An Integrated Framework to Address the Work Integrated Learning Challenges Faced by Engineering Diploma Students at Select South African Universities of Technology

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Supervisor: Professor Krishna Govender

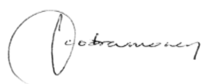
Declaration of Authenticity

I declare that the research project, An Integrated Framework to Address the Work Integrated Learning Challenges Faced by Engineering Diploma Students at Select South African Universities of Technology, is my own work and that each source of information used has been acknowledged by means of a complete Harvard Referencing System. This thesis has not been submitted before for any other research project, degree, or examination at any university.

27 February 2024

Durban, KwaZulu Natal, South Africa

Da Vinci Information



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Abstract

The South African Universities of Technology (UoT) encounter a range of challenges in securing readily available and suitable placement opportunities for learners to complete the Work-Integrated Learning component of the engineering-related qualification, thus delaying graduation, and consequently increasing the labour market demand for technicians and engineers. For optimal productivity, the engineering and industrial technology industries depend on a highly competent and qualified technical personnel to guarantee high uptime of engineering machinery and equipment. The design and execution of projects in industrial processing and manufacturing facilities as well as other engineering industries also require a highly skilled engineering personnel.

To achieve a deeper and more meaningful grasp of Work-Integrated Learning (WIL) challenges, the study objectives included an exploration of the WIL challenges encountered by Universities of Technology and employers/organisations that provide WIL opportunities as well as an assessment of WIL challenges experienced by the learners. The study was undertaken at the Durban University of Technology and the Mangosuthu University of Technology and limited to the industries based in KwaZulu-Natal, South Africa only.

The mixed-methods approach was used in the study, combining qualitative and quantitative research techniques. Survey questionnaires and focus group interviews were used to gather the data required for the study. The quantitative data from the closed-ended questions was statistically analysed and presented in charts, graphs, and tables. Coded data from the focus group interviews was constructed into themes and thereafter qualitatively analysed. The qualitative findings were presented as textual descriptions, tables and as bullet points.

The study discovered a range of challenges encountered by the University of Technology staff, WIL learners and the Industry Mentors. Recommendations were made to mitigate some of the challenges that the study identified and alternate models for WIL were proposed. The proposals included technology advancements, novel concepts, human resource development and the implementation of processes and systems. Furthermore, a thorough framework was developed based on the research findings to guide future WIL interventions to decrease barriers and improve performance from all stakeholders. The measuring of the capabilities and competencies of the Industry Mentors, whose credentials, experience, skills, training, and personality were not sufficiently addressed by the research, emerged as an essential priority area for future research.

Key words: Work-Integrated Learning, placement, University of Technology, industry mentor, graduation, technicians.

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CESA	Consulting Engineers South Africa
CHE	Council on Higher Education
DHET	Department of Higher Education and Training
DUT	Durban University of Technology
ECSA	Engineering Council of South Africa
NSA	National Skills Authority
NSDS	National Skills Development Strategy
NSDS III	National Skills Development III Strategy
RMIT	Royal Melbourne Institute of Technology
SASCE	Southern African Society for Cooperative Education
SDA	Skills Development Act
SETA	Sector Education and Training Authorities
UNISA	University of South Africa
WACE	World Council and Assembly of Cooperative Education
WIL	Work-Integrated Learning

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Overview and Background to the Study

The study focuses on the challenges encountered in accessing opportunities for suitable workplaces to fulfill the Work-Integrated Learning (WIL) component of the National Diploma in Engineering and related qualifications at the Universities of Technology (UoT), as supported by McLennan and Keating (2008), who state that as WIL becomes more widespread, securing placements and other resources becomes difficult. A deeper and more meaningful grasp of Work-Integrated Learning (WIL) challenges required are therefore the study will include an investigation of the WIL, in addition to processes and performance of the Universities of Technology, the challenges of workplaces and the challenges of learners. The consequences of limited access to suitable workplaces, however results in delayed learner graduation or poor throughput, the lack of valuable work-ready skills and delayed employment, negatively impacting on learners becoming idle and demotivated while awaiting access into the workplace. The study proposed and tested a conceptual framework to build a strategy for the increase of access to the workplace.

While lecturing at Durban University of Technology (DUT), the researcher became interested in the topic of WIL after observing the plight of learners who were ready for WIL placement but were not taken up by industry consequently graduation throughputs to suffer. This is supported by Roodt and du Toit (2009), who state that the National Diploma of the Universities of Technology graduation throughputs are the most affected by WIL challenges.

The researcher was involved in the following WIL activities at DUT:

1. Visiting learners at the workplace
2. Interviewing learners and mentors
3. Placing students
4. Providing support for learners doing WIL
5. Co-ordinating departmental Advisory Board meetings.

Active participation in the UoT's industrial liaison structures for engineering departments in particular has revealed that learners ready for WIL placement could not graduate on time because access to industry was limited, prompting an investigation into WIL challenges. In response to issues in the post-school sector, including UoTs, the South African Department of Higher Education and Training published a White Paper outlining initiatives to strengthen the Post-School Education and Training system, which noted the following challenges.

1. Inadequate research capacity,
2. Lack of labour market expertise,
3. Lack of Industry expertise,
4. Poor Data Management, and
5. A lack of planning expertise (Department of Higher Education and Training, 2013),

   with the Minister of Higher Education and Training calling for more meaningful engagement between the universities and the workplace and an increase in related research (Nzimande, 2014).

Research, however, demonstrates that WIL is broad in nature, complicated, and unique, which poses substantial issues for formulation, planning, and conducting of WIL assessments, since the academic institutions cannot forecast, predict, or control the details of the workplace (Hodges, 2011). Apart from the difficulty of co-ordinating WIL activities with the workplace a lack of commitment for WIL participation from academics, time and financial pressures create greater barriers to workplace access (Associates, 2018). These complexities are further compounded by the management of additional administrative WIL responsibilities requiring additional time, effort, and other resources, which may be perceived as unproductive to the workplace. On the other hand, academia also finds challenges in maintaining the pace and size of changes that occur within the industrial landscape (Laslett & Zegwaard, 2011). Consequently, implying that change and constant redesign of the curricula becomes pertinent (Choy, Delahaye & Fisher, 2011). However, curricular reviews and changes are a complex and time-consuming procedure that necessitates involvement from experienced academic personnel and can demand a significant amount of time from already overworked senior lecturers.

On the other hand, learners encounter their fair share of challenges since the limitations imposed by confidentiality agreements impair and limit their reports (Laslett & Zegwaard, 2011). As a result, the learners' technical reports and portfolios deteriorate in quality. More research on WIL-related challenges is warranted for these reasons alone, with the goal of increasing industry uptake by providing additional access to workplaces for WIL, the challenges highlighted are emanating from the UoT, learner, and industry, which became the focus areas for this study.

The landscape in South Africa presents similar broad WIL challenges encountered globally, as the demand for WIL programs grows, increasing access to the workplace is required, as Nzimande (2014) states that more successful partnerships between universities and the workplace are required while Choy and Delahaye (2011) recommend that more research is required to reduce WIL challenges.

Helyer and Corkill (2015) highlight the challenges of academic institutions building sufficient and suitable industry partners to grant access to the workplace for the provision of WIL. The lack of relationships and agreements between academic institutions and workplaces for the purposes of WIL, may consequently result in the demand for and acceptance of these qualifications to be drastically reduced, even though WIL qualifications provide a multitude of benefits. Other challenges raised by industry includes the following areas:

1. Communication Skill,
2. Organizational Skills,
3. Personal Skills,
4. Interpersonal Skills, and
5. Computer Literacy (Magogwej & Nterekei, 2014).

The lack of healthy communication practices between industry and university on WIL issues is a great concern (Jin, 2020).

This study is expected to unveil additional shortcomings, challenges, and areas of concern with regard to WIL, together with the reasons for the lack of placement opportunities and access into industry.

1.2 Overview of WIL

WIL may be defined as the integration of classroom learning and the application in the workplace, with claims that the first WIL model was devised by Herman Schneider a young, dynamic dean at the University of Cincinnati (UC) in 1906 (Cedercreutz & Cates, 2010). The practical component of Schneider's approach was to deliver learning in the workplace in an innovative way through interaction with job activities, giving rise to cooperative education and experiential learning as we know them today, (Dewey, 1938:25), reinforced this concept, expressing the philosophy that “all genuine education comes through experience”. David Kolb went on to divide learning into four stages: concrete experience, reflective observation of the new experience, abstract conceptualization, and active exploration (Mcleod, 2017); however, Zegwaard and Coll (2009) point out that research shows that learning methodology is implicit because learning occurs through observation, while Sykes and Dean (2013) express a contrasting viewpoint that the reflective learning method utilized in WIL has significant limitations. Sovilla and Varty (2011) likewise argue that the level of integration of knowledge between the academic institutions and the workplace may be insufficient. It can be argued that even though the learning pedagogy is not explicit, the overall benefits of WIL outweigh the limitations. In addition to observation, learning takes place through involvement and the “hands-on” opportunities WIL provides. WIL may be defined as an additional "period of time" where instruction is supported in the workplace, giving learners the chance to gain useful experience in this setting (Msukwini, 2017:3, citing Engelbrecht, 2003:14). Learning that is less didactic and more situated, participative, and 'real world' oriented is how WIL is described by the Council for Higher Education, (Winberg, Engel-Hills, Garraway, & Jacobs, 2011). Action-learning, apprenticeships, cooperative education, experiential learning, inquiry learning, inter-professional learning, practicum placements, problem-based learning, project-based learning, scenario learning, service-learning, team-based learning, virtual or simulated WIL are all examples of WIL (Winberg, Engel-Hills, Garraway, & Jacobs, 2011).

Nonetheless, there is strong support for the application of classroom learning in the workplace because WIL allows for the transfer of valuable knowledge, various skills, and attitudes in the workplace through participation, observation, reflection, discussion, research, and other modes of learning in the work environment.

Figure 1.1 reflects the finding of research conducted by Helyer and Corkill (2015), who attempted to determine description of experiential learning, through researching the question "What is experiential learning?" The findings clearly indicate that the majority of the respondents agree that it is linked to "doing" and to the workplace.

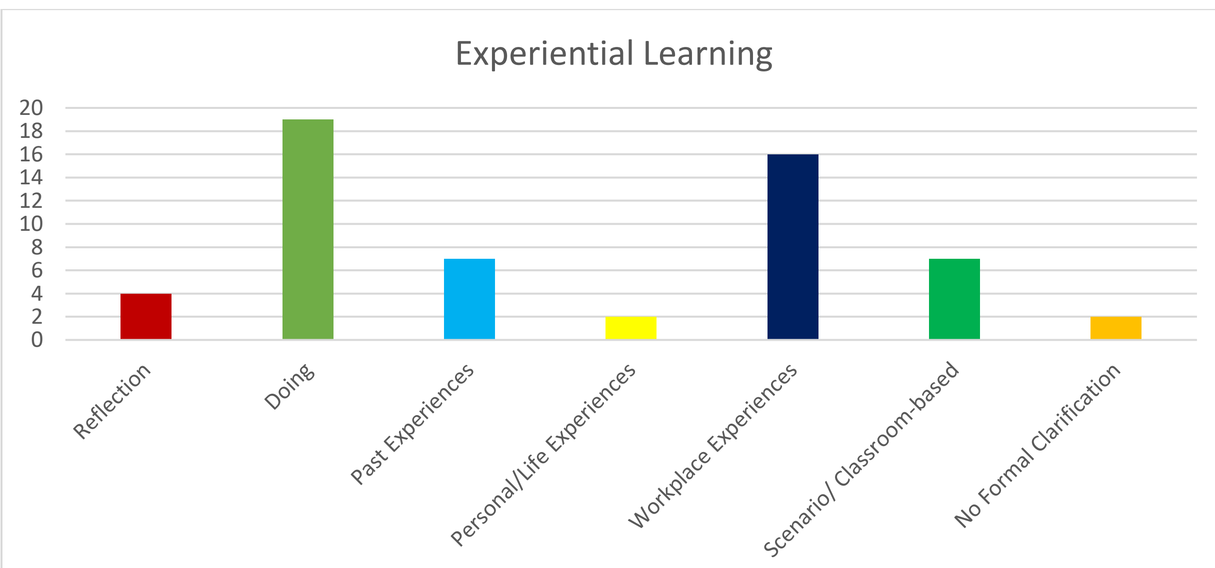


Figure 1.1: Experiential Learning

Source: Helyer and Corkill (2015: 127)

WIL activities can include internships, practicums, work placements, and field observations, according to Purdie, Ward, McAdie, King and Drysdale (2013), as these activities incorporate learning into the working environment (Smith, Brooks, Lichtenberg, McIlveen, Torjul & Tyler, 2009) and are expressed as a strategy for delivering a rich, active, and contextualized learning experience in a setting that offers learners a variety of effective learning opportunities (McLennan & Keating, 2008), the key advantages include possibilities for practical and cognitive learning that complement the academic knowledge acquired from technology universities.

Rook (2017) observes that the government and industry prefer graduates to be work-ready, which is supported by McLennan and Keating (2008), who emphasize concerns expressed by research over the last decade regarding the state of graduates' work-readiness while Samadi (2013), adds that industries favour those who have the necessary engineering knowledge and abilities and can communicate well.

As a result, there is a greater demand for workplaces that provide opportunities to prepare learners for the world of work through the transfer of information, skills, and attitudes. The demand for suitable workplaces is exacerbated further because apprenticeships, learnerships, and internships all require a workplace component. This is further exacerbated as Jackson (2017) points out, by employers' reluctance to participate in WIL programs, despite the fact that the program may be beneficial to employers. Rook (2017) relates extended delays in learners graduating on time to a lack of industry interest in providing WIL opportunities. Rook (2017) also attributes a lack of resources as a fundamental factor to WIL problems. Rook (2017), however does not provide sufficient information as to the resources required for WIL, whether the lack pertains to industry, the UoT or the learner. This study will endeavour to provide answers to these uncertainties.

Engel-Hills (2005), on the other hand, points out that the changes in the modern workplace brought a series of challenges. Mechanisation, technological advances, robotics, organizational structure, skilled workforce efficiency and output, and high profitability characterize modern industry. According to Smith (2012), workplaces must possess experienced supervisors and mentors who understand business operations, the induction process, safety legislation and standards in order to maintain continuous workflow and high safety standards when inducting learners. Supervisors and mentors should also be familiar with the processes and systems needed to offer adequate learner assistance (Smith, 2012). Workplaces require learners to be able to work in teams, interacting, engaging, and cooperating with others of different ages, skills, personalities, and backgrounds, while delivering on common company objectives (Smith & Gibson, 2016; Winborg & Hagg, 2022). As a result, workplace tasks and objectives can be successfully completed due to co-workers engaging and working together when information and skills are shared (Galleta-Williams, Esmail, Grigoroglou, Zghebi, Zhou, Hodkinson & Panagioti, 2020).

A need exists for intensive research to be conducted on the Universities of Technology program offerings. Additionally, long-term partnerships for the purposes of support and funding for the Work- Integrated Learning component of the qualifications, should be fostered (Nzimande, 2014). The slogan, "turning every workplace into a training space" is embedded in the National Skills Development Strategy (Department of Higher Education and Training, 2014). The call for intensive research emphasizes the importance of the role of industry in providing WIL opportunities.

Collaborative efforts by educational institutions, government, and industries to enhance graduate skills, through WIL, are important for alignment with world economy and international politics (Moloi, 2015). A further call embedded in The South African National Development Plan (2012) encourages greater focus and investments in research and development and the promotion of enhanced cooperation between the various sectors.

To position this study within its context, this chapter discusses the National Diploma Qualification (Engineering) offered at the Universities of Technology. The chapter also presents an overview of the research design and methods followed to collect, interpret, and analyse data in support of the research aim and objectives. A brief description of the thesis structure concludes the chapter.

1.3 Overview of WIL at the Universities of Technology in South Africa

After successfully completing the academic subjects and earning a placement offer, UoT students are eligible for the workplace component of the National Diploma. Formal registration for the work experience modules is necessary. A technical report, portfolio of evidence, or a completed logbook is required for the evaluation of the learner's work experience. The workplace component lasts two semesters (P1 and P2), with twenty-four weeks per semester.

Figure 1.2 is a graphical representation of the how the engineering diploma program is implemented. There are four six-month semesters (S1 to S4) of academic learning and two six months semesters of WIL (P1 and P2). The entire, qualification is scheduled over three years. The challenge of gaining access in industry for the workplace modules soon after completion of their academic study results in delaying the completion of the diploma and graduation.

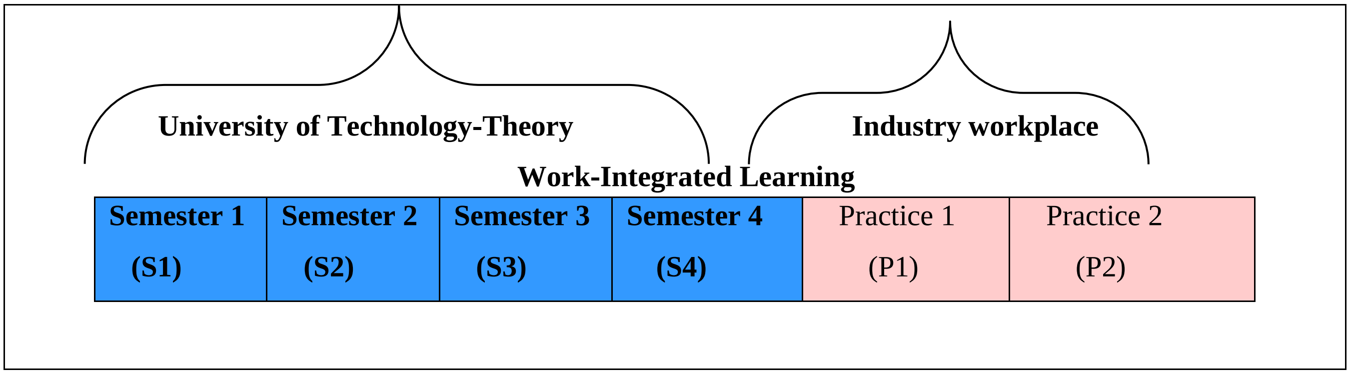


Figure 1.2: Co-operative Education Model

Source: Developed by the researcher

The revised National Skills Fund Strategic Plan from 2015 to 2020 identifies the partnership between educational institutions and employers as a key area to promote linkages for Work-Integrated Learning. The National Skills Fund further structured funding mechanisms to reduce the Work-Integrated Learning gaps for learners who have completed the theoretical component of their qualifications but lack the workplace component. The revised South African National Skills Fund committed to the following in the revised Strategic Plan for 2015 to 2020:

1. To fund and encourage ongoing research, in the area, of Work-Integrated Learning,
2. To facilitate stakeholder relationships to build partnerships between the academic institutions and the workplace, through funding mechanisms, and
3. To organize and fund initiatives that give students hands-on experience by incorporating WIL into the broader value chain (National Skills Fund, 2015).

Many educational institutions offering WIL programs have a resident cooperative education department that provides a vital link between the education institutions and the workplace. For instance, the Cooperative Education Unit of University of Waikato, Hamilton, New Zealand, has staff employed as cooperative co-coordinators and administrators (Eames, 2000). The establishment of strong partnerships between the academic institution and other stakeholders involved is critical to the success of WIL (Forbes, 2006). Cooperative Education departments are established at the various South African Universities of Technology; however, the management of WIL is unique to each institution (Smit, 2014).

WIL programs have evolved and grown steadily over the years, despite the numerous challenges they encountered, as evidenced by Herman Schneider's introduction of the first WIL model, which faced economic challenges, much experimentation, policy changes, and the regular shifting of educational institutions' priorities (Sovilla & Varty, 2011). WIL qualifications having survived these hurdles today have international recognition and are offered by renowned leading academic institutions that are actively expanding and growing.

Thus, the study aims to rapidly facilitate the opening of access into workspaces to meet the growing demand for WIL qualifications and the consequent need for an increased number of workplaces through the understanding of the WIL challenges experienced. The study will identify these challenges, prioritise them, and propose a framework as a strategy to mitigate the challenges. These challenges currently result in qualifications taking too long to complete, delays in graduation, and the growing demand in the labour market for engineering technicians. The global labour market demands a knowledge-driven economy with more competitiveness for skilled workers (Smith, 2018). WIL qualifications which include the workplace experience as a component of the qualification, become a very attractive option to the current labour market trends.

However, the impact of the long duration to complete WIL qualifications with the workplace component, has the effect of reducing the qualification's popularity and sustainability. Figure 1.3 clearly indicates that the major challenge encountered by learners on WIL qualifications in different South African Universities of Technology, is failure to obtain immediate placement.

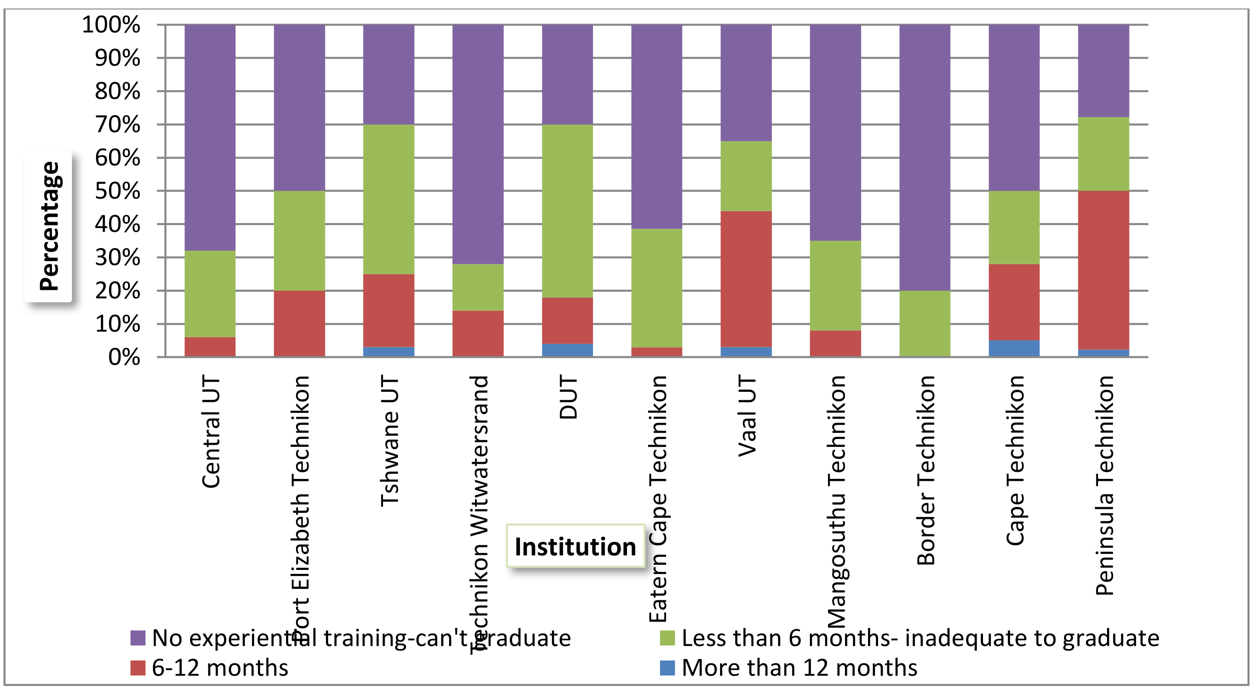


Figure 1.3: CESA Experiential Training
Source: SASCE (2013)

The lack of available data for a very important area clearly indicates the need for research in this field. According to the South African Society for Cooperative Education (SASCE), most of the academic institutions are faced with the challenge of limited access to suitable workplaces, consequently many students fail to graduate timeously, thus limiting the supply of much-needed technicians (Southern African Society for Cooperative Education, 2013). The delayed graduation of learners because they are not being suitably placed in industry, result in a greater demand for technicians.

The problem is further emphasized in the publication of the National Scarce Skills list of Top 100 occupations in demand (Department of Higher Education and Training, 2014). Featuring strongly in this list are many occupations that could be filled by graduates who have successfully completed qualifications with a compulsory component of Work-Integrated Learning as part of that specific qualification (SASCE, 2013).

Table 1.1 shows the possible occupations that could be filled by learners who have completed qualifications that have a workplace component. The qualifications include University of Technology WIL qualifications, apprenticeships, and other programs with a workplace component. It must, however, be remembered that the focus of the researcher is University of Technology engineering diploma qualifications in South Africa.

Table 1.1: National Scarce skills list

No.	Occupation	Code
1	Electrical Engineer	215101
2	Civil Engineer	214201
3	Mechanical Engineer	214401
8	Industrial and Production Engineer	2141
9	Electrician	671101
10	Chemical Engineer	214501
12	Mining Engineer	214601
14	Energy Engineer	215103
16	Electronics Engineer	215201
17	Metallurgical Engineer	214603
19	Telecommunications Engineer	2153
20	Energy Engineering Technologist	215104
21	Millwright	671202
31	Boilermaker	651202

32	Fitter and Turner	652302
33	Carpenter and Joiner	641501
34	Welder	651202
35	Environmental Engineer	2143
41	Plumber	642601
42	Motor Mechanic	653101
43	Agricultural Engineer	214905
45	Mechanical Engineering Technologist	214402
46	Toolmaker	652201
47	Electrical Engineering Technologist	215102
48	Diesel Mechanic	653102
50	Electronic Instrument Trade Worker	672105
51	Metal Fabricator	651401
54	Industrial Machinery Mechanic	653301
55	Air Conditioning and Mechanical Services Plumber	642701
60	Automotive Electrician	672106
63	Civil Engineering Technologist	212202
65	Electrical Installation Inspector	214908
67	Mining Engineering Technologist	214602
68	Metallurgical Engineering Technologist	214604
69	Electronics Engineering Technologist	215202
70	Computer Network and Systems Engineer	252301
71	Mechatronics Technician	671203
73	Chemical Engineering Technologist	214502
76	Pressure Welder	651201
79	Computer Network Technician	351301
95	Ship’s Engineer	315101
96	Rigger	651501

Source: SASCE (2013)

The University of South Africa (UNISA) also offers cooperative educational programs; for example, the National Diploma in Engineering is offered as a distance learning program. UNISA will not award the diploma qualification if the WIL component is incomplete, even though the criteria for the academic component have been met. In addition, UNISA insists that the workplace component be supervised by a qualified person (Pityana, 2006). The knowledge and skills the learner will acquire throughout the work experience depend heavily on the suitability of the Industry Mentors appointed to supervise engineering learners in the workplace.

Many studies are currently being conducted across many fields under the rubric of WIL. The World Association of Cooperative Education (WACE) was established to gather stakeholders interested in WIL issues from around the world to discuss and investigate challenges and find possible solutions to these challenges. The Southern African Society for Cooperative Education (SASCE) was established to facilitate work placement opportunities and promote the blending of academic study with valuable workplace experience. Further emphasis on the importance of WIL and work placement was highlighted in the National Skills Development III Strategy document (Department of Higher Education and Training, 2014). The Minister of Higher Education and Training, Dr. Blade Nzimande, clearly pointed out in the National Skills Development Strategy III (2013), that "Central to the objectives of the NSDS III is improved placement of both students and graduates, especially from the Further Education and Training colleges and Universities of Technology".

Having been employed as a lecturer in the Department of Power Engineering at the Durban University of Technology, the researcher was inundated with learner challenges and difficulties in securing workplace opportunities. WIL concerns and issues were also the main topics of discussion at the Departmental Advisory Board Meetings at the University of Technology.

1.4 Research Problem

Without the occupational component of the Nation Diploma in Engineering leaners cannot obtain their qualifications and graduate, therefore the maximum degree of educational attainment for these learners would be matriculation and an incomplete tertiary qualification. Therefore, a study which investigates the challenges associated with workplace access required by the engineering diploma learners may significantly contribute to improving the situation.

The situation is adequately summed up by the Council for Quality Assurance in General and Further Education and Training (Umalusi, 2005), which asserts that 'the current state of uncertainty, with regards to the workplace component of qualifications impacts negatively on learner morale and leads to low throughput for the university and a shortage of much-needed technical skills in the labour market. To meet this labor market need, there must be an increase in the creation of competent engineering technology graduates. Cosser (2010) observes that engineering students on graduate programs typically graduate outside of the minimum regulated period, a point reaffirmed by Fisher and Scott (2011), who state that learners who have WIL in their program take longer to complete due to, among other things, a lack of suitable workplaces to accommodate their needs. The identification of the challenges experienced by academia, the organisations where workplace placement could be located and the learners, can drastically improve throughput rates of UoT engineering diploma students and close the gap between supply and demand for these skills. Industry prefers to employ graduates that have been exposed to the work environment and are work ready possessing the relevant knowledge, skills, and attitudes. The cascading positive effect can create more job opportunities for the youth and can impact on the poverty levels and possibly even on crime statistics, since the reduction of poverty and inequality are key challenges in South Africa (Leibbrandt, Woolard, Finn & Argent, 2010). Quality educational qualifications are also important for employment success and there is a strong correlation with socio-economic status (Spaull, 2012).

