates that the technological process affords students the opportunity to be innovative and creative and to develop a genuine full skill set in the field of work. In the support of technological process as a key to assessment in Civil Engineering and Construction studies, the findings align with Masoabi (2015), DBE (2011b:10), Van der Walt (2009), and Mokhothu (2019) when they further explicate six steps of technological process as follows: Step 1, identify: Make a meaningful summary of the problem from the scenario given or created; Step 2, Investigation: The design brief describes a problem; how do you think you can solve it? and draw free-hand three possible solutions, Write the specification and the constraints. Step 3: Design: A formal drawing plan with full details using the scale and material list Step 4: Make: Physically make your project using guided instructions and a formal plan. Step 5: Evaluation and Test: Compile a Checklist for the Project Step 6, Communication: Presentation of the Project (Portfolio, Project Exhibition, and Flow Chart) Therefore, Step 6 concedes what Joughin (2010) and Mokhothu (2018) assert: that oral assessment is one of the most powerful tools and moments where the students can express knowledge without a restricted space of discussion between lecturer and student in a private assessment space.

The researcher went further in the interview to explore the questions asked in a questionnaire about the challenges faced by the lecturer during the implementation and what are the solutions in place. Q8 *was "What are the challenges that you encounter during the use of ALA in CEC studies?* and Q9 *How do you solve these challenges as you experience them during the use of ALA in CEC studies?* The interview specified the real challenge and the temporary solution for the lecturers to roll the wheel of teaching and learning. The lecturers highlighted that they do not have problems with infrastructure, but they do have a problem with insufficient material because orders take time to be delivered due to changed procurement systems. In addition, they further complained about the inadequate time allocated to the workshop. Both problems have forced them to reduce real projects to scale models and to improvise by grouping students during practical time.

The above-mentioned finding concurs with Terblanche, Albertyn and van Coller-Peter (2017) when they sustain that there is a gap between the fields of study in which lecturers are qualified and what results they need for curriculum content to produce and whether the work experience they have gained is directly linked to what is currently needed to deliver industrial and employment programmes. However, Mtshali, Ramaligela and Makgato (2019) contend that the difficult part of teaching practical skills in Civil Technology, Civil Engineering, and Construction Studies is caused by lecturers who lack adequate pedagogical subject knowledge conveyance and the inadequacy of teaching materials and facilities. While Han, Turns, Cook, Mason and Shuman (2022) in their study found that students relied on analogous examples or equations from textbooks during the problem-solving process instead of developing a conceptual understanding.

In TVET colleges, to achieve an accurate integration of content knowledge and practical work through an ALA, the college should be in a position of having appropriate classrooms and workshops with sufficient equipment and materials. This has been attested to by Maeko (2016), who states that high-quality skills training requires appropriate workshop equipment, an adequate supply of training materials, and practise by students (Maeko, 2016; Yangben & Seniwoliba, 2014). In contrast, inadequate training equipment and a lack of instructional materials are some of the aspects that decrease the efficacy of training for meeting the objectives in civil engineering construction knowledge and abilities.

However, according to Kennedy (2008) and Mtshali, Ramaligela, and Makgato (2018), the training of students is hampered by a shortage of facilities such as workshops, laboratories, equipment, and materials. As a result of this circumstance, students in civil engineering construction graduate with just academic knowledge and no practical skills.

TVET colleges should make staff development a top priority to deliver high-quality programs. This means lecturers will need to acquire all the essential skills and knowledge to conduct relevant and responsive vocational education and training programmes (Mmako, 2015; Pitso, 2018). In addition, Pitso (2018) emphasised that graduates with disciplinary, professional, and technical expertise are in high demand. TVET colleges need to be cognizant of and deliver on the quality, quantity, and equity imperatives. According to Terblanche, Albertyn and van Coller-Peter (2017), training in specific skills is more effective when it is built on a strong foundation of generic technical and vocational education.

5.4 CONCLUSION

The aim of the study was to explore the use of action learning as a teaching approach with reference to content knowledge and practical work in Civil Engineering Construction Studies at TVET colleges and to review existing formulas and models. The researcher used the SPSS statistical package to analyse the data that was gathered through a questionnaire. A face-to-face interview was conducted to collect data, which was transcribed, analysed, and presented. The findings revealed that most of the lecturers are aware of ALAs, but they are not certain of the terminologies used as most of them do not have teaching qualifications. Lecturers further expressed their frustration with the time allocated for teaching and learning, especially the practical parts. Further, it is suggested that the N-course time schedule should be revised to 6 months or a year. The lecturers are requesting to be professionally upgraded with teaching qualifications to implement the teaching and learning process effectively. Chapter six below addresses: summary, conclusions and recommendations of the study.

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter presents the summary of the findings from both the questionnaire and the interviews conducted with the lecturers as participants from TVET colleges. The aim of the study was to explore the use of action learning as a teaching approach with reference to content knowledge and practical work in civil engineering construction studies at TVET colleges and to review existing formulas and models. While the problem statement of the study in summary was “researcher’s personal experience, it was observed that lecturers at TVET colleges are only teaching the theory part of the programme and they shifted practical work to work-integrated learning (WIL), which is at the end of the programme”.

The main research question of the study was, “How are action learning approaches used to promote and enhance the pedagogic practises in civil engineering and construction studies at TVET colleges?” The researcher explored the use of action learning approaches to enhance pedagogical practises in civil engineering and construction and used the following objectives to measure the responses:

- To determine the teaching approaches used at TVET Civil Engineering Construction studies Curriculum.
- To assess the extent to which action learning approach is employed in teaching content knowledge and practical work in Civil Engineering Construction studies at TVET.
- To evaluate the sequence/procedure lecturers use to assess content knowledge and practical work at TVET colleges.
- To determine the challenges that TVET lecturers may experience during the implementation of action learning approach.
- To develop a formula for capacitating TVET lecturers in action learning approach to produce good quality work at TVET colleges - regarding the integration of content knowledge and practical work.

This chapter further discusses the conclusions and lecturers recommendations that were made during the data collection period. The study also provides recommendations regarding the researcher’s observations and experiences.

6.2 SUMMARY OF THE FINDINGS

6.2.1 Summary from the questionnaire with Lecturers

6.2.1.1 Teaching approaches used in TVET colleges engineering studies curriculum

The study uncovered that lecturers are aware of different teaching approaches used in TVET colleges' engineering studies curriculum. The results diametrically provided unquestionable evidence when lecturers in the majority agreed with questions Q1 to Q9 (see Table 5.7), which were raised to understand the awareness of different teaching and learning approaches. In addition, in Q5 and Q7 (see Table 5.7), most lecturers disagree with the statements posed when the results reveal that lecturers are more interested in exploring different resources to integrate effective teaching and learning.

6.2.1.2 The extent lecturers use action learning approaches in Civil Engineering and Construction Studies at TVET colleges

The study indicated that lecturers are using ALAs in Civil Engineering and Construction Studies at TVET colleges. The findings revealed that lecturers in the majority agreed with Q10 to Q17 (see Table 5.8) that they apply different teaching methods to implement effective teaching and learning in civil engineering and construction studies at TVET colleges. Furthermore, in Q12 to Q17 (see Table 5.8), lecturers in the majority revealed that they use ALAs for teaching and learning processes in civil engineering and construction studies. However, the study further highlighted that lecturers were not aware that they were practising action learning approaches, as most of the lecturers are not professional educators and lack formal training.

6.2.1.3 Sequence lecturers use to assess content knowledge and practical work at TVET colleges

The study exposed that lecturers use different types of assessment to assess content knowledge and practical work at TVET colleges. In Q18 to Q20 (see Table 5.9), the results highlighted that lecturers in the majority agree with the use of oral tests to boost confidence and save time for effective and sound practical assessment. While in Q21 to Q30 (see Table 5.9), the study further indicated that lecturers in the majority use many different assessments to integrate practical and theoretical knowledge, which also allows critical thinking and problem solving to nourish technical skills.

6.2.1.4 Challenges that TVET lecturers experience during application of ALA

The study shows that lecturers do experience challenges during the application of action learning approaches in Civil Engineering and Construction Studies at TVET colleges. In Q31 toQ34 (see Table 5.10), most lecturers agree that timetables and time structure are challenges for effective action learning approach implementation. In Q35 to Q39 (see Table 5.10), lecturers in the majority further highlighted that infrastructure in general works as a challenge for effective operation in action learning. In addition, lecturers announced that students do not value college work, but they take it as a bridge to university entrance, which also raises the challenges of motivation and dedication.

6.2.1.5 Lecturers capacitated to use ALA to produce quality work at TVET colleges – pertaining to the integration of content knowledge and practical work

The study revealed that lecturers in Civil Engineering and Construction Studies at TVET colleges are keen and in need of support for their professional development. In Q40 to Q44 (see Table 5.11), the majority strongly agree that they really need any form of expeditious formal professional development or training to enable them to work more effectively through relevant skills and knowledge. While in Q45 to Q49 (see Table 5.11), lecturers in the majority agree when pronouncing that human resources in general should be well equipped and sufficient to close skill mismatches and mobilise effective implementation of ALAs.

6.2.2 Summary from the Interview with Lecturers

6.2.2.1 Theme 1: Action learning in CEC studies

The lecturers in this study highlighted that ALAs in civil engineering and construction at TVET college play a vital role as they promulgate the integration of theory content and practical work. In addition, action learning provided a fair chance for all students to work together with others who had clear and pure minds.

6.2.2.2 Theme 2: Favourite techniques in ALA in CEC

Most lecturers indicated that they prefer a demonstration-based, project-based, and practical approach as effective techniques in civil engineering and construction studies at TVET colleges. Therefore, all lecturers declare demonstration as their main technique.

6.2.2.3 Theme 3: Makes of favourite techniques in ALA for CEC

The study revealed that lecturers regard demonstration as the best technique because it is divided into two steps that allow both students and lecturers to understand each other well. Step-by-step processes grant opportunities to grab knowledge while lecturers demonstrate and pause. Meanwhile, in the hole process demonstration, students are afforded a chance to observe the hole procedure and interrogate at the end.

6.2.2.5 Theme 4: Use of favourite techniques of ALA in CEC

The study revealed that most lecturers use teaching models to stimulate teaching and learning in the class. Moreover, students are allowed to be hands-on during the teaching process. Therefore, lecturers blend both demonstration steps to afford all students and the lecturer a chance to select an accessible way to gain both knowledge and critical skills.

6.2.2.6 Theme 5: Learning methods of techniques

All lecturers attested that they use project-based and simulation methods or techniques during the application of the ALA in Civil Engineering and Construction Studies. Moreover, almost all lecturers emphasise extra methods such as problem solving and self-discovery, while others prefer to blend (hybrid) as it drives clear understanding to different individuals' capacities.

6.2.2.7 Theme 6: Assessment for ALA in CEC

All lecturers indicated that types of assessments are prescribed by DHET to be implemented and lecturer capacity for assessment is regarded as informal. However, most lecturers, while practising within the prescripts of DHET, opted to expand opportunities on assessments by adding technological processes as the main informal general assessment for Civil Engineering and Construction studies at TVET College. Therefore, statements reveal that lecturers are not comfortable with the prescribed assessments from DHET as they limit knowledge, skills, and value transfer between lecturer and student.

6.2.2.7 Theme 7: Outcomes of assessment of ALA in CEC

The findings revealed that all lecturers who used action learning assessment approaches and measured the impact of assessment outcomes are satisfied with the outcomes. They further highlighted that students learn and perform well as they are exposed to freedom of action learning. In addition, regarding action learning, students work in sets, and practical work promotes teamwork to solve problems.

6.2.2.8 Theme 8: Challenges of ALA in CEC

All lecturers pronounced that insufficient materials were one of the key challenges to performing practical work. In addition, they further highlighted the time scheduled for teaching and learning processes as another challenging factor in civil engineering and construction studies at TVET colleges. Therefore, they should be allowed to develop their own assessment tasks to be able to measure the clearly planned objectives of integrating theory and practical work.

6.2.2.9 Theme 9: Solving challenges of ALA in CEC

Many lecturers highlighted that to solve material problems, they always improvise by reusing materials and also by scaling down the main projects into models. While others mentioned that they do not follow the schedule but rather compress the syllabus, Moreover, others further announced that they do not stand a chance but to use group work for practical purposes.