According to Wessels and Jacobs (2010), there is limited data concerning the views of companies and higher education institutions on cooperative education. More research is required to address WIL related problems and challenges (Billet & Choy, 2011). The scarcity of research literature on the value and relevance of WIL in the South African context is a matter of great concern (Swart, 2014). The broad challenges of WIL include legislation, policy, financial resources partnerships, misalignment, capacity and factors both internal and external. The cumulative effect of WIL challenges contribute to the negative growth of individuals, industry and the economy.

Thus, current literature does not provide sufficient information with regards to the challenges experienced by the various stakeholders with respect to WIL who are part of the University of Technology Engineering Diploma qualification, necessitating the need for more research, in the field of WIL. The research purposed to critically assess the challenges experienced by University of Technology staff involved in WIL related matters, the challenges encountered by WIL learners and the WIL mentors from industry.

1.5 Research Gaps

The numerous challenges of WIL are unique and complex, which limit the timeous graduation of learners, the increase of access to the workplace and the supply of work-ready graduates to the labour market. While many bodies and organisations have been set up to manage WIL, many policies established to promote and support Work-Integrated Learning and various research studies conducted, no study has systematically identified and then prioritised the range of WIL challenges. The study is expected to produce a set of identified challenges. This gap provides the researcher with an opportunity to develop a conceptual framework to mitigate the challenges. The study will include recommendations for the findings and propose alternate models for the workplace modules to reduce the “wait time until placement”.

1.6 Research Aim and Objectives

The aim of the study is to identify the challenges experienced by Universities of Technology, industry mentors and the engineering students, with regards to the WIL component of the study in terms of its impact on workplace access, and to propose a conceptual framework to assess and analyze the identified challenges and constraints.

The objectives of the study are to:

1. Explore the WIL challenges encountered by Universities of Technology.
2. Assess the WIL challenges experienced by the learners.
3. Explore the challenges experienced by workplaces that provide WIL opportunities.
4. Develop a conceptual framework that addresses the identified challenges.
5. Recommend alternate WIL models to mitigate the challenges.

1.7 Research Questions

The focus of the research is to determine the reasons for the difficulty in accessing readily suitable experiential learning opportunities for the National Diploma of Engineering qualification offered by South African Universities of Technology. The following research questions emanate from the objectives:

1. What are the WIL challenges experienced by the Universities of Technology, learners and employers providing WIL?
2. How can the challenges experienced by the various groups be mitigated?
3. What conceptual framework could be proposed to address the challenges?

1.8 Envisaged Contributions of the Study

The major contribution of this study is the development of a proposed integrated conceptual framework which, when validated, will provide a framework for the analysis of WIL challenges to be used by the various stakeholders and partners to develop policies that will improve access to the workplace which will enable a more efficient allocation of resources to improve workplace access. The elements of various existing models WIL models will be examined, and an optimal model will be proposed.

This study is expected to significantly contribute to the improvement in the graduation delays and the production of more work ready graduates. An expected increase in the pool of skilled technicians will address the shortage in supply to the labour market. The cumulative benefit would result in the improvement of the socio-economic sector and positively impact the country's economic growth by reducing graduate unemployment and an improved tax-base.

1.9 Research Methodology

The researcher used the mixed methods methodology for this study. The mixed methods approach is considered the most suitable as the study encompasses the exploration and identification of a range of WIL challenges of a complex nature. It allows and guides researchers to seek answers to complex and multi-faceted research questions that cannot be addressed using a singular method (Doyle, 2009). A more accurate analysis may be achieved as both qualitative and quantitative data will be used for processing. The research questionnaire used the Likert Scale to rate the questions and the data gathered was analysed statistically. The researcher hosted focus group interviews with carefully selected participants to provide the qualitative data for the study. A more detailed description of the methodology and research design is provided in Chapter Three.

1.10 Chapter overviews

The thesis comprises six chapters with an introduction and a chapter summary.

Chapter 1: Overview of the study and Background Information

The introduction provides a definition of WIL and an overview of the broad WIL practices and challenges encountered with background to the study. A brief discussion on the South African WIL landscape and practices at the Universities of Technology in KwaZulu-Natal. A rationale for the study was provided and the proposed contributions of the research was highlighted. A research strategy and the scope and limitations of the study was presented.

Chapter 2: Literature Review

A more in depth and better understanding of the WIL practices and challenges of the international and South African Landscape will be provided. The South African landscape will highlight the legislation, polices and state organs established to promote WIL. The literature review will examine WIL concepts and models that will be used to propose a conceptual framework.

Chapter 3: Theoretical and Conceptual Framework

The chapter outlines the key theoretical contributions made by renowned researchers in the field of education. It further discusses key concepts derived from the literature gathered in Chapters 1 and 2 to build a conceptual framework that will be used for the study.

Chapter 4: Research Methodology

This chapter provides a description of the methodological approach used for the study, the sampling information, data gathering processes and data analysing techniques.

Chapter 5: Research Findings

This chapter presents the research findings using graphs, tables, and descriptive analysis. The qualitative analysis will include "word clouds" and sentiment analysis.

Chapter 6: Discussion of the Research Findings

In this chapter, the major findings will be outlined and discussed. The discussion will focus on the difficulties that academic staff at the Universities of Technology, Industry Mentors, and learners encountered with Work-Integrated Learning challenges. in the light of the findings.

Chapter 7: Conclusions and Recommendations

This chapter reviews how the findings address the research objectives and question. The chapter will provide recommendations and propose alternate models for WIL.

1.11 Conclusion

Cooperative education qualifications, which include the component of WIL, are an educational strategy used globally. In South Africa, the Work-Integrated Learning programmes are highly commended and are drafted into a wide range of subjects in the technical, vocational, education and training colleges and the Universities of Technology. As explained in this chapter, the completion of cooperative qualifications and throughput rate are negatively affected by WIL challenges. The chapter provides a rationale for the study, using contributions from journal articles and other sources to highlight the research question. The objectives of the study were developed to form the boundaries of the study. The research portrays the immense societal benefits in addition to benefits in the labour market, industry, and academia.

The next chapter will review the literature related to WIL. Chapter Two will also include a global perspective with regard to Work-Integrated Learning practices from some renowned universities in other countries and provide a conceptual framework for the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The study focuses on the challenges encountered by engineering University of Technology learners, in gaining access to workplaces to complete the workplace module for the National Diploma qualifications in electrical and mechanical engineering, respectively. South Africa requires technically competent graduates to compete in the global economy (Brink & Jacobs, 2022), whose importance and great need is expressed by Lewis (2020), who stated that qualified and experienced engineering technicians are fully involved in engineering projects and technologies, including the installation and commissioning of new equipment, machinery, or plants. Technicians are also required to perform operational and maintenance functions of existing engineering infrastructure (Lewis, 2020). This chapter will look at the literature on WIL that has been published in South Africa and around the world.

2.2 Work-Integrated Learning Challenges

UoT resources

Universities encounter challenges due to limited curricula resources and time (Cooper, Orrel, & Bowden 2010), which has a direct negative impact on the transmission of knowledge and skills to learners. Furthermore, providing tough working circumstances for academic staff. University of Technology electrical and mechanical engineering diploma courses include subjects that necessitate well-equipped laboratories, workshops, and computer hardware and software. These resources have extraordinarily high initial setup costs. The financial strain on academic institutions is exacerbated by the need to stay up with the ongoing technical advances in industry in terms of tools, equipment, machinery, and systems. As a result, there are larger curriculum gaps between academic institutions and the workplace (Alwan, Abualkishik, Abdull & Gulzar,2022).

Cultural Differences between UoTs and the Workplace

Cultural differences between academic institutions and the industry pose another challenge for learners to manage when placement at the workplace (Cooper, Orrel & Bowden, 2010). The rapid change to the work environment in terms of punctuality and attendance, dress code, and work pressure may make adaption difficult. It is typical for university learners to miss lectures, arrive late for sessions, and fail to complete tasks or duties allocated to them without consequence, to the point of being permitted to redo the coursework and examinations for poor performance. The workplace, on the other hand, expects learners to be consistent and punctual, as well as accountable to their mentors. Failure to fulfil specified work and tasks may lead to termination. As a result, high levels of accountability, responsibility, work ethic, and performance are required in the workplace. According to researchers, cultural disparities between the University and the workplace constitute a difficulty, as described by Msukwini (2017), who emphasized the growing necessity to explore the challenges faced by Co-operative Education Practitioners. Msukwini (2017) further explains that additional support provided by the Co-operative Education Practitioners enhances employment opportunities through resumé building workshops, programs teaching, job interview skills and professional development course.

Communication and Interpersonal Skills

According to Fleming, Martin, Hughes, and Zinn (2009), learners should enter the workplace with technical, cognitive, and behavioural skills as well as the ability to apply theoretical knowledge learnt in the academic institution. The workplace requires the use of knowledge and technical skills, in addition to interpersonal and social abilities (ESCO, 2022: Brunner & Ehlers, 2022). These characteristics will aid learners in smoothly transitioning into the workplace, as the workplace demands learners to operate immediately. Acceptable levels of interpersonal skills in the workplace are expected for good communication and teamwork (Zegwaard, 2006; Fleming, Martin, Hughes & Zinn, 2009). According to Magogwe, Nkosana, and Ntereke (2014), the pressure and demands of global markets necessitate workforces to have high communication skills, organizational skills, personal skills, and interpersonal skills in order for industry to remain competitive. Poor communication and interpersonal skills can have a detrimental impact on workplace learning because they are required for engagement with Industry Mentors, colleagues, team members, administrators, and other personnel.

Work-Integrated Learning has traditionally emphasized social connection (Eames & Cates, 2011; Drewery, Pretti & Fannon, 2022). The manner in which learners interact with Industry Mentors may have a substantial impact on the quality of learning from their work experiences (McRae, 2014: Drewery, Pretti, & Fannon, 2022). Engagement with the Industry Mentor is crucial for learners to complete the many activities required to complete the workplace modules; yet, meaningful engagement is limited when learners lack good communication and interpersonal skills, which affects learners' work performance. Good communication skills are required for learners to operate well when executing tasks in groups.

Computer Literacy

Computer literacy, customer service orientation, teamwork and cooperation, self-confidence, and a willingness to learn, were identified to be the most important essential abilities for graduates in the workplace (Rainbury, Hodges, Burchell & Lay, 2002). Computerisation in the modern industry is widely applied; learners without adequate levels of computer literacy will be adversely affected and may not be entrusted with meaningful projects. The acquisition of these skills should be achieved while at the academic institution. Customer service, orientation, teamwork, and cooperation are not the academic institution's primary focus; rather, the transfer of engineering knowledge and skills is the primary priority. However, innovative interventions are required to cater for these secondary skills, and their importance in the workplace environment cannot be overstated. Workplaces, on the other hand, should attempt to correct the identified gaps and weaknesses, as well as give learners additional guidance and motivation to keep their attention focused, as they provide fresh perspectives to the work environment despite their lack of experience.

With software engineering playing a significant role in the engineering discipline, technological advancements in the domestic, commercial, medical, industrial, and other sectors have firmly accepted software applications in their settings (Gurcan & Kose, 2017). Given that contemporary industries have already embraced technology from the Fourth Industrial Revolution (4IR), educational institutions should provide learners with knowledge and abilities in fields including artificial intelligence, robots, genomics, data science, and nanomaterials (Yusuf & Walters, 2020).

Curriculum Alignment

Another major source of concern is the implementation of the workplace module; frequently, the learning outcomes expected from the academic institution, as laid out in a logbook template, are unattainable (Ajjawi, Tai, Huu Nghia, Boud, Johnson, & Patrick, 2020). Industry being driven by productivity, may be easily led to engage learners in priority-related tasks rather than those that prescribed in the logbook, resulting in learning outcome gaps. Though the tasks may be complex and provide essential exposure to high level engineering skills and concepts, they may not be prescribed in the logbook. On the other hand, learners may be assigned to mundane and unrelated tasks without getting any engineering-related experience. It is important therefore, that the learners' progress is tracked and monitored by academic institution to ensure that workplace learning is relevant and aligned.

Workplace Demand

According to Orrel (2004), the increase in programmes which includes a workplace component creates other potential problems, as this requires an increase in scarce resources, such as quality learning environments, additional commitment from supervisors, and additional risk management processes. The demand for more workplaces due to the rise in Work-Integrated Learning programs adds to the stress on the services and support needed (Drewery, Woodside & Eppel, 2022). Driven by the growing demand for additional workplaces, academic institutions are necessitated to expand their network of workplaces through aggressive attractive advocacy initiatives, adopting new workplaces and developing cooperative agreements in order to absorb and transmit the necessary skills to learners.

WIL Policy Framework

Blom (2015) argues that the apparent distance between the university and the workplace, makes it difficult for a policy framework for learning based on the workplace, the reality being that the academic institution and the workplace are two different worlds. The author agrees with this viewpoint since academic institutions and workplaces operate independently and, as a result, will develop policies to attain their own goals and aims as a top priority. As a result, excellent ties and partnerships with the workplace are essential before embracing any UoT policy or guideline for workplace learning. Current gaps between the skills that the academic institutions can offer and those that are required by industry is changing and evolving at an ever-increasing rate as industry is embracing digital technology (Brunner & Ehlers, 2022).

The current WIL scenario, along with the range of issues highlighted in the literature reviewed thus far, necessitates further investigation into the challenges that are encountered by the various stakeholders, with the goal of opening increased access into the workplace once the challenges are explored.

The work experience component is a compulsory credit bearing requirement for the learner to graduate. For the purposes of attaining a comprehensive literature review, the researcher decided to obtain literature on the global landscape of WIL practices and challenges from as many countries as possible. It is pointed out by Blom (2015), that the availability of international literature on workplace learning, specifically on the technical and vocational education and training is limited, and more attention should be given to international literature on workplace-based learning in higher education needs.

The literature will briefly explore the various models of WIL and the types presented by Abeysekera (2006) will be explained. Blom (2015) observes that since the 1980s, universities throughout the world introduced work-based learning interventions due to various external pressures. According to Blom (2015), growing interest in work-based learning is reflected in the following publications: *The World Association of Cooperative Education's (WACE's) International Handbook for Cooperative and Work- Integrated Learning (2011) and SAGE Handbook of Workplace Learning (2011).*

Blom (2015) highlights that these publications show significant global increase in research interest covering WIL approaches in various fields of study. Haddara and Skanes (2007) reaffirm an increase in the number of co-operative education programs after 1960, pointing out also that only towards the end of the 90's that researchers focused in the area of co-operative education.

Figure 2.1 below provides an overview and contextualizes WIL cycle. Central to the WIL cycle is the relationships between the learners, the institution and industry. Strong, meaningful relationships is recommended for the success of WIL programs. As indicated in Figure 2.1, the learners after the completion of the academic component of the National Diploma qualification should be prepared for work readiness by the academic institution, subsequently to be placed in suitable industries for a structured work learning program to be followed. The workplace ideally should be approved by the academic institution to deliver the outcomes or tasks articulated in the logbooks. The learner is normally placed under the supervision and guidance of a mentor who is qualified and experienced in the field of engineering that the learner studied. During the period of placement at the workplace the learners are to be visited regularly by academic staff to monitor their progress and mitigate any challenges experienced by the learner or the workplace. Learner progress is measured and assessed by the logbook entries, performance, and progress reports. The WIL process presented by Forbes (2006) may work in the ideal world, however the significant delays in the placement process because of limited access to workplaces disrupts the continuity of learning and calls for alternate WIL models.

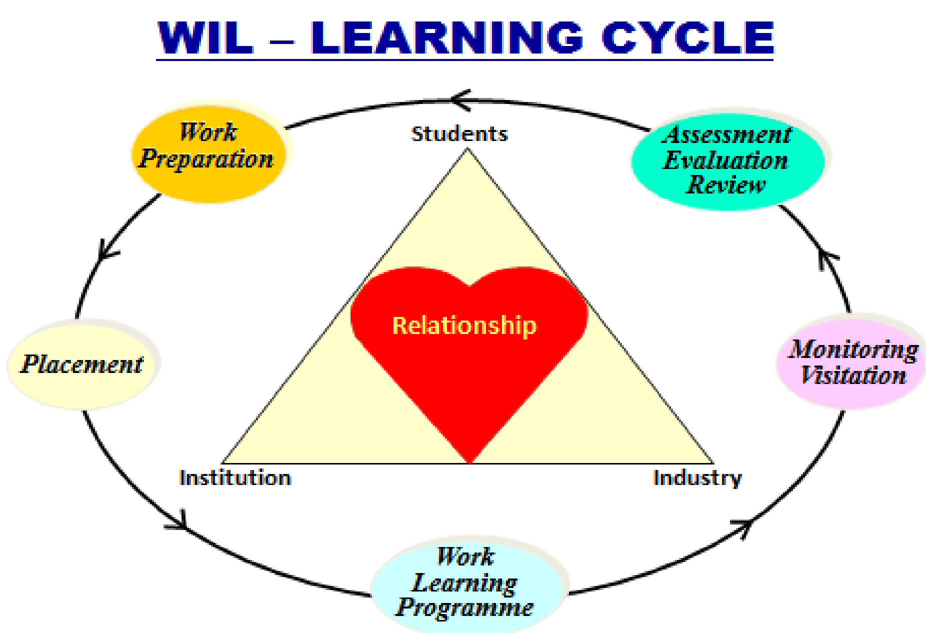


Figure 2.1: WIL Cycle
Source: Adapted from Forbes (2006)

2.3 Various WIL models

WIL qualifications may be delivered through a variety of well-structured approaches; however, an *ad hoc* approach to WIL is also implemented, in which exposure to diverse workplace tasks is determined by company priorities. In other words, even if a well-structured WIL curriculum is developed, the learner may not be able to implement or experience the tasks assigned as outlined in the logbook. However, exposure to varied engineering tasks as and when available, still results in significant skills transfer to the learners. According to Reeders (2000), the flexibility of this approach fits a more adaptive curriculum; it must be noted that some essential learning outcomes may not be fulfilled if opportunities to execute specific tasks are not available during the length of the workplace component. Reeders (2000), on the other hand, concludes that despite the flexible structure, this model still ensures that the student applies his classroom learning in a work environment- this WIL structure and purpose being unique still provides the learner with the fundamental concepts and skills (Doolan, Piggott, Chapman, & Rycroft, 2019). Although successful to a significant extent, the ad hoc strategy may lead to inadequate management and quality control of the work experience, resulting in employers paying little attention to learners.

Abeysekera (2006) describes a more structured cooperative education model in which academic credit is given for an organized work experience in which the time spent in the workplace is a component of an academic curriculum, a logbook prescribing the work tasks or a memorandum of understanding outlining the duties to be carried out at the workplace serves as an agreement between the workplace and the academic institution.

Abeysekera (2006) points out that some organisations design and develop customised work-based programs to fulfil the need of learners who are unable to attend university, this model also largely benefits the organisation’s needs because of the program’s customisation. Kirkpatrick and Garrick (2001) argue that additional organisational benefits with this model would include areas of the organisation’s culture, structure, management, and company systems as part of the learning. Despite the strong emphasis for this model of WIL, academic institutions still struggle to involve business and industries in these educational opportunities (Atkinson, 2016). The WIL model, in which a whole qualification is obtained at work, might be considered the work-based model (Rose, McKee, Temple, Harrison, & Kirkwood, 2001). Employed learners may demonstrate a stronger work ethic and independence understanding the benefits of future prospects in the organisation. The achievement of the qualifications is fast tracked because of the experience and independence of learners who are employed, but this is a highly expensive exercise because the qualification must be tailored for each industry or firm, and general administration, travel expenses, and workplace evaluation charges must be considered (Samadi, 2013).

Customised qualifications provided at the workplace necessitate fewer contact hours, allowing students to graduate in less time adds, (Wojtas, 2000). This program design, according to Trigwell and Reid (1998), contains a variety of learning outcomes for the mutual benefit of all stakeholders. Another advantage mentioned by Barnett (1997) is that prospective students can begin the programme at any time. He goes on to say that this methodology allows for greater flexibility in terms of the kind and scope of assessments. Students have the opportunity to participate in real-world learning situations in which theoretical concepts are applied through practical tasks, ultimately improving graduate employability, and providing students with career guidance, industry connections, and quick employment after graduation, as well as improved research and critical thinking skills (Ferns, Campbell, & Zegwaard, 2014). The author agrees that this model provides good outcomes because it is managed and controlled by industry, yet it is exclusively for employed learners within the organisation.

The internship program is another model of the WIL where the students' workplace activities are closely monitored with specific outcomes to be achieved within specified timelines. This model allows for the professional development of the student as they become familiar with the organisational structure and operations (Katula & Threnhauser, 1999). Learners can be helped to better utilize their concepts at work by integrating conceptual knowledge and training through academic internship programs. Academic internships serve as a link between theory and practice by having participants engage in supervised, scheduled tasks These internship programs enhance learners' professional development and experience while also enhancing their personal abilities (Anjum, 2020).

Service learning or community service is also recognised as a WIL model and accepted by the Universities of Technology in South Africa to fulfil the WIL requirements for the diploma. This approach expects to achieve the similar outcomes of the internship model. Learners enhance their critical thinking abilities during this process by engaging in public service initiatives that could eventually lead to research (Samadi, 2013). Community projects are identified to produce specific learning outcomes for the student to achieve within the duration of the WIL period. Opportunities exist to learn new skills while participating in service or community initiatives, such as critical thinking, communication, and planning. Furthermore, the community recognizes the learner's contribution through a successful project, which bodes well for future employment or business prospects.

Learner support and guidance is provided by the cooperative education department duration placement at the workplace throughout the WIL program. In order to make sure that the learners' work experience fulfil the necessary institutional requirements, it is frequent practice at academic institutions to have departmental lecturers carry out monitoring tasks at the workplace. Industry Mentors are appointed to ensure that the learners' exposure to the workplace in line with the predetermined tasks as laid out in the logbooks are carried out.

To summarize, all WIL models impart essential technical skills to learners; nevertheless, physical placement in the workplace must be readily available. The lack of acceptable workplaces poses a significant difficulty, as delays in placement result in delayed graduation, low levels of learner morale, and a detrimental influence on the labor market demand for competent engineering technicians. The information above clearly indicates the broad description or definition of WIL, however for the purpose of this study the researcher will focus mainly on the cooperative education model of Universities of Technology, specifically on the credit bearing (P1 and P2 model).

2.4 Global Work-Integrated Learning Landscape

2.4.1 Australia and New Zealand

Labour market demand for skilled and work-ready graduates drove the Australian Higher Education sector to respond accordingly (AC Neilsen Research Services, 2000; Organisation for Economic Co-operation and Development, 2004). Jackson and Rowe (2022) communicate a similar message that robust mechanisms for institutional funding initiatives and industry cooperation must be formed in order to considerably increase the generation of work-ready graduates.

The Australian Business, Industry, and Higher Education Council proposed in 2007 that the workplace module be integrated in the academic curriculum as a method to increase work readiness skills (Cleary, Flynn, Thomasson, Alexander, and McDonald, 2007). Australian Universities, responding under increasing pressure, developed and included the Work-Integrated Learning component in their curricula of their program offerings (Bradley, Noonan, Nugent, & Scales, 2008). McLennan (2008) argues that the workplace experience during the Work-Integrated Learning is a valuable and unique environment providing learners with a rich, active, and contextualized experience. Australian universities continue designing WIL models that allow for flexibility while optimising outcomes for stakeholders in order to increase industry participation, having adopted WIL as a national goal and as part of their strategic direction (Kay, Ferns, Russell, Smith, & Winchester-Seeto, 2019). The trend for developing academic which include the workplace component is clearly gaining traction in Australian and New Zealand landscape. Australia is expanding investments, through increasing funding for WIL models to include WIL programs for PhD graduates, recognising the crucial importance of industry knowledge and experience (Wood, Zegwaard, & Fox-Turnbull, 2020).

A scoping study conducted by the Queensland University of Technology to map out the key concepts of WIL, identified a range of issues and challenges that were experienced to expand and increase WIL opportunities (Patrick, Pocknee, Webb, Fletcher & Pretto, 2008). This study highlighted various challenges, among which the availability of suitable workplaces for enriching the student's learning was prominent. Further challenges were identified in the areas of integrating the world of work with learning, including the nature of work complexity of WIL, and the demanding expectation of students, professional bodies, universities, and government policies (Patrick, Peach, Pocknee, Webb, Fletcher, & Pretto, 2008). In order to lessen or limit some of the WIL issues, experiments with alternative WIL models using virtual and remote modalities are now being conducted, the authenticity of which is currently being tested (Dean, & Campbell, 2020).

Debates about the University of Waikato's accountability and the integrity of assessments have emerged from the difficulty of implementing best practices for the evaluations of learners in the workplace (Ferns & Zegwaard, 2014). Participation of more workplaces with thorough understanding of WIL processes, including assessment criteria, are required. Jackson (2018) recognises the shortage of industry partners to meet the demand for learner placement as well as the significance of WIL for non-technical skills, discipline, and self-management traits.

WIL has been firmly identified and championed as a tool to prepare learners for the world of work, but funding and industry participation remain issues. The Australian landscape reflects a concentrated effort by numerous stakeholders to increase learners' work readiness and employability skills via WIL interventions.

The study, which undertook a critical assessment of the WIL difficulties encountered by learners, industry, and academic institutions, disclosed fresh insights that aid in the formulation of possible proposals and solutions.

2.4.2 Europe and the United States of America

Brewer (1990) points out that a program having the curriculum of cooperative education programs started in United Kingdom around the middle of the 19th century. A model to integrate academic learning at the workplace was established in 1974 in the state of Baden-Württemberg, Germany. The German university, Berufsakademie, established collaborative partnerships with European countries through exchange programs with Finland, United Kingdom, Netherlands, France, and Spain (Reinhard, 2006).

According to Sovilla and Varty (2004), a cooperative programme, where a component of the program required learners to spend time in the workplace, was launched in the early 1900s. A similar program in

Canada is believed to have started in the 1950's, resulting in a sharp increase in the engineering and technological education (Sovilla & Varty, 2004).

During an economic slump, WIL programs allowed higher education institutions in Europe to look at teaching employability skills. Focussing on academic programs that transfer core skills and traits required by the workplace allows students and graduates to find, acquire, adapt, and continually improve the knowledge, understandings, and personal qualities that increase their likelihood of finding and creating meaningful paid and unpaid work that benefits themselves, the workforce, the community, and the economy (Oliver, 2015). Apart from providing employability skills, the innovative model wholistically developed learners with personal traits and values that impacted workforce and community alike.

Universities in Germany, Australia, and South Korea collaborated on research into methods for strengthening practical skills, acknowledging that academic institutions globally which do not offer qualifications with a WIL component, face challenges in generating graduates who have the relevant practical skills needed in the workplace (Reinhard, Wynder, & Kim, 2020). Graduates who are not prepared for the job lack technical knowledge, communication skills, and technological proficiency; they have trouble adapting to the workplace, showing an inability to endure work-related pressure, and the lack of "hands-on" experience (Heang, Ching, Mee & Huei, 2019). Hence, easier, and smoother integration of work-ready graduates into the workforce. Employers favoured hiring learners who had completed a qualification that included a work component (McCarthy & Swayn, 2019; Bell, Bartimote, Mercer-Mapstone, Moran, Tognolini, & Dempsey, 2021).

Higher education institutions in Europe are under more and more pressure to do a better job of preparing leaners for the workforce, which is furthered by the growing use of graduate employment indicators to evaluate student performance (Jackson & Meek, 2021).

The need for work-ready graduates is growing in America as well. WIL, a process to involve workplaces, higher education institutions, government, commerce, and industry, has become a strategy for many organisations to enhance the quality of workforce (Cooper, Orrel, & Bowden, 2010). The findings of a University of Sydney investigation into the benefits and challenges of online or virtual Work-Integrated Learning for a variety of programs, including Information Technology and Engineering, with learners from Australia and the United States of America revealed that while some employability skills were gained, learners missed out on workplace interactions (Bell, Bartimote, Mercer-Mapstone, Moran, Tognolini, & Deming, 2021).

Immense and intensive efforts are being made by both academic and corporate sectors to generate work-ready graduates, with WIL increasingly being the preferred option. Despite the challenges associated with offering WIL programs, the transmission of industry-required technology skills occurs. The outcomes of the study resulted in recommendations and other WIL models to address many of the WIL difficulties experienced.

2.4.3 The South African Landscape

The South African WIL landscape is currently being considered a major focus area by government departments, universities, Technical, Vocational, Education and Training (TVET) colleges and employers driving WIL policies, programs, and interventions to improve the various aspects of Work-Integrated Learning. Innovative programs, policy changes and funding interventions have been introduced to improve and minimize the Work-Integrated Learning challenges. The Higher Education Qualifications Framework (HEQF, 2007) declared that the Work-Integrated Learning (WIL) become the total responsibility of University of Technology.