6.4 RECOMMENDATIONS OF THE STUDY

The findings of the study were analysed, interpreted, and discussed in Chapter 5 regarding the establishment of concrete recommendations to answer the main research question of the study: “How are action learning approaches used to promote and enhance the pedagogic practises in Civil Engineering and Construction studies at TVET colleges?” Furthermore, the researcher, during the design of the research tools, included recommendations for the solutions as a last question in both the questionnaire and the interviews (see Table 5.23). The lecturers recommended that:

- ALAs should be formalised and used as the main teaching and learning process in Civil Engineering and Studies at TVET colleges, as they promote the integration of theory and practical work. Moreover, the main definition of action learning is learning by doing with the support of others. Hence, McGill and Beaty (2013) pronounce action learning as “a continuous process of learning and reflection, supported by colleagues, with the intention of getting things done”. Therefore, TVET colleges should be the skills hub, producing high-level skills (practical) and less theory.
- In addition, they further recommended that DHET introduce an action learning course for TVET lecturers and management, as it encourages working together while learning from each other and from the situation.
- Lecturers strongly recommend that all courses scheduled for a three-month period be extended to six months or a year. The course should be able to cover both theory and practical work. The study revealed that time is one of the challenges that precludes effective implementation of ALAs.
- The insufficient consumable materials and equipment infrastructure were found to be one of the negative impacts of the implementation of an effective teaching and learning process that integrated theory and practical work. The lecturers highlighted that the new supply chain purchasing processes are the main hiccup, as everything takes time to be delivered and students miss the practical work. The lecturers recommended that the traditional systems of petty cash be

reactivated to allow smooth operation in all areas of teaching and learning in civil engineering and construction studies at TVET colleges.

- The ready-made or prescribed assessments by DHET were also mentioned by the lecturer as one of the factors that are impeding the smooth process of achieving the main objective of TVET, which is to develop a hub of skills. Because ready-made is cast in stone that compromises creativity and innovations that can contribute to economic development through skills, The lecturers recommended that DHET approve the autonomous system of TVET to allow for the development of vivid skills.
- The technological process method was also mentioned as one of the effective methods of assessment to integrate theory and practise in Civil Engineering and Construction Studies through ALA. Therefore, lecturers recommended that the technological process should be formalised as a one-way assessment method as it integrates theory and practical work concurrently.
- In addition, lecturers recommended the use of ALAs should incorporate verbal assessment to balance the abilities of various students at TVET colleges in Civil Engineering and Construction Studies.

In reference to the aforesaid findings and recommendations, the researcher recommends that:

- DHET should sponsor underqualified and unqualified lecturers to pursue their professional qualifications. that it will enable them to implement ALAs more formally as they recommended.
- DHET should also take cognizance of and expedite the TVET autonomous system like other institutions under DHET so it can allow unconditioned creativity and clear innovation.
- DHET should consider ALAs as the main enhancement of pedagogical practise in civil engineering and construction studies at TVET colleges to advance problem-solving skills and critical thinking.
- DHET should intensify their link with the Department of Labour to strengthen industry attachments to TVET colleges and refresh lecturers with the new skills in the industrial space so that lecturers can implement responsive curriculum effectively.

- DBE and DHET should both meet and review the curriculum of NCV as most of the lecturers' raised concerns about the subject and curriculum of NCV. They further claimed they were dropouts from high school due to a lack of performance and had hope that NCV could solve their challenges.
- DHET should consider piloting the suggested ALAs outlined in the study in civil engineering and construction studies at TVET colleges.

6.5 THE FORMULA BY THE STUDY FOR IMPLEMENTING ACTION LEARNING APPROACHES IN CIVIL ENGINEERING AND CONSTRUCTION STUDIES

$$L = Q_1 + P + Q_2 + I + E + C$$

Figure 6.1: A formula for action learning approaches in Civil Engineering and Construction Studies

Detailed discussion of the formula's components:

L: is a learning process.

Q_1: Questioning of the problem (What, When and How)

P: Planning and programme knowledge via Set, Meetings, Generation of ideas and facilitation role

Q_2: Questioning or interrogation of ideas, solutions and provide alternatives

I: Implementation to test or simulate solutions

E: Evaluation period (reflect) via assessment (theory + practical= community engagements)

C: Communicate final implementation via confirmation of competency and certifying

Figure 6.1 above is an ALA formula developed by the study to enhance and promote meaningful and relevant pedagogical practises in Civil Engineering and Construction Studies. The proposed formula varies or adds more components of specialisation as it is influenced by the common six steps of the technological process. Formerly, the researcher adapted the technological process concept into ALAs. However, this point should be stressed: the above formula is not completely new, but it has been reviewed as it provides a grounded encapsulation of all previous ALA formulae and six steps of technological process. Moreover, this formula is developed to address or achieve objective 5 of the study: To develop a formula for capacitating TVET lecturers in an ALA to produce good quality work at TVET colleges, regarding the integration of content knowledge and practical work. Also based on the findings as expressed above in the previous Chapter 5. The following questions were used to achieve the finding that they are dynamic and reactive:

- What teaching approaches are used in TVET colleges engineering studies curriculum?
- To what extent are lecturers using action learning approaches in Civil Engineering and Construction studies at TVET colleges?
- What sequence lecturers use to assess content knowledge and practical work at TVET colleges?
- What challenges do TVET lecturers experience during application of ALA?
- How can lecturers be capacitated to use ALA to produce and integrate quality work at TVET colleges?

In addition, from the perspective of research questions, the formula presented in Figure 6.1 stimulates awareness of and comprehensive implementation of teaching, learning, and assessment using an ALA in Civil Engineering and Construction studies. which point out a pivotal step of learning (L), of which it indicates learning as a general programme, that means the initial step of learning concepts or problems. While at the second step of the research question, the formula asked a question about to what extent using ALAs would be intertwined with (Q1) in the formula (what, when, and how), in which it was questioning the problem to be solved or learned. The other research question flexibly investigates the knowledge content and practical assessment imparted and addresses the (P) from the formula, which gravitate planning and programme knowledge via set meetings, the generation of ideas, and the facilitation role (interchangeable knowledge generation). Exploring further with research question 4 and investigating challenges experienced in attempting or during the application of ALAs is also in line with the formula in Q2, where questioning or interrogation of ideas, solutions, and providing alternatives will be established before application. Research question four also covers the formula part of I, where implementation to test or simulate solutions is used to further construe the challenges' solutions prior to final implementation and have a chance to amend if necessary. In reference to research question five, the capacity to use ALAs to produce and integrate quality work which is also referring to the formula part of (E) where the evaluation period (reflect) is conducted via assessment [theory + practical = community engagements], which is also intertwined to produce integrated work (theory and practical). Explaining further, in Civil Engineering and Construction Studies, integration of theory and practical is the main objective to develop strong critical thinking to solve problems. Furthermore, research question five on quality work also blends with formula part (C): communicate final implementation via confirmation of competency and certifying. At this part, the emphasis is on producing quality work and how to extent the final execution of the product. Therefore, the aforementioned information state is necessary to convince the adaption of the suggested formula in Civil Engineering and Construction Studies to effectively implement the ALAs as the key to the teaching and learning process.

In referring to the constructivism: cognitive and social theories from Chapter 2, which formed the framework of the study (see pages 36–40), Students' intellectual development is facilitated through opportunities for exploration, discovery, problem-solving, and critical thinking, contended Nowak-Fabrykowski (2018:264). Students must learn to think symbolically because the environment is made up of symbols that we meet every day in life and in school (Nowak-Fabrykowski 2018:264). The underpinning of Vygotsky's social constructivism (1978) is the interaction between a student's activity or action and sociocultural activities that produce learning through environmental action around them. Social constructivism enables students to develop their own learning process through interaction with the outside world. In addition, according to Kolbs' (1984) experiential learning model, students need to possess four various types of skills to engage in practical learning in action learning (see page 41): concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualization abilities (AC), and active experimentation abilities (AE). Kolb (1984) also underlines the idea that students should not be afraid of trying new things because they will lead to better understanding and experiences. Therefore, the action learning formula promulgated by the study promulgates and enhances the freedom of teaching and learning between students and lecturers in Civil Engineering and Construction Studies.

6.6 RECOMMENDATIONS FOR FURTHER RESEARCH

The study was conducted at four TVET colleges in the Free State province of South Africa in the engineering field, specifically Civil Engineering and Construction Studies, with lecturers only. Nevertheless, the study does not claim to provide all the responses emanating from the research. The study suggests that further research be conducted to explore the specific ALAs used to enhance pedagogical practises in civil engineering and construction studies at TVET colleges to intensify the integration of theory and practical work. Therefore, both lecturers and students should be involved as participants in the case study. In addition, further research needs to be conducted on the impact of lecturers' training with reference to ALAs. Last but not least, further research should be conducted to explore the aims of both NCV engineering and technical secondary school subjects such as civil technology.

6.7 CONCLUSION

The research aims, objectives, and questions were measured through a research study to acquire accurate and reliable results. The objectives were offered, together with research tools, to generate dynamic, measurable study findings.

In conclusion, lecturers provided responses via questionnaire and substantiated to vivify the views through face-to-face, semi-structured interview questions. The findings of the study uncovered that lecturers in general are aware of ALAs. However, their professional practise capacities were limited. Moreover, lecturers indicated their interest in professional development to enable effective, proper action-learning approaches. Furthermore, the study revealed that lecturers are not satisfied with the main assessment provision from DHET as it limits the scope of knowledge to be acquired at TVET colleges. In addition, they further emphasised that the assessment provision from DHET precludes creativity and problem-solving skills.

The study also discovered that lecturers are not satisfied with the new supply chain system introduced when purchasing workshop consumable materials because the delivery comes late when the students have already completed the module. They further outlined that the time scheduled for the course should be changed from three months to six months, which will provide sufficient time for the integration of theory and practical work. Therefore, the study findings proved the dynamic and clear understanding that most lecturers use ALAs, and they want it to be formalised as the main approach to enhance pedagogical practises in civil engineering and construction studies at TVET colleges. While also DHET provides professional development to unqualified lecturers.

REFERENCES

A Guide to Coaching & Being Coached (nd) :https://www.personal-coaching-information.com/action-learning-principles.html (accessed: 2020/01/16)

Afeti, G. (2017). 8th ADEA-WGHE/AAU Webinar: TVET Strategy for African Technical Universities, 2017. Retrieved from http://www.adeanet.org/en/news/8th-adea-wghe-aau-webinar-tvet-strategy-for-african-technical-universities. (accessed 07/03/2021)

Aguilar, K. (2013). How Coaching Can Impact Teachers, Principals, and Students. George Lucas Educational Foundation. 25 March. US

Ahmad, A., Nordin, M. K., Ali, D.F. & Nabil, A. (2015). Conducting Hands-On Task in Vocational Education: Teaching Method in Automotive Courses. *Journal of Technical Eduation and Training,* 7(1): 23-21

Akoojee, S., (2016). Developmental TVET rhetoric in-action: the white paper for post-school education and training in South Africa. *International journal for research in vocational education and training*, 3(1), 1-15.

Akoojee, S., Gewer, A. & McGrath, S. (2005). South Africa: Skills development as a tool for social and economic development. Vocational education and training in Southern Africa, 99-117.

Alaba, S.O. & Adekomi, B. (2012). Improving Science, Technology and Mathematics Education in Nigeria: A case study of Obafemi Owolowo University, Ile-Ife. *World of Journal of Education*. 2(6).

Alam, G.M. (2008). The role of technical and vocational education in the national development of Bangladesh. *Asia-Pacific Journal of Cooperative Education*. 9(1): 25-44.

Albashiry, N.M., Voogt, J.M. & Pieters, J.M. (2015). Teacher collaborative curriculum design in technical vocational colleges: a strategy for maintaining curriculum consistency? *The Curriculum Journal*, 26(4): 601-624.

Alexander, E. (2001). Dispositions for Learning in Childcare Students. Childcare students: learning or imitating? Presentation to the British Educational Research Association Annual Conference, 13-15 September 2001, University of Leeds, Leeds.

Allen, R.R. & Rott, R.K. (1969). The Nature of Critical Thinking. Report from the Concepts in Verbal Argument Project. Theoretical Paper No. 20.

Ames, H., Glenton, C. & Lewin, S. (2019). Purposive sampling in a qualitative evidence synthesis: A worked example from a synthesis on parental perceptions of vaccination communication. *BMC medical research methodology*, 19(1), 1-9.

Anastasiou, M. & Kyriakou, M. (2017). Exploring effective teaching methods in the Vocational Education of Cyprus. *Vocational Training: Research and realities*, 28(1): 3-21.

Anderson, T. (2004). Towards a theory of online learning. *Theory and practice of online learning,* 2, 109-119.

Ankiewicz, P. (1995). The planning of technology education for South African schools. *International Journal of Technology and Design Education*, 5(3), 245-254.