WIL, in its various forms, has always formed an important part of technical, vocational, and professional higher education. The Council on Higher Education in South Africa highlighted the importance of programmes that promote graduates' successful integration into the world of work (Council on Higher Education, 2011). This view is supported by higher education institutions in South Africa, who are obliged, in accordance with the South African Higher Education Qualifications Framework (HEQF), Department of Education Government Notice No 928, gazetted (No. 30353) 5 October 2007 as policy in terms of the Higher Education Act, to place students for prerequisite WIL, thus compelling the institutions to ensure that learners are placed in workplaces and proper monitoring and supervision is conducted (Department of Education, 2007). However, this still poses a massive responsibility on the academic institutions as industry participation is voluntary and may not commit to placement agreements. Another disadvantage is that learners desire to be placed in reputable companies and refuse to accept placement possibilities in organisations recommended by the academic institution. When learners are placed, they must also consider travel distances and accommodation. Because academic institutions only provide a limited number of opportunities, it is still the learners' responsibility to secure placements.

Groenewald (2008) emphasizes that WIL is an integral component of the curriculum. Groenewald (2004) further states that in 2002, the National Commission for Co-operative Education offered a more inclusive definition of WIL as a structured strategy integrating classroom learning through productive related work experiences. The Higher Education Framework (2007) indicated that the engineering diplomas offered by the Universities of Technology should all include the workplace component. The Higher Education

Framework (2007) also advocates that WIL should be included in more professional and vocational programmes. For many years, the inclusion of a workplace component in engineering curricula has been promoted and advocated, and while WIL programs have been implemented by South African academic institutions, major challenges remain, necessitating research to delve into the challenges in order to find solutions and recommendations.

The Engineering Professions Act of 2000 empowers the Engineering Council of South Africa (ECSA), to conduct "accreditation audits" at the Universities of Technology and the implementation of the WIL component is a key component of the audit. This is supported by the Higher Education Qualification Sub-Framework which emphasises that the institutions offering qualifications that have a Work-Integrated Learning component should have the responsibility of finding suitable placement opportunities, (HEQSF, 2013). Accordingly, the end result will be increased pressure on universities to place these students (Samadi, 2013). Nevertheless, timeous placement is still a major issues with the delayed placement resulting in delayed graduation.

HEQF (2007) placed a high value on workplace organization, proper supervision mechanisms, and quality assessment standards. Within the South African context, the following organs of state are involved in promoting WIL directly or indirectly through law and policy development:

1. White Paper for Post School Education and Training (2014)
2. The National Qualifications Framework Act (NQF Act)
3. Workplace-based Learning Policy framework
4. Higher Education Act (1997) of HE (1997)
5. National Plan for Higher Education (2001)

2.5 Legislation, Policies and Government Bodies affecting Work-Integrated Learning

2.5.1 Skills Development Act No. 97

The above Act became effective in 1998, the intention being to improve labour skills, to position South Africa to compete in the global market, by promoting education and training in the workplace (Republic of South Africa, 1998). The Act governs the National Skills Authority (NSA) and the National Skills Fund (NSF), the skills development levy-grant scheme, the Sector Education Training Authorities (SETAs), labour centres and the Skills Development Planning Unit, through fostering partnerships between the public and private sectors of the economy to improve the work readiness levels of new entrants into the labour market (Republic of South Africa, 1998).The current status, however, of the lack of qualified and experienced technicians in the disciplines of mechanical and electrical necessitates the promotion of education and training in the workplace now with more aggression and vigour to meet the demand.

2.5.2 National Development Plan

The National Development Plan was released in 2011 as a roadmap to take South Africa to a position where poverty could be eliminated by building an inclusive economy, enhancing capabilities, growing state capacity and through the promotion and building of leaders and the partnerships throughout society (National Development Plan 2030, 2012). Thus, embedded in the National Plan is the need to improve graduation statistics and work ready graduates to be achieved through the improvement of WIL programs.

2.5.3 National Skills Authority

The National Skills Authority, is an advisory body, providing recommendations to the Minister of Higher Education and Training on policy and strategy related to skills development (Department of Higher Education and Training, 2009). It updates the ministry on the progress made with regards to skills development. Important information on skills development is obtained from the various SETAs (Department of Higher Education and Training, 2009). The members of the National Skills Authority are constituted to represent a wide range of interests and experience (Department of Higher Education and Training, 2009).

2.5.4 National Skills Fund

The Ministry is further supported by the National Skills Fund. The National Skills Fund rolls out key projects for which it funds, with many WIL initiatives frequently funded (Department of Higher Education and Training, 2009). WIL programs of all tertiary institutions, including the TVET colleges, are funded. The funding covers all project management costs, placement costs and learner stipends. However, funding for WIL resources and capital projects are excluded.

2.5.5 Work-Integrated Learning, Partnership, and Innovation Directorate

This directorate under the umbrella of the Department of Higher Education and Training is responsible to promote the WIL activities of the post school system. The responsibilities of the department are listed below:

1. Coordinate the development, implementation, and monitoring of a web-based system to register all learning programs within the post-school system that require WIL.
2. Ensure that the system managing WIL is integrated and linked with other systems within the post-school education.

3. Monitor and evaluate the compliance of the management of WIL.
4. Approve of WIL service providers.
5. Develop and implement a national framework for WIL, (Department of Higher Education and Training, 2018).

Deliverables under the directorate's authority are highly sought after, but the outcomes are still far from being realized; this can only be accomplished through rigorous interaction with academic institutions, industry partners, and other key stakeholders.

2.5.6 Southern African Society of Cooperative Education (SASCE)

While the Southern African Society of Cooperative Education (SASCE), represented the former Technikons, thereafter the Universities of Technology, now has members from public and private colleges, Report 2 (Blom, 2015). SASCE, is also a member of the World Association of Cooperative Education (WACE). SASCE recognises the aspects that link learning to the workplace, namely learning **for** work, learning **at** work, and learning **through** work as described by Forbes (2007).

The following definitions adopted by the Council for Higher Education is also validated by SASCE:

1. **Cooperative education** can be defined as "a philosophy of learning that promotes the concept of enhanced learning based on cooperation between education institutions and industry, commerce and the public sector" (HEQC, 2004; Forbes, 2007).

2. **Experiential learning** is a component of a learning qualification that focuses on the application of institutional academic learning in an authentic work-based context (also called work-based learning). It addresses specific skills and competency requirements for the achievement of vertical added-value learning within a qualification that will enhance employability (HEQC, 2004; Forbes, 2007).

3. **Work-Integrated Learning** is a structured part of a qualification designed to incorporate periods of required work that integrate with classroom study which should be properly supervised and assessed (DoE, 2007; Forbes, 2007). The purpose of WIL according to SASCE, should be directed towards the achieving of a professional or occupational qualification. The collaboration between the university, workplace and the learner should be accomplished in a spirit of trust, accountability, and transparency, for a Work-Integrated Learning program (Forbes, 2007).

2.5.7 South African Qualifications Authority

The South African Qualifications Authority (SAQA) Act, 1995 (Act No. 58 of 1995) promulgated the establishment of SAQA to ensure quality assurance, create the National Learners' Records Database and establish supporting structures for standards and moderation (SAQA, 2000). SAQA's additional roles include the following:

1. Oversee the implementation of National Qualifications Framework (NQF) and collaborate with the Quality Councils.
2. Develop and implement NQF policies and criteria.
3. Register qualifications and part-qualifications on the NQF.
4. Recognise professional bodies and register professional designations.
5. Undertake research and collaborate with international counterparts.
6. Maintain the National Learners' Records Database.
7. Provide an evaluation and advisory service with respect to foreign qualifications.
8. Inform the public about the NQF.
9. Provide advice to the Minister of Higher Education and Training

All UoT qualifications with the workplace component are registered and reside within the SAQA database.

2.5.8 South African National Qualifications Framework

The National Qualifications Framework (NQF) is a single, integrated system made up of three coordinated qualifications sub-frameworks: the Quality Council for Trades and Occupations, the Council for Higher Education, and the General and Further Education and Training. The objectives of the NQF are to create a single integrated national framework for learning achievements; facilitate access to, and mobility and progression within, education, training, and career paths; enhance the quality of education and training; and accelerate the redress of past unfair discrimination in education. The NQF offers standards, directives, and records of student success. Through the facilitation of national recognition of knowledge, skills, and occupational learning, this integrated system improves the quality of learning (SAQA Act, No. 58 of 1995). National Diploma in Engineering are pitched at NQF level 6 on South African National Qualifications Framework.

2.5.9 Department of Higher Education and Training

The Department of Higher Education and Training (DHET) oversees the programs offered by the traditional universities, the Universities of Technology and the Technical Vocational Education and Training (TVET) colleges. The quality assurance function is handled by three bodies, namely, the Quality Council for Trades and Occupation (QCTO), The Council for Higher Education (CHE) and Umalusi. The Ministry of Higher Education and Training is assisted by the National Skills Authority, a body which advises the Minister on various s affecting Higher Education and Training (Department of Higher Education and Training, 2018). Department of Higher Education faces a mountain of complexity challenges, some of which are highlighted and mapped onto challenges for WIL in Table 2.1 below:

Table 2.1: Mapping of DHET Challenges

Department of Higher Education challenges	WIL Challenges		
	Learner Challenge	**UoT Challenge**	**Workplace Challenge**
1. Higher Teacher Attrition rate	√	√	
2. Financial handicaps	√	√	√
3. Social Handicaps	√	√	√
4. Educational Handicaps	√	√	
5.Low graduation at Tertiary Institutions	√	√	
6.Low remuneration for academics		√	
7.Dysfunctional Primary, Secondary and Tertiary Education	√	√	
8.Devastating effect of unemployment, impoverishment in rural areas on education	√		

Source: Adapted from Chetty and Pather (2015)

2.5.10 Sector Education and Training Authorities (SETAs)

The SETAs were established to develop and improve the skills levels of employees in the member companies in specific sectors. Member companies contribute 1% of the salary bill as skills development levies to the South African Revenue Services, on behalf of the SETAs (Department of Higher Education and Training, 2018). Research conducted by the SETAs, identifies the skills gaps in the specific sector and skills programs, learnerships, apprenticeships and other learning interventions are funded, implemented and quality assured by the SETAs.

It is vital to emphasize that WIL interventions have been advocated and sponsored by SETAs because they are part of the sector skills plan. Companies willing to provide work placement for WIL learners are provided with funding, which is mostly used to provide stipends to learners.

The sector skills plan is annually developed from research in the sector to address the skills gaps in the sector.

2.5.11 Engineering Council of South Africa (ECSA)

The Engineering Profession Act, 2000 (Act 46 of 2000) permits the Engineering Council of South Africa (ECSA) to accredit the Universities of Technology to offer the National Diplomas in engineering once every 5 years, where a team of specialists carry out detailed audits of the management and quality of the Engineering Diplomas. The workplace component of the qualification is audited during these visits to ensure compliance. The key exit level outcome for workplace modules Practice1 (P1) and Practice2 (P2) requires the understanding for solutions to engineering related problems in the workplace by applying the academic learning gained from the University of Technology. The Engineering Council of South Africa notes the purpose of Work-Integrated Learning as the connecting the learners academic learning with workplace practice.

The international comparability of this engineering technician education qualification is ensured through the Dublin Accord which was signed in 2002 by Canada, United Kingdom, Republic of Ireland and South Africa. The agreement established mutual recognition of the qualifications which underpin the granting of the Engineering Technician as a title to those who successfully complete the engineering diploma which includes the workplace modules. During the ECSA audits, however, a snapshot of the UoT’s database of workplaces is examined, and physical visits to these workplaces for inspection may occur, verifying that suitable workplaces are used to offer the workplace component.

2.6 **Work-Integrated Learning Institutions**

The WIL component is required in some program offerings from all institutions of higher learning. In South Africa there are 25 universities, which includes 5 universities of technology and, 50 Technical, Vocational, Educational and Training (TVET) colleges spread across the nine provinces of South Africa. The quality assurance bodies for these institutions are the Council on Higher Education, The Quality Council for Trades and Occupation and Umalusi (Umalusi, 2005).

Although WIL is a component of the curricula from all the institutions of higher learning, the researcher will focus on the WIL component of the universities of technology program offerings, specifically the electrical and mechanical diploma.

Many of the universities of technology today have evolved from Technikons. The Durban University of Technology for example, is a merged institution between the Natal Technikon and the M L Sultan Technikon. Natal Technikon was set up to facilitate the development of the white community during the apartheid regime. The establishment of M.L Sultan Technical College, on the other hand, an example of an achievement, during the dark era of apartheid, by a determined community spirit was funded by Mohamed Lappa Sultan in 1941 and in May 1979 the status of the technical college changed to a Technikon. The Natal Technikon and the ML Sultan Technikon was separated by a road, even though both institutions offered similar programs, since one serviced the tertiary needs of the white population and the other of the non-white population. The merger of the Natal Technikon and the ML Sultan Technikon occurred in April 2002 to form the Durban Institute of Technology soon after the collapse of the apartheid government.

The Durban Institute of Technology soon evolved into a fully-fledged university, after a directive from the Department of Education for tertiary Institutions to be globally competitive and became the Durban University of Technology. A core requirement of many of the program offering at DUT has a compulsory workplace module, without which a learner who having completed all the academic subject, cannot graduate.

The other disadvantaged University of Technology, based in KwaZulu-Natal, a coastal province in South Africa, is the current Mangosuthu University of Technology which evolved from Mangosuthu Technikon. The Technikon was established for the training of technicians from the South African black community and in November 2007, was renamed the Mangosuthu University of Technology. The researcher intends to include the participants and related information from the Mangosuthu University of Technology for this research study as well.

2.7 Other Initiatives, Policies and Bodies

South Africa has undertaken many initiatives and established many bodies to enhance knowledge and skills to drive the economy in a positive direction. Among the many bodies established and interventions initiated are the following:

1. Council of Higher Education.
2. Quality Council of Trades and Occupation
3. Umalusi
4. White Paper for Post -School Education and Training
5. National Skills Accord
6. The National Economic Development and Labour Council
7. The Higher Education Qualifications Framework (HEQF)

8. The Higher Education Qualification Sub-Framework (HEQSF)
9. The New Growth Plan
10. National Development Plan 2030

2.7.1 National Skills Development Strategy 3

NSDS III seeks to encourage and actively support the integration of workplace training with theoretical learning, and to facilitate the journey individuals make from school, college, or university, or even from periods of unemployment, to sustained employment and in-work progression.

In highlighting the many of the achievements and difficulties facing South Africa's skills development Kraak (2015), found the following issues that adversely affected skills development:

1. A lack of political will to ensure the success of the "integrated" approach to education and training that South Africa formally adopted after 1994.
2. Serious governance issues with regards to the management of Sector Education and Training Authorities (SETAs).
3. Including financial mismanagement and fraud, and a plethora of operational issues that make the rollout of the NSDS a very challenging and complex task (Kraak, 2015).

Kraak's (2015) concerns, namely a lack of political will, governance issues, and financial mismanagement, are averse to the development of any organization or project, and so any effort to promote WIL will be futile.

2.7.2 White Paper for Post-School Education and Training

The purpose of this white paper is to outline ideas for expanding the present delivery of Education and Training in South Africa, improving its quality, integrating the various post-school system streams, and including industry, business, and employers to participate in developing a skilled workforce. The "Green Paper for Post-School Education and Training" served as the foundation for the paper's development, which involved stakeholder participation, (South Africa, Department of Higher Education and Training, 2014.Included in the white paper is a plea for increased industry partnerships and further WIL related research.

2.7.3 National Plan for Post-School Education and Training: 2021–2030

According to the Department of Higher Education and Training (2021), the National Plan for Post School Education and Training outlines the objectives, approaches, and roles for realizing the White Paper's vision of an enhanced, transformed, extended, responsive and articulated post-secondary education and training system. It anticipates a South Africa that is socially just, inclusive, and peaceful, with decreased unemployment, eroded poverty, and reduced inequality. In order to bridge the gap between theoretical and practical knowledge and skills, the White Paper lays out a policy vision for a stronger and more collaborative interaction between Post-School Education and Training (PSET) institutions and the workplace. Strengthening academic programs and qualifications at system and institutional levels, as well as encouraging employers to participate therein, will help to improve education and employment outcomes, as will greater industry involvement in the financing of research and development and in developing partnerships and promoting synergies with higher education institutions and research councils. Not least, PSET provider institutions must be assisted to drive innovation that addresses industry and community challenges. Cooperation between lecturers and researchers in PSET provider institutions, and between employers, planners, and practitioners in the wider world of work, will be supported (Department of Higher Education and Training, 2021).

2.7.4 National Skills Accord

The National Skills Accord (2011), signed by Government and social partners to set a NEW GROWTH PATH for South Africa. The accord has been signed on behalf of:

1. Organised Labour
2. Business
3. Community Constituents
4. Department of Higher Education and Training

With the following commitments:

1. To expand the level of training
2. To make internship opportunities and placement available within workplaces
3. To set guidelines of ratios of trainees: artisans to improve level of training
4. To improve funding of training, incentivizing companies
5. To set annual targets for training in SOEs
6. To improve seta governance and financial management
7. Align training for economic growth
8. To improve the performance of Technical, Vocational and Education and Training (TVET) colleges

The signatories to the National Skills Accord have the potential to make considerable advances in increasing access to workplaces, but their impact has yet to be realized. The study identified many challenges that lie outside the scope of the National Skills Accord.

2.7.5 The National Economic Development and Labour Council

The National Economic Development and Labour Council is the vehicle by which government, labour, business, and community organisations will seek to cooperate, through problem solving and negotiation, on economic, labour and development issues and related challenges facing the country. NEDLAC has been established in law through the National Economic Development and Labour Council Act, Act 35 of 1994.South Africa has been characterised by severe inequality in income, skills, economic power, ownership, and a skewed pattern of social development. This together with large scale unemployment and inadequate economic performance has created major problems in our society. Government, organised labour, organised business, and community-based organisations need to develop and to strengthen cooperative mechanisms to address the challenges facing the new democracy.

2.8 Co-operative Education Directorate in South African Universities of Technology

The study will focus on the universities of technology in KwaZulu-Natal, namely, the Mangosuthu University of Technology and the Durban University of Technology. The engineering diploma offered by these institutions, in addition to four (4) semesters of academic learning, includes two (2) by six (6) month blocks of Work-Integrated Learning in relevant workplaces. In South Africa, the Universities of Technology (UoTs), have the Department of Cooperative Education to co-ordinate and manage the workplace learning component (Bezuidenhout, 2015). Figure 2.2 provides a graphical repersenatation of the human resources required by the Department of Cooperative Education in order to co-ordinate and manage the WIL functions of a University of Technology.

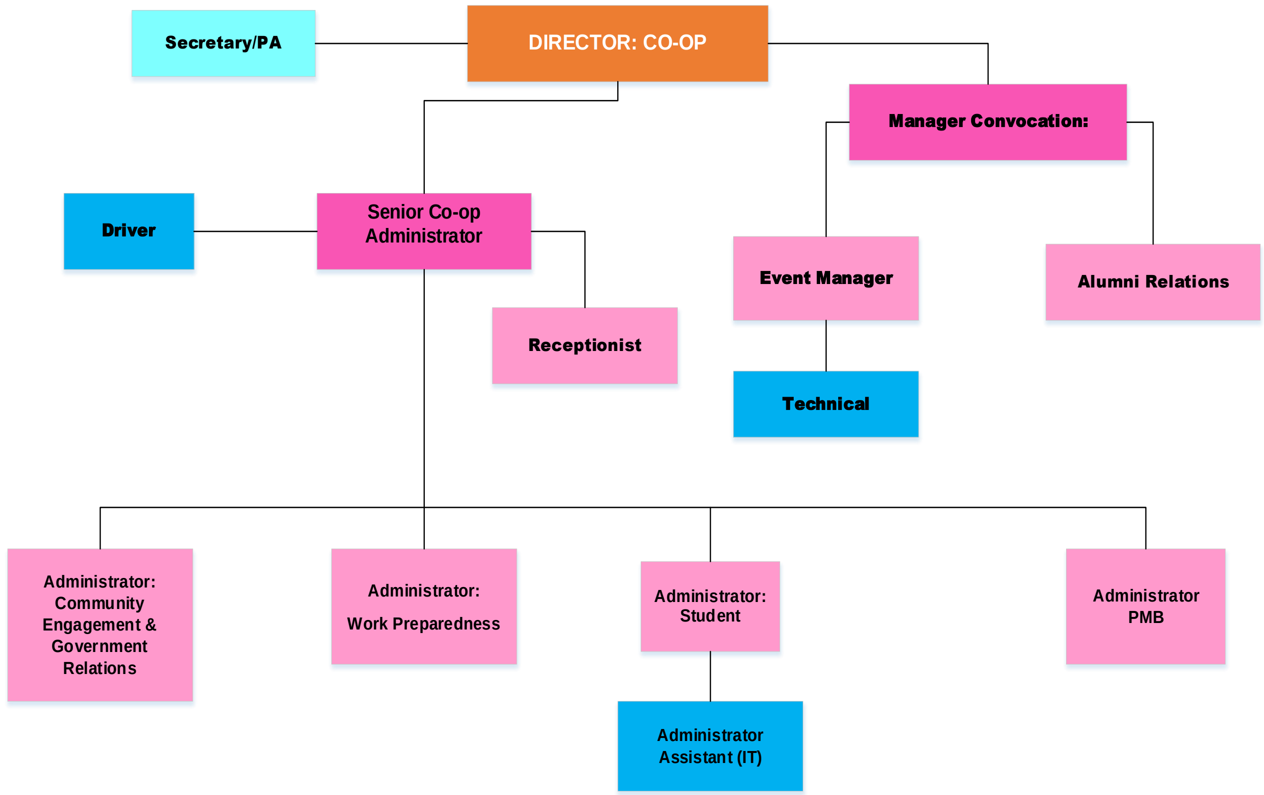


Figure 2.2: DUT Co-Operative Department Organogram
Source: DUT (2019)

The workplace component of the engineering diploma is coordinated by the Cooperative Education Department at the Durban University of Technology. The key responsibility is to build partnerships with industry and maintain a database of learners requiring WIL opportunities. The onus however is for the learner to find a suitable work environment for the workplace component of the diploma. The workplace module is expected to provide “hands-on” experience for the learner.

However, the major support for the WIL program is to be provided by the Co-operative Education Practitioners. Jacobsz and Wessels (2012), citing De Lange (2004), describe the magnitude and importance of role that Co-operative Education in Higher Education Institutions play, which extends to include among others, national and international networks, strong and wide industry connection and relationships, engagement with alumni(past students who are influential figures in the corporate world), continuous training and development of staff, financial planning and budgeting, involvement curriculum development, partnership with industry and research in Co-operative Education and related fields.

Industry Liaison meetings are organised on a bi-annual basis, where representatives from industry provides input into various issues to improve the program to make the qualification more relevant. Industrial participation in these meetings is generally, extremely poor (Committee, Nov., 2018).

2.9 Co-operative Education Practitioners

The co-operative education programs offered at the South African Universities of Technology are serviced by a dedicated Co-operative Education Department with the lecturers from various departments providing further support. The functions of the Co-operative Education Department are listed below:

1. Learners pursuing the mechanical and electrical engineering diplomas will submit their comprehensive their curriculum vitae (CVs) at the Co-operative Education Department offices once they have completed all the academic modules for work experience opportunities, these CVs are emailed to companies inducting learners.
2. Companies and industries planning to provide workplace experience opportunities to engineering learners will contact the co-operative Education Department for CVs. And arrangements are made for interviews after a shortlisting process.
3. Coordination and funding of Industrial Liaison Meetings, which are held twice a year. The Co-operative Education Department arranges suitable venues and refreshments since hosting key decision makers from industry professionals committing their time and expertise.
4. Plans and arranges the World of Work events where companies offering potential workplace or employment market themselves at dedicated stands at the same time the engineering departments provides information about their respective offerings.
5. Provides support to the subject matter specialists or departmental lecturers when they visit the learners on site.
6. Provide support to the department lecturers who visit companies to monitor learner progress and quality of learning.
7. Coordinates and Hosts alumni events, a platform to engage with past students who have successful careers to offer WIL opportunities to learners.

In summary, the Co-operative department is the initial point of contact for workplaces endeavouring to induct learners, it is the link between the engineering departments, learners, and the workplaces. Through various interventions the Co-operative Department sustains and maintains a healthy relationship with the workplaces and hosts many events to expand the database of workplaces.

2.10 WIL Registration Process at the University of Technology

The workplace component of the diploma is comprised of two blocks of six months exposure in a suitable workplace [Practice 1(P1) and Practice 2 (P2)]; however, a process of registration is required for the workplace component.

Outlined below is the UoT's registration process.

2.11 Registration Process for P1 and P2 Electrical and Mechanical

Students have to register a month after finding placement. For registration they report their placement to the faculty where they complete a form with the employer's details. This form is perused by the WIL Co-ordinator or the Administrator in the Co-operative Education Office. Once verified for authenticity, the student is issued with a Logbook and this process is followed for both P1 and P2.

2.12 Approval Process for workplaces for P1 and P2

For workplace approval, the WIL Coordinator visits the site (where possible before the student starts work or within 3 months of placement. For approval, the WIL Coordinator conducts inspection against a checklist to establish suitability of the placement to offer both P1 and P2. If the company satisfies the requirements, a Site Verification certificate (with a life span of 3 years) is issued to the company. This is signed and issued by the Director Co-operative Education.

2.13 WIL – Africa Conference

This conference is Africa's premier WIL event, the inaugural conference being held in 2015. The 3rd conference was held at the Umhlanga Convention Centre the organisers of the conference being SASCE and the NSA (National Skills Authority) and the conference theme for 2018, WIL: Policy to Implementation. In his opening address of the 3rd WIL-Africa Conference, the SASCE President, Carva Pop, stressed the importance of work ready graduates to meet the expectations of industry (Pop, 2018).

2.14 World Association for Co-operative Education

The World Council and Assembly on Cooperative Education (WACE) was founded in 1983 by a group university academics and employers to foster Co-operative Education and other WIL programs worldwide. WACE today has established itself as the international association for Work-Integrated Learning, with a world-wide membership of academia and employers, holding world conferences every two years. These conferences are held around the world, with research presentations published in respective journals, strongly demonstrating the global effort to address WIL issues and enhance WIL practices.

2.15 Work-Integrated Learning Objectives and Benefits to Learners

The electrical and mechanical engineering diploma qualification offered at the Universities of Technology, have embedded in the qualification the workplace component. Learners enrolling for these qualifications expect to obtain a qualification which would increase their employment opportunities and being employed enjoy independence (Msukwini, 2017, citing Moleke, 2015). According to Boles and Beck (2007), the WIL exposure prepares students for the world of work and prepares them in identifying their roles and functionalities in it, providing the organisation with better educated and work-ready employees.

The workplace module provides an enrichening experience for the leaners. Jackson (2013) points out that the workplace module boosts student confidence and further improves their employability skills. Fallows and Steven (2000) reaffirm the notion that WIL equips learners with more employability opportunities. The unique design of WIL affords learners the opportunity to garner useful skills and positions them to embrace potential future careers while encouraging economic innovation and growth (Bell, Bartimote, Mercer-Mapstone, Moran, Tognolini & Dempsey, 2021). The WIL strategy is considered a successful method for giving learners realistic, real-world learning experiences and boosting their employability opportunities through improved confidence, organization, and communication skills, however, time restrictions, learner cohort numbers, and insufficient human resources capacity were highlighted as challenges encountered (Doolan, Piggott, Chapman & Rycroft, 2019). Hodges and Birchell (2003) pointed out that the skills and competencies gained through the WIL experience are highly rated by employers.

The quantity and quality of learning through the workplace experience can be vast, Sovilla and Varty (2004) perceive that significant learning may be gained by learners from the workplace module which is further emphasised by Hodges and Birchell (2003), who believe that the WIL qualification design can offer the learner an opportunity to acquire a range of valuable competencies and skills. WIL offers a priceless opportunity for the fusion of theory and practice by exposing potential graduates to the world of work (Govender & Wait, 2017). Due to a perceived increase in workload, the majority of academics appear to be reluctant to encourage WIL, depriving themselves and their learners of the benefits of WIL, particularly for student career prospects (Govender & Wait, 2017).

The Council for Higher Education’s Work-Integrated Learning: Good Practice Guide (CHE, 2011) places great emphasis on the preparation of graduates for the world of work who should be equipped with a set of competencies and skillset which should satisfy a potential employer’s requirements. The WIL model provides valuable work preparation and readiness. Work-Integrated Learning :Good Practice Guide (2012) highlights the following as benefits of Work-Integrated Learning qualifications:

1. Improvement in academic performance.

2. Expansion and enhancement of interdisciplinary thinking.
3. Greater eagerness to learn.
4. Communication skills, teamwork, leadership, and co-operation are additional skills could be learnt during the workplace module.
5. Career benefits, for example, career clarification, professional identity, increased employment opportunities and salaries, development of positive work values and ethics.
6. Increased competence at the workplace through the development of skills and technical knowledge.