Ankiewicz, P., de Swardt, E. & Engelbrecht, W. (2005-2016). Technology Education in South Africa since 1998: A shift from contents (conceptual knowledge) to process-based learning programmes. Pupils Attitudes Towards Technology (PATT 15) International Conference at: Haarlem, The Netherlands, 15(15):1-19. http://www.iteaconnect.org/PATT15/PATT15.html, 1-18. [accessed: 13/07/2021]

Atchoarena, D. & Delluc, A. (2002). Revisiting Technical and Vocational Education in Sub-Saharan Africa: An Update on Trends, Innovations and Challenges. New Trends in Technical and Vocational Education. UNESCO-IIEP, Socit Gnrale, 10 rue Thenard 75005 Paris, France (19.82 Euros).

Babbie, E. (2007). *Tile practice of social research*. Istanbul Bilgi University Library.

Banek Z.M. & Lujanac, A. (2009). *Education in virtual environment.*

Banek Zorica, M. & Lujanac, A. (2002). Education in Virtual Environment. *Digital Resources and Knowledge Sharing,* 557-564

Barnett, A. (2006). Using recovery modalities between training sessions in elite athletes. *Sports medicine*, 36(9), 781-796.

Bearman, M., Palermo, C., Allen, LM, NutrDiet & Williams, B. (2015). Learning Empathy Through Simulation: A Systematic Literature Review. *Journal of the Society for Simulation in Healthcare,* 10(5): 19-308.

Bennett, M.P., Roche, B., Dymond, S., Baeyens, F., Vervliet, B., & Hermans, D. (2020). Transitions from avoidance: reinforcing competing behaviours reduces generalised avoidance in ne contexts. *Quarterly journal of education psychology*, 73(12): 2119-2131

Berg, M.V., Page, M. & Lou, K. (ibid). Using Experiential Learning Theory to Promote Student Learning and Development in Programs of Education Abroad.

Bergman, M. (2008). *Advances in mixed methods research: Theories and applications.*

Bertram, C., Mthiyane, N. & Mukeredzi, T. (2013). It will make me a real teacher: Learning experiences of part time PGCE students in South Africa. *International Journal of Educational Development,* 33(5), 448-456.

Bird, D.K. (2009). The use of questionnaires for acquiring information on public perception of natural hazards and risk mitigation–a review of current knowledge and practice. *Natural hazards and earth system sciences*, 9(4), 1307-1325.

Bizami, N.A., Tasir, Z. & Kew, S.N. (2022). Innovative pedagogical principles and technological tools capabilities for immersive blended learning: a systematic literature review. *Education and Information Technologies*, 1-53.

Bless, C. & Smith, C.H. & Sithole, S.L. (2013). *Fundamentals of Social Research Methods: An African Perspective*, 5th edition, Lansdowne: Juta education (Pty) Ltd.

Bless, C. & Smith, C.H. (2000). *Fundamentals of Social Research Methods: An African Perspective*, 3rd edition, Lansdowne: Juta education (Pty) Ltd.

Bloemkolk, D., Defares, P., Van Enckevort, G. & Van Gelderen, M. (1971). Cognitive processing of information on varied physiological arousal.

Blumke, K. (2021). Virtual Coaching Takes Off. *George Lucas Educational Foundation*. 18 February. US

Bogdan, R. & Biklen, S.K. (1997). *Qualitative research for education*. Boston, MA, USA: Allyn & Bacon.

Booyens, I. (2012, March). Creative industries, inequality and social development: developments, impacts and challenges in Cape Town. *Urban Forum*, 23(1), 43-60.

Botha, D.F. (2019). Knowledge Management and the Digital Native Enterprise. In *Imagination, Creativity, and Responsible Management in the Fourth Industrial Revolution* (207-239). IGI Global.

Boyd, L.D. (2002). Reflections on clinical practice by first-year dental students: a qualitative study. *Journal of Dental Education*, 66(6), 710-720.

Brantley-Dias, L, Kinuthia, W, Shoffner, MB, de Castro, C & Rigole, NJ. (2007) Developing Pedagogical Technology Integration Content Knowledge in Preservice Teachers, *Journal of Computing in Teacher Education*, 23(4), 143-150.

Brook, C & Pedler, M. (2020). Action Learning in Academic Management Education: A State of the Field Review. *The international Journal of Management of Education,* 18(100415), 1-10.

Bruner, J.S. (1960). On learning mathematics. *The Mathematics Teacher*, 53(8), 610-619.

Burns, J. (2000). The dynamics of accounting change inter-play between new practices, routines, institutions, power and politics. *Accounting, auditing & accountability journal*.

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 and Training,* 70(3), 364-383

Buthelezi, ZG. (2016). *At the policy-practice interface: exploring Technical Vocational Education and Training Lecturers' Educational reform experiences*. PhD thesis, University of KwaZulu-Natal, Pietermaritzburg, South Africa

Byrne, A., McNeill, J., Rogers, K. & Porter, S. (2018). Impact of Enquiry Based Learning (EBL) on student midwife praxis. *Midwifery*, 58, 83-85.

Cajas, F. (2000). Technology education research. *Potential directions*, 2(1).

CETA. (2018). Annual report 2018/2019. 2019-construction-education-and-training-authority-(ceta)-annual-report.pdf (nationalgovernment.co.za) www.ceta.org.za. [accessed: 25/06/2020]

Chakamba, J., Jumo, C., Edziwa, X. & Misozi, C. (2013). The demise of technical subjects: the case of selected high schools in Harare, Zimbabwe. *International Journal of Education*, 5(3), 557-565.

Chang, C.-C., Liang, C., Chou, P.-N. & Lin, G.-Y. (2017). Is game-based learning better in flow experience and various types of cognitive load than non-game-based learning? Perspective from multimedia and media richness. *Computers in Human Behaviour,* 71, 218-227.

Cherif, C.C. (1995). Maximizing Learning: Using Role Playing in Classroom. *The American Biology Teacher,* 57(1), 28-32

Chernikova, O., Heitzmann, N., Stadler, M., Holzberger, D., Seidel, T. & Fischer, F. (2020). Simulation-based learning in Higher Education: A meta-analysis. *Review of Educational Research*, 90(4): 499-541

Chia, M.Y., Huang, Y.F., Koo, C.H. & Fung, K.F. (2020). Recent advances in evapotranspiration estimation using artificial intelligence approaches with a focus on hybridization techniques—a review. *Agronomy*, 10(1), 101.

Chingombe, SI. (2013) Impacts of the Demonstration Method in the Teaching and Learning of Hearing-Impaired Children. *Journal of Humanities and Social Science*, 12(1): 48-54

Clerigo, J.C. & Sario, A.A., 2014. Towards A Metaethic Of Supererogation. Philosophia, 42, 55-61.

Cobb, P. (1989). Experiential, cognitive, and anthropological perspectives in mathematics education. *For the Learning of Mathematics,* 9(2):32-42.

Cobb, P., & Yackel, E. (1996). Constructivist, emergent, and sociocultural perspectives in the context of developmental research. *Educational Psychologist,* 31(3): 175-190

Cohen, L, Manion, L and Morrison, K. (2011). *Research methods in education*. 7th Ed. London: Routledge Farmer.

Cowan, G. A., Pines, D., & Meltzer, D. (1994). *Complexity: Metaphors, models, and reality*. Eds. New York, NY: Addison-Wesley.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (3rd ed.).* Thousand Oaks, CA: Sage Publications

Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). *Advanced mixed methods research designs.* Thousand Oaks, CA: Sage.

Creswell, J.W. (2003). A framework for design. Research design: Qualitative, quantitative, and mixed methods approaches, 9-11.

Creswell, J.W. (2011). Controversies in mixed methods research. The Sage handbook of qualitative research, 4(1), 269-284.

Creswell, J.W. (2012). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. 4th Ed. Pearson, Boston,

Creswell, J.W. & Creswell, J.D. (2005). Mixed methods research: Developments, debates, and dilemmas. Research in organizations: Foundations and methods of inquiry, 2, 315-326.

Dawadi, Saraswati, Shrestha, Sagun & Giri, Ram A. (2021). Mixed-Methods Research: A Discussion on its Types, Challenges, and Criticisms. Journal of Practical Studies in Education, 2(2) 25–36.

De Vos, A., De Hauw, S. & Willemse, I., 2011. Competency development in organizations: building an integrative model through a qualitative study.

De Winter, J. C. F. (2013). Using the student's t-test with extremely small sample sizes. *Practical Assessment Research & Evaluation,* 18(10):1-13

Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods*. New York: Praeger.

Department of Basic Education (2011). *Curriculum assessment policy statements (CAPS): Civil technology.* Available from download. Aspx?

Department of Basic Education (2011a). Curriculum assessment policy statements (CAPS): Civil technology. Available from download. Aspx?

Department of Basic Education. (2018a). The three stream report 2018. Pretoria: Department of Basic Education. https://equaleducation.org.za/wp-content/uploads/2018/05/Three-Stream-Report.pdf. [accessed: 29/09/2021]

Department of Education (DoE). (2008). National Plan for Further Education and Training Colleges in South Africa. Pretoria: DoE.

Department of Higher Education and Training (DHET). (2011). National Skills Development Strategy 3. Pretoria: DHET.

Department of Higher Education and Training (DHET). (2013). Government Gazette No36554, Notice 410, 11 June 2013. Pretoria: DHET.

Department of Higher Education and Training (DHET). (2013). White Paper for Post-School Education and Training. Pretoria: DHET.

Department of Higher Education and Training. (2011). *FET 2010 staff and student data-sets, FETMIS*. Pretoria: Department of Higher Education and Training.

Department of Higher Education and Training. (2012a). Green paper for post-school education and training. Pretoria: Department of Higher Education and Training.

Department of Higher Education and Training. (2013a). Annual Report 2012/2013. Pretoria: Department of Higher Education and Training.

Department of Higher Education and Training. (2013b). Higher Education Act, 1997 (Act No.101 of 1997) and National Qualification Act, 2008 (Act No. 67 of 2008). Policy on professional qualifications for Lecturers in Technical and Vocational Education and Training. Government Gazette, 36553:410, 11 June.

Department of Higher Education and Training. (2018). SETAs' Workplace-Based Learning Programme Agreement Regulations. Government Gazette No 42037. Pretoria: DHET.

Department of Higher Education and Training. (2019). Promulgation of the National Skills Development Plan. Government Gazette No 42290. Pretoria: DHET.

Department of Higher Education and Training. (2020a). SETA Interview Report on Skills Development. Pretoria: DHET.

Department of Higher Education and Training. (2020b). National University Entrepreneurship Ecosystem: Baseline Report. Pretoria: DHET.

Department of Public Service and Administration (2021). The Public Service Occupational Dictionary (Draft for Consultation). Tshwane: Department of Public Service and Administration.

Department of Transport and Public Works brochure. (2010). *Design Education*, 20(1):191-215. https://www.westerncape.gov.za/assets/departments/transport-public-works/Documents/j39204_nys_brochure_dl_fa.pdf [accessed: 14/02/2019]

Dewey, J. (1938). *Experience and education*. New York: Collier

Dewey, J. (1998). *Experience and Education*. The 60th. Anniversary Edition., Lecture Part. Kappa Delta Pi, International Honor Society in Education

Dieleman, H. & Huisingh, D. (2006). Game by which to learn and teach about sustainable development: Exploring the relevance of games and experiential learning for sustainability. *Journal of cleaner production,* 14(2006): 837-847

Dixon-Krauss, L. (1996). *Vygotsky in the classroom. Mediated literacy instruction and assessment.* White Plains, NY: Longman Publishers.

Donaghy, M. E. & Morss, K. (2000). Guided reflection: A framework to facilitate and assess reflective practice within the discipline of physiotherapy. *Physiotherapy Theory and Practice,*16(1), 3-14.

Dongkun, Z. (2018), *The Winnipeg design centre: Rethinking architecture education in the 21st century*. Master's Thesis, University of Manitoba, Canada.

Doolittle, P.E. (2014). Complex Constructivism: A Theoretical Model of Complexity and Cognition. *International Journal of Teaching and Learning in Higher Education,* 26(3): 485-498

Doolittle, P.E. & Camp, W.G. (1999). Constructivism: The career and technical education perspective. Journal of vocational and technical education, 16(1), 23-46.

Doolittle, W.F. & Inkpen, S.A. (2018). Processes and patterns of interaction as units of selection: An introduction to ITSNTS thinking. Proceedings of the National Academy of Sciences, 115(16), 4006-4014.

Eachempati, P., KS, K.K., Komattil, R. & Ismail, A.R.H. (2017). Heutagogy through Facebook for the Millennial learners. MedEdPublish, 6(194), p.194.