While practices differ vastly from country to country, this community of practitioners agree that workplace-based learning share at least the following six characteristics:

Partnerships which benefit both parties: 'between an external organization and an academic institution', to foster and extend learning.

1. Learners are considered employees: this is in contrast with the question still being asked about the identity of 'learner-workers' in South Africa.
2. The program that is followed is derived from the needs of the workplace and does not necessarily only follow a disciplinary or professional curriculum: 'work is the curriculum'.
3. Learners enter the workplace as learner-workers on the based on current competencies, which in turn, will depend on when in the program the workplace-based learning will take place.
4. Learning projects are undertaken in the workplace which are 'oriented to the challenges of work and the future needs of the learner and the organisation.
5. The assessment of learning outcomes remains the responsibility of the educational institution, which suggests close working relationships between academics and workplace mentors and supervisors (Boud & Solomon, 2001).

2.16 Impact of COVID-19

The globe entered a completely unanticipated and extraordinary new year at the turn of the year 2020. COVID-19 made its debut towards the end of the year, and shortly after that, an outbreak that spread to practically every country in the world. The rapid spread of the virus resulted in 29,155,581 confirmed cases and around 926,544 fatalities worldwide, as reported by the World Health Organization (Khalfan & Ismail, 2020).

The following COVID-19 effects were highlighted in the water sector:

1. COVID-19 has shown the importance of the water industry for public health during a pandemic.
2. The COVID-19 crisis has brought to light the urgency of recognizing water access as a public health priority.
3. The pandemic has led to an increase in domestic water demand whilst a decreased demand for businesses.
4. The pandemic has had a positive impact on accelerating technology use for progressing and delivering water sector projects and
5. Staff have been adaptable to the changes of working in accordance with COVID-19 secure guidelines (Renukappa, Kamunda & Suresh, 2021).

The water sector and other industries that rely heavily on engineering operations suffered greatly due to the lack of highly skilled artisans, technicians, and engineers as a result of the pandemic's devastation, which accelerated technological innovations through investment in automation.

Work is no longer simply done within the confines of a constrained office; rather, the nature of work has evolved new practices and ways of being, leading to the adoption of remote work settings, variable time constraints, and constant connection (Reckwitz 2017; Dean & Campbell, 2020). Work has evolved, with vast portions of the workforce that had previously been unaffected by emergent and progressive change, being suddenly pushed into new methods of working away from colleagues and the workplace (Dean & Campbell, 2020). While the transition to remote working environments may have been a worthwhile option during the pandemic, it is still debatable whether the option is appropriate for all sectors post-pandemic, as many organisations have reverted to the preference of staff being permanently office-based, with some organisations have adopted a hybridized model of remote work mixed with office-based work.

2.16.1 Impact of COVID-19 in SA

Active employment fell by 40% after a month of strict lockdown. Workers did not anticipate returning to their occupations in over half of these situations, which might have long-lasting impacts on the labour market. Existing inequalities were greatly worsened by the pattern of job loss, and authors project that the number of people living in poverty has increased significantly (Jain, Budlender, Zizzamia, & Bassier, 2020).

There are four ways that a lockdown and other measures are anticipated to affect economic activity:

1. The forced reduction in production caused by a national lockdown and other restrictions on non-essential business operations,

2. The impact of the lockdown on consumer demands for goods and services,
3. The impact of disrupted global production and supply chains on South Asia, and
4. The effect of uncertainty on business investment (Arndt, Davies, Gabriel, Harris, Makrelov, Modise & Anderson, 2020).

2.16.2 The impact of COVID-19 on WIL

As the world responds to the consequences of COVID-19, Work-Integrated Learning (WIL) programs around the world are impacted similarly. Work-Integrated Learning learners either let go of their WIL experience or switched to working remotely, according to Kay, McRae, and Russell (2020); some academic institutions and industries faced difficult problems as a result of this upheaval, which had an impact on student learning, program delivery, risk management, staff capability, and industry involvement (Kay, McRae, & Russell, 2020). Hospitality and tourism education providers, on the other hand, developed technologically enabled WIL interventions to support industry-relevant learning through simulative WIL or WIL placements carried out in remote WIL contexts (Kay, McRae, & Russell, 2020).

Teaching and learning processes in postgraduate education have been significantly impacted by COVID-19, and disruptions to WIL have had a detrimental effect on student learning. Hence adjustments to the curriculum and other alternate methodologies or approaches for WIL should be developed to assist learners requiring industry placements as a result of the disruptions to WIL caused by the pandemic (Bilsland, Nagy & Smith, 2020). Apart from the impact on student learning, the pandemic also disrupted the performance of academic staff who had to find alternate approaches for WIL. Such alternate approaches are required to provide workplace projects in real time for WIL which has been challenging. COVID-19 negatively affected academic staff, whose teaching principles were questioned; it disrupted students' education, workplaces, and personal lives (Prior, Griffin, O’Brien & Van Dam, 2020).

The pandemic had a negative impact on technical vocational education and training (TVET) training and Work-Integrated Learning (WIL) assessment activities in particular (International Labour Organization, [ILO], 2021; Hondonga, Chinengundu, & Maphosa, 2022). Higher education, likewise, moved to rapidly change and adapt to distance work and learning methods. The global pandemic restrictions also prompted teachers to transition quickly to entirely online and distance learning (Dean, & Campbell, 2020).

The pandemic has redefined the definition of a workplace, as shifts to various modes of working caused by forced lockdowns have resulted in remote working, online work, meetings moving away from physical offices and boardrooms to be hosted on virtual platforms, and slots of online work combined with work in physical workplaces.

Hence, the changes in the workplace caused by the pandemic accelerated the development of diverse online, innovative, and creative WIL practices, (Dean & Campbell, 2020, Kay, Ferns, Russell, Smith, Younger, 2022; Kay, Fenton, Ramji, & Ivkovic, 2022). It is, however, argued that remote WIL may distance learners from their support networks and social groups, disrupting their sense of social connectedness, sense of belonging and well-being (McBeath, Drysdale, & Bohn, 2017; Stanton, Zandvliet, Dhaliwal, & Black, 2016; Taylor, Milne, Tam & Stirling, 2022).

Emerging WIL models

The COVID-19 pandemic has provided a sudden and significant push for the rapid transformation and adoption of creative online WIL pedagogies and practices that are sustainable and innovative without the need for industry, necessitating a comprehensive re-design and shaping of WIL in non-workplace settings, with well-structured and purposefully designed WIL models for the future.

Non-placement WIL which are closely linked to mirror the world of work, are at the forefront of this thinking and practice (Hains-Wesson, 2012; Hains-Wesson & Campbell, 2014; Kaider, Hains-Wesson & Young, 2017). Non-placement WIL, which provides an alternative experiential learning model on campus, allows trainees to engage in authentic experiences that integrate theory with practices and notions of work, may also need an alternative assessment (Dean & Campbell, 2020). Hondonga, Chinengundu, & Maphosa, (2022) support a similar concept in which learners can participate in maintenance and manufacturing units in relevant engineering disciplines inside the university. This model would require massive investments in infrastructure and equipment for the engineering streams, and a further requirement would be the skilled human resources to operate and maintain the machinery and equipment.

Many healthcare services cancelled placements for healthcare students, (O'Flynn-Magee, Hall, Segaric, & Peart, 2021; Bacon & Hopkins,2022); however, many other healthcare services innovatively transitioned to telehealth models of placement, allowing WIL placements to continue during the pandemic for learners complete their course (Park & Shim, 2021; Bacon & Hopkins, 2022). For sustainability and quality, these new techniques must be time tested, allowing for the acquisition of appropriate knowledge, skills, and personal development.

The virtual platforms provided significant opportunities for worldwide participation on numerous WIL activities and interventions, leading to new insights on international quality design and delivery. The pressing need for global engagements and co-operation gave birth to the concept of Global WIL modules: a foundational module "Global Perspectives in WIL" was the first module to be launched with the intention to enhance the understanding and relationship between the global players in the WIL space, (Zegwaard, Johansson, Kay, McRae, Ferns, & Hoskyn, 2019; Ferns, Kay, Hoskyn, Zegwaard, Johansson, & Mcrae, 2022). The commencement of the pandemic accelerated worldwide interaction in order to gain useful experiences from participants in the WIL sector in order to solve the pandemic's placement hurdles and limits (Kay, Fenton, Ramji, & Ivkovic, 2022). With technology enabling the provision of WIL greater than we could ever have expected, and certainly greater than tertiary institutions had prepared for, global collaboration enabled greater networks of WIL across disciplines, sectors, countries, and higher education academic institutions. As a result, WIL programs have expanded around the world and diversified well beyond placement-based experiences (Kay, Ferns, Russell, Smith, & Winchester-Smith, 2019; Dean & Campbell, 2020; Kay, Fenton, Ramji, & Ivkovic, 2022). Additional advantages of global collaboration may include greater social, economic, cultural, political, and intellectual learning opportunities for learners, as well as better global citizens with a higher level of cultural intelligence, (Kay, Fenton, Ramji, & Ivkovic, 2022). International participation and collaboration on WIL challenges should significantly impact the WIL industry, with many innovative and creative WIL models expected to surface in the future.

WIL models in which learners participate in shorter, more genuine activities, such as micro-placements, hackathons, competitions, and events, may reduce the amount of time necessary in the workplace (Kay, Ferns, Russell, & Smith, 2018; Dean & Campbell, 2020). When planning or structuring the numerous short activities, however, consideration should be given to relevancy, quality, and coverage of the placement curriculum. The scaffolding WIL model is structured and organised in a similar manner.

Scaffolded WIL is characterized by a series of WIL experiences that structure fundamental disciplinary areas within a program curriculum (Jackson, 2015; Kaider & Bussey, 2018; Zegwaard & Rowe, 2019), where WIL related activities may be embedded and merged as formal components into to form part of the assessments (Jackson & Bridgstock, 2020; Tezcan, Durakovic, Lloyd, & D'arcy, 2020). Planning and preparation for scaffolding of WIL experiences is paramount for enabling good learning experiences (Dean, Eady & Yanamandram, 2020; Rowe & Winchester-Seeto, in press; Rowe & Zegwaard, 2017; Zegwaard & Rowe, 2019). Tezcan, Durakovic, Lloyd and D'arcy (2020) further support the scaffolding WIL experiences as an alternate design, suggesting the delivery mode to be simulation (Zegwaard, Pretti, & Rowe, 2020).

Learners may articulate skills learnt through alternative forms, such as explicit activities of written reports and documents, presentations, productions, or the creation of artefacts and building of portfolios (Meier, Kropp, & Perellano 2016; Brink & Joseph, 2022).

As a result of the pandemic, technological platforms enabled growth in online projects and virtual placements (Kay, Ferns, Russell, Smith, Winchester-Seeto, 2019), as well as other forms of online simulations (Bayerlein & Jeske, 2018) and virtual reality WIL experiences (Shehri, 2012; Dean, &

Campbell, 2020). Simulations, both online and offline, as an alternative for WIL increased significantly, and several WIL activities merged simulation and artificial intelligence to acquire transferable skills (Stellar, McLean, & Doodley, 2022). However, because online simulations lack the mentorship component and dimensions of experiences that actual work placements provide, they may have different effects on student learning (Iipinge, Batholmeus, & Pop, 2020; Zegwaard, Pretti, & Rowe, 2020). However, it may be argued that in the lack of physical WIL placements, online simulations can provide a viable substitute for acquiring workplace skills components.

According to Dean and Campbell (2020), new models of non-placement WIL provide scalability of access and opportunity where the mentor: learner ratio in industry is typically one-to-one but may expand to one-to-many. However, it should be noted that many organisations and industries who participate in WIL placement use a lot of mentors and typically absorb a large number of learners on a yearly basis. Non-placement WIL also increases variability in learner experiences and organizational requirements because these shorter, less resource intensive WIL activities indicate an increased willingness of industry and community to partner with higher education institutions in new ways that include greater contributions to the co-design of WIL models (Kay, Ferns, Russel, & Smith; 2018).

The pandemic introduced a varied spectrum of creative non-placement WIL models; however, the quality of these experiences must be tested. Previous study has described the benefits and drawbacks, but the experiences of WIL learners who transitioned to remote working should be investigated, (Pretti, Etmanski, & Durston, 2020). Dean and Campbell (2020) support the quality assurance process for these new emerging WIL models by stating that improvement through policy recommendations and program development requires close monitoring and evaluation.

Non-placement WIL model benefits are listed below:

1. The learner must now manage their own time more effectively, use a broader range of digital skills and literacies to communicate effectively in this new context, and develop appreciations of workplace culture and supervisor expectations through short-structured interactions rather than immersion in the physical setting.
2. The non-placement model introduced new approaches to WIL that necessitates unique considerations for quality assurance methodologies.
3. It might be argued that in the aftermath of the recent COVID-19 outbreak, some non-placement WIL alternatives have now permanently replaced the conventional WIL model.

4. While the design of WIL opportunities has gradually evolved over the last few years, it is time for WIL to become more aligned with the numerous and diverse ways of using technology and performing work.
5. Giving learners opportunities to take on a variety of authentic roles through various WIL models would improve learning and students' capacity to adapt to diverse sorts of work (Dean & Campbell, 2020).

According to Nolan (200), as well as Dean and Campbell (2020), the reality is that changes are more piecemeal, industry- and sector-specific, and frequently driven by specific organizational goals, with the major challenge of building models that integrate humans with technology (Orlikowski, 2007; Volini, Schwartz, Denny, Mallon, Durme, Hauptmann, Yan & Poynton, 2020; Dean & Campbell, 2020).

While certain remote WIL model innovations have made substantial inroads as alternatives and, in some cases, replacements for conventional WIL, there has also been scepticism and pessimism as to their viability and sustainability. According to Nolan (2000), and Dean and Campbell (2020), the reality is that changes are more piecemeal, industry and sector specific, and frequently driven by specific organizational goals, with the major challenge of building models that integrate humans with technology (Orlikowski, 2007; Volini, Schwartz, Denny, Mallon, Durme, Hauptmann, Yan & Poynton, 2020; Dean & Campbell, 2020). For others, remote WIL poses significant challenges for student learning, such as the inability to directly observe a colleague completing a task, the blurring of work and personal spaces, and limited exposure to the nuances of workplace communication (Bowen & Pennaforte, 2017).

Other studies found a lack of communication when doing remote work, leading to feelings of isolation (Bartel, Wrzesniewski, & Wiesenfeld, 2012; Charalampous, Grant, Tramontano, & Michailidis, 2019; Pretti, Etmanski, & Durston, 2020). This hampered communication may have an impact on their ability to deliver productive work (Bailey & Kurland, 2002; Jansen-Perry, Rubino, & Hunter, 2018; Pretti, Etmanski, & Durston, 2020). Supervisor support is critical for the success of virtual WIL because it reduces feelings of isolation and uncertainty (Bentley, Teo, Mcleod, Tan, Bosua, & Gloet, 2016; Charalampous, Grant, Tramontano, & Michailidis, 2019; Jeske & Axtell, 2018; Pretti, Etmanski, & Durston, 2020). This suggests that if learners are well supported by their industry mentors, remote work terms may be more successful than without mentorship.

Major changes and innovations in WIL implementation have occurred as a result of the pandemic; however, when economies recover, the sustainability and success of these new models will be tested and appraised. The emerging new WIL models with the common characteristic of non-placement and promises of a multitude of benefits may permanently shape the future of WIL. However, the author has misgivings about the success of non-placement WIL models in the engineering disciplines. Off-site infrastructure setup for simulation purposes incurs significant costs in terms of space, equipment, machinery, tools, and additional human resources. Learners should continually be encouraged to participate in virtual platforms and other technology interventions such as simulations, robotics, and software programs combined with artificial intelligence. Importantly, when new and alternative forms of WIL emerge, it is critical to maintain a focus on the essence of quality WIL practice and mentoring.

2.17 Conclusion

The researcher attempted to include a global perspective on WIL practices and provided some background to the landscape in Australia, New Zealand, Europe, and Asia. The practice of WIL from countries in Africa was also researched and limited literature was available, however special attention was given to WIL landscape in South Africa covering relevant government initiatives and stakeholder bodies. review the practice of WIL in academic institutions, the different models, legislation governing and influencing WIL, the systems used by the Universities of Technology, the mentoring aspects, assessment models and industry practices and challenges. The emerging trends of WIL implementation driven by the pandemic was thoroughly discussed detailing the innovative global practices for non-placement WIL.

CHAPTER 3

THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 Introduction

The theoretical framework is designed from existing theory in a particular field of study, for the purpose of guiding the researcher throughout the study (Adom & Hussein, 2018). Lester (2005) confirms that the data required for any study should be guided by a theoretical framework. Concepts from the evaluated literature, specifically in the field of WIL, were extracted to construct the primary themes for examination in this study. According to Grant and Osanloo (2014), the theoretical framework should include theoretical principles, constructions, concepts, and tenets that serve as a roadmap for the study. The chapter outlines the key theoretical contributions made by renowned researchers in the field of education. It further discusses key concepts derived from the literature gathered in Chapters 1 and 2 to build a conceptual framework that will be used for the study.

3.2 Co-operative Education

Herman Schneider, an American architect, engineer, and educator, first started cooperative education in the United States as early as 1906 (WIlliams, 2017). The concept of Co-operative Education is based on the application of theory of the academic learning in the real world of work where practical skills are developed using current technology and techniques (Stanley, 2005). Work-Integrated Learning practitioners recognise the value and importance of relationships and connections for the placement of learners in suitable workplaces (Rempel, 2020). The Universities of Technology designed structured cooperative education diploma qualifications to include the workplace learning component, under the umbrella nomenclature, Work-Integrated Learning. The workplace component is included as part of the University of Technology engineering diploma qualification. This modality of WIL is now being globally accepted by many academic institutions.

3.3 Learning by doing

Academic courses, exhibitions, workshops, and conferences are events designed to transfer knowledge, but according to Kolb (1984) and Lewis and Williams (1994), these events do not produce true learning. “Learning by doing” has been a principle of education that has been established and practised for thousands of years, for Reese (2011). Therefore, a WIL component is embedded in the design of the National Diploma qualification, consisting of two blocks of six months of exposure in a work environment where learners are involved in "hands-on" activities, with WIL provides valuable opportunities to apply knowledge gained in the classroom setting. This mode of learning involves the interaction with the environment, and impacts on our lives, shaping our identity, however learning requires personal commitment to deal with complex problems while interacting with others and engaging with our emotions (Boud, Cohen & Walker, 1993); thus, without commitment, learning suffers. WIL provides the opportunity for actual tasks to be performed which aids in the development of the learner's capacity to perform practical skills and apply knowledge learned at the academic institution. Work necessitates planning, communication, implementation, quality assurance, and testing abilities, which can be refined through repetition.

Boud, Cohen and Walker (1993) further emphasise that experience is the central consideration of all learning and add that despite the availability of good teachers, learning resources and opportunities, the learner must be engaged in the experiential activities for learning to occur. Experiences were categorized in three groups, namely, cognitive, affective, and conative or psychomotor, dealing with the learner's thinking, the values and feelings and activities. All experiences add up and build upon each other as a seamless whole (Boud, Cohen, & Walker, 1993). The far-reaching benefits of "learning by doing" goes beyond the practical skills developed and extends to thinking, reason and remembering, in addition to responsibility, work ethic and commitment.

3.4 Kolb's Experiential Learning cycle

Psychologist David Kolb in 1984 outlined his theory of experience being a source of learning and development. Kolb describes a four-stage model that learners undergo starting with a concrete experience, the learners then formulate a set of observations and reflections about that particular experience, the next stage of learning would be to begin forming abstract generalizations. The generalizations would be tested in new situations and the cycle of learning is repeated. The workplace provides multiple possibilities for learners to go through these stages, from real experiences through observations and reflections, and finally knowledge formation that can be used in other situations.

Kolb's experiential learning styles and experiential learning cycles are graphically represented in Figure 3.1 below.

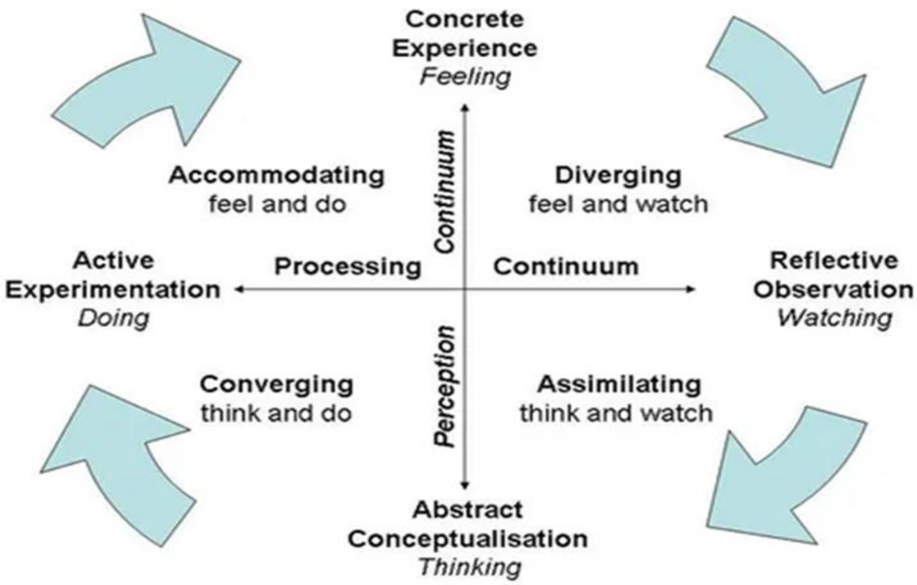


Figure 3.1: Kolb's Experiential Learning Styles
Source: SA McLeod (2017)

A description of the different stages of the of Kolb's experiential learning styles are provided below.

1. **Diverging**

During the divergent stage a learner views concrete situations from several different perspectives, this results in ideas generation. Learners are allowed to work in groups or teams, learning from each other's inputs and contributions. WIL learners encounter numerous opportunities being exposed to a range of situations where learners may weigh the various options to determine the most suitable approach. WIL also offers opportunities to work together in teams where learning from each other may take place.

2. **Assimilating**

The learning stage requires a concise and logical approach with clear explanations where the information is understood and organised in a meaningful format. Greater focus is given to ideas and to abstract concepts. Engineering tasks requires a concise and logical approach with clear explanations where the information is understood and organised in a meaningful format. A project plan and the gathering and interpretation of all required documentation is essential with a greater focus given to ideas and to abstract concepts.

3. Converging

Problems are solved problems using learning or the theoretical principles to find solutions to practical and technical issues. This, learning phase requires learners to experiment with new ideas, to simulate, and to work with practical applications. The author agrees with the application of theoretical principles to find solutions, however the experimentation with new ideas requires caution as the engineering environment is unforgiving and untested applications may result in damage to property and human lives, the process of testing new ideas using simulation would be more acceptable.

4. Accommodating

This stage of learning is through "hands-on" engagement with practical tasks and activities. The experiential approach produces knowledge and skills by virtue of the practical involvement with the tasks. Learners are enriched with valuable learning opportunities during this phase (McLeod, 2017).

The "hands-on" approach is essentially the method of learning WIL advocates, this tried and tested approach to learning can be achieved through the completion of the logbook tasks – a process ensuring the acquisition of employability skills.

3.5 Pragmatism

John Dewey, an American philosopher, impacted education with the contribution of the philosophy of pragmatism. Dewey believed in social learning where students learn, that is, in a natural social setting (Flinders & Thornton, 2013; Williams, 2017). He believed that learners must interact with their environment in order to adapt and learn. Interaction with the environment must go beyond the classroom, blackboard, and desks and to use the conditions of the local community, physical, historical, economical, and occupational as educational resources. The workplace provides a setting for engagement with an industrial environment that is equipped with machinery and infrastructure for engineering tasks to be completed, as well as a setting for classroom learning to be applied. According to Maddux and Donnett (2015), a deeper comprehension of Dewey's philosophical agenda will strengthen our use of reflection in service-learning. Pragmatism is clearly dedicated on dealing with the 'issues of mankind' in visionary ways; it is a strategy for dealing with difficulties, but it is a method that is founded on an awareness of human nature and knowledge (Elkjaer, 2018). Dewey's philosophy of pragmatism and progressivism emphasizes the need to learn by doing and the "hands-on approach" (Gutek, 2014; Williams, 2017).

Dewey believed that learners were unique and advocated that student interest should drive the direction and content of teacher instruction (Dewey, 1938; Williams, 2017). This notion was to shift away from traditional means of teaching and toward more effective and meaningful methods of learning, and WIL gives a meaningful alternative to traditional methods of learning.

3.6 Technology, Innovation, People, Systems (TIPS) Solution

The Da Vinci Institute embeds the Technology, Innovation, People and Systems (TIPS) framework very deeply within its qualifications as a model to develop leadership skills and to ultimately bring solutions to work-based challenges. The framework has demonstrated to be an innovation that is exceptional due to its function in fusing Technology, Innovation, People, and Systems to produce successful results within the world of work (Anderson, 2018). In South Africa, this model of developing leaders contributes significantly towards socio-economic development and transformation. By incorporating the TIPS framework, leaders are better equipped to collaborate, align and be flexible when developing new workplace realities (Anderson, 2018). According to Fuller (2023), the TIPS model of leadership development equips leaders to navigate complex workplace difficulties while leading from the brink of chaos. Links to situations in the real world are also guaranteed by the implementation structure. In order to jointly develop a networked workplace that is results-driven and creative, TIPS techniques help to create and manage productive working connections. The TIPS management leadership paradigm enables the transition from a market-based industrial economy to a networked creative economy, which calls for more independent workers with drive, imagination, and passion (Jarcqe, 2013 & 2015; Fuller, 2023). The framework also offers a systematic understanding of the various subsystems at work and allows reflection on current management and leadership frameworks. The TIPS model encourages awareness of mental models, the capacity to reconsider and analyse performance presumptions, and the ability to create a framework that could help leaders and managers jointly build effective performance solutions (Fuller, 2023).

3.7 The four pillars of the Technology, Innovation, People, Systems (TIPS) model

3.7.1 The Management of Technology

The ability to perform tasks with tools and instruments qualifies each of us as managers of the technology available and utilised (Anderson, 2018). Great strides have been made in technology, today, in every sector ranging from medical, transportation, industry, education, finance, astronomy, defence, information technology and others. The optimal management of the available technology to a specific work-based challenge may contribute significantly towards possible solutions. By using the proper tools, instruments, measurement standards and procedures, performance should be improved, and noticeable differences made (Fuller, 2023).

3.7.2 The Management of Innovation

This is essentially about how an organisation firstly capitalizes on the ideation process to develop an innovative product, service, the process of the system and as a result to commercialize and implement such innovation (Anderson, 2018). Many innovative ideas are waylaid by the poor management and lost before being realised. These ideas if managed properly could have resulted in solutions to complex problems. For innovation to produce an outcome, a process has to be managed and the mindset to manage the innovation process has to be established (Kahn, 2018).

3.7.3 The Management of People

For organizational processes to be successfully implemented, the management of human resources, their abilities, skills, and potential has to be optimally utilised. The understanding of this human element when properly managed impacts positively in the maintenance and growth of businesses and organisations (Anderson, 2018). Central to an organisation is their people. The characteristics that distinguish effective organisations from less effective ones are typically their talent, skills, effort, and ability (Griffin, Phillips & Gully, 2016).

3.7.4 The Management of Systems

For the smooth operation of an organisation the harmonious blending and integration of the various activities, processes and systems are required for optimal performance and the solution of unique problems, resulting in organisations that could become extremely competitive in a global landscape. Furthermore, it presupposes that one views reality as a blend of known, knowable, chaotic, and complicated elements (Anderson, 2018). Assessing and redesigning of organizational processes and systems determines whether they are successful or unsuccessful (Bolden, 2016). Academic institutions are brimming with systems for varied operations in numerous departments, but for harmonious integration and functionality, these systems must be managed optimally. Workplaces, like academic institutions, are subject to numerous systems, and their harmonious and proper management is required for interaction between academic institutions and workplaces.

In linking and integrating the above domains with each other, Da Vinci argues that people should be able to then demonstrate the following behaviours:

3.7.4.1 Being agile: Integrating the management of technology and the management of innovation

Organisations can develop, improve, and adjust their technical requirements, as well as generate enough creative ideas that can be used in the organization to boost market share and profit margins. Academic institutions and workplaces can benefit considerably from incorporating technological management and innovative ideas to improve a variety of aspects of WIL. Technological inputs have been recommended for improvement in a variety of WIL issues.

3.7.4.2 Being aligned: Integrating the management of technology and the management of people

By providing the organization the necessary human capabilities and skills, either through internal development or external hiring of competent and experienced human capital for the current state of technology, allows organisation to be more productive. The management of academic staff and industry mentors' continued development, linking them with necessary technologies for a better knowledge of WIL procedures and activities, is critical to minimizing WIL problems.