Easa, S.M. (2013). Framework and guidelines for graduate attribute assessment in engineering education. Faculty of Engineering and Architectural Science, Ryerson University, Toronto, Ont., Canada. *Canadian Journal of Civil Engineering*, 40(6):547-556.

Education News. (2014). Why FET Colleges are changing their Names to TVET Colleges. Oxbridge Academy on 20 September 2014. http://www.bizcommunity.com/Article/196/98/121709.html [Accessed 31/01/2017]

Eisenhart, M. A., & Borko, H. (1991). In search of an interdisciplinary collaborative design for studying teacher education. *Teaching and Teacher Education,* 7(2), 137-157.

Engelbrecht, W., Ankiewicz, P. & De Swardt, E. (2006). Technology Education in South Africa Since 1998: A Shift to Decentralised Continuous Professional Teacher Development.

Ennis, R.H. (1987). A taxonomy of critical thinking dispositions and abilities.

Enosh, G., Tzafrir, S. S., & Stolovy, T. (2014). The development of client violence questionnaire (CVQ). Journal of Mixed Methods Research, 9(3), 273–290. https://doi.org/10.1177/1558689814525263

Eriksson, P., & Kovalainen, A. (2015). Qualitative methods in business research: A practical guide to social research. Qualitative Methods in Business Research, 1-376.

Ernst, P. (1995). *The one and the many, in: Constructivism in education*. Eds. Hillsdale, NJ: Lawrence Erlbaum

Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. Performance Improvement Quarterly, 26, 43–71. doi:10.1111/j.1937-8327.1993.tb00605.x [Crossref], [Google Scholar]

ETDP SETA. (2018). Annual Report 2018/2019. https://www.etdpseta.org.za/etd/sites/default/files/2022-12/2018-2019-annual-report.pdf. [accessed: 15/11/2021]

Ferguson, E.S. (1994) Engineering and the Mind's Eye, 4(1). The MIT Press

Fernandes, M.A., Wammes, J.D. & Meade, M.E. (2018). The Surprisingly Powerful Influence of Drawing on Memory. *Current Directions in Psychological Science*, 27(5): 302:308 https://doi.org/10.1177/0963721418755385 [accessed: 04/03/2021]

Field, A. P. (2006). *Discovering statistics using SPSS*. London: Sage Publishers.

Finlay, L. & Gough, B. eds. (2008). Reflexivity: A practical guide for researchers in health and social sciences. John Wiley & Sons.

Fisher, R. A. (1956). *Statistical methods and scientific inferences*. Oliver and Body, Edinburgh, UK

Franklin, S., Madl, T., Strain, S., Faghihi, U., Dong, D., Kugele, S., Snaider, J., Agrawal, P. & Chen, S. (2016). A LDA Cognitive Model Tutorial. *Biological Inspired Cognitive Architectures,* 16: 105-10

Gall, M.D., Gall, J.P. & Borg, W.R. (2007). *Educational research: An introduction (8th ed.).* White Plains, New York: Longman.

Gall, M.D., Gall, J.P., Borg, W.R. and Mendel, P.C. (2007). A guide for preparing a thesis or dissertation proposal in education, for Gall, Gall, & Borg Educational research: an introduction and Applying Educational Research'. Pearson Education.

Ganesh, H., & Cave, V. (2018). P-values, P-values everywhere. *New Zealand Veterinary Journal,* 66(2): 55-56

Gessner, F. (1956). Das Plankton des Lago Maracaibo. In: Gessner F. & Vareschi V. (Eds.) Ergebnisse der deutschen limnologischen. Venezuela Expedition 1952, 67–92.

Gibbs, G. (1988). Learning by Doing: A guide to teaching and learning methods. London: Further Education Unit.

Gravemeijer, K. and Doorman, M. (1999). Context problems in realistic mathematics education: A calculus course as an example. Educational studies in mathematics, 39(1), 111-129.

Graven, M.H., 2014. Poverty, inequality and mathematics performance: The case of South Africa's post-apartheid context. Zdm, 46(7), 1039-1049.

Green, D.O., Creswell, J.W., Shope, R.J. and Clark, V.L.P. (2007). Grounded theory and racial/ethnic diversity. The Sage handbook of grounded theory, 472-492.

Greene, K. and Larsen, L. (2018). Virtual andragogy: A new paradigm for serving adult online learners. International Journal of Digital Society, 9(2), 1376-1381.

Gumbo, M.T., Toit, A., Khumalo, S., Maluleke, K., Mapotse, T.A., Ngetu, C., Sibanda, D., & Thompson, R. (2019). *Teaching Technology Intermediate to Senior Phase*. Cape Town: Oxford University Press Southern Africa (Pty) Limited.

Hadi, M.Y.A., Hassan, R., Razzaq, A.R.A. and Mustafa, M.Z. (2015). Application of thinking skills in career: A Survey on Technical and Vocational Education Training (TVET) qualification semi-professional job duties. Procedia-Social and Behavioral Sciences, 211, 1163-1170.

Hall, K, Murphy, P, & Sole, J. (2008). *Pedagogy and Practice: Culture and Identities,* Alexander, R. 2001. *Pedagogy, Curriculum and Culture.* SAGE Publications, London.

Hamisu, M.A., Salleh, K.M., Sern, L.C, Adamu, B.Y. & Gambo, K. (2017). Proposed Competency Model for Technical and Vocational Education and Training (TVET) Lecturers Teahing in Technical Colleges, Bauchi State in Perspective. *Traektoria= Path of Science*, 3(9):5001-5009.

Han, Y.L., Turns, J., Cook, K.E., Mason, G.S. & Shuman, T.R. (2022). Students' Experience of an Integrated Electrical Engineering and Data Acquisition Course in an Undergraduate Mechanical Engineering Curriculum. IEEE Transactions on Education, 65(3), 331-343.

Harkness, E.L., Harris, L.M., Jones, M.K. & Vaccaro, L. (2009). No evidence of attentional bias in obsessive compulsive checking on the dot probe paradigm. Behaviour research and therapy, 47(5), 437-443.

Harvey, M., Coulson, D. & McMaugh, A. (2016). Towards a theory of the ecology of reflection: Reflective practice for experiential learning in higher education. Journal of University Teaching & Learning Practice, 13(2), p.2.

Hase, S. (2016). Self-determined learning (heutagogy): Where have we come since 2000? *Southern Institute of Technology Journal of Applied Research*, 1–20

Hase, S. & Kenyon, C. (2000). From andragogy to heutagogy. UltiBASE In-Site.

Hashim, S., Utami, P., Rahman, M.H.A., Jumaat, N.F. & Phon, D.N.E. (2019). Knowledge Construction Process in an Open Learning System Among Technical and

Vocational Education and Training (TVET) Practitioners. Journal of Technical Education and Training, 11(1).

Hawes, G.R. & Hawes, L.S. (1982). *The concise dictionary of education*. New York: Van Nostrand Reinhold Company.

Hegland, P. A., Aarlie, H., Strømme, H. & Jamtvedt, G. (2017). Simulation-based training for nurses: Systematic review and meta-analysis. *Nurse Education Today*, 54(1), 6–20. https://doi.org/10.1016/j.nedt.2017.04.004

Heitzmann, N., Seidel, T., Opitz, A., Hetmanek, A., Wecker, C., Fischer, M., Ufer, S., Schmidmaier, R., Neuhaus, B., Siebeck, M., Stürmer, K., Obersteiner, A., Reiss, K., Girwidz, R., & Fischer, F. (2019). Facilitating diagnostic competences in simulations: A conceptual framework and a research agenda for medical and teacher education. *Frontline Learning Research*, 7(4), 1–24. https://doi.org/10.14786/flr.v7i4.384

Hill, J., Walkington, H. & France, D. (2016). Graduate attributes: implications for higher education practice and policy. *Journal of Geography in Higher Education*, 40(2):155-163

Holland, J. H. (1998). *Emergence: From chaos to order.* Reading, MA: Addison-Wesley

Howe, K. R. (1988). Against the quantitative–qualitative incompatability thesis or dogmas diehard. *Educational Researcher*, 17, 10–16. http://www.dhet.gov.za/SiteAssets/Latest%20News/December%202016/TVET%20colleges%20AC%201216%20ap%20web%20story.pdf

http://www.vanuatutvet.org.vu/about-us/what-is-tvet/

https://www.gtac.gov.za/perdetail/10.1%20Summary.pdf

https://www.un.org/counterterrorism/ctitf/en/uncct/technical-and-vocational-education-and-training-tvet

https://www.westerncape.gov.za/assets/departments/transport-public works/Documents/j39204_nys_brochure_dl_fa.pd

Igborgbor, F.O., 2006. Cultism and its impact on leanring process. In a workshop on cultism for principals of secondary schools in Delta State of Nigeria, organized by the State Post Primary Education Board, Asaba, Nigeria, November (Vol. 1).

Inglis, S., 1994. Making the Most of Action Learning. Gower, Old Post Road, Brookfield, VT 05036-9704.

Inman, P.L. & Vernon, S., 1997. Assessing Workplace Learning: New Trends and Possibilities. New Directions for Adult and Continuing Education, 75, 75-85.

Inuwa, U., Abdullah, Z. & Hassan, H. (2018). A Mixed-Method Study of the Effect of the Demonstration Method on Students' Achievement in Financial Accounting. *International Journal of Instruction,* 11(4): 577-592.

Jabareen, Y. (2009). Building a Conceptual Framework: Philosophy, Definitions and Procedure. *International Journal of Qualitative Methods*, 8(4).

Jackson, D. (2017). Developing pre-professional identity in undergraduates through work-integrated learning. Higher Education, 74(5), 833-853.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly*, 24, 602–611.

Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

Jonassen, D. H., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist leaming environments. *Educational Technology, Research, and Development* 47(1):61-79.

Jones, E. & Killick, D. (2013). 'Graduate Attributes and the Internationalized Curriculum: Embedding a Global Outlook in Disciplinary Learning Outcomes'. *Journal of Studies in International Education*, 17(2):165-182.

Jones, M. & Araje, L. (2002). The Impact of Constructivism on Education: Language, Discourse, and Meaning. *American Communication Journal*, 5(3).

Joppe, G. (2000). Testing reliability and validity of research instruments. Journal of American Academy of Business Cambridge, 4(1/2), 49-54.

Joughin, G. (2010). A short guide to oral assessment Available at http://www.leedsment.ac.uk/publications [Accessed 1 February 2020]

Justus, F. (2020). Learning Through Conversation. 10/04/2020. https://medium.com/age-of-awareness/learning-through-conversation-fb2e20e89b39 [accessed 20/06/2021]

Kanyane, M.C. (2016). Lecturers' Experiences of the Implementation of the National Certificate (Vocational) in Technical Vocational Education and Training Colleges in South Africa (Doctoral dissertation, University of South Africa).

Karia, K., Rucmenya, B., Krishna, L. & Kavi, A. (2018). Learning while competing-3D modelling & design. International Conference on Technology for Education (T4E). https://arxiv.org/ftp/arxiv/papers/1905/1905.07644.pdf. DOI 10.1109/T4E.2018.00026

Kasilingam, G, Ramalingam, M. & Chinnavan, E. (2014). Assessment of learning domains to improve student's learning in higher education. *Journal of Young Pharmacists,* 6(4): 27-33

Kayes, D.C. (2001). Experiential learning in teams: A study in learning style, group process and integrative complexity in ad hoc groups. Case Western Reserve University.

Kayes, D.C., 2002. Experiential learning and its critics: Preserving the role of experience in management learning and education. Academy of Management Learning & Education, 1(2), 137-149.

Kearsley, G. (2003). Exploration in Learning & Instruction: The Theory into Practice Database. Stanford University. http://www.stanford.edu/dept/SUSE/projects/ireport/articles/general/Educaional%20Theories%20Summary.pdf [accessed: 15/07/2022]

Kehm, B. (2001). The challenge of lifelong learning for higher education. International Higher Education, (22).

Kennedy, O.O. (2008). Reappraising the Work Skill Requirements for Building Technology Education in Senior Secondary School for Optimum Performance in Nigeria. 3(2). IDOSI Publications.

Kennedy, P. (2008). A guide to econometrics. John Wiley & Sons.

Kheza, J.P. (2018). *Designing a framework for the advancement of lecturer capacity in developing graduate attributes at a Technical and Vocational Education and Training College*. PhD Thesis, Central University of Technology Free State, Bloemfontein, South Africa.

Khosa, D.K., Croyle, S.L., Belage, E., LeBlanc, S.J., Haley, D.B. & Kelton, D.F. (2019). Dairy farmers' expectations and receptivity regarding animal welfare advice: A focus group study. Journal of dairy science, 102(8), 7385-7397.