3.7.4.3 Being engaged: Integrating the management of people and the management of innovation

Maintaining employee loyalty and motivation is essential to the organization's expansion and success. Maintaining commitment levels and innovation contributions can be achieved by rewarding individuals through incentive and recognition programs (Anderson, 2018). Figure 3.2 shows how the TIPS attributes may be linked. The research will identify possibilities for WIL stakeholders, including UoT staff, learners, and industry mentors, to collaborate on potential novel ideas and improved ways to conduct WIL.

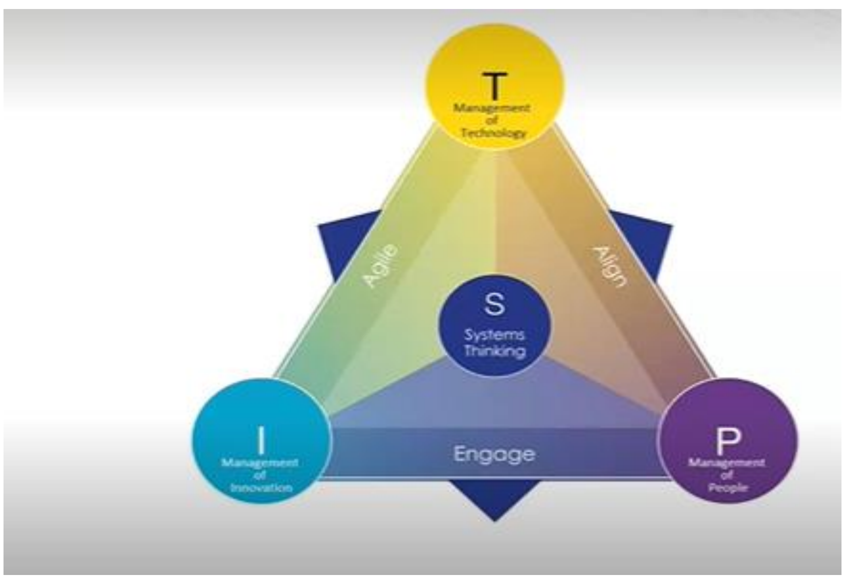


Figure 3.2: TIPS Model
Source: Fuller (2023)

The schools of thought discussed above all point towards supporting the workplace module where valuable skills, including personal skills, cognitive skills and technical skills may be gained in a natural setting, through the application of theory learnt in the classroom.

3.8 Conceptual Framework

A conceptual framework is defined as a network of linked concepts or the existence of a relationship between concepts (Jabereen, 2009). The conceptual framework directs the research by functioning as a "map" or "rudder" to direct the investigation toward the accomplishment of the objectives (Regoniel, 2015). Kivunja (2018) defines the conceptual framework as a logical decomposition of the entire study issue and procedure.

Flinders University identified five areas of emphasis for WIL qualifications: management of WIL, supervision or mentoring of WIL learners, assessment of the workplace component, legal and ethical issues, and partnerships with host organisations (Orrell, 2004; Samadi, 2013).

Figure 3.3 depicts the various concepts that require careful attention in order for the WIL qualifications to be well managed.

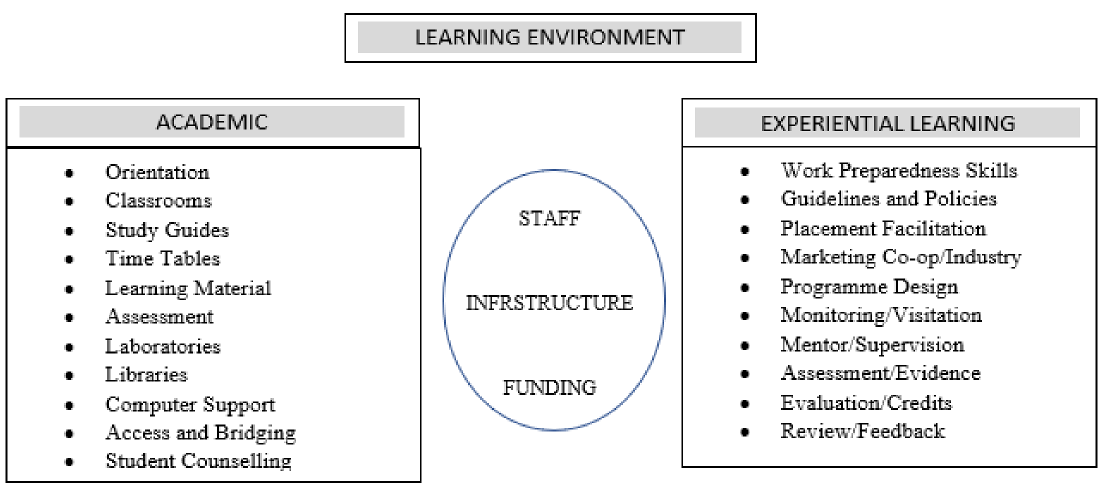


Figure 3.3: Supports for learning environment
Source: Forbes (2005)

UoT's have widely adopted the WIL cycle designed by Brian Forbes to prepare the learners for the workplace (Msukwini, Ori, Pillay & Forbes, 2010).

Figure 2.1 in the previous chapter graphically provides an overview and contextualizes WIL cycle as described by Brian Forbes. Central to the WIL cycle are the relationships between the learners, the institution and industry, where the learners after the completion of the academic component of the National Diploma qualification, are prepared for work readiness by the institutions to be placed in suitable industry for work experience where learners are monitored and assessed.

3.8.1 UoT Lack of Resources

Rook (2017) identified that the lack resources negatively affected the WIL opportunities available to learners.

3.8.2 Human resources for WIL

A concern is raised that staff involved with WIL related activities are inadequately capacitated (Msukwini, *An Investigation into the Human Capacity for WIL*, 2017). Increased workload and time constraints experienced by staff involved with WIL have also been identified as a challenge (Clark, Rowe, Cantori, Bilgin & Mukuria, 2016; Rook, 2017). According to Vardi (2009) and Cilliers (2015), academics normally are overloaded working long hours; however, the added load of WIL responsibilities places increasing demands on them.

3.8.3 University of Technology Financial resources

The lack of available funding opportunities has negatively impacted on the provision of placement opportunities, often forcing the universities to use student revenue for placement expenses (Rook, 2017). Moloi (2015) further points out that the funding to undertake WIL activities is absent. Mthembu (2013) argues that the South African academic institutions offering WIL qualifications do not adequately plan for the workplace component of learning nor do they include a budget to fund WIL.

Lawson, Fallshaw and Papadopoulos (2011) and Rook (2017) note that WIL support from academic institutions is limited, and the lack thereof places considerable negative impact on the resources required for the development and delivery of quality WIL initiatives.

3.8.4 University of Technology-Industry Partnerships

Due to an excellent relationship between the academic institutions and the employers, most students requiring Wil are placed without going through an interview or selection process (Jacobs, 2015).

Many universities offering WIL programs do not give them priority or importance, and therefore allocate minimal funding resources towards WIL activities, resulting in placement challenges (Lawson, Fallshaw & Papadopoulos, 2011; Rook, 2017).

More respect, appreciation, and value should be provided in the domain of WIL, according to Emslie (2011) and Rook (2017); this approach will then allow enhanced access to resources. Understanding WIL and its benefits in greater depth may mean comprehending the influence and contributions workplace modules make in enhancing the learner's level of knowledge and skills.

Rook (2017) recommends that all stakeholders should be involved when designing and implementing WIL programs, and that the relationships between relevant stakeholders results in productive contributions and inputs which ultimately address many challenges.

3.8.5 Communication

Meaningful, regular communication amongst stakeholders is an important factor for fostering successful connections and collaborations, according to Rowe, Mackaway, and Winchester-Seeto (2012) and Rook (2017). In order to address the various challenges around the development and the delivery of WIL qualifications, healthy communication channels should exist.

3.8.6 Curriculum Mismatch

Communication between the academic institutions and the industry around curriculum amendments is necessary for the sharing of ideas and to support curriculum alignment (Cilliers, 2015). Moloi (2015) points out that for a long time, the outputs of the academic institutions and the expectation of the employers that offer the workplace opportunities have not been aligned. Quality assurance systems to ensure the quality and relevance of the workplace learning have been absent (Mthembu, 2013). Workplaces may offer tasks that are not aligned to the curriculum of the academic institution, work that is irrelevant, or duties that are too sophisticated for the required level of the diploma qualification. However, Universities of Technology provide a logbook prepopulated with tasks for the learner to attempt while in the workplace. Mentors should utilize the logbook tasks as a guideline for developing projects and work opportunities for the learner. Learner experiences are documented in the logbook, which serves as an assessment tool for the University of Technology in awarding credits for the learner's employment experience.

3.8.7 Industry Mentors

According to Jacobs (2015), the quality of mentoring is related to the degree of relationship between academic institutions and employers; the stronger the relationship, the greater the mutual understanding of their roles and responsibilities, resulting in an improved quality of workplace experience for the learner. Groenewald (2004), Forbes (2007), Jacobs (2015) and Rook (2017) all emphasize the importance of workplace Industry Mentors in learners' effective growth and accumulation of knowledge, experiences, and personal development.

3.8.8 Delayed Placement

The curriculum for apprenticeships, learnerships, and other learning interventions includes a workplace component, and as the demand for workplaces rises, it becomes more challenging to place learners immediately after they have completed the academic portion of a diploma qualification (McLennan & Keating, 2008; Rook, 2017).

The South African Gazetted White Paper (2013) stresses the importance of building and maintaining close relationships with employers to improve placements of learners at the workplace. According to the White Paper (2013), university graduates have trouble finding jobs because they lack the practical experience and relevant skills required by employers.

3.9 Thesis Statement

WIL challenges experienced by Universities of Technology, Industry Mentors and the engineering learners negatively affect access to workplaces. Figure 3.4 graphically represents a conceptual framework for the study.

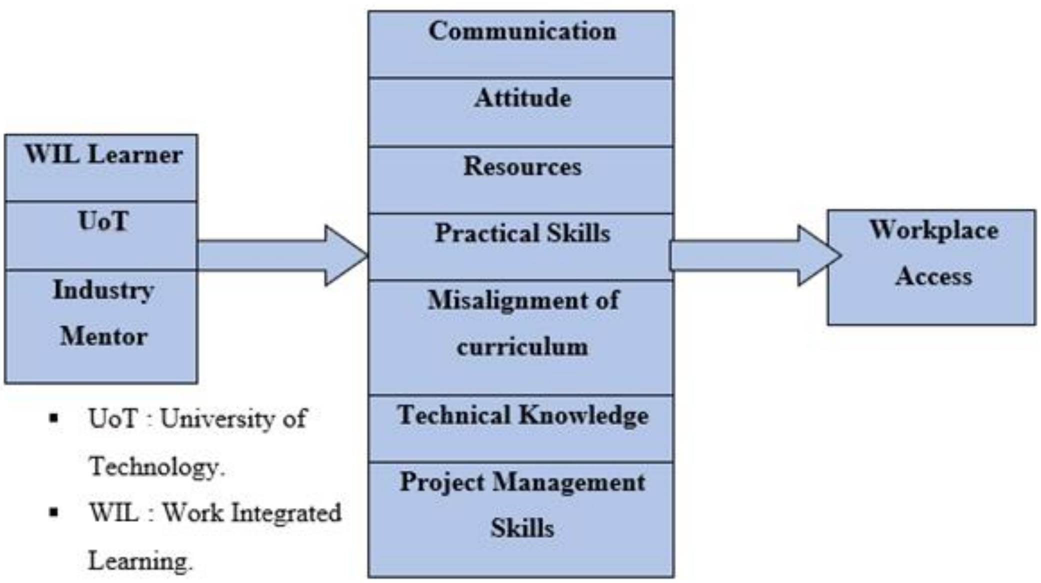


Figure 3.4: Conceptual Framework
Source: Researcher's Conception

3.10 Conclusion

The theoretical and conceptual framework discussed in this chapter contributes significantly to the basis of this study and provides guidance to the researcher in addressing the WIL challenges encountered at UoTs.

The chapter summarised the key concepts identified from the literature review, providing a roadmap for the research, and guiding the data required for the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

This chapter introduces the research methodology used for the study on WIL challenges. The research uses the mixed method approach for the study, however theory on the dominant approaches, namely, qualitative, and quantitative are also discussed. “Quantitative and qualitative methods are the engine behind evidence-based outcomes” (Enas, 2021). A mixed method research technique entails gathering, analyzing, and combining quantitative and qualitative data in a single study (Bulsara, 2015).

A deeper understanding of the WIL challenges was achieved by combining qualitative and quantitative data analysis. This chapter describes the research approach that was used.

The research onion assisted in the clarification of the research methodology. According to Raithatha (2017) and Melnikovas (2018), an acceptable research technique may be constructed step by step using the research onion model, and thus it can be employed as the primary academic research model.

The literature review in Chapter 2 highlights the importance of the workplace component of the Universities of Technology diploma qualifications for the mechanical and electrical engineering technicians. The understanding of these challenges can pave the way to open greater access for learners to gain suitable workplaces opportunities. The researcher intends to understand the experiences and expand the range of understanding possible challenges to critically analyse the challenges associated with Work-Integrated Learning.

The workplace module is a compulsory credit bearing component of the University of Technology engineering qualifications required for the learners to graduate. This study therefore focuses on the employees of Universities of Technology who are engaged with WIL, including academics from engineering departments and WIL practitioners from the Co-operative Education Departments. Industry Mentors who provide the workplace exposure and learners on the engineering diploma qualifications are participants of this study. The selected participants in the various categories, namely WIL learners, the University of Technology employees engaged with WIL activities and the Industry Mentors will be required to respond to questionnaires, comprising both open-ended and closed-ended questions. Focus group interviews were conducted with carefully selected members who possess strong links and association with WIL activities. The design of the survey questions and the focus group interview content was informed by the literature review undertaken in Chapter 2.

A detailed explanation of the research process, research design, research approach and the research instruments used will form the core of Chapter 4. Chapter 4 concludes the discussion on the validity, reliability, and ethical issues applicable to this research.

4.2 The Research Onion

In order to design a robust and sound research methodology, the researcher plans to use the systematic approach guided by the research onion framework (Figure 4.1), proposed by Saunders, Lewis, and Thornhill (2012). Figure 4.1 pictorially explains the process of examining the various aspects of the research and the researcher will follow the steps outlined in the research onion in order to develop a systematic and sound design. The onion's different layers give the study framework and boundaries within which data gathering methodologies, data processing, and analysis procedures should be chosen. However, in research, the outer layers of the onion serve as the root, while the middle layers serve as the research's building pieces (Sahay, 2016).

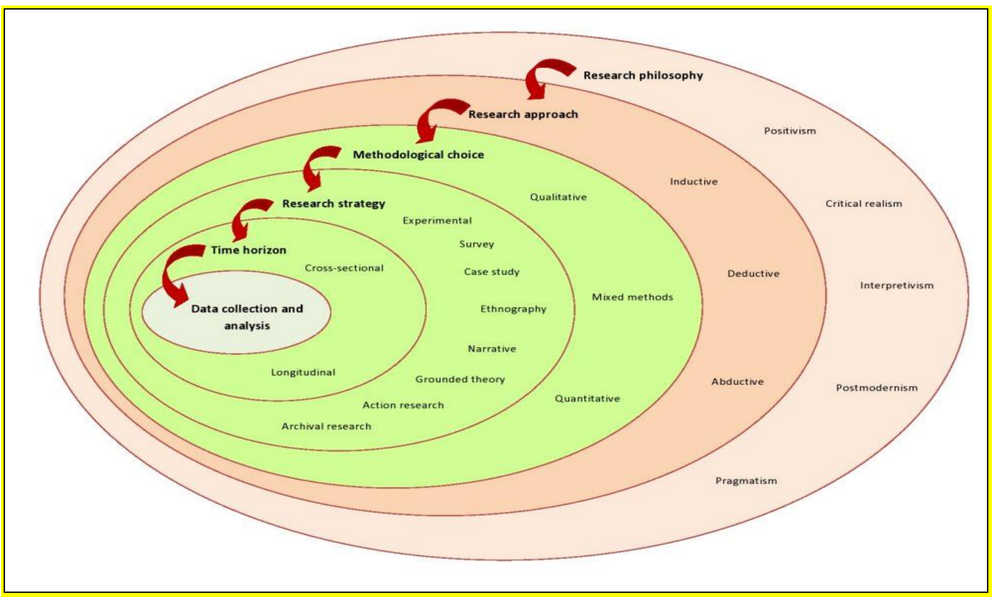


Figure 4.1: Research Onion
Source: Saunders, Lewis, and Thornhill (2012)

The research onion, developed by Saunders, graphically details the steps to be followed when undertaking research. This research will adapt the methodology using the various layers on the research onion as its guidelines.

4.3 Research Design

Apuke (2017) defines research as “a scientific and systematic search for pertinent information on a specific topic”. The research process includes the explanation and justification required to support the potential solutions recommended. The researcher adopted a systematic and methodical approach to gather the required data for this study and perform a range of statistical analysis in an attempt to address the research questions with particular attention given to methodology applied in this study, where research methodology can also be simply defined as the holistic steps followed in the research journey (Leedy & Ormrod, 2001; Apuke, 2017).

Bougie (2013) refers to the research design as a blueprint required for data collection, measurement, and analysis of data, which is guided by the research questions. The researcher, therefore, discusses the targeted population, the sampling method selected for this study, the data collection strategy, and the data analysis techniques to be applied, in this chapter.

The study design will entail the creation of instruments to collect data from the targeted population, in order to address the research aims and objectives and offer sufficient and trustworthy data to arrive at significant findings and recommendations. The development of survey questionnaires, the selection and composition of a focus group, data collection methods, data analysis methodologies, findings, and suggestions will all be part of the design process.

4.4 Research Paradigm

The term paradigm was used by American philosopher Thomas Kuhn (1962) to refer to a philosophical mode of thinking (Kivunja & Kuyini, 2017). According to Saunders, Lewis, and Thornhill (2009) and Mayer (2015), research philosophy is concerned with the evolution and nature of knowledge, as well as a researcher's distinctive perspective on the issue under study. Mackenzie and Knipe (2006), as well as Kivunja and Kuyini (2017), extend the definition of a paradigm to include the researcher's thinking, or school of thought, or set of shared beliefs, in addition to the researcher's 'worldview' or perspective that informs the meaning or interpretation of research data. It is the lens through which a researcher examines the methodological components of their research project in order to establish the research methodologies that will be employed and how the data will be analysed (Kivunja & Kuyini, 2017). A paradigm consists of four fundamental elements: epistemology, ontology, methodology, and axiology (Lincoln & Guba, 1985; Kivunja & Kuyini, 2017).

Axiology

Axiology refers to the ethical issues that need to be considered when planning a research proposal. It considers the philosophical approach to making decisions of value or the right decisions (Finnis, 1980; Kivunja & Kuyini, 2017). It involves conducting the research activities in an ethical manner with clear understanding of the concepts with careful consideration given to the various aspects of the research, the participants, and the data. To minmise harm and reputational damage to any of the collaborating institutions or respondents, the study paid particular attention to ethical concerns. Prior to beginning the data gathering procedure, permission letters were obtained from the collaborating academic institutions, including an ethical clearance from the Da Vinci Institute, which approved the study.

Furthermore, participants responded anonymously to the survey questionnaires. Focus group members selected were senior managers and subject matter experts who were presumed to be highly aware of reputational risk. Personal information about focus group members was kept confidential. Furthermore, participants were assured that copies of the research findings would be made available to them upon request.

Ontology

Ontology is the study of the nature of reality that is independent of human perceptions and theories (Maxwell, 2103; Nyawo, 2020). Ontology is concerned with the assumptions we make in order to believe that something makes sense or is real, as well as the nature or substance of the social phenomenon under study. It aids in conceptualizing the shape and character of reality, as well as what you believe can be known about that reality. Philosophical beliefs regarding the nature of reality are critical for understanding how you interpret the evidence you collect. These assumptions, conceptions, or propositions aid in orienting your thoughts about the research problem, its significance, and how you might approach it in order to contribute to its resolution (Kivunja & Kuyini, 2017).

Epistemology

Epistemology, on the other hand, is the study of the universe through perception, which calls into question the relationship between the inquirer and the knowing (Guba, 1990; Govender, 2021). Understanding of knowledge can be obtained through measuring and employing dependable designs and instruments best suited for probing the problem and interpreting the results to identify underlying meanings. It seeks to determine the real nature, or the foundational concepts which constitute themes that we analyse to make sense of the meaning embedded in research data (Kivunja & Kuyini, 2017).

In simple terms, is used to describe the process to acquire and validate knowledge of the truth or reality (Gall, Gall, & Borg, 2003). It also focuses on the types of human knowledge and cognition that a researcher might gain to extend, broaden, and deepen understanding of a specific subject under inquiry. It is also concerned with the transmission and communication of knowledge to others (Cohen, Manion, & Morrison, 2007, p. 7).

4.5 Methodology

Methodology is the broad term used to refer to the research design, methods, approaches, and procedures used in an investigation that is well planned to find out something (Keeves, 1997; Kivunja & Kuyini, 2017). In summary, the methodology articulates the logic and flow of the systematic processes followed in conducting a research project, so as to gain knowledge about a research problem including data gathering, participants, instruments used, and data analysis, are all parts of the broad field of methodology (Kivunja & Kuyini, 2017).

4.6 Dominant Research Paradigms

A large number of paradigms have been proposed by researchers. Candy (1989) refers to the dominant paradigms as the Positivist, Interpretivist, Critical paradigms, and Pragmatic.

Positivist Paradigm

The Positivist paradigm, first proposed by a French philosopher, Auguste Comte (1798 - 1857), defines a viewpoint to study that is grounded in what is known in research methodologies as the scientific method of investigation (Kivunja & Kuyini, 2017). Comte (1856) proposed that experimentation, observation, and experience-based reasoning should be the foundation for understanding human behaviour, and hence the only valid means of advancing knowledge and human understanding (Kivunja & Kuyini, 2017). The scientific method, in its purest form, is a process of experimentation that is used to investigate observations in order to determine cause and effect linkages in nature. It has been chosen as the preferable worldview for research that attempts to understand observations in terms of facts or quantifiable entities (Fadhel, 2002; Kivunja & Kuyini, 2017). According to Fadhel (2002), a Positivist paradigm advocates an ontology naive realism, objectivist epistemology and an experimental technique.

The Interpretivist Paradigm/Constructivist Paradigm

The Interpretivist Paradigm's central endeavour is to comprehend the subjective realm of human experience (Guba & Lincoln, 1989). The technique seeks to comprehend and interpret the meaning of context or the viewpoint of the subject under study rather than the observer's viewpoint. Understanding the individual and their interpretation of the world around them is prioritised. As a result, the Interpretivist Paradigm's central principle is that reality is socially produced (Bogdan & Biklen, 1998; Kivunja & Kuyini, 2017). The

Interpretivist Paradigm is also known as the Constructivist Paradigm. In this paradigm, theory follows research rather than preceding it, so that it is founded on the evidence provided by the research act. As a result, while using this paradigm, data is acquired and analysed in accordance with grounded theory (Strauss & Corbin, 1990). This paradigm assumes a relativist ontology, a subjectivist epistemology, and a naturalist methodology, which is a qualitative approach that involves observing individuals in their natural environment in order to collect data for the study.

The Critical Paradigm/Transformative Paradigm

The Critical Paradigm grounds its study in social justice issues and tries to address the political, social, and economic challenges that lead to social oppression, conflict, struggle, and power systems at any level and also frequently referred to as the Transformative paradigm since it attempts to reform politics in order to combat social injustice and enhance social justice in the situation (Kivunja & Kuyini, 2017). This paradigm is based on a historical realism ontology, a transactional epistemology (in which the researcher interacts with the participants), and a dialogic methodology in which critical analysis is accomplished through various aspects of discourse and interpersonal communication with the participants.

The Pragmatic Paradigm

Robust debates centred on a worldview providing more than one method appropriate for studying a phenomenon was argued by philosophers such as (Alise & Teddlie, 2010; Biesta, 2010; Tashakkori & Teddlie, 2003a, and 2003b; Patton, 1990). As a result, a search was conducted for research approaches that could be more practical and pluralistic, allowing for the combination of methods that, when combined, could shed light on participants' actual behaviour, the beliefs that underpin those behaviours, and the consequences that are likely to result from various behaviours, giving rise to the Pragmatic Paradigm, which encourages the use of mixed approaches as a pragmatic way to understand human behaviour. The Pragmatic paradigm advocates a relational epistemology and a non-singular reality ontology (that there is no single reality, and that each individual has their own and unique interpretation of reality), a mixed methods methodology (a combination of quantitative and qualitative research methods).

The study is focussed on challenges associated with workplace module offered as part of the curriculum of engineering diplomas offered by Universities of Technology. The assessment of the literature reviewed points to a study with a plural ontological reality (individuals have their own and unique interpretation of reality), a relational epistemology, and a mixed methods approach; therefore, the researcher adopted the Pragmatic paradigm to guide this study. Furthermore, an ethical clearance was obtained to continue the study, and ethics was observed in all processes involved in conducting the study, with special attention paid to participant anonymity and the protection of the reputations of the academic institutions and workplaces that participated in the research.

4.7 Research Approach

The choice of the research approach is important as it contributes to identifying the relevant variables and themes (Fellows, 2021). Gratton and Jones (2010) add that the research techniques to be used are dependent on the research approach. Due to the mixed-methods approach used in the study, which combines qualitative and quantitative research techniques, both qualitative and quantitative data were collected, and both inductive and deductive analysis were performed on that data.

4.7.1 Inductive Reasoning

Inductive reasoning is a bottom- up approach (Mallia, 2014). Inductive reasoning, according to Goswami (2011), goes beyond the knowledge that is readily available or that is used to draw conclusions. The study employed a "mixed methods" methodology, which combines qualitative and quantitative analysis. The quantitative data gathered for the study through survey questionnaire responses were examined using inductive analysis, which makes use of statistical techniques.

4.7.2 Deductive Reasoning

Deductive reasoning is top-down, whereas inductive reasoning is bottom-up. Through the use of an explicit theoretical framework created through engagement with the literature, the deductive reasoning technique involves the use of pre-ordinate themes (Proudfoot, 2022). Concepts were drawn from the available literature and theories that was reviewed to build a framework.

4.8 Research Methodology

The most common research methodologies applied currently are qualitative, quantitative, and mixed methods, which provide rules, principles, and guidelines for researchers to follow when conducting research. A qualitative research methodology refers to participants' accounts, experiences and perceptions enabling the researcher the opportunity to use an open and flexible design.

Bhandari (2020) describes quantitative research as the process of collecting and analysing numerical data which, when analysed, may be used in different formats to support the research argument. Quantitative research methods require a larger sample to be processed for more accurate results. For this study the questionnaire will be designed using a Likert scale. According to Readings (2019), the analytical objectives for a quantitative study are to describe data variations; describe and explain relationships between concepts; describe the experiences of individual participants; and describe the group norms or behaviour patterns that exists in various groups of the participants. Apuke (2017), in agreement with Leedy and Ormrod (2007), argues that quantitative research can potentially expand existing theories in addition to test theories. Apuke (2017) further indicates quantitative research answers questions and proves null hypotheses which are further underpinned by positivist or post-positivist research paradigms. Panwar (2017) reaffirms that social sciences' research is based on observable and empirical analytic facts. Panwar (2017) cites Petter and Gallivan (2004) and Deluca, Gallivan and Kock (2008), as they confirm the idea of the mixed paradigm by combining positivism and interpretivism and making a new paradigm named post-positivism. Quantitative research designs may include descriptive, experimental, quasi-experimental or relationship-based research designs (Apuke, 2017).

Abuhamda, Ismail, and Bsharat (2021:3) assert that quantitative studies often utilise statistical models and statistics for research, producing more objective analytical data. Apuke (2017) indicates that probability sampling techniques are predominantly used for quantitative research; however, non-probability sampling techniques are sometimes included as a technique for sampling. This study attempts to use purposive sampling for both the quantitative and qualitative approaches. Data for this quantitative research will be gathered from structured questionnaires comprising both quantitative and qualitative questions, interviews, and structured observations. The analysis of the data gathered will be performed using statistical analysis. The findings in quantitative research are expressed in terms of their reliability, internal and external validity, and construct validity. Findings are presented in various formats which includes statements, data, tables, and graphs that address the research question or hypothesis with the intent of drawing conclusions or providing insight for future theory (Apuke, 2017).

Researchers are at liberty to choose the research methodology that best suits their needs and are free to utilize a combination of the qualitative and quantitative approaches if the expected results provide a more meaningful conclusion and a better understanding of the research problem. The researcher, after giving careful consideration, to the various research methodology approaches discussed above, decided to apply an approach that would be broad yet deep. The mixed methods approach would be the most appropriate to provide the reliability and validity for the quantitative analysis and trustworthiness for the qualitative analysis. The mixed methods approach is frequently used to unfold complex research topics (Salman, Sumaya & Jawad, 2017).