Khotimah, R.P. & Masduki, M. (2016). Improving teaching quality and problem solving ability through contextual teaching and learning in differential equations: A lesson study approach. JRAMathEdu (Journal of Research and Advances in Mathematics Education), 1(1), 1-13.

Kim, B. (2006). *Social Constructivism from Emerging Perspective on Learning, Teaching and Technology*. The University of Georgia. Retrieved from "http://epltt.coe.uga.edu/index.php?title=Social_Constructivism"

Kiraly, D. (2000). *A social constructivist Approach to translate education: Empowerment from theory to practice*. First edition, Routledge, New York, USA.

Kivunja, C. & Kuyini, A.B. (2017). Understanding and applying research paradigms in educational contexts. International Journal of higher education, 6(5), 26-41.

Knaub, J. R. (1987). Practical Interpretation of hypothesis test. *The American Statistician*, 41(3): 246-247.

Knight, D., Hock, M., Skrtic, T.M., Bradley, B.A., & Knight, J. (2018). Evaluation of video-based instructional coaching for middle school teachers: Evidence from a multiple-baseline study. *The Educational Forum*, 76: 50-51.

Knight, J. (2018). *The impact cycle: What instructional coaches should do to foster powerful improvements in teaching*. Thousand Oaks, CA: Corwin

Knight, J. (2019). Students on the margins: how instructional coaching can increase engagement and achievement. *The Learning Professional*, 40(6): 28-32.

Knowles, M. S., Holton, E. F. & Swanson, R. A. (1998). The adult learner: The definitive classic in adult education and human resource development. Houston, TX: Gulf Publishing Company

Knowles, M.S. (1980) In: The modern practice of adult education: from pedagogy to andragogy. Revised and updated. 40-62. Chicago, Illinois, Association Press.

Koehler, M. & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. Contemporary issues in technology and teacher education, 9(1), 60-70.

Kolb, A. & Kolb, D. (2018). Eight important things to know about the experiential learning cycle. Australian educational leader, 40(3), 8-14.

Kolb, B. (1984). Functions of the frontal cortex of the rat: a comparative review. Brain research reviews, 8(1), 65-98.

Koo, B.H., Lee, C., Yilmaz, H.B., Farsad, N., Eckford, A. & Chae, C.B. (2016). Molecular MIMO: From theory to prototype. IEEE Journal on Selected Areas in Communications, 34(3), 600-614.

Korn, P. (2015). Why we make things and why it matters: The education of a craftsman. Random House.

Kraak, A. & Hall, G. (1999). Transforming Further Education and Training in South Africa: A Case Study of Technical Colleges in KwaZulu-Natal. Volume One: Qualitative Findings and Analysis.

Krathwohl, D.R. & Smith, L.N. (2005). *How to prepare a dissertation proposal*. New York: Syracuse University Press.

Kuany, M.D.W. (2012). *Improving my Professional Practice and Students' Learning Skills through Action Learning in Economics Education*. Master's Thesis, Islo and Akershus University College of Applied Sciences, South Sudan

Kuhn, T.S. (1962). Historical Structure of Scientific Discovery: To the historian discovery is seldom a unit event attributable to some particular man, time, and place. Science, 136(3518), 760-764.

Kumar, N. (2005). The power of power in supplier-retailer relationships. Industrial marketing management, 34(8), p.863.

Lekhu, M.A. (2013). Relationship between self-efficacy beliefs of science teachers and their confidence in content knowledge. Journal of Psychology in Africa, 23(1), 109-112.

Lerotholi Polytechnic. (2018): www.lesothoreview.com/content/education.training [accessed: 25/03/2019]

Lewis, S.M. (1994). The mechanism of V (D) J joining: lessons from molecular, immunological, and comparative analyses. Advances in immunology, 56, 27-150.

Lindeman, E. C. (1926). *The meaning of adult education*. New York, NY: New Republic.

Livingston, E.H. (2004). The Mean and Standard Deviation: What Does it All Mean. *Journal of Surgical Research,* 119(2): 117-123.

Lombard, K. & Grosser, M. (2008). Critical thinking: are the ideals of OBE failing us or are we failing the ideals of OBE?. South African journal of education, 28(4), 561-580.

Loynes, K (2017). TVET College Times: Special 50th Edition. [accessed 09/04/2021]

Lucas, B., Spencer, E. & Claxton, G. (2012). How to teach vocational education: A theory of vocational pedagogy, The City & Guilds Centre for Skills Development (01December 2012)

Lucas, B., Spencer, E., & Claxton, G. (2012). How to teach Vocational Education: A theory of Vocational pedagogy. https://www.academia.edu/36404510/How_to_teach_vocational_education_A_theory_of_vocational_pedagogy. [accessed: 14/04/2021] Lucas, B. & Spencer, E. (2015). *Remaking apprenticeships: powerful learning for work and life. London*, UK The University of Winchester.

Lucubrate Magazine. (2019) Learning through conversation in Vocational Education 20/08/2019. https://magazine.lucubrates.com/learning-through-conversation-in-vocational-education/ [accessed:01/05/2021]

Lucubrate magazine. (2019). Learning by listening, transcribing and remembering in Vocational Education, 29/08/2019. https://magazine.lucubrates.com/learning-by-listening-transcribing-and-remembering-in-vocational-education/ [accessed 17/05/2021]

Mabale, MB. (2012). *Challenges by Lecturers in Implementation of National Certificate Vocational Curriculum at Mopani South East Colleges*. MEd Dissertation. Turfloop: University of Limpopo.

Mabela, C.S. (2012). Mental well-being among the unemployed: The role of government intervention (Doctoral dissertation).

Maclean, R., & Pavlova, M. (2013). Vocationalisation of Secondary and Tertiary Education: Challenges and Possible Future Directions. In: Maclean R., Jagannathan, S., Sarvi, J. (eds) Skills Development for Inclusive and Sustainable Growth in Developing Asia-Pacific. Technical and Vocational Education and Training: Issues, Concerns and Prospects. Dordrecht: Springer.

Maeko, M.S.A. (2013). *Practical Activities in Civil Technology: A Case Study of Three Technical School in the Eastern Cape Province*. MEd Dissertation. Tshwane University of Technology.

Maeko, M.S.A. (2016). *Investigating the instructional practices of the practical component of Civil Technology for lecturer training in selected South African Institutions of Higher Learning.* D.Ed. Thesis, Tshwane University of Technology, Pretoria, South Africa

Magnus, G., Prinsloo, F., Bird, A. & Singh, A. (2013). Concept Document – Building a Technical and Vocational Education and Training System in South Africa. Pretoria: DHET.

Maharaj, R. & Mason, R.B. (2016). An exploratory critique of action learning in higher education in South Africa: Barriers and challenges. International Journal of Educational Sciences, 13(3), 298-309.

Maimane, JR. (2019). Student Teacher' perceptions of using a Blackboard as a tool in the teaching and learning environments. *International Journal of Innovation and Research Technology*, 4(2):157-163

Makgato, M. & Adelabu, F. (2019). Pedagogic Practices in Classrooms and Workshops at Technical and Vocational Education Training (TVET) Colleges. *International Journal of Management and Applied Science,* 5(9): 8-86

Makgato, M.M. (2000). The maize stalk borer. SA Grain (South Africa).

Makhwathana, R.M. (2007). Effects of curriculum changes on primary school educators at Vhumbedzi Circuit, Limpopo (Doctoral dissertation, Tshwane University of Technology).

Makole, KZ. (2015). *The Implementation of the National Certificate Vocational Programme at Tshwane North FET College*. MM Dissertation. Johannesburg: University of Witwatersrand.

Makura, A.H. & Nkonki, V.J. (2017). Constraints and Enablers of Articulation from Further Education and Training Colleges to universities: Perceptions from South Africa. *African Perspectives of Research in Teaching & Learning,* 1(1): 103-115

Makura, A.H., & Shumba, A. (2014). Drug abuse by learners in South Africa: a replication and extension study. Journal of Psychology in Africa, 24(2), 197-199.

Maluti TVET college prospectus. (2018/2019). https://southafricaportal.com/maluti-tvet-college-prospectus-pdf/ [accessed:16/11/2019]

Maree, J.G. (2009). Career counselling in the 21st century: South African institutions of higher education at the crossroads. South African Journal of Higher Education, 23(3), 436-458.

Marsick, V.J. & O'Neil, J. (1999). The many faces of action learning. Management learning, 30(2), 159-176.

Martin, B. (1999). *The schema, in Complexity: Metaphors, models, and reality*. Eds. New York, NY: Addison-Wesley

Martin-Erro, A., Dominguez, M. and Espinosa, M.D.M. (2016), March. The role of sketching in engineering design and its presence on engineering education. In Proceedings of INTED2016 Conference (3465-3471).

Marvakis, A. & Schraube, E. (2019). Against Bisected Learning. *Annual Review of Critical Psychology,* 16(1): 434-452

Marvakis, A. & Petritsi, I. (2014). Solidarity, not Adjustment: Activism learning as (self-) transformation. In Psychology in Education (129-143). Brill Sense.

Masoabi, C.S. (2015). *The Effect of Student Teams Achievement Divisions (STAD) as a Cooperative Learning Method in Cultural-Diverse School Setting*. Doctorate Degree thesis, Bloemfontein: University of Free State.

Matea, M.J. (2013). *The Evaluation of Skills Development Facilitation in Gauteng Public Further Education and Training (FET) Colleges*. DEd Thesis. University of South Africa.

Mbeki, T. (2004). State of the nation address by the President of South Africa, Thabo Mbeki to the joint sitting of the houses of Parliament, Cape Town.

Mbingo, S.J. (2006). *An investigation into the implementation of the new curriculum by foundation phase teacher*, MA (Curriculum Studies) Mini dissertation, Johannesburg: University of Johannesburg.

McCormick, R. (1997). Conceptual and procedural knowledge. International journal of technology and design education, 7(1), 141-159.

McGill, I. & Beaty, L. (2013). Action learning: A practitioner's guide. Routledge.

McGill, I. & Brockbank, A. (2004 rev ed). *The Action Learning Handbook: Powerful Techniques for Education, Professional Development and Training,* Abingdon, Routledge Falmer.

McMillan, J.H. (2000). Fundamental assessment principles for teachers and school administrators. Practical Assessment, Research, and Evaluation, 7(1), p.8.

McMillan, J.H. & Schumacher, S. (2006). *Research in Education. Evidence based inquiry*.6th edition. Boston: Pearson Education.

McNiff, J. (2013). Action research: Principles and practice. Routledge.

Meeder, R.L. (2012). *Andragogical Characteristics and Expectetions of University of Hawaii Adult Learners in a 3D Multi-user Virtual Environment*. PhD in Education Thesis. University of Hawaii.

Memon, N.A. & Alhashmi, M. (2018). Islamic pedagogy: Potential and perspective. In Islamic Schooling in the West (169-194). Palgrave Macmillan, Cham.

merSETA. (2019). Annual performance plan 2019/2020. merSETA-Annual-Performance-Plan-2019_2020.pdf [accessed: 25/11/2021]

Mmako, M.M. (2015). Employee Engagement: Evidence from TVET Colleges in South Africa. Proceedings of the 28th Annual Conference of the Southern African Institute of Management Scientists. Retrieved from http://www.up.ac.za/media/shared/643/ZP_Files/2016/Papers/hrl5_full.zp9_7846.pdf [accessed 04/05/2021]

Mokhothu, K., Maimane, J.R. & Rankhumise, M.P. (2015). The Integration of Technical Subjects in Civil Technology Curriculum with Special Reference to Further

Education and Training (FET) Technical Schools. *International Journal of Educational Sciences.* 9(1): 11-18.

Mokhothu, K.G. (2015). *The Integration of Technical Subjects in Civil Technology Curriculum with Special Reference to FET Technical Schools*. MEd Dissertation. Bloemfontein: Central University of Technology Free State.

Mokhothu, K.G. (2018) The effectiveness of demonstrational method in promoting student centred method: A case study. Education and New Development 6th Ed. Lisbon, Portugal. (322-325), ISBN: 978-989-99864-8-0

Mokhothu, K.G. (2019). Preventing Spectators in a Group-work: Civil Technology Student's perspective. Education and New Development 8th Ed. Lisbon, Portugal. (117-120), ISBN: 978-989-54312-5-0

Mokhothu, K.G. (2020). Investigating the impact of learn by doing Civil Technology class: Students Action. Education and New Development 8th Ed. Lisbon, Portugal. (164-167), ISBN: 978-989-54816-2-1

Mollo, P.P. (2019). *Exploring integration of Information Communications Technology (ICT) in Curriculum of Pre-service Teacher Education and Training in South Africa*. DEd Thesis. Bloemfontein: Central University of Technology Free State.