4.8.1 Mixed Method Research Design

Qualitative and quantitative research approaches have been the dominant method to conduct research, however, the mixed method is becoming popular for conducting social and human science studies. Mixed methods research utilizing both qualitative and quantitative data in a single study topic providing an alternate methodological approach (Halcomb & Hickman, 2015). For a deeper understanding and greater scope of corroboration, aspects of qualitative and quantitative research approach (viewpoints, data collecting, analysis, and inference techniques) are merged (Bazeley, 2017).

The design of the research proposal framework should include the approach and research methodology. In a mixed methods research design both qualitative and quantitative data are used in the study. Fischler (2014) depicted the mixed method research methodology is a method to collect and analyse both quantitative and qualitative data for the purpose of providing solutions to a research problem. The mixed method approach embraces different world views, assumptions, different forms of data collection and analysis. Morse (2016) supports the use of mixed methods designs for conducting social science research.

Morse (2016) points out that the feasibility of using the mixed method must be thoroughly considered with a clear rationale identified before attempting to use this method for the research. Morse (2016) further explains the need to identify the data collection strategy and the research design to be employed in the study, the development of quantitative and qualitative data and the analysis thereof.

The researcher acknowledges the tremendous value of the mixed method approached as articulated by Fischler (2014) and Morse (2016); however, the logistical challenge to extend the research outside the Universities of Technology based In KwaZulu-Natal is enormous. The researcher furthermore believes that the study, though limited to KwaZulu-Natal, will be representative of WIL challenges in South Africa and globally. The global labour market is depending on higher education institutions to participate in building a competent workforce in response to the needs of the global economy (Gardner & Perry, 2011; Ferns & Zegward, 2014).

In summary, a mixed methods approach may be used to enhance and validate the research for the following reasons:

1. Variation in data collection leads to greater validity
2. Answers the question from different perspectives.
3. Ensures that there are no ‘gaps’ to the information/data collected.
4. Ensures that pre- existing assumptions from the researcher are less likely.
5. When one methodology does not provide all the information required, Bulsara (2015).

Focus group interviews were conducted to gather the qualitative data required for this research. Focus groups offer the opportunities for in-depth interviews to be conducted among a small group of participants, with discussion within the group **centred** on the analysis of a particular issue, (Mishra, 2016). For best results, the group size is important; Mishra (2016) points out that small groups run the risk of having little discussion, while large groups can be disruptive, difficult for the moderator to control, and upsetting for participants who feel they don't receive enough opportunity to speak. The study included a focus group with six participants, and the interviews and discussion were professionally conducted and extremely fruitful as the responses from the group provided greater depth of understanding on the various challenges that were explored.

Quantitative research, according to Roger (2015), is characterised by a systematic investigation of a social phenomenon and analysed using statistical or numerical data for trends and relationships. For Creswell (2012), the quantitative methodology analyses large quantifiable data provided in response to narrow, specific questions. Apuke (2017) further indicates that the quantitative methodology involves the application of statistical techniques that are required for the processing of the data. The quantitative methodology is also used to provide explanations on issues and phenomenon (Apuke, 2017; Aliaga & Gunderson, 2002). Likert scales were used in the design of survey questions in order to collect the data needed for the quantitative analysis.

The format of the quantitative questions is shown below:

1. Manual Questionnaire

Please answer by marking with an "X" in the relevant box on the right.

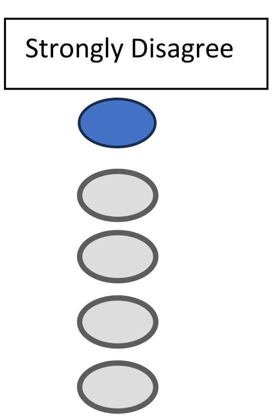
Adequate monitoring visits were conducted by the academic staff while you were at the workplace.

a. Strongly disagree	b. disagree	c. Neither agree nor disagree	d. Agree	e. Strongly Agree

2. Online Questionnaire

The University of Technology is sufficiently resourced with staff to perform Work-Integrated Learning functions.

Mark only one oval



Strongly Agree

Responses from the focus group and the responses from the online and manual survey questionnaires were collected for analysis.

4.8.2 Research Strategy - Action Plan

Figure 4.2 graphically represents the research plan for the “mixed methods” study. Survey questionnaires, using a Likert scale, were designed with closed-ended questions and a broad and general open-ended question for the University of Technology academic staff, Industry Mentors, and the Work-Integrated Learning learners to respond to. Options to complete the survey questionnaires online or on printed copies were available. Focus group interview were conducted to provide data required for the qualitative analysis.

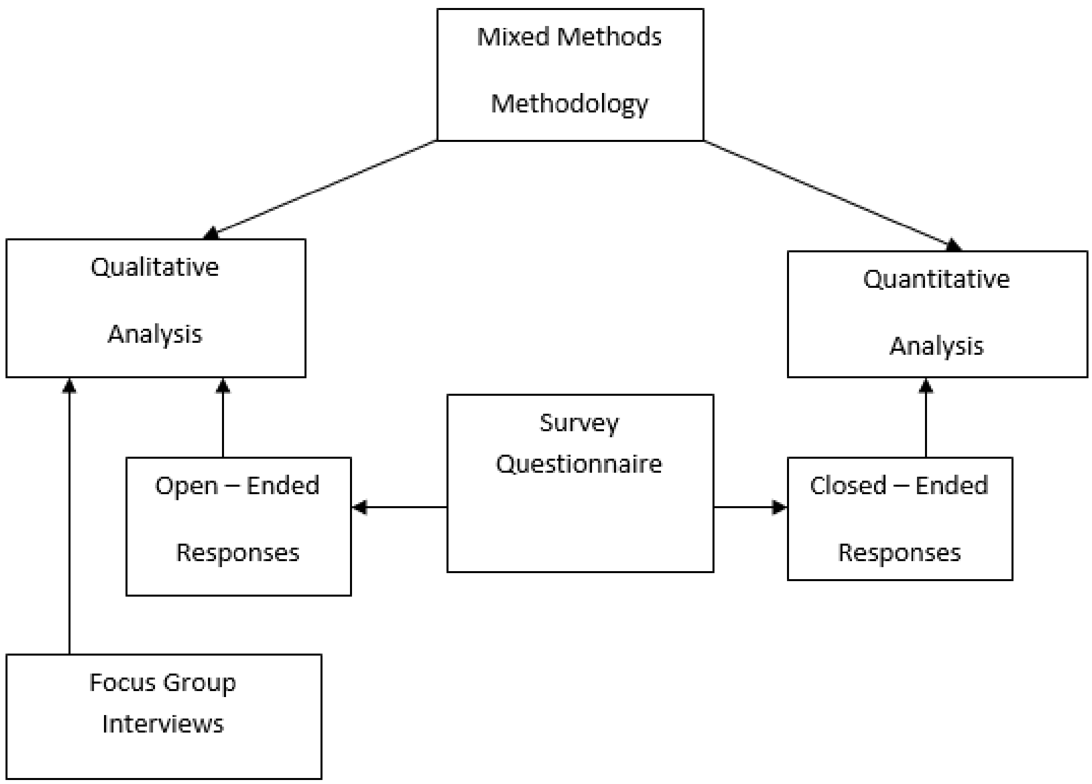


Figure 4.2: Research Action Plan
Source: Developed by the Researcher

A summary of the research design is graphically represented in Figure 4.3.

Philosophy	Pragmatism
Research Approach	Inductive and Deductive Reasoning
Methodological Choice	Mixed Methods: Qualitative + Quantitative Analysis
Research Strategy	Survey questionnaires + Focus Group Interviews
Time Horizon	Cross-section time frame (data collected within six months)
Data Collection and Analysis	**Quantitative** ▪ Online and manual responses ▪ Sampling: Convenience + Purposeful ▪ Statistical Analysis **Qualitative** ▪ Focus Group Interviews ▪ Transcribing and coding data ▪ Thematic Analysis

Figure 4.3: Summary of Research Design
Source: Developed by Researcher

4.9 Survey Design

Research studies could be exploratory, descriptive, or causal in nature (Bougie, 2013). Utilizing simple but professionally designed survey questions, a descriptive study design may be used to collect both quantitative and qualitative data (Korb, 2012). Survey questionnaires may be readily electronically sent or couriered to gather the required data, effectively employing time, money, and other resources (McBride & Sigler, 2019). The survey questionnaire was designed for online and manual completion.

According to Bougie (2013), a survey is a method for gathering data or information from a large group of participants that will then be examined and analysed to address the research objectives for the purpose of addressing the research problem.

Beglar (2014) asserts that Likert-scale questionnaires are widely used to easily gather large amounts of research data. For this study, survey questionnaires using the Likert-scale will be used to gather large scale data, which allows for the responses to be quantified. Beglar (2014) advocates that constructs, theme development, feedback collection, objectives and questionnaire piloting be considered while designing Likert-scale instruments.

The researcher designed three sets of questionnaires to be distributed to the different groups of participants identified for this research. The targeted population groups for the research are the University of Technology employees, WIL learners and the Industry Mentors. A separate survey questionnaire was designed for each of the targeted population group. The University of Technology staff, WIL learners and the Industrial Mentors are all assumed to be literate adults, able to respond to the questionnaires without any difficulty. All the participants in this study were expected to have been involved directly or indirectly with the WIL programs. The well-structured questionnaire allowed for participants to give full attention and time required to provide their responses to the questions. The questionnaire format was close-ended in respect of quantitative responses whereby the respondent is required to provide one of the possible answers provided. While the exact wording of the questions could be debated and perfected, the questionnaire was forwarded to a fellow academic subject matter expert to review the questions survey structure and questions for relevancy and acceptance.

For the qualitative component participants were allowed to respond without restrictions to a broad and general open-ended question. Data for the qualitative element of a study was collected through survey open-ended responses (Proudfoot, 2022).

The research participants consisted of University of Technology academic staff involved with WIL responsibilities and WIL learners from the two Universities of Technology based in the province of KwaZulu Natal (KZN), namely, the Durban University of Technology and the Mangosuthu University of Technology. Mentors from industries based in KZN also participated in the research. Permission letters for this study were granted by both the Durban University of Technology and the Mangosuthu University of Technology. The survey questionnaires used to gather the data for the research included a range of closed-ended questions, allowing the participants to respond on a 5-point Likert scale.

The population of interest was selected in light of the challenges experienced in accessing suitable workplaces. The population of interest that best represents the population and contributes to the research question are the UoT academic staff involved with WIL related activities, Industry Mentors and WIL learners. The appropriate selection of the population of interest is critical to the research (McBride & Sigler, 2019).

Table 4.1 shows that the survey questionnaire from all participating groups responded to a combination of quantitative and qualitative questions.

Table 4.1: Survey Questionnaire

Participant	Quantitative Question	Qualitative Question
1.WIL Learner	Likert Scale – closed-ended questions.	Broad and general open-ended question
2.UoT Staff	Likert Scale – closed-ended questions	Broad and general open-ended question
3.Industry Mentor	Likert Scale – closed-ended questions.	Broad and general open-ended question

4.9.1 Focus Group Size and Members

The focus group for this study consisted of six participants who were carefully selected based on their involvement and expertise with WIL issues. A placement officer, a training manager, facilitators, senior technicians, and a corporate director participated in the focus group. All focus group participants worked closely with WIL learners, University of Technology faculty, academic staff, Industry Mentors, and other stakeholders interested in WIL issues.

4.9.2 Focus Group Discussion

The focus group discussions centred on themes that would contribute to addressing the aims of the research. A set of questions, designed for the interviews, was put forth to the members and a very healthy discussion ensued as the members engaged and consequently provided valuable inputs and contributions. The conversation was logged, transcribed, and organised under themes and categories. Chapter 5 provides a detailed account of the themes and categories derived from the focus group interviews.

4.10 Time Horizon

The study's timeline was determined by this layer. Research time horizons were divided into two categories: cross-sectional studies and longitudinal studies.

4.10.1 Cross-sectional

A cross-sectional or short-term study involves the gathering of data over a specific point of time while the longitudinal studies involve data gathering repeatedly over a long period of time in order to compare data (Melnikovas, 2018). Cross-sectional research might be either analytical or descriptive (Kesmodel, 2018).

Setting up a cross-sectional study requires a shorter space of time (Caruana, Roman, Hernández-Sánchez & Solli, 2015).

4.10.2 Longitudinal

Longitudinal studies regularly track specific individuals, events, or subjects under observation over an extended period of time, often years or decades, collecting data to be analysed using appropriate statistical techniques to determine changes, behaviour, or patterns over the extended research time frame (Caruana, Roman, Hernández-Sánchez & Solli, 2015).

All of the data needed for this study was acquired during a six-month period using a cross-sectional time frame.

4.11 Data Collection

Planning was necessary for this study's data gathering procedure to reduce complexity, expense, and time. Data was collected using the mixed methods methodology for both quantitative and qualitative analysis. Additionally, survey forms were distributed to three separate target populations, including the academic staff at the Universities of Technology, Industry Mentors, and WIL learners.

4.11.1 Sampling

Sampling was used to select the participants to provide the data required for the study. The accuracy of the research is highly dependent on the quality, method, and sampling process (Bhardwaj, 2021). According to Acharya, Prakash, Saxena and Nigam (2013), sampling is a representative fraction of an entire population, being researched as the entire population cannot be studied. The population may be an entire group of people, events or area of interest that needs to be researched (Bougie, 2013). Asiamah, Mensah and Oteng-Abayie (2017) describe the research population as particpants that have some characteristics of interest in the subject being researched.The particpants selected for this study are all associated with WIL actvities in some way or the other.

Further benefits of a representative sample are the reduction of costs, time taken to do the research and the manpower needed to conduct the study (Acharya, Prakash, Saxena & Nigam, 2013). Sampling techniques are broadly classified into probability and non-probability samples. The probability sampling technique randomly selects any individual from the targeted population for the study. Non-probability sampling, however. is a sampling technique in which the researcher selects the samples suitable for the research study.

4.11.2 Convenience Sampling

The convenience of data collection from the study participants is the main purpose of the convenient sampling method (Acharya, Prakash, Saxena & Nigam, 2013). This sampling method considers the ease of the sampling exercise, the target population should be easily accessed, and participants should be strategically located, available and willing to be included in the study as summarised by Etikan, Musa & Alkassim (2016). The research findings, however, will be representative of Work-Integrated Learning challenges experienced by learners at other institutions that offer qualifications that include a workplace component. The research findings and recommendation may be used nationally and globally and encourage further research in this field.

4.11.3 Purposive Sampling

According to Etikan, Musa, and Alkassim (2016), a researcher purposively seeks out potential respondents who, having experience and knowledge, can participate in the data gathering exercise. These willing participants may provide rich information to the study.

4.11.4 Sampling Process

The sample population will be purposively targeted to be comprised of University of Technology staff, Industrial Mentors and WIL learners. Etikan, Musa, and Alkassim (2016) state that this group of individuals has the ability to communicate experiences and opinions in an articulate, expressive, and reflective manner. The researcher expected the data gathered from this group, specifically involved in WIL related activities, to make a valuable contribution towards the research findings. For logistical convenience, the researcher further limited the research to the UoT staff involved in WIL related activities, WIL learners, and Industry Mentors from the workplaces, located in the province of KwaZulu-Natal. Bougie (2013) recommends that the target population should be defined in terms of elements, geographical boundaries, and time. The target population comprised the current WIL learners, who have registered for University of Technology engineering diploma qualifications; the current UoT staff involved with WIL and Industry Mentors who have been involved with WIL programs.

4.11.5 Sample Size

When considering the sample size sample size careful attention should be given in order to ensure adequate and valid conclusions can be generalised (Singh & Masuku, 2014). Andrade (2020) in agreement, states that a poorly chosen sample size may lead to unethical or unscientific results. Bougie (2013) adds that the research objectives should also be considered when deciding on the sample size for a study.

The researcher planned to employ a purposeful convenient sampling methodology for the study. The targeted respondents would include University of Technology Engineering students, University of Technology engineering staff and engineering Industry Mentors. The researcher limited the distribution of the survey questionnaires to the WIL learners and academic staff involved in WIL from only the Universities of Technology located in KwaZulu-Natal. The distribution of survey questionnaires was also limited to mentors from KwaZulu-Natal industries that absorb WIL learners. It was noted that the anticipated responses, being difficult to predict, could be drastically low, specifically for the academic staff and the Industry Mentors. However, the researcher planned to carefully select statistical tools and apply techniques handle a lower number of responses if that be the case. According to Islam (2018), sample volumes close to 30 respondents may be deemed sufficient without contributing to significant sampling errors.

The Co-operative Department's total staff dedicated to WIL activities was limited to 10 individuals (Fundiswa, 2022), in addition to another 10 lecturers from the Engineering Departments. Retired University of Technology workers who were participating in WIL activities were also targeted as respondents, their experience and knowledge being relevant to the research, therefore the UoT staff population size was estimated to be between 30 to 50.

Information regarding the sourcing of workplaces hosting WIL learners was provided by the Co-Operative Education Department and the members of the Industrial Advisory Board, of which the researcher is a member. The population size for Industry Mentors was determined based on industry representation at Advisory Board meetings, with a population size of 30 to 40 Industry Mentors.

The population for the sampling exercise may be very large if the participants of the entire South Africa are considered. Sampling such a large population would therefore result in major cost and time constraints. Giving careful considerations, to the above yet maintaining a sampling size that would not compromise the research findings, the researcher endeavoured to ensure an acceptable sample size, as guided by Islam (2018). Table 4.2 provides a breakdown of the different groups of the target population and the numbers of participants that responded. The ascertaining of the learner population has been a difficult task to estimate as the number of learners exiting the UoT and qualifying for work placement fluctuates annually. A further challenge experienced is the difficulty to contact learners as they frequently change contacts details. However, the number of WIL learners requiring placement for 2018 was 73 (Annexure 4).

Table 4.2: Sample Distribution minimum criteria met as guided by Islam (2018)

Group	Responses Received Online		
	Online	Manual	Total
University of Technology staff	20	5	25
Industry Mentors	18	10	28
WIL Learners	80	85	165

The estimated timelines to collect data was between 3 to 6 months and the completed data was gathered was gathered within six months.

Learner Population

Estimated Learner Population Size (annual number of unplaced learners = 73 x 2 = 146 x 2 institutions = 292.

Actual responses received = 80 online + 85 manually completed = 165

Population size for sample size of 165 learners for 5% accuracy = 275+ (as per sampling size chart, figure 4.4)

Populated size for sample size of 165 learners for 7% accuracy = 450 + (as per sampling size chart, figure 4.3)

The sample size therefore is sufficient and acceptable for all categories. Figure 4.3 represents sampling sizes for the different accuracy levels.

Size of Population (N)	Sample Size (n) for Precision (E) of:		
	±5%	±7%	±10%
100	81	67	51
125	96	78	56
150	110	86	61
175	122	94	64
200	134	101	67
225	144	107	70
250	154	112	72
275	163	117	74
300	172	121	76
325	180	125	77
350	187	129	78
375	194	132	80
400	201	135	81
425	207	138	82
450	212	140	82

Figure 4.3: Sample Size Chart
Source: Islam (2018)

UoT Staff and Industry Mentor Population

Although a large sample yields higher accuracy, as detailed within the limitations of the study, the population of the staff involved with WIL activities was limited to the two UoTs located in the province of KwaZulu Natal, namely the Durban University of Technology and the Mangosuthu University of Technology, thus wholistically the number of the WIL staff is far less than a hundred (rule of thumb minimum for Factor Analysis).Similarly, the population for the Industry Mentors were limited to the industries, offering WIL placement opportunities to engineering learners, based in province of KwaZulu Natal only, therefore the wholistic number of Industry Mentors is far less than a hundred (rule of thumb minimum for Factor Analysis).

However, the approval and compliance were given to the author to conduct the research under these limitations, nonetheless this analysis was conducted with caution.

The data from the two institutions (Durban University of Technology and Mangosuthu University of Technology) were not separated because a comparative analysis between the two UoTs was not within the scope of the study. A comparison study may also raise ethical concerns. The researcher avoided presenting any data that would show that one institution outperforms the other.

4.12 Questionnaire Distribution

The questionnaire used for data collection was distributed using an online survey link, created using Google Forms, for participants with computers, iPads, tablets, and smart phones to conveniently access and populate the questionnaire. The researcher was able to download a spreadsheet from Google Forms providing survey data from all the participants that completed the survey. The data available was coded as the questionnaires are designed using the Likert Scale system. Provision was also made for printed copies of the questionnaires to be manually completed for those participants who could not complete the questionnaires electronically.

As mentioned in Chapter 1, the study was limited to the two Universities of Technology in KwaZulu-Natal, namely, the Durban University of Technology and the Mangosuthu University of Technology. Permission was requested from these institutions to make available the WIL learner database, the contact details for the staff members involved with WIL and the contact details for the industry mentors. Permission letters were granted by the Universities of Technology: these provide access to WIL related information. Participation in the research was voluntary and the questionnaires were completed anonymously. The potential participants were then contacted to determine who required the survey link, email copies of the questionnaire or the printed copies of the questionnaire. The researcher arranged for the printed copies to be delivered to respondents for manual completion.

4.13 Questionnaire Routing

Three separate questionnaires, one for the WIL learners, one the University of Technology staff and the other for Industry Mentors, were uploaded, using Google Forms, to be accessed by potential participants for the online survey. Upon activation on the online survey link (https://docs.google.com/forms/d/e/1FAIpQLSfmIE-Onxnr0nNVTQWlgqFUJFeu3_f3bRqKRgSkmbKr_rlDHA/viewform?usp=sf_link\).

The participant was requested to respond to the question as depicted below.

Which of the below best describes you?

1. University of Technology staff
2. Industry Mentor
3. WIL Learner

The response of the participant to the question above in selecting was set to automatically direct route the participant to the set of questions for the category selected. Therefore, if 1 was selected as the category, the participant was routed to the questionnaire for the University of Technology staff; if 2 was selected as the category, then the participant was routed to the questionnaire for the Industry Mentor, and if 3 was selected, the participant was routed to the questionnaire for the WIL learner to complete. The feedback was analysed and tested for flaws, errors and other issues and corrections and improvements were made before the full questionnaire was distributed to the sample of the targeted population.

4.14 Embedded Mixed Methods Designs

The embedded design incorporates both qualitative and quantitative data, with one set largely used for the research study and the secondary data set supporting the research (Creswell, Gutmann, Hanson, & Clark, 2003). The researcher intended to employ embedded mixed techniques with a primary set of quantitative data and a secondary set of qualitative data. Surveys were used as the primary instrument for gathering quantitative data for the study; however, embedded within the survey was a broad open-ended question to supplement and support the quantitative data collected, as well as the qualitative data gathered from focus group interviews.

Figure 4.4 below provides a simple graphical representation of the embedded mixed methods design.

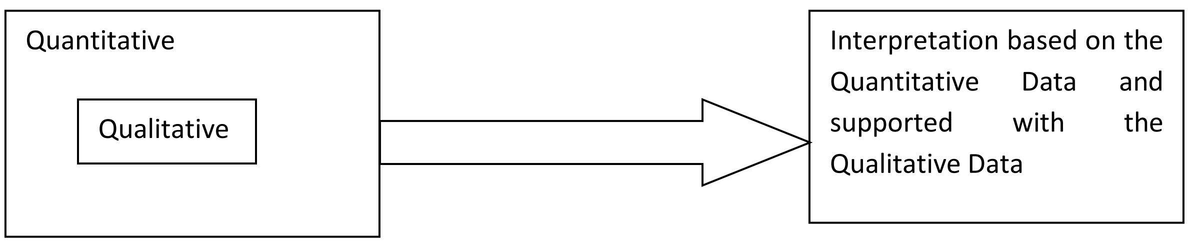


Figure 4.4: Embedded Mixed Method Design
Source: Adapted from Creswell, Gutmann, Hanson and Clark (2003)

4.15 Quantitative Data

The main source of the data required for the study was attained from the respondents through the survey questionnaire and the data was analysed quantitatively using statistical tools. The process of data preparation included editing, coding, and data entry. This process, according to Cooper and Schindler (2014), ensures the accuracy of the converted raw data to a usable form for analysis. This process may require outliers to be removed and decisions to be made on the manner in which inconsistencies and blank responses will be handled.

1. Addressing Missing Data: responses with vast amounts of missing information are removed, and where possible, an imputation was done to clean up responses with minimal amounts of missing data. The researcher assessed the impact of the missing data before deciding to remove or perform an imputation on the responses.

2. Outlier detection: responses were screened for pattern outliers (respondents who systematically show signs of quickly trying to terminate the interview such as saying "strongly agree" for all questions etc.). Such respondents were to be removed.

Screeners: By design, the questionnaire would route respondents into sections of the survey that apply to them. Hence, not all questions would be answered by all groups of respondents since questions to the Work-Integrated Learning learners, University of Technology staff, etc. differed to some extent.

Data coding involves the assignment of numbers to the responses before entering into a data base. Questionnaires were completed electronically and manually. The design of the questionnaires using the Likert scale allowed the responses to be automatically coded. The database of the responses from the questionnaires completed online was generated as an excel spreadsheet. The responses from the manually completed questionnaires were manually captured into the respondents' database. The screened data was then statistically analysed using statistical tools and instruments and presented in tables, charts, spreadsheets, reports, and other formats. This information was to be interpreted to arrive at findings and recommendations that may address the research outcomes.

4.16 Qualitative Data

Word clouds were used to analyse the qualitative data. Words and themes were extracted from the responses of the open-ended qualitative questions which were included in the survey questionnaire. The analysed data was used to support the primary quantitative analysis of the quantitative data.

4.17 Reliability

Reliability could be defined as the degree of repeatability and consistency of the measurements. In the case of this study, reliability refers to the consistency of the responses for the items of the survey questionnaires, under the same conditions and the same subjects. The quality and correctness of the interpreted data is highly dependent on the validity and reliability (Bakker, Hartman, Hopman & Hopkins, 2020).

4.18 Test: Re-Test

A method to estimate the degree of reliability involves test re-test, meaning that the responses should be the same for repeated tests. This method involves two tests of the same concept being measured, and the results compared, to determine the reliability estimate.

4.19 Internal Consistency

A degree of reliability could be achieved by the questionnaires being designed in groups measuring the same concept. The responses of these groups of questions may be correlated to test the reliability, for example, one could write two sets of three questions that measure the instrument used. Cronbach's Alpha, a software program that splits the questions from the questionnaire in various ways, can be used to compute correlation. The correlation co-efficient derived from the computing will indicate the degree of reliability, a value closer to one indicates a higher reliability estimate.

This study used a combination of both methods to test the reliability estimate. The instruments to be used for the data gathering are the survey questionnaire. The same questions were used in the questionnaires, the responses will indicate the degree of reliability.

Furthermore, the instrument used for data gathering has questions grouped together measuring the same concept. Correlations can therefore be made to compute the reliability estimate.

4.20 Validity

Validity, defined by Heale and Twycross (2015), is the degree of accuracy of the measurement of a concept in a quantitative study. In other words, the design of an instrument to measure a concept must result in that particular concept being measured. There are three major categories of validity, namely, content validity, construct validity and criterion validity. Content validity examines the degree to which the content is covered with respect to the variable. Construct validity is applied by making inferences from the test results or responses. The third category of validity is criterion validity where other instruments are also used to measure the same variable. The measurements from the different instruments may be examined to determine the degree of correlation.

4.21 Ethical considerations

It is imperative for ethical considerations to be given to participants of the study and other stakeholders, which includes organisations, institutions, and other bodies. Informed consent should be attained from these participants and bodies. The study should cause no harm to any person or institution and privacy must be respected.

The researcher has included in the survey instruments, a description of the purpose of the study. The study aim is to benefit the Work-Integrated Learning sectors, namely, the universities of technology, the learner and industry. Other educational institutions, which include the TVET colleges, may also draw from the study findings and recommendations.

The "Statement on Ethical Research and Scholarly Publishing Practices" endorsed the following principles in order to advance research integrity.

1. Responsibility: All stakeholders involved in research are responsible to actively maintain research integrity and to report unethical practices.
2. Ethics and Integrity: Researchers are required to perform their own work under supervision and to honestly publish accurate and reproducible findings.
3. Methodology and Data: Researchers are to apply appropriate research for the study, critically assessing all outcomes, keeping records of the research and objectively report and interpret research findings.
4. Authorship: All contributing authors to the research should be acknowledged in the study and they should read the final draft before submission.
5. Acknowledgments of contributions: Acknowledgements of material contribution to the research must be appropriately referenced or cited.
6. Peer Review: Peer reviewers must be sufficiently qualified and follow the ethical principles of researchers.
7. Social awareness: The researcher should consider the impact their study may have on society. The study's benefits should be weighed against the harm the research may cause.
8. Conflicts of Interest: Conflicts of interest whether financial or personal must be declared.
9. Editorial: No bias should be given to manuscripts submitted for publication by editors or members of the editorial board.
10. Research Publishing Environment: Research institutions should ensure that the research environment encourages ethical practices by developing relevant policies and procedures and through education.
11. Predatory Journals: The researcher should ensure that the avenues selected for publishing their research are authentic and credible.
12. Quality over quantity. The quality of publishing outputs should be of acceptable standards and the focus should be on quality over quantity.