Montessori, M. (1912). A critical consideration of the new pedagogy in its relation to modern science.

Montessori, M. (1912). *The Montessori Method*. (A. E. George, trans). New York: Stokes.

Montessori, M. (1997). *Çocuk Eğitimi: Montessori Metodu* (Education for Child: Montessori Method). Çev. Güler Yücel, Özgür Yayınları, İstanbul.

Morgan, D. (1998). Practical strategies for combining qualitative and quantitative methods; Applications to health research. *Qualitative Health Research*, 8, 362–376.

Morrison, M. (2017). Action Learning and Action Learning Sets- Reg Revans. https://rapidbi.com/action-learning-sets/ [accessed: 15/01/2020]

Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing Research*, 40, 120–123.

Mosebekoa, M.J. (2019). *The Technical and Vocational Education and Training as The Basis for Societal Development: The Comparative Study of the Republic of South Africa and Lesotho*. D.Ed. Thesis. Central University of Free State, Bloemfontein, South Africa

Motheo TVET college prospectus. (2018/2019). https://www.google.com/search?q=Motheo+tvet+college+prospectus+2018+pdf+download&sca_esv=559523683&rlz=1C1GCEU_enZA1032ZA1032&ei=AYLmZP6kOY. [accessed: 16/11/2019]

Mtshali, T. I., Ramaligela, S. M., & Makgato, M. (2018). Challenges faced by Civil Technology teachers in preparing and presenting theory and practical lessons in South African schools: A case of five schools in the Ekurhuleni district. Magister in Education. Pretoria: Tshwane University of Technology.

Mtshali, T. I., Ramaligela, S. M., & Makgato, M. (2019). Usage of digital resources in Civil Technology: A case of teaching tools and equipment. African Journal of Science, Technology, Innovation and Development, 1–9.

Mtshali, T.I, (2021). Occupational training for TVET College Civil Engineering students in the modern era: Has anything changed? Journal of Technical education and training, 14(13): 82-91

Mtshali, T.I. (2020). Critical thinking skills for Civil Technology practical assessment task (PATs). *World Transactions on Engineering and Technology Education*,18(2): 237-241.

Mumford, A. (2006). Action learning: nothing so practical as a good theory. *Action Learning Research and Practice*, 3(01): 69-76

Mumford, D. (1995). Algebraic geometry I: complex projective varieties. Springer Science & Business Media.

Mumford, E. (1996). Systems design: ethical tools for ethical change. London: Macmillan.

Myers, M. D. (2009). *Qualitative research in business and management.* London: Sage Publications.

Nasir, S.B. (2012). Strategy to Revitalize Technical and Vocational Training (TVET): Management Perspectives. *Global Journal of Management and Business Research*, 12(1): 10-14

Ndebele, H. (2020). Exploring the challenges of information and communication technology localization in South African higher education: a language management approach. *International Journal of Multilingualism*, DOI: 10.1080/14790718.2020.1717496

Njabili, U.E. (2004). *Empirical test of the AOR approach*. Unpublished PhD thesis, University of South Africa, Pretoria

Nowak-Fabrykowski, K. (2018). Current Trends in Teacher Education and Evaluation in the USA. International trends in preparation of early childhood teachers in a changing world, p.19.

NQF South Africa explanation (2017), Created: 2 March 2017 http://South_African_Qualifications_Authority#/media/File:NQF_explanation_graph.svg [accessed: 10/04/2019]

NQF South Africa explanation (2017). http://South_African_Qualifications_Authority#/media/File:NQF_explanation_graph.svg [accessed: 10/04/2019]

Ntshaba, L.P. (2012). *A study of Technology Education Instructional Practices in Grade nine Classrooms: A Case Study of Three Senior Secondary Schools in the King William's Town District.* MED dissertation. University Fort Hare.

O'Neil, J & Marsick, V.J. (2007). *Understanding Action Learning*. American Management Association, New York, USA.

Okeke, C.C. & Van der Westhuize, G. (2020), Learning from professional conversation: A conversation analysis study. *South African Journal of Education*, 40(1): 1-10

Olsson, M., Mozelius, P. & Collin, J. (2015). Visualisation and gamification of e-learning and programming education. Electronic journal of e-learning, 13(6), pp452-465.

Palincsar, A.S. (1998). Social constructivism perspective on teaching and learning, *Annual Review of Psychology*, 49:345-75.

Pallant, J. (2007). *SPSS Survival Manual: A Step by Step Guide to Data Analysis using SPSS for Windows.* New York: Open University Press.

Papier, J. (2008). *Report on the training of FET college lecturers in* South *Africa, England and other international contexts for the British Council EAP Project.* Unpublished report

Papier, J. (2010). From policy to curriculum in South African vocational teacher education: A comparative perspective. *Journal on Vocational Education* & *Training,* 62(2): 153-162

Papier, J. (2011). Vocational teacher identity: Spanning the divide between the academy and the workplace. *Southern African Review of Education,* 17: 101-119 André Portela Souza

Pedler, M.J. (1991), "Questioning ourselves", in Pedler, M. (Ed.), Action Learning in Practice, 2nd ed., Gower, Brookfield, VT

Pew, S. (2007). Andragogy and pedagogy as foundational theory for student motivation in higher education. InSight: a collection of faculty scholarship, 2, 14-25.

Piaget, J. (1970). *Genetic epistemology.* New York, NY: Columbia University Press.

Piaget, J. (1971). *Science of education and the psychology of the child*. New York: Viking Press

Piaget, J. (1973). *To understand is to invent*. New York, NY: Viking Press.

Piaget, J. (1977). *Equilibration of cognitive structures*. New York, NY: Viking Press.

Pitso, A.R.M. (2018). Assessing the effects of inadequate human capital affecting brand image of the hospitality and tourism industry (Doctoral dissertation).

Poth, C., & Munce, S. E. P. (2020). Commentary—Preparing today's researchers for a yet unknown tomorrow: Promising practices for a synergistic and sustainable mentoring approach to mixed methods research learning. International Journal of Multiple Research Approaches, 12(1), 56-64. doi:10.29034/ijmra.v12n1commentary

Powell, K.C. & Kalina, C.J. (2009). Portal TESOL and Constructivism: Language. COMMUNITIES OF PRACTICE, p.34.

President of Republic of South Africa. (2013). Protection of Personal Information Act, 2013 (No.4 of 2013). Government Gazette, 37067:581, 26 November.

Rahaman, A. (2013). The influence of an action learning process on transformative learning and leadership behaviour in a government agency (Doctoral dissertation, The George Washington University).

Revans, R.W. (1980), Action Learning: New Techniques for Managers, Blond & Briggs, London.

Revans, R.W. (1982), The Origins and Growth of Action Learning, Chartwell-Bratt, Bromley

Rhoda, A.R. (2011). The fivefold openness of the future. God in an open universe: Science, metaphysics, and open theism, 69-93.

Rijuan, L. (2009). Problems encountered with the teaching of computer applications technology and information technology at senior secondary school level: a managerial approach (Doctoral dissertation, Bloemfontein: Central University of Technology, Free State).

Rimanoczy, I. (2009). Bringing action reflection learning into action learning. *Action Learning: Research and Practice*, 5(2):185-192.

Rimanoczy, I. & Turner, E. (2008). Action Reflection Learning: solving real business problems by connecting learning with earning, US, Davies-Black Publishing.

Roberts, M. S. (2007). *Applying the Andragogical Model of Adult Learning: A Case Study of the Texas Comptriller's Fiscal Management Division.* Texas State.

Robinson, K. (2001). Mind the gap: The creative conundrum. Critical Quarterly, 43(1), 41-45.

Ropohl, G. (1999). Philosophy of socio-technical systems. Society for Philosophy and Technology Quarterly Electronic Journal, 4(3), 186-194.

Rutherford-Hemming, RN. (2012). Simulation Methodology in Nursing Education and Adult Learning Theory. *Adult Learning*, 23(3): 129-137 Sample of Bachelor of Science in Civil Engineering. (2017). https://ched.gov.ph/wp-content/uploads/2017/10/Sample-Curricula-Bachelor-of-Science-in-Civil-Engineering.pdf [accessed 11/10/2021]

Salkind, N.J. (2014). 100 questions (and answers) about statistics. SAGE Publications.

Saville, N. (2012). Applying a Model for Investigating the Impact of Language Assessment within Educational Contexts: The Cambridge ESOL Approach. Cambridge ESOL: Research Notes 50.

Scriven, M., & Paul, R. (2004). Defining critical thinking. Retrieved November 28, 2005, from http://www.criticalthinking.org/aboutCT/definingCT.shtml.

Serumu, I. (2015). Challenges of Implementing Technical and Vocational Education and Training (TVET) Curriculum in Delta State Colleges of Education. *Global Advance Research of Educational Research and Review*, 4(5): 072-080.

Seward, L. (2016). Using action learning as a strategy for developing nurses in their professional practice: a participative approach to the theory and practice of evaluation enquiry (Doctoral dissertation, University of Southampton).

Shannon-Baker, P. (2018). A multicultural education praxis: Integrating past and present, living theories, and practice. International Journal of Multicultural Education, 20(1), 48-66.

Sharp, J.A., Peters, J. & Howard, K. (2017). The management of a student research project. Routledge.

Shi, Z., Luo, G. & He, L. (2017). International Journal of Emerging Technologies in Learning, 12 (2):16-26, 10.3991/ijet.v12i02.6681

Shulman, L.S. & Shulman, J.H. (2004). How and what teachers learn: A shifting perspective. *journal of Curriculum Studies,* 36(2): 257-271.

Shunk, R. (2000). A cardiac physical examination curriculum. Academic Medicine, 75(5), 552-553.

Singer, J. L. (1995). *Mental processes and brain architecture: Confronting the complex adaptive systems of human thought (An overview), in the mind, the brain, and complex adaptive systems.* (Eds.) New York, NY: Addison-Wesley

SIPs. (2012). Progress report. https://www.dhet.gov.za/Commissions%20Reports/SIPS%20March%2012%20close%20out%20report.pdf. [accessed: 02/11/2019]

Skaar, K. (2019). Is Augmented Reality a useful tool in Vocational Education? 01/09/2019. https://magazine.lucubrates.com/is-augmented-reality-a-useful-tool-in-vocational-education/ [accessed 17/05/2021]

Skule, S. (2004). Learning conditions at work: a framework to understand and assess informal learning in the workplace. International journal of training and development, 8(1), 8-20.

Slade, E.M., Riutta, T., Roslin, T. & Tuomisto, H.L. (2016). The role of dung beetles in reducing greenhouse gas emissions from cattle farming. Scientific reports, 6(1), 1-9.

Smith, M.E., Thorpe, R. & Jackson, P. (2008). Management research. LA: SAGE.

Sondlo, A. & Ramnarain, U. (2021). The factors influencing the pedagogical orientations of the final year Physical Science pre-service teachers. Education and New Development 9th Ed. Lisbon, Portugal. (501-505), ISBN: 978-989-54815-8-3

Souza, A.P., Lima, L., Arabage, A., Camargo, J., De Lucena, T. and Soares, S. (2015), June. Vocational Education and Training in Brazil. In Knowledge sharing forum on development experiences: Comparative Experiences of Korea and Latin America and Caribbean.

Stephan, P. (2015). How economics shapes science. Harvard University Press.

Sulastri, F.N.M. (2020). Problem Based Learning Model through Constextual Approach Related with Science Problem Solving Ability of Junior High School Students, *Integrative Science Education and Teaching Activity Journal.* 1(1): 50-58.

Sutherland, P. (1998). *Adult Learning: A Reader* (New ed). Routledge.

Tashakkori, A. & Teddlie, C. (2007). *Handbook of mixed methods in social and behavioral research*. Thousand Oaks, CA: Sage.

Tavakol, M & Dennick, R. (2011). Making Sense of Cronbach's Alpha. *International Journal of Medical Education,* 2:53-55. Editorial.

Teaching Approaches: www.openuni-clsu.edu.ph/openfiles/modules/ed710/lesson4.doc [Accessed: 7/12/2016] Technical and Vocational Training in Lesotho: www.lesothoreview.com/content/education.training [Acceded: 28/03/2018]

Teddlie, C., & Tashakkori, A. (Eds.) (2009). Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches In the Social and Behavioral Sciences. Sage Publications

Teis, N.J.P. (2010). *Problem-solving Teaching Strategies in Civil Technology in the Free State*. MEd Thesis, Unpublished. Bloemfontein: University of the Free State.

Terada, Y. (2019). The Science of Drawing and Memory. George Lucas Educational Foundation. 18 February. US: https://www.edutopia.org/article/science-drawing-and-memory [accessed 04/04/2021]

Terblanche, N.N.H., Albertyn, R.M. & van Coller-Peter, S. (2017). Designing a coaching intervention to support leaders promoted into senior positions. SA Journal of Human Resource Management, 15(1), 1-10.

Thorndike, E.L. (1898). Animal intelligence: An experimental study of the associative processes in animals. The Psychological Review: Monograph Supplements, 2(4), p.i.

Thorndike, E.L. (1906). An empirical study of college entrance examinations. Science, 23(596), 839-845.

Timire, J. & Teis, N. (2019). Practical Skills Competences for Mechanical Technology Student Teachers in a TVET Environment. *International Journal of Latest Trends in Engineering and Technology,* Special issue: 35-49

Torabi, F., Warnell, G. and Stone, P., 2019. Recent advances in imitation learning from observation. arXiv preprint arXiv:1905.13566.

Truskanov, N. & Lotem, A. (2017). Trial-and-error copying of demonstrated actions reveals how fledglings learn to 'imitate' their mothers. Proceedings of the Royal Society B: Biological Sciences. 284. 20162744.

TVET Colleges Explained: https://educonnect.co.za/tvet-colleges-explained/ [accessed 01/06/2018]

TVET country profile Brazil (2018). https://unesdoc.unesco.org/ark:/48223/pf0000373104 [accessed: 15/02/2019].

Umalusi (2017). Report on the quality assurance of the November 2017 Technical and Vocational Education and Training Examinations and Assessment. Retrieved from http://www.umalusi.org.za/list.php?type=Quality%20Assurance%20Reports. [accessed: 21/08/2020]

Umalusi. (2017). Certification and Verification. https://www.umalusi.org.za/services/verification/#1560327730757-c29086ad-d332 [accessed 21/08/2020]

Umunadi, E.K. (2014). Relational Study of Technical Education in Scotland and Nigeria for Sustainable Skill Development. International Journal of Higher Education, 3(1), 49-57.

UNESCO. (2002). *Technical and vocational education and training for the twenty-first century*. UNESCO and ILO recommendations, UNESCO, Paris; ILO, Geneva

United Nations Educational, Scientific and Cultural Organization. (2017) http://www.unesco.org/new/en/media-services/single view/news/brazils_sectorial_funds_face_challenges_in_their_mission/ (accessed:17/04/2019.)

Uzoagulu, A. E. (1992). Towards an Effective Equipment Management (EEM) in Schools for Economic and Technological Self-reliance. A paper read at the 7th annual conference of the NVA held at FCE (T), November 25th – 28th, Umunze, Nigeria. Unpublished.

Van der Walt, A.J. (2009). Property in the Margins. Bloomsbury Publishing.

Van der Walt, P N. (2008). Civil Technology for Grade 11. 1st Edition. Bloemfontein: Van der Walt Publishers.

Van der Walt, PN. (2007). Civil Technology for Grade10. 2nd Edition. Bloemfontein: Adonia Trust.

Van Niekerk, E., Ankiewicz, P. & Swardt, E. (2010). A process-based assessment framework for technology education: A case study. *International Journal of Technology Education*, 20(2):191-215

Van Teijlingen, E., Rennie, A.M., Hundley, V. & Graham, W. (2001). The importance of conducting and reporting pilot studies: the example of the Scottish Births Survey. *Journal of Advanced Nursing*. 34: 289-295.

Van Teijlingen, E.R. & Hundley, V. (2001). The importance of pilot studies.

Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. MIS Quarterly, 37(1), 21-54.

Vergara, D., Rubio, M.P., Prieto, F. & Lorenzo, M. (2016). Enhancing the teaching/learning of materials mechanical characterization by using virtual reality. *J. Mater. Educ*, *38*(3-4), 63-74.

Vilaythong, V. (2011). *The Role of Practical Work in Physics Education in Lao PDR*. Sweden: Print and Media, Umeå University.

Vollenhoven, G. (2016). Workplace learning experiences of TVET College candidates in learnership programmes: An exploration of the workplace learning environment.

Volpert, V.A. & Volpert, A.I. (1999). Existence and stabilty of multidimensional travelling waves in the monostable case. Israel Journal of Mathematics, 110(1), 269-292.

Vu, P. & Feinstein, S. (2017). An exploratory multiple case study about using game-based learning in STEM classrooms. International Journal of Research in Education and Science, 3(2), 582-588.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.

Vygotsky, L.S. (1987). The collected works of LS Vygotsky: Problems of the theory and history of psychology (Vol. 3). Springer Science & Business Media.

Wagner, D.R., Castañeda, F., Bohman, B. & Sterr, W. (2019). Comparison of a 2D iP ad application and 3D body scanner to air displacement plethysmography for measurement of body fat percentage. Journal of Human Nutrition and Dietetics, 32(6), 781-788.

Watson, W.E., Johnson, L. & Zgourides, G.D. (2002). The influence of ethnic diversity on leadership, group process, and performance: An examination of learning teams. International Journal of Intercultural Relations, 26(1), 1-16.

Whitton, B.A. ed. (2012). Ecology of cyanobacteria II: their diversity in space and time. Springer Science & Business Media.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Child Psychiatry,* 17, 89−100.

Woodruff, A. (2017). How do we learn by watching? 26/06/2017. https://npjscilearncommunity.nature.com/posts/18081-how-do-we-learn-by-watching. [Access 13/06/2021]

Xu, B., Chen, N. & Chen, G. (2020). Effects of Teacher role on Student Engagement in WeChat-Based online Discussion Learning. *Computer & Education*, 157(1039560):1-11.

Yachin, T. & Barak, M. (2019), May. Promoting healthy nutrition through educational escape games. In InSITE 2019: Informing Science+ IT Education Conferences: Jerusalem (217-226).

Yackel, E. (1995). *Children's talk in inquiry mathematics classrooms, in the emergence of mathematical meaning: Interaction in classroom cultures*. (Eds.). Hillsdale, NJ: Lawrence Erlbaum.

Yangben, P. N. & Seniwoliba, A. J. (2014). Career challenges in construction craft training in Technical Vocational Education and Training in Ghana [Online]. *International Journal of Vocational and Technical Education,* 6(3):13-29. Available from http://www.academicjournals.org/IJVTE. [access 20/06/2021]

Yew, E.H. & Goh, K. (2016). Problem-based learning: An overview of its process and impact on learning. Health professions education, 2(2), 75-79.

Yulindar, A., Setiawan, A. & Liliawati, W. (2018), May. Enhancement of problem solving ability of high school students through learning with real engagement in active problem solving (REAPS) model on the concept of heat transfer. In Journal of Physics: Conference Series (Vol. 1013, No. 1, p. 012052). IOP Publishing.

Yusti, I, Ganefri, & Ridwan. (2017). Design of Simulator for Replacement of Tools Practice Digital Engineering in the Vocational School. International Conference on Technical and Vocation Education and Training 4th Ed, Padang, Indonesia: (257-259). ISBN 978-602-1178-21-8

Zhang, J. & Ohn-Bar, E. (2021). Learning by watching. 2021: 1-11 arXiv:2106.05966v1 [cs.CV].

APPENDICES

ANNEXURE A: RESEARCH QUESTIONNAIRE

Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training in Free State Province

Questionnaires for TVET Civil Engineering Construction Lecturers

SECTION A

Please make a cross**(x)** at appropriate block.

1	**GENDER**	Male	Female	**RACE**	Black	Coloured	White	Other	
2	**AGE**	Under 25	25-35	36-45	46-55	Over 56			
3	**Years of experience**	Under 3	3-6	7-10	Over 11				
4	(Fill in): **Teaching qualifications / other**								
5	(Fill in): **Major subjects on teaching/ other qualification**								

SECTION B

Indicate the degree to which you agree or disagree with the statement. Respond by making a cross **(x)** over the number that match your answer.

Strongly agree	**1**
Agree	**2**
Disagree	**3**
Strongly disagree	**4**

A	**Teaching approaches used in TVET colleges engineering studies curriculum**				
1	I know the concept, teaching and learning approaches.	**1**	**2**	**3**	**4**
2	I understand different teaching and learning approaches.	**1**	**2**	**3**	**4**
3	I was trained how to apply different teaching and learning approaches.	**1**	**2**	**3**	**4**
4	I use student-centred approaches for teaching and learning	**1**	**2**	**3**	**4**
5	I only apply what is prescribed in the textbook or curriculum for teaching and learning in engineering studies.	**1**	**2**	**3**	**4**
6	I prefer interactive approaches to teaching and learning.	**1**	**2**	**3**	**4**

7	I prefer to use lecturer-centred approach in my class	**1**	**2**	**3**	**4**
8	I mostly use constructivist/Pragmatism Approach (for example means thinking of or dealing with problems in a practical way, rather than by using theory or abstract principles).	**1**	**2**	**3**	**4**
9	I mostly use action learning approach in my class.	**1**	**2**	**3**	**4**

B	**The extent lecturers use action learning approaches in Civil Engineering and Construction studies at TVET colleges**				
10	I understand the difference and relationship between approaches and methods of Action Learning.	**1**	**2**	**3**	**4**
11	I use case studies as a teaching and learning technique frequently in my class.	**1**	**2**	**3**	**4**
12	I use simulations frequently as a teaching and learning technique in my class.	**1**	**2**	**3**	**4**
13	I use projects frequently as a technique to teach other aspect of the content.	**1**	**2**	**3**	**4**
14	I use research as a teaching and learning technique frequently to promote critical thinking in my class.	**1**	**2**	**3**	**4**
15	I use demonstration method as the main teaching method in my class.	**1**	**2**	**3**	**4**

16	I use problem solving method to teach integration of content knowledge and practical work in my class.	**1**	**2**	**3**	**4**
17	I use technological process method to teach integration of content knowledge and practical work in my class.	**1**	**2**	**3**	**4**
C	**Sequence lecturers use to assess content knowledge and practical work at TVET colleges**				
18	I use Oral test as part of content knowledge formal assessment in my class	**1**	**2**	**3**	**4**
19	Oral test reveal student content knowledge understanding without limits (freedom of expression than writing).	**1**	**2**	**3**	**4**
20	Oral test serves as report back and reflection after group discussions (separate the two) or lesson.	**1**	**2**	**3**	**4**
21	I use written test to assess content knowledge in my class.	**1**	**2**	**3**	**4**
22	I use simulation to assess practical work readiness of the students.	**1**	**2**	**3**	**4**
23	Simulation plays role of preparatory assessment toward the evaluation of authentic practical tasks.	**1**	**2**	**3**	**4**
24	I use practical test to assess students' skills and values on authentic practical tasks.	**1**	**2**	**3**	**4**

25	Practical test helps me to recognize the level and quality of practical skills acquired by students.	**1**	**2**	**3**	**4**
26	I use projects to assess students' group work qualities and abilities.	**1**	**2**	**3**	**4**
27	Project technique promotes team work and awareness of world of work in building environment.	**1**	**2**	**3**	**4**
28	I use practical assessment task to evaluate the integration (application) of content knowledge into authentic practical tasks.	**1**	**2**	**3**	**4**
29	Practical assessment task gives a student freedom of creativity and critical thinking.	**1**	**2**	**3**	**4**
30	Student portfolio of learning process experience demonstrate student's fitness to practice.	**1**	**2**	**3**	**4**
D	**Challenges that TVET lecturers experience during application of ALA**				
31	Action learning approach requires me to study how to use it before I could implement in my classroom.	**1**	**2**	**3**	**4**
32	Action learning approach techniques require long preparation periods. Secondly, ALA techniques require extended classroom time during implementation. Consuming	**1**	**2**	**3**	**4**

33	TVET college curriculum and time table does not provide sufficient time to implement all ALA techniques.	**1**	**2**	**3**	**4**
34	My class is overcrowded to apply action learning approaches	**1**	**2**	**3**	**4**
35	I have a fully equipped and functional workshop that can accommodate all my students.	**1**	**2**	**3**	**4**
36	I can demonstrate any civil engineering construction practical work to my class.	**1**	**2**	**3**	**4**
37	Students do not value college work they take it as bridging to University entrance	**1**	**2**	**3**	**4**
38	Trade testing stations are few in the Free State province for us to collaborate with for the enhancement of practical skills and competencies of our students.	**1**	**2**	**3**	**4**
39	Trade testing stations are expensive and that demotivate student's moral of learning	**1**	**2**	**3**	**4**
E	**Lecturers capacitated to use ALA to produce quality work at TVET colleges – pertaining to the integration of content knowledge and practical work**				
40	I would like to have Industrial exposure every term.	**1**	**2**	**3**	**4**

41	I would like to attend practical refresher courses annually.	**1**	**2**	**3**	**4**
42	I would like to register and further my studies in education.	**1**	**2**	**3**	**4**
43	I need training in action learning approach techniques to enhance teaching and learning in Civil Engineering classes.	**1**	**2**	**3**	**4**
44	I recommend cluster subject group to assist each other	**1**	**2**	**3**	**4**
45	Theory classes and practical workshop should be well equipped	**1**	**2**	**3**	**4**
46	Time tables should allow ample time for integration of Content Knowledge and Practical Work.	**1**	**2**	**3**	**4**
47	Qualified laboratory technicians should be employed on fulltime based contracts.	**1**	**2**	**3**	**4**
48	Civil Engineering Construction NATED 191 courses academic duration should be changed from 3 months to 6 months or a year for the inclusion of practical work within the college.	**1**	**2**	**3**	**4**
49	To ensure quality work of integrating content knowledge and practical, I recommended ALA Civil Engineering Construction NCV subjects	**1**	**2**	**3**	**4**

ANNEXURE B: RESEARCH INTERVIEW QUESTIONS

SEMI-STRUCTURED INTERVIEW QUESTIONS

i. What teaching approaches are used in TVET colleges engineering studies curriculum?
ii. To what extent are lecturers using action learning approaches in Civil Engineering and Construction studies at TVET colleges?
iii. What sequence lecturers use to assess content knowledge and practical work at TVET colleges?
iv. What challenges do TVET lecturers experience during application of ALA?
v. How can lecturers be capacitated to use ALA to produce and integrate quality work at TVET colleges?