Every attempt was made to adhere to these principles.

4.22 Conclusion

In summary, the process and methodology of gathering the data required for the study was discussed in this chapter. The philosophy to be used was briefly described and justified. The researcher also detailed how the sampling process was undertaken. Chapter 5 will deal with the analysis of the data collected; the results will be presented in tables, charts, flowcharts, word-clouds, and descriptions.

CHAPTER 5

DATA ANALYSIS

5.1 Introduction

In order to increase access to suitable workplaces that can offer WIL opportunities, the study's objective was to critically analyse the WIL challenges encountered by students, University of Technology staff engaged in WIL activities, and Industry Mentors. This chapter will analyse both the quantitative information gleaned from survey questionnaire responses and the qualitative data gathered from the focus group interviews with carefully selected members. In an effort to provide a framework to address the problems with WIL in South Africa and expand access to eligible workplaces, the study employed a mixed methods approach. Research findings are represented using graphs, tables, themes, ideas, and textual descriptions.

5.2 Quantitative Data Analysis

Potential participants were given an online link to access the survey questionnaires, and those without internet access were given printed hard copies of the manually filled-out questions. Participants comprised the students taking part in Work-Integrated Learning, faculty from the universities of technology, and industry mentors. On a 5-point Likert scale, participants were asked to rate their responses. A total of 145 questionnaires were filled out for all three categories.

5.2.1 Reliability

The consistency of the questions was assessed using Cronbach's alpha. Scale dependability is said to be measured by Cronbach's alpha. The study's research questions had a minimal reliability coefficient of 0.87 according to Cronbach's alpha. The categories for internal consistency and the Cronbach's alpha coefficient are shown in Table 5.1.

Table 5.1: Reliability Coefficients

Group	Cronbach's Alpha	Internal Consistency
WIL Learners	0,938	Excellent
UoT WIL staff	0,952	Excellent
Industry Mentors	0.897	Good

The above results show the internal consistency of the questions is highly reliable for all categories.

The statistics presented in table 5.1 (Reliability Coefficients) were computed post the removal of outliers.

5.2.2 Validity

According to Heale and Twycross (2015), validity is the degree of precision with which a notion is measured in a quantitative investigation. Factor analysis was conducted to assess validity. The overall findings showed that the study was acceptable, but several elements fell below the suggested validity standards as recorded in Tables 5.3, 5.5 and 5.7. The element of communication, in particular, featured highly; this was explained by the study's design, which called for a comparatively lower sample size. However, focus group interviews were held to verify the relevance of the themes.

5.2.2.1 Factor Analysis

Factor analysis is a statistical technique that reduces a set of variables by extracting all the commonalities into a smaller number of factors. Factor analysis is also referred to as data reduction. The factor analysis was computed using the R-Data Science statistical tool (Lavaan Package).

i. *Quantifying variability of questions for Industry Mentors.*

Table 5.2 tabulates the variables extracted for the Industry Mentors.

Table 5.2: Factor Analysis for Industry Mentors

Questionnaire	Question	Factor
Communication between the University of Technology and workplace is adequate.	QIM1	Communication
The Industry Liaison Committee (Advisory Board) is a productive and informative forum.	QIM2	Communication
The University of Technology process for placement of learners at the workplace is simple.	QIM3	UoT Placement System
The canvassing of the University of Technology to secure more workplace opportunities, are adequate.	QIM4	UoT Placement System
The usage of media, website, newsprint, and other channels by the University of Technology used to attract workplaces opportunities is adequate.	QIM5	UoT Placement System

The logbook tasks are aligned to Industry requirements.	QIM6	Communication
The workplace provides the full scope of the logbook requirements.	QIM7	Workplace Resources
The learner is able to apply the theory learnt at the University of Technology.	QIM8	Mentorship Training
The learner’s communication skills are acceptable for your industry requirements.	QIM9	Communication
The learner’s practical skills are adequate to perform related tasks in the workplace.	QIM10	Mentorship Training
You understand the role and responsibilities as ‘mentor’ to perform the mentoring duties of a University of Technology learner.	QIM11	Mentorship Training
The training/explanation on your mentoring role (from the University of Technology) is adequate.	QIM12	Mentorship Training
The learner’s maturity level in terms of responsibility is acceptable for industry requirements.	QIM13	Attitude
The learner’s maturity level, in terms of accountability, is acceptable for industry requirements	QIM14	Attitude
The learner’s maturity level, in terms of work ethic is acceptable for industry requirements.	QIM15	Attitude
The learner’ ability to work in a team is acceptable for industry requirements.	QIM16	Attitude
The workplace is sufficiently resourced to support student development during WIL.	QIM17	Workplace Resources
The workplace is sufficiently resourced with the relevant tools and equipment to perform the required tasks as per the WIL logbook.	QIM18	Workplace Resources
The workplace is sufficiently resourced with access to information, related to the operation.	QIM19	Workplace Resources

The workplace provides a reasonable stipend/ remuneration to cover the transport costs for the WIL learner.	QIM20	Workplace Resources

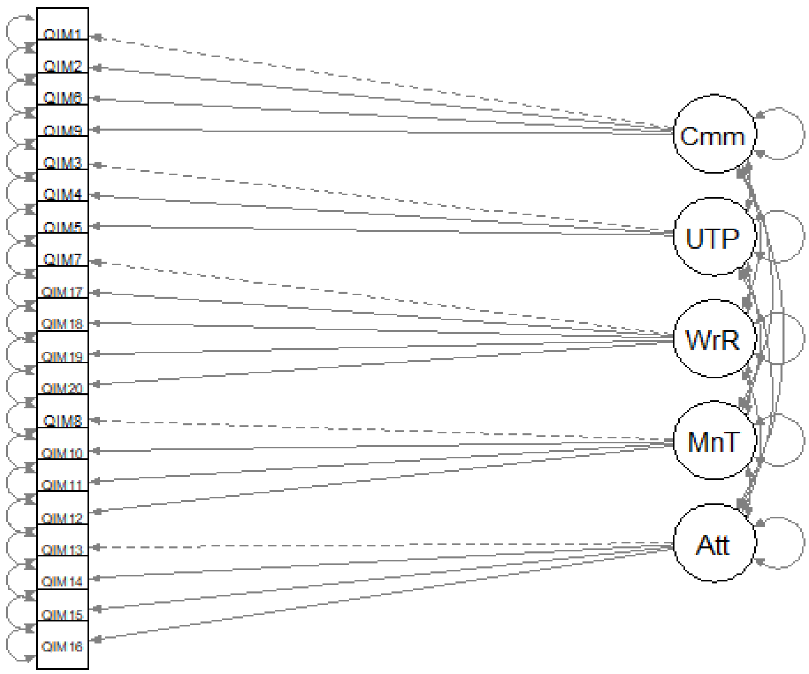


Figure 5.1: Factor Analysis Mapping for Industry Mentors

Table 5.3 shows the Factor analysis results for Industry Mentors, with overall acceptable results; however, due to low volumes of some of the survey responses, some values were below the accepted average. The focus group interviews did provide positive responses to support the robustness of the themes.

Table 5.3: Factor Analysis results for Industry Mentors

	Communication	UoT Placement System	Workplace Resources	Mentorship Training	Attitude
alpha	0.639251	0.800137	0.485367	0.719938	0.898673
omega	0.659791	0.837512	0.523227	0.762127	0.909391
omega2	0.659791	0.837512	0.523227	0.762127	0.909391
omega3	0.663812	0.852571	0.54535	0.770579	0.926914
avevar	0.342475	0.645482	0.18763	0.477204	0.716699

ii. Quantifying variability of questions for UoTs.

Table 5.4 reflects the themes derived from the survey questions for the University of Technology staff involved with WIL activities.

Table 5.4: Factor Analysis results for UoT

Questionnaire	Question	Factor
The University of Technology is sufficiently resourced with staff to perform Work-Integrated Learning functions	QS1	UoT Resources
The University of Technology is sufficiently resourced with respect to finances to perform WIL functions	QS2	UoT Resources
The University of Technology has an adequate supply of vehicles available for visiting learners at the workplace	QS3	UoT Resources
The process to schedule monitoring visits of learners at workplace is simple	QS4	Monitoring
The academic engineering department is sufficiently resourced for workplace monitoring visits	QS5	UoT Resources
You are familiar with the services provided by the co-operative education department	QS6	Communication

The communication levels between the co-operative education department and YOUR engineering department are adequate	QS7	Communication
The communication levels between the co-operative education department and learners requiring placement are adequate	QS8	Communication
The communication levels between the co-operative education department and workplaces are adequate	QS9	Communication
The communication levels between YOUR engineering department and workplaces are adequate	QS10	Communication
The Industry Liaison Committee (Advisory Board) is a productive and informative tool	QS11	Industrial Liaison Meetings
The frequency of the Industry Liaison Committee (Advisory Board) meetings is acceptable	QS12	Industrial Liaison Meetings
The Industry Liaison Committee (Advisory Board) meetings is well represented by Industry	QS13	Industrial Liaison Meetings
The co-operative education department's system for learner placement after lodging of learner curriculum vitae and statement of results is effective	QS14	Placement
Your engineering department's system for placement of learners is effective	QS15	Placement
The co-operative education department's system for the monitoring of learners at the workplace is effective	QS16	Monitoring
Your Engineering Department's system for the monitoring of learners at the workplace is satisfactory	QS17	Monitoring
The statement of results of learners qualifying for placement is timeously forwarded to the co-operative education department	QS18	Placement
The workplace gives feedback to the co-operative education department when it provides placement opportunities to learners	QS19	Monitoring

The workplace gives feedback to your engineering department when it provides placement opportunities to learners	QS20	Placement
Your engineering department provides feedback to the co-operative education department when learners are registered for the workplace component	QS21	Placement
The time taken for co-operative education department to place learners is acceptable	QS22	Placement
The marketing interventions of the University of Technology in growing the industrial network to increase workplace opportunities is adequate	QS23	Communication
The University's usage of media, website, newsprint and other channels used to attract workplaces opportunities is adequate	QS24	Communication
The workplace logbook is reviewed frequently to ensure the alignment with changes in technology at the workplace	QS25	Mentorship Training
The communications skills transferred to the learner from the University of Technology are sufficient for workplace requirements	QS26	Communication
The practical skills transferred to the learner through the institutional program are sufficient to perform related tasks in the workplace	QS27	Mentorship Training
The workplace mentors are sufficiently experienced to perform the mentoring role	QS28	Mentorship Training
The training/guideline provided by the University of Technology to workplace mentors is adequate	QS29	Mentorship Training
The learner's responsibility level at the time of work placement is acceptable for industry requirements	QS30	Attitude
The learner's accountability level at the time of work placement is acceptable for industry requirements	QS31	Attitude
The learner's work ethic at the time of work placement is acceptable for industry requirements	QS32	Attitude

The guidance provided by the department and the University of Technology to learners with regards to the process of registration for the WIL program is adequate	QS33	Placement
The information provided by the University of Technology about the process of securing WIL opportunities through the institution is sufficient	QS34	Placement
The overall assistance and support provided by the University of Technology in securing a workplace for WIL is adequate	QS35	Placement

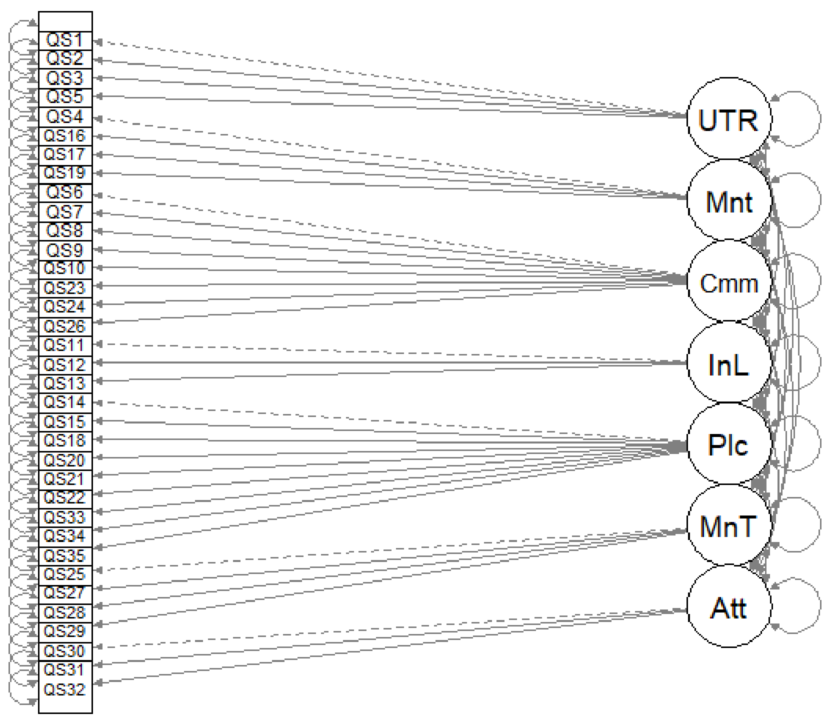


Figure 5.2: Factor Analysis Mapping for UoTs

Table 5.5 illustrates the results of the factor analysis, and the results strongly support the themes.

Table 5.5: Factor Analysis for UoT

	UoT Resources	Monitoring	Communication	Industry Liaison	Placement	Mentorship Training	Attitude
alpha	0.784001	0.752968	0.807042	0.874589	0.835742	0.79071	0.668724
omega	0.787728	0.783707	0.793748	0.882246	0.839611	0.801981	0.707143
omega2	0.787728	0.783707	0.793748	0.882246	0.839611	0.801981	0.707143
omega3	0.788802	0.799047	0.738457	0.880604	0.814652	0.803767	0.716591
avevar	0.484074	0.493362	0.346975	0.718104	0.394749	0.512341	0.464489

iii. Quantifying variability of question for WIL learners.

Table 5.6 Reflects the factors derived from the survey questions for the WIL learners.

Table 5.6: Factor Analysis for WIL learners

Questionnaire	Question	Factor
The University of Technology has sufficient capacity (staff, finance, vehicles) to perform WIL functions	QL1	UoT Resources
Adequate monitoring visits were performed by the academic staff while you were at the workplace.	QL2	UoT Resources
The engineering department is sufficiently resourced to perform workplace monitoring visits	QL3	UoT Resources
There were sufficient University of Technology programmes and interventions to enhance your understanding of WIL	QL4	UoT Resources
The communication levels between learners qualifying for WIL and the	QL5	Communication

co-operative education department are adequate		
The communication levels between learners qualifying for WIL and the engineering department are adequate	QL6	Communication
The communication levels between co-operative education department and the learner while at the workplace are adequate	QL7	Communication
The communication levels between the engineering department and the learner while at the workplace are adequate	QL8	Communication
The communication levels between the engineering department and the mentor at the workplace are adequate	QL9	Communication
The communication levels between the co-operative education department and the mentor at the workplace is adequate	QL10	Communication
Feedback from the engineering department providing information regarding Industry Liaison Committee (Advisory Board) meetings and Work-Integrated Learning issues raised are given to learners	QL11	Placement
The co-operative education department's system for placement of learners is very effective	QL12	Placement
The engineering department system for placement of learners is very effective	QL13	Placement

The co-operative education department staff performs adequate monitoring visits to learners at the workplace	QL14	Monitoring
The engineering department staff performs adequate monitoring visits to learners at the workplace	QL15	Monitoring
The engineering department's system for the monitoring of learners at the workplace is well organised	QL16	Monitoring
The marketing strategy of the University of Technology in growing the industrial network to increase workplace opportunities is adequate	QL17	Placement
The University of Technology's usage of media, website, newsprint and other channels used to attract workplaces opportunities are adequate	QL18	Placement
The logbook tasks are aligned to the tasks at the workplace	QL19	Mentorship Training
The workplace provides the full scope of the logbook requirements	QL20	Mentorship Training
Much of the theory learnt at the University of Technology was applied in the workplace	QL21	Attitude
The level of your work preparedness provided by the University of Technology with regards to communication skills is acceptable for industry needs	QL22	Attitude
Your work preparedness level with regards to practical skills from the	QL23	Attitude

University of Technology is acceptable to perform related tasks in the workplace		
Your workplace “mentor” successfully performs the mentoring duties	QL24	Mentorship Training
The workplace mentor’s attitude towards you, as the learner, is acceptable	QL25	Mentorship Training
Your mentor’s attitude towards others is acceptable	QL26	Mentorship Training
Your mentor’s knowledge about the logbook tasks is acceptable	QL27	Mentorship Training
The workplace is sufficiently resourced to support your development as a Work-Integrated learner	QL28	Workplace Resources
The workplace is sufficiently resourced with tools and equipment your development during Work-Integrated Learning	QL29	Workplace Resources
The workplace is sufficiently resourced with information related to the operation through the availability of manuals and other information	QL30	Workplace Resources
The knowledge and information provided by the department and the University of Technology with the process of registration for your WIL program was adequate	QL31	UoT Resources
Health and Safety is sufficiently covered during the academic program	QL32	UoT Resources

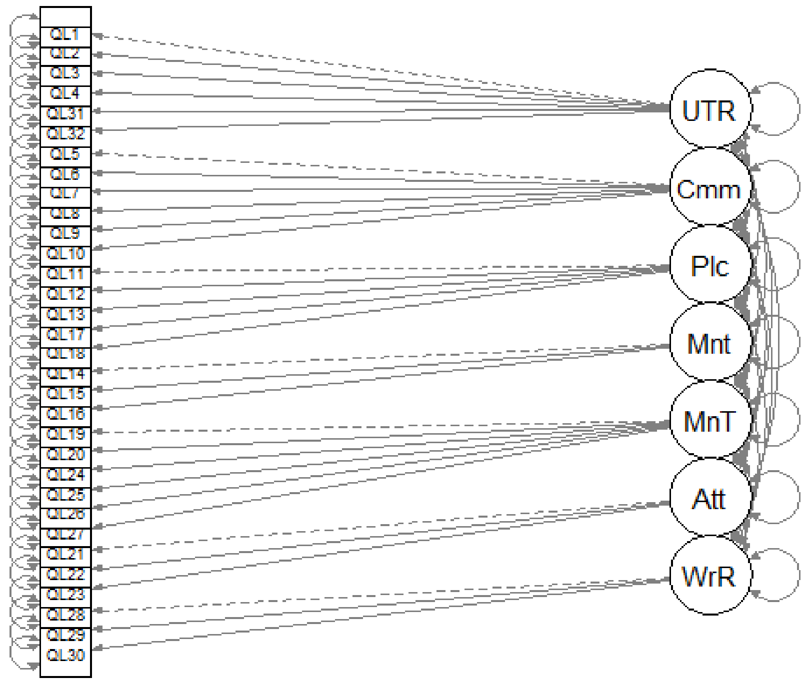


Figure 5.3: Factor Analysis Mapping for WIL Learners

Table 5.7: Factor Analysis Results for WIL learners

	UoT Resources	Communication	Placement	Monitoring	Mentorship Training	Attitude	Workplace Resources
alpha	0.83061	0.867279	0.850716	0.907539	0.822785	0.638476	0.823181
omega	0.856656	0.879157	0.855182	0.917124	0.813864	0.670369	0.822716
omega2	0.856656	0.879157	0.855182	0.917124	0.813864	0.670369	0.822716
omega3	0.865363	0.883673	0.859345	0.926647	0.7907	0.68085	0.821026
avevar	0.529602	0.561927	0.544428	0.787995	0.424714	0.417108	0.607901

5.2.3 Demographics

The gender and ages of the survey respondents, namely, the learner, Industry Mentor and University of Technology staff, were captured and analysed; this information is illustrated in the graphs in Figure 5.4 below.

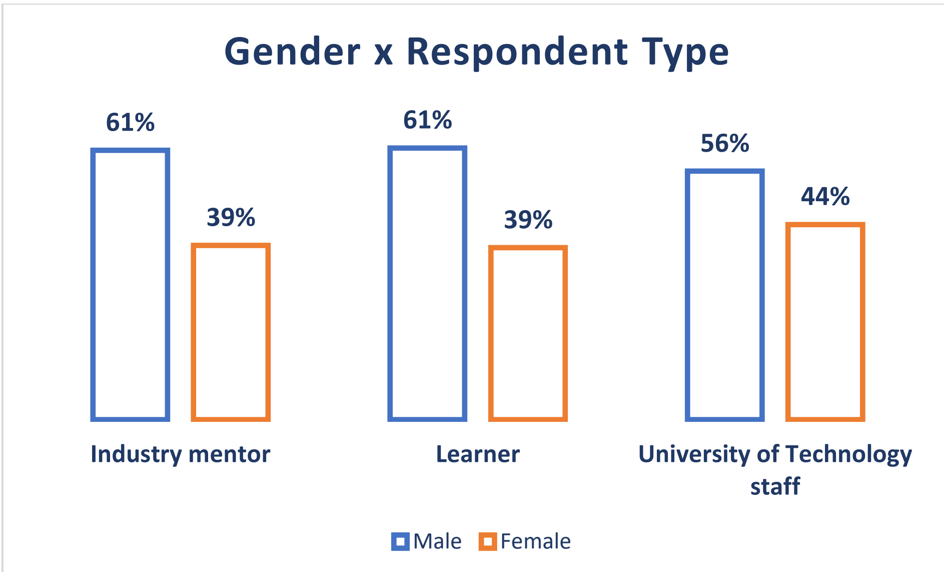


Figure 5.4: Gender of Respondents

The data analysis showed that there were 54% male and 46% female participants in the study. Male participants from the University of Technology made up 56 % and female participants made up 44% of the total. The survey attracted a sizable percentage of female University of Technology employees, demonstrating their interest in exploring possibilities to address WIL issues. WIL learner participants accounted for 57% of the total, comprising 61% male and 39% female. The Industry Mentors included 61% male and 39% female participants. According to the data, there has been a significant change from an engineering industry that was primarily male to one that enrols a sizeable portion of female learners. The various genders may interact with the environment differently and hold different viewpoints; the research findings may thus be seen as being more representative.

5.2.4 Age of Respondents

The study attracted participants across a wide range of the age spectrum, and multi-generational participants produce rich contributions. Younger individuals will contribute to the study with fresh ideas, while older participants will add value to it with their own wisdom and experience. Figure 5.5 shows a bar graph of the ages of the various categories of the research participants. The graph indicates the age of participants who includes WIL learners, University of Technology staff, and Industry Mentors. The participants' ages range from 20 to 69, demonstrating the broad interest in the WIL challenges.

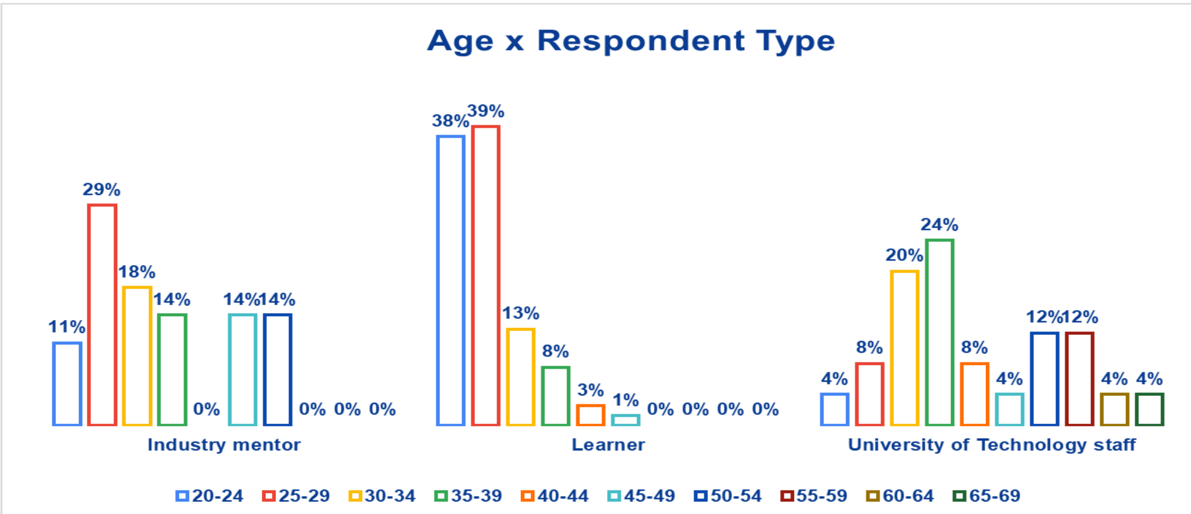


Figure 5.5: Age of Respondents

According to the data analysis, 38% of the Industry Mentors who took part in the study were between the ages of 25 and 29%, and 11% of them were between 20 and 24 years old. It is anticipated that the younger mentors will only impart a small amount of their expertise and abilities. Contributions to the economy by poorly developed engineering are therefore limited. It could be challenging for the younger mentors to persuade senior management and executives to expand the employment options for future graduates. Only a small portion of the senior engineering staff who were qualified and experienced took part in the survey.

The majority of the participants, according to the data analysis, were under 30 years old. However, 21% of learners between the ages of 30 and 40 years of age participated in the study. It is also noteworthy that 4% of WIL students between the ages of 40 and 50 took part in the study; this shows how challenging it can be for some students to find placement opportunities in the workplace soon after finishing their academic work and how long that wait can be.

The data analysis shows that 52% of the University of Technology staff participating in the research were under 40 years of age, with 44% being between the ages of 30 and 40 years old. The University of Technology staff involved with WIL responsibilities, according to the data, appear to be young implying that the staff have limited exposure to industry themselves. Academic staff responsible for WIL require insight and knowledge of the complex nature of activities prevalent in an industrial setting. An engineering plant operation or an industrial setting consists of a variety of related machinery and equipment operating methodically together to produce predetermined products, data reporting and storage, employees carrying out specific tasks, policies, standards, and procedures, as well as many other activities. To accomplish the organization's precise and focused goals, human and physical resources are blended and integrated, (Schutte, Kennon & Bam, 2016).

The graph below shows that 45% of the Industry Mentors are made up of technicians who have been through WIL programs themselves and are suitable candidates to perform mentoring functions however it could be argued that the balance of the based mentors, having completed qualifications without any WIL component may contribute to mentoring gaps. Nonetheless, training interventions may enhance and improve mentoring skills of Industry Mentors.

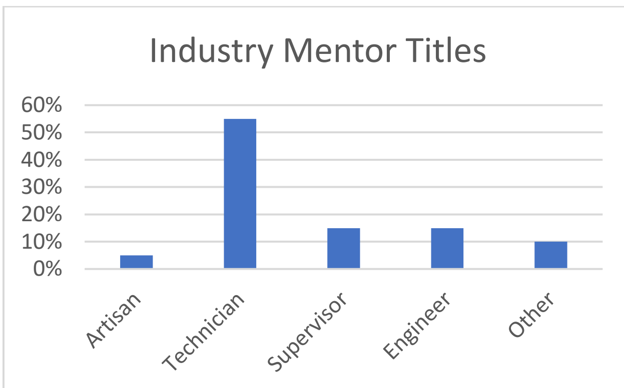


Figure 5.6: Industry Mentor Titles

Academic staff, on the other hand, have strong academic qualifications with the minimum of a degree qualification, however the graph below shows that approximately 20 % of the academic staff have more than 10 years of industrial experience, noting also that the industrial experience gained is also dependant on the positions held in the workplace. Therefore, on analysing the data it is justifiable that academic staff involved with WIL activities, lack adequate industrial experience, and further require training interventions and industrial exposure.

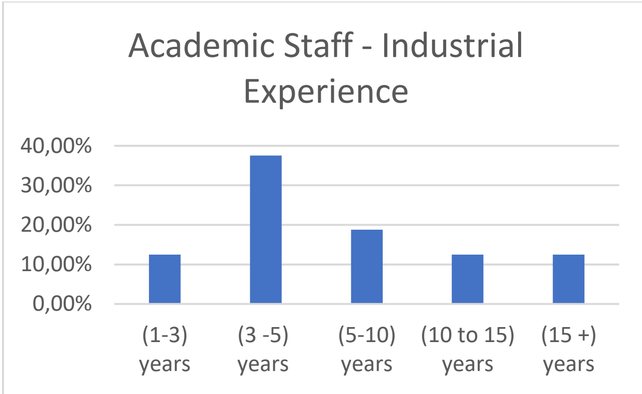


Figure 5.7: Academic Staff -Industrial Experience

5.2.5 Waiting Time Until Placement

Learners must spend time in the workplace to gain exposure to the working world and connect their practical abilities to the amount of theory they have learned in order to acquire their engineering qualification. However, the placement in suitable workplaces for some learners is delayed. Figure 5.8 illustrates the dilemma of learners waiting to be placed in the workplace after completing the academic component of the Engineering Diploma.