ANNEXURE C: PARTICIPANTS CONSENT LETTER AND FORM

Central University of Technology

Private Bag X20539

BLOEMFONTEIN

9300

Informed Consent

INVITATION TO PARTICIPATE

Dear Participants

PROJECT TITLE: **Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training in Free State Province**

RESEARCHER: KG Mokhothu

LETTER OF CONSENT TO PARTICIPATE IN RESEARCH

Primary researcher: Mr KG Mokhothu, M Ed (Education)

Promoter: Dr S Masoabi CS, Central University of Technology Free State, Bloemfontein

Co-Promoter: Prof Makura AH, Central University of Technology Free State, Bloemfontein

I would very much appreciate it, if you could participate in my research project – for my Doctor of Education studies (D.Ed.) – Central University of Technology. I am Mr MOKHOTHU KHOJANE GEOFFREY Civil Technology Lecturer at the Central University of Technology in Bloemfontein and a registered student in the Doctor of Education programme with the Central University of Technology Free State student number: 2080866225. Please read this form carefully, should you have questions or concerns please contact Mr Khojane G Mokhothu, 071 054 9604/ kmokhothu@cut.ac.za

PURPOSE OF THE STUDY

The purpose of the study is to explore the use of action learning as a teaching approaches with reference to content knowledge and practical work in Civil Engineering Construction studies at TVET colleges and to review existing models.

PROCEDURES

You will be requested to, complete questionnaire, answer interview questions, and where necessary to show the researcher school workshops and classrooms to observed structural setting of where teaching and learning occurs. Participants will have maximum of five days to complete and return the questionnaire. It is expected that this interview will take on average anywhere from 30 to 60 minutes to complete.

POTENTIAL RISKS AND DISCOMFORTS

There are no expected risks or discomforts associated with participating in this study. As the study will adhere with precautionary measures of COVID/19.

PAYMENT FOR PARTICIPATION

There is no compensation for participating in this research. Only the findings of the final study report will be presented, if required by the College internal reflection.

CONFIDENTIALITY

Any gathered data in connection with this study from you, will remain confidential. All responses will be combined in a way that assures anonymity. No names of the participates and institutions will be mentioned in a final report of this study. Your cooperation and participation are greatly valued as there is a dire need to enhance integration of content knowledge and practical work at TVET college through action learning approaches.

PARTICIPATION AND WITHDRAWAL

While I greatly appreciate your consent in this study and the valuable contribution you can make, participation remains voluntarily and in is no compulsory. If you choose to take part and issue arises that causes discomfort, you may cease your participation at any time. Please feel free to contact me directly to discuss it.

Please fill in and return this page. Keep this letter above for future reference

……………………………………………………………………………………………
…………………………………………………………….

PROJECT TITLE: **Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training in Free State Province**

RESEARCHER: **Mr KG Mokhothu**

……………………………………………………………………………………………
…………………………………………………………….

Participant

Name and Surname: ____

Contact number: ____

☐ hereby give free and informed consent to participate in the aforementioned research study.

☐ I understand what the study is about, why I am participating and what are the risk and benefits

☐ I give the researcher a permission to use the all types of data gathered from my participation, subject to the information indicated in the above latter.

Signature: _______________________Date: _____ /____ / 20____

ANNEXURE D: ETHICAL CLEARANCE CERTIFICATE

Central University of Technology, Free State

RESEARCH ETHICS APPROVAL

Date: 29 November 2021

This is to confirm that ethical clearance has been provided by the Faculty Research and Innovation Committee **[01/06/16]** in view of the CUT Research Ethics and Integrity Framework, 2016.

Ethical clearance number: **HREIC 14/19/07 ST. D.Ed**

Applicant's Name and student number	KG Mokhothu 208066225
Supervisor's Name for Student Project	Dr C Masoabi Prof A Makura
Level of Qualification for Student's Project	D.Ed
Tittle of research project	Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training in Free State Province
FRIC approval number	FRIC 14/19/07

All conditions as set out below have to be met as set out in your LS 262 a form.
As this research focuses primarily on human beings you will be ethically responsible for:

- protecting the rights and welfare of the participants;
- gaining the trust and co-operation of all the participants with the assurance that the information collected will be kept confidential;
- informing the participants from the outset that their participation will be voluntary, and that the data collected will be conducted with the consent of the relevant authorities and the participants;
- adhere to the principles of rigorous data collection, analysis and interpretation consistent with the design of the study;
- keeping a data trail for possible auditing purposes and safe-keeping of raw data for a period of three years after publication of the results/findings;
- respecting the confidentiality of the data.

We wish you success with your research project.

Regards

Prof JW Badenhorst
(Chairperson: Faculty of Humanities Research Ethics and Integrity Committee)

ANNEXURE E: PERMISSION APPROVALS FROM TVET COLLEGES

higher education
& training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

Flavius Mareka
TVET
College
Embrace your Future

Enquiries: Tema MJ
Email: temaj@fmtvet.co.za
Contact: 016 976 0829

August 17, 2021

KG Mokhothu
kmokhothu@cut.ac.za

Dear Mr Mokhothu

RE: PERMISSION TO CONDUCT RESEARCH AT FLAVIUS MAREKA TVET COLLEGE

Kindly be advised that permission has been granted for you to conduct research at Flavius Mareka TVET College on the topic ***"Using action learning approaches to enhance pedagogic practices in Civil Engineering and Construction studies at Technical Vocational Education and Training in the Free State Province"*** as stated on your request.

This permission is subject to your compliance with the ethical considerations as stipulated in your application as well non-interference with teaching and learning activities at the College.

Flavius Mareka TVET College wishes you triumph in your studies and will enthusiastically await to be informed of the result of your research.

Yours faithfully

FM Chechile
PRINCIPAL (Acting)

Central Office
c/o Fichardt & Bell Street
P/Bag X2009
Sasolburg
1947
Tel: (016) 976 0815
Fax: (016) 973 1618

Kroonstad Campus
Bukes Street
P/Bag X22
Kroonstad
9500
Tel: (056) 212 5157
Fax: (056) 212 7815

Mphohadi Campus
Tang Street
P/Bag X22
Kroonstad
9500
Tel: (056) 214 1341
Fax: (056) 214 2691

Sasolburg Campus
c/o Hertzog Rd. & Fraser Street
P/Bag X2009
Sasolburg
1947
Tel: (016) 976 0829
Fax: (016) 973 1618

Online Resources
Website:
www.flaviusmareka.net
Facebook:
facebook.com/fmtvet
Twitter:
@FlaviusTVET

Central Office
Mampoi Road
Private Bag X870
Witsieshoek
9870
Tel: 058 713 6100
Fax: 058 713 6975
officeman.cent@malutitvet.co.za

MALUTI TVET COLLEGE

higher education & training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

LT-ADM-Letterhead-2014-R01 2017-09-15 Page 1 of 1 KLM/klm

Enquiries: Molete MM 28 September 2021

TO WHOM IT MAY CONCERN

Re: Mr MOKHOTHU KG-LETTER OF APPROVAL TO CONDUCT RESEARCH AT MALUTI TVET COLLEGE

This communique confirms that Maluti TVET College has granted **approval** for you to conduct research on **Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical and Vocational Education Training Colleges.** We are convinced that through the study the College will benefit hence the support.

We wish you all the best in your studies.

Regards.

Mr ME Tsotetsi
Acting Principal

Cell : **082 8066 181**
Tel : **058 713 6100**
Website : **www.malutitvet.co.za**
e-mail : **academic.dep@malutitvet.co.za**

Central Office
Mampoi Road
Private Bag X870
Witsieshoek
9870
Tel: 058 713 6100
Fax: 058 713 6975
officeman.cent@malutitvet.co.za

MALUTI TVET COLLEGE

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MOTHEO TVET COLLEGE

CENTRAL OFFICE

Ref: K. Mokhothu

Using Action Learning Approaches to Enhance Pedagogic Practices in Civil Engineering and Construction Studies at Technical Vocational Education and Training in Free State Province

The College has evaluated your request and has decided to grant you permission to undertake the above research.

As part of your research it is noted that you will distribute questionnaires to Civil Engineering Lecturers and conduct an interview with Mr Maqondeni at Hillside View Campus. You are advised to obtain further permission from the participants before commencing with your study.

The topic of your research is of great interest to the College and will therefore be appreciated if you could share the findings of your research with the College upon completion.

Yours faithfully

Prof MDM Phutsisi

Principal| Motheo TVET College

Date: 22/07/2021

"The Gateway to Employability"

Central University of Technology, Free State

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

GOLDFIELDS TVET COLLEGE

28 July 2021

PRIVATE BAG X 95
WELKOM
9460

admin@goldfieldstvet.edu.za
www.goldfieldstvet.edu.za

CENTRAL OFFICE
36 BUREN STREET
FLAMINGO PARK
WELKOM
9459

TEL: 057 910 6000
FAX: 057 392 1082

TOSA CAMPUS
14107 NDAKI ROAD
THABONG
WELKOM
9463

TEL: 057 910 6700
FAX: 057 395 1304

WELKOM CAMPUS
CNR PETRUS BOSCH & TORONTO ROAD
JAN CILLIERS PARK
WELKOM
9459

TEL: 057 910 1600
FAX: 057 353 2298

PRIVATE BAG X 95
WELKOM
9460

admin@goldfieldstvet.edu.za
www.goldfieldstvet.edu.za

Att: Mr KG Mokhothu
Central University of Technology Free State
Private bag x20539
Bloemfontein
9300

Dear Mr Mokhothu

RE: Permission to conduct research at Goldfields TVET College

The above matter bears reference:

The office of the Principal acknowledges receipt of your request to do research data collection at Goldfields TVET College.

Therefore, the Principal approves your request to conduct research in the public Colleges. Kindly note that as the country is placed at adjusted level 3 Goldfields TVET College is practicing a strict covid 19 protocol.

For enquiries contract Mr MG Pheko, Assistant Director: Human Resource Management at (057) 910 6000 or mokoai@goldfieldstvet.edu.za during office hours.

MR FS MAHLANGU
PRINCIPAL: GOLDFIELDS TVET COLLEGE

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ANNEXURE F: LANGUAGE EDITOR AND PROOFREADING

Central University of Technology, Free State

PROF EDIT MBA

Marieta Grundling (MBA)

366 Rosemary Street
Grootfontein Country Estates
Pretoria, 0081
081 354 1596
edit@profeditmba.co.za
11 November 2022

To Whom It May Concern

This serves to confirm that the dissertation: **USING ACTION LEARNING APPROACHES TO ENHANCE PEDAGOGIC PRACTICES IN CIVIL ENGINEERING AND CONSTRUCTION STUDIES AT TECHNICAL VOCATIONAL EDUCATION AND TRAINING COLLEGES IN FREE STATE PROVINCE** by **Khojane Geoffrey Mokhothu** was edited. The language, presentation, and referencing system (both in-text and against the Reference List), were checked and corrected.

M Grundling
11 November 2022