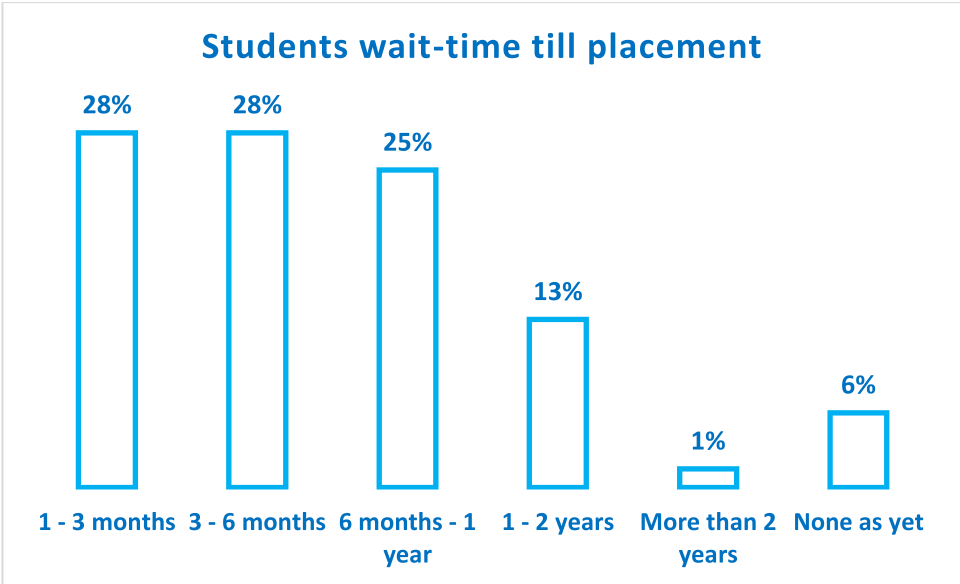


Figure 5.8: Waiting Time Until Placement

The data that has been analysed shows that less than 30% of students are placed in three months. Additionally, 45% of students wait more than six months to be placed in an industry to gain the required exposure (Figure 5.6). The supply of skilled technicians for industry and the improvement in learners' socio-economic standing are severely impacted by learners' placement delays and non-placements. A startling 20% of learners, according to the data, find placement opportunities in suitable workplaces with a wait time of more than a year.

The students' uncertainty about obtaining the necessary work experience before certifying makes this a significant obstacle. High wait times can be a sign that students are starting to lose their conceptual understanding, getting distracted by looking for jobs too soon, and not engaging in productive economic activity. Increasing access to more workplaces will provide WIL learners with rapid placement opportunities.

5.2.6 Survey Participant Gaps.

Table 5.8 contains the responses of the survey participants indicating areas of shortcomings and gaps.

Table 5.8: Participant Gaps

	Gaps	Learner	UoT Staff	Industry Mentor
1.	Theoretical Knowledge	13%	8%	48%
2.	Practical Skills	29%	42%	56%
3.	Computer Skills	12%	13%	11%
4.	Communication Skills	36%	38%	26%
5.	Punctuality	32%	33%	19%
6.	Attendance	20%	38%	15%
7.	Interpretation of Drawings and Documents	12%	17%	30%
8.	Project Management Skills	22%	25%	26%
9.	Working in a Team	22%	25%	33%
10.	Attitude	35 %	46%	19%

5.2.6.1 Theoretical Knowledge

Within the data sourced, the counterparts were asked to feedback on the areas of lack.

Figure 5.9 shows the results of the learners' level of theoretical knowledge required in the workplace, through the lens of the learners, University of Technology staff and the Industry Mentors.

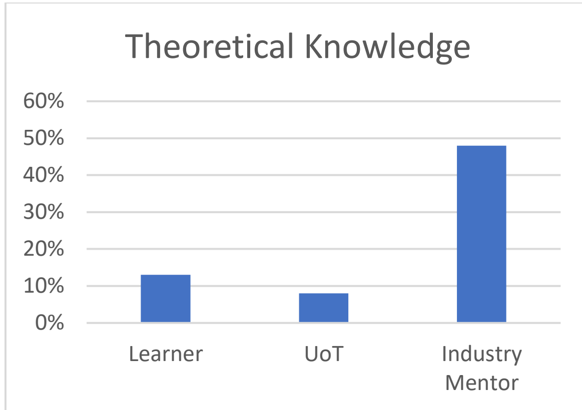


Figure 5.9: Learners Level of Theoretical Knowledge

Theoretical knowledge of engineering principles, concepts and technology enhances the ability for practical applications in the workplace. The application and practice of tasks in the workplace is underpinned by the theoretical knowledge gained from academic institutions (Wheelahan, 2007). "Theoretical knowledge allows a society to connect the material and immaterial, the known and the unknown, the thinkable and the unthinkable, the here and the not here, the specific and the general, and the past, present and future" (Young 2003; Wheelahan, 2007). The pace of change requires the continuous improvement and updating of theoretical knowledge and its application in the workplace and the responsibility of the tertiary institutions to establish the integration of theoretical knowledge into practice at the workplace (Katajavouri, Lindblom-Ylanne & Hirvonen, 2006).

The University of Technology provides four semesters of academic learning before learners are placed at workplaces for experience. The data results show that learners are confident that they possess sufficient theoretical knowledge required in the workplace, approximately 13% indicated that they have a shortfall of theoretical knowledge required by the workplace.

The University of Technology staff also showed their confidence that learners are well equipped with the relevant theoretical knowledge required by the workplace for learners to competently perform engineering tasks. The transfer of the academic knowledge is aligned to the curriculum. Only 8% of the University of Technology staff indicated that learners lack the theoretical knowledge required to adequately perform at the workplace, indicating that the curriculum is designed to sufficiently meet the knowledge requirements of the real world.

The Industry Mentors, however, indicated a vast gap when compared to the responses of the learners and the University of Technology staff. This is consistent with Lewis (2020), who points out that the deficiency of technicians may be attributed to the lack of relevant theoretical knowledge required for the work environment. The data analysis showed industry mentors were balanced on their view on whether the learners had possessed adequate theoretical knowledge required by the workplace. Approximately 50% of the industrial mentors indicated that there exists a lack on the part of the learners of the theoretical knowledge required by industry for the engineering tasks performed at the workplace.

5.2.6.2 Practical Skills

The work environment requires a range of basic and specialized practical skills required for the successful completion of various engineering related tasks. The opportunity for learners on WIL programs to apply their institutional learning at the workplace is highly dependent on their work ready preparedness as the work environment demands that the learners be equipped with the necessary practical and other skills. Learners ready for the placement in the workplace should possess a balanced set of generic and specialised skills to allow for an ease of transition into the workplace, to further equip them to adapt to the fast-changing workplace requirements (Field, Hoekel, Kis & Kuczera, 2009). Figure 5.10 illustrates the analyses of the survey responses on the learners' level of practical skills as required by the workplace.

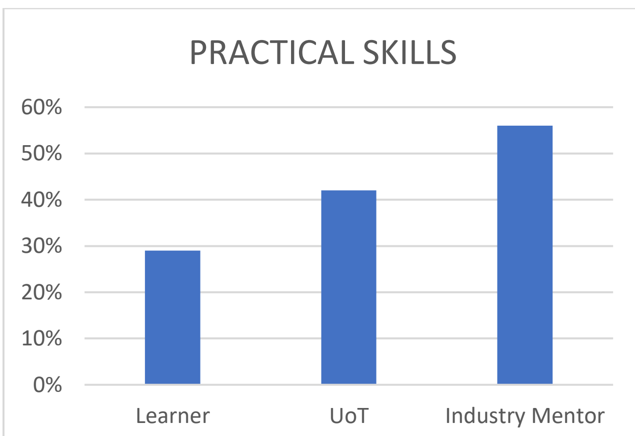


Figure 5.10: Learners' Level of Practical Skills

The engineering WIL learners requires a range of practical skills in order to perform adequately at the workplace. The data analysis indicated that 29% of the learners that participated in the study agreed that they lack the practical skills required by the workplace. The exposure to unfamiliar industrial plant processes, sophisticated and expensive equipment requires specialised skills to be operated or worked on.

The risk of damage to property or danger to lives is great when one attempts to work on plant equipment without the relevant knowledge and skills.

The University of Technology staff supported the view that the learners were not provided with the necessary practical skills to perform the workplace tasks competently. Approximately 42% of the University of Technology staff agreed that engineering learners did not possess the skills required by industry. This implies the huge gulf between the skills provided by the institution and those required by industry.

The industry mentor, who engage actively with the learners on the application of the learners' knowledge and skills gained at the university of technology, agreed that engineering learners lack the practical skills to perform competently at the workplace. The data analysis shows that 56% of the industry mentors agreed that the engineering learners possess a lack of the practical skills required by industry. The learners have two semesters at the workplace to learn a vast range of basic, generic, and high-level skills. This time limitation drastically reduces the ability of the learners to gain and acquire the much-demanded skills required to competently perform in the real world of work. Collaborative efforts should be made to prepare the WIL learners to be more "hands-on" for a smooth transition into the workplace.

5.2.6.3 Computer Skills

In today's world, computer skills are widely required, more so in the field of engineering. Computer literacy is included and highly ranked as a required competency in the workplace. The scope of computer literacy for WIL learners at the workplace includes the efficient use of computer technology for report writing, engineering related research, presentations, organising and formatting information (Magogwe, Nkosana & Ntereke, 2014). Higher levels of computer skills are required for the current fourth industrial revolution (4IR) and the introduction of 3D printing, robotics, the Internet of Things, and the extensive use of artificial intelligence for plant processes and various engineering systems (Rotatori, Lee & Sleeva, 2021). Competency is defined as the learners' ability to apply the theoretical knowledge and skills gained at the institution, as well as attitudes and values to required standards of the workplace (Rainsbury, Hodges & Burchell, 2002). The analysis of survey responses about the learners' level of computer skills as required is shown in Figure 5.11.

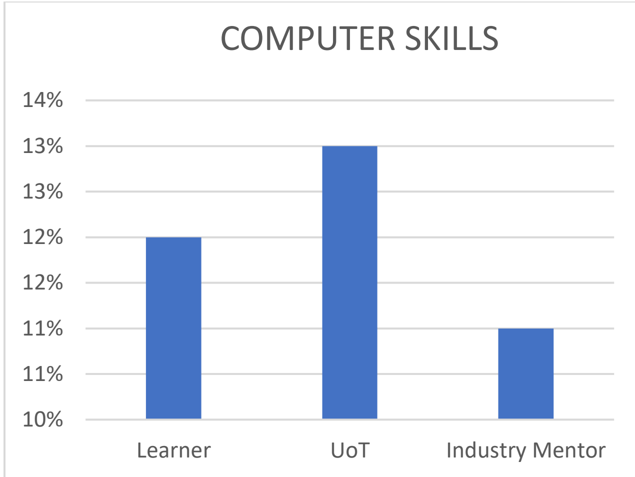


Figure 5.11: Learners' Level of Computer Skills

The data analysis indicates that the majority of learners are confident that they possess sufficient and relevant computer skills required by industry. A total of 12% of WIL learners, however, indicated that they lacked the required computer skills to perform the engineering tasks at the workplace. This perception may have resulted from their performance in the subject offered at the institution. The data revealed that the University of Technology staff agreed with the learners, as only 13% of the University of Technology staff indicated that the learners lacked the relevant computer skills for the workplace. Their perception also could be based on the performance of the learners in the computer subject taught at the institution.

The industry mentors also indicated that the majority of the learners do possess the require computer skills necessary to adequately perform at the workplace. The data reveals that a total of 11% of the University of Technology staff indicated that the WIL learners lacked the required computer skills. The level of computer skills may be sufficient for the current status of the workplaces, as South Africa is currently in the early stages of the fourth industrial revolution; this may not, however, be adequate once the workplaces fully embrace the complex technologies of the fourth industrial revolution.

5.2.6.4 Communication Skills

An organization's ability to operate effectively depends on its employees having strong communication skills in all fields. Employers want to hire workers with the necessary "soft skills" and "hard skills" to positively contribute to the organization in today's highly competitive and dynamic global market, where effective communication skills are highly valued for fostering relationships with all stakeholders. Employers require careful listening to instructions, good verbal communication skills for discussion and explanation, report writing and presentations (Magogwe, Nkosana & Ntereke, 2014). According to Brink and Costigan (2015), listening skill was found to be a major communication challenge at the workplace. Figure 5.12 illustrates the communication skills level for the workplace requirements based on the responses of the WIL learner, University of Technology staff, and Industry Mentor.

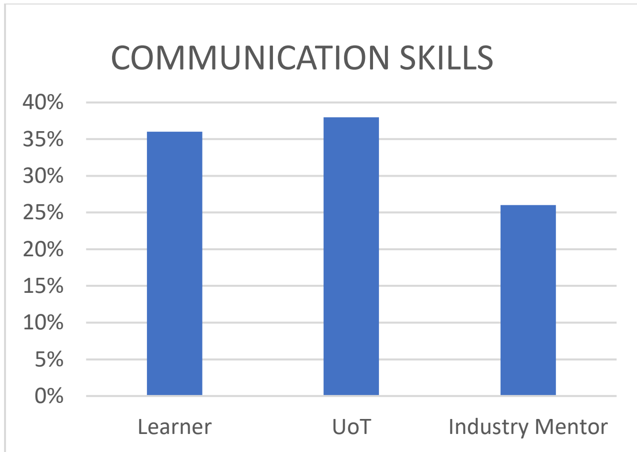


Figure 5.12: Communication Skills - WIL Learner

The data analysis showed that a significant number of learners acknowledge they do not possess the communication skills required in the workplace. As much as 36% of the learners indicated they lacked the required communication skills to be able to comfortably communicate in an industrial environment. Poor communication skills may result in learners' underperforming in the workplace and employers being dissatisfied.

The University of Technology staff also indicated that learners have challenges in the area of communication. A total of 38% of the University staff indicated that learners lacked the required communication for industry purposes. Industry mentors engage with learners on a daily basis giving instructions and allocating tasks. The data analysis indicates that a total of 26% of industry mentors are dissatisfied with the level of communication skills learners possess when they enter the workplace.

5.2.6.5 Punctuality

Industry regards the punctuality of staff members as a key criterion for an efficient operation. Going to work late results is productive time lost and has negative implications for industry. Employees display their commitment by starting on time without causing any delays to other team members who go early to begin working on important projects and meeting deadlines. Punctual employees further display discipline and organisational skills which are highly regarded in the workplace. Based on the data, Figure 5.13 displays the results of the responses on the question of learner punctuality.

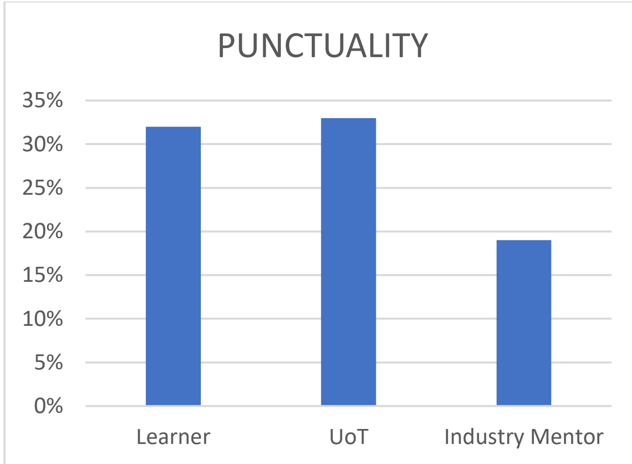


Figure 5.13: Punctuality of Learner

A significant percentage of learners responded that they encounter challenges with punctuality. Turning up late for university lectures or at the workplace drastically affects the learners' performance. A total of 19% of learners acknowledged that they arrive late to work; however, 33% of the University of Technology staff responded that learners are challenged with punctuality. The industry mentors also indicated the problem of late coming to the workplace existed with learners. However, 19% of the industrial mentors indicated that learners have a punctuality problem. Arriving late to work is disruptive to planning, scheduling and the timeous completion of tasks and projects.

5.2.6.6 Attendance

Regular attendance is critical to the functionality of any organisation. For the continuity of activities, processes, and engineering tasks it is imperative for key personnel to be regular at the workplace. The absenteeism of WIL learners results in various hidden costs to organisations which includes the indirect costs of additional staffing, re-scheduling of tasks or delaying projects, re-training of staff who has been absent for a significant time, lost productivity, diminished moral of colleagues who have to carry additional workloads, turnover, and the cost of lost opportunities (Saravanan, 2013). Figure 5.14 presents the findings of the responses to the learner attendance question as per the data.

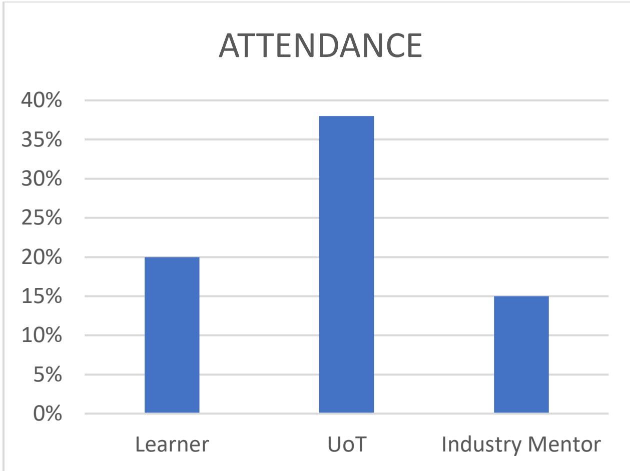


Figure 5.14: Learner Attendance

Learners have demonstrated a very low level of consistency in their attendance at work. A total of 20% of learners acknowledged that they struggled to be regular while at the workplace. Poor attendance will force the industrial mentors to refrain from including learners in critical and high-level tasks. University of Technology staff has indicated that learners have a major problem with attendance, and the data analysis indicates that 38% of learners have challenges with regular attendance. Industry mentors have major problems with poor attendance of learners. A total of 15% of the industry mentors responded that learners lacked good attendance habits.

5.2.6.7 Interpretation of Drawings and Documents

Engineering work requires a sound understanding of drawings and documentation. Engineering drawings and documentation are the chiefly used as a mode of communication team members working on a specific project or general day-to-day activities. For the efficient and effective operation of global businesses, expertise in the use of engineering related drawings and documentation is essential. However, it has been found that the comprehension and interpretation of engineering drawings was a challenge to engineering students (Abdullah, Burvill, & Field, 2011). Learners, when placed at the workplace, will be required to interpret drawings and work with documentation as part of their exposure to engineering related tasks. Figure 5.15 illustrates the learners' ability to interpret technical drawings and documentation in order to perform engineering tasks competently for the workplace based on the responses of the WIL learner, University of Technology staff, and Industry Mentor.

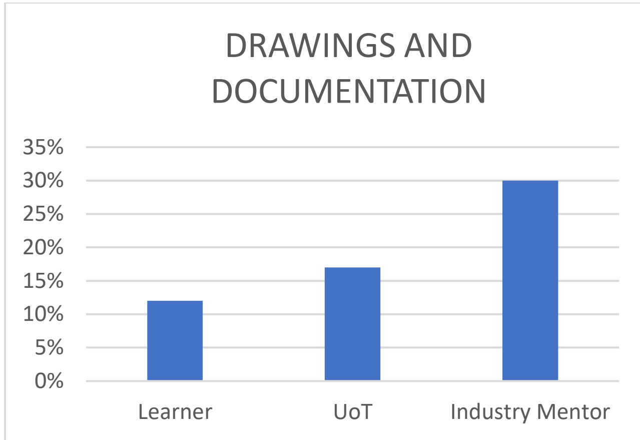


Figure 5.15: Drawings and Documentation

This requirement is vital for technicians and engineers to perform adequately in industry as most high- level engineering tasks includes drawings and documentation. However, a significant percentage of 12% of learners indicated they lacked the necessary skills to interpret drawings and work with documentation. The learners' perception of their knowledge and understanding of drawings and documentation, when compared to the responses of the University staff and the Industry Mentors, is different.

The University of Technology staff also indicated that learners struggle with drawings and documentation. A total of 17% responded that learners lacked the required level of understanding to comfortably interpret technical drawings and work with documents, while the Industry Mentors who engage with the WIL learners, responded that learners really struggled with the interpretation of drawings and working with documents. A total of 30% of the industry mentors responded that learners had challenges working with drawings and documentation.

5.2.6.8 Project Management Skills

Managing projects is an important function that engineering technicians and engineers are expected to perform in the workplace. Project Management skills are therefore critical for engineering projects to be successfully completed. The current workforce is characterized by employees who are well trained, can adapt and learn with ease to changes, more responsible and accountable, in order to meet the demand of the global economy. There is a growing demand for project management skills in all sectors of business (Pant & Baroudi, 2008).

Figure 5.16 graphically displays the responses from the learners, University of Technology staff and the Industry Mentors on the question of the leaners' project management skills.

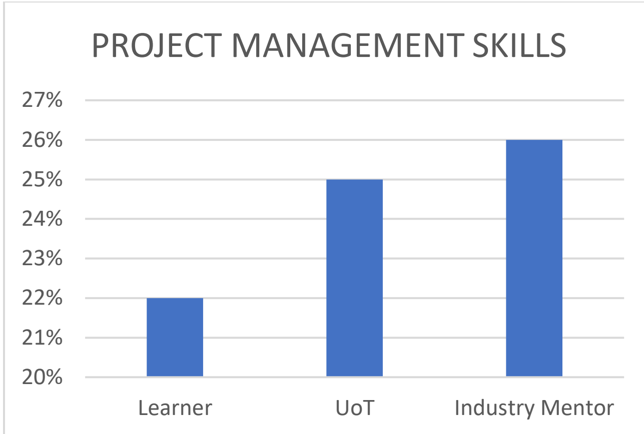


Figure 5.16: Project Management Skills

The survey responses indicate that a significant number of learners lack the required skills to manage projects in the industrial environment. A total of 22% of learners indicated that they lacked sufficient and relevant project management skills to perform adequately in the workplace. The University of Technology staff further confirmed that the learners had challenges in the area of project management, with 25% responding that the learners lacked project management skills required for the workplace.

Industry mentors who engage with WIL learners in the workplace environment have acknowledged that learners lacked the project management skills required to manage projects in the workplace successfully. A total of 26% of Industrial Mentors responded that learners do lack the relevant project management skills required in the workplace.

5.2.6.9 Working in a Team

The concept of teamwork may be defined as the engagement of work colleagues combining and sharing and bringing together their various expertise, skills, and experiences to perform common workplace outputs. The combined team effort results in a less stressful work environment, higher levels of job satisfaction and improved productivity outputs (Williams, Esmail, Grigoroglou, Zghebi & Panagioti, 2020).

Teamwork is vitally important in successfully completing any workplace project as many employees, sometimes from different departments are involved in the project. The current complex and highly demanding workplace require the harmonious working of members in a team more necessary than ever (Ritter, Small & Mortimer, 2017). Teamwork is an important and significant performance enhancing tool which is neglected in work environment the contributing to under-performance and decreased productivity (Sanyal & Hisam, 2018). Figure 5.17 illustrates the responses of the various participants on the question of the learners' ability to work in a team during work assignments at the workplace.

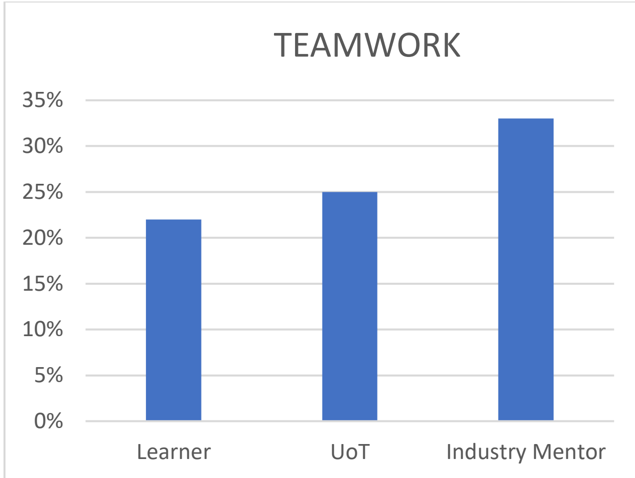


Figure 5.17: Working in a Team

Learners are required to be able to work together with other team members in various tasks and projects in order for successful completion. A total of 22% responded that they struggled with working together with other team members.

University of Technology staff members also acknowledge that many learners lacked the skills required to work in a team. The data analysis revealed that, according to the University of Technology staff, 25% of the learners lacked the skills required to work in a team.

The Industry Mentors work very closely with the WIL learners and allocate various tasks to learners, acknowledging the importance of teamwork skills. A total of 33% Industry Mentors have responded that learners had major challenges in projects requiring teamwork.

5.2.6.10 Attitude

The correct attitude towards work and colleagues contributes significantly to an efficient and productive organisation. Poor mental health or bad attitude towards work for various reasons will lead to low performances and non-productivity (Wang & Gorenstein, 2014).

The tendency of learners in the workplace to display attitudes of self-importance and highly knowledgeable coming into the workplace with tertiary knowledge, expect to high rewards and recognition, yet their performance levels are mediocre (Dasborough, 2015; Dragova-Koleva, 2018). It is required of learners to have the proper attitude towards the mentor and other work colleagues and seniors.

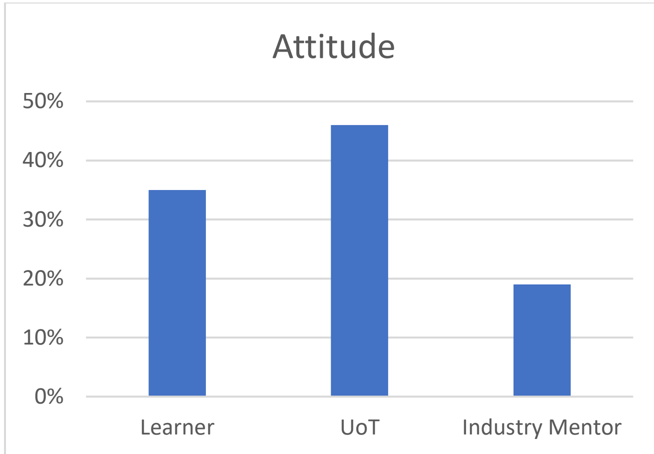


Figure 5.18: Learner Attitude

The University of Technology staff have responded with 46% indicating that the learners lacked good attitude which will affect the learners' placement in the workplace. It is clear that learners have displayed bad attitude towards the University of Technology staff. The Industry Mentors responded that learners do display incorrect attitudes in the workplace. A significant percentage of 19% indicated that learners lacked the attitude expected at the workplace.

5.2.7 The Industry Liaison Committee (Advisory Board)

The Universities of Technology hosts bi-annual meetings with representatives from workplaces. For the benefit of the students, universities of technology and business, various WIL related challenges are discussed and debated. High on this agenda are discussions on ways to improve access into the workplaces. Regarding the effectiveness and productivity of the Industry Liaison Board sessions, approximately 10% of the respondents were agreed, however many of the respondents offered no opinion. More emphasis should be given to these collaborative meetings, which should be used to as an opportunity to draw the academic institutions and the workplaces to build stronger and closer working relationships.

5.2.8 WIL Registration Process

For a learner to be placed in industry for WIL, a structured process is required to be followed.

1. An application is made for acceptance of the placement in a workplace,
2. The placement-offer or contract by the potential workplace is submitted to the academic institution.
3. Permission is granted for registration, which could be done online or manually, at the academic institution.

4. Proof of registration must be submitted to the Engineering Department so that the process for supervising/monitoring of the student may be planned.

When requested to respond to the placement process 25,9% of industry mentors disagreed that the process was simple. Since efficiency is the focus of industry, the lengthy, complicated, and bureaucratic procedures to integrate WIL trainees may pose a detrimental effect on employers' desire to offer placement opportunities.

5.2.9 WIL Advocacy

Many high-achieving students frequently struggle to find appropriate WIL placement options (Jackson & Greenwood, 2015). The expectation is that universities of technology will aggressively canvass businesses to increase the number of workplace opportunities to accommodate the learners waiting for WIL placements. A sizeable number of 48.1% of the mentors responded that the canvassing exercises were insufficient when asked to comment on the academic institutions marketing efforts. Industry Mentors could argue that direct endeavours made by the Universities of Technology to recruit more WIL learners was lacking.

5.2.10 Logbook Tasks Alignment and Scope

The University of Technology provides logbooks with specific tasks that students must complete. Even while engineering is the main focus of each workplace, each one is unique and has its own set of rules, equipment, and tools, which can provide WIL learners a variety of experiential opportunities. A total of 40,7% of the industry mentors said that the logbooks did not correspond to the responsibilities and opportunities offered by their specific workplace, and that the workplace experience also did not cover the entirety of the logbook.

The pace of change in the workplace driven by global competitiveness, new technologies, climate change, government policies and other factors may drive drastic changes in the systems, processes, and equipment of engineering organisations. The workplace may offer additional pertinent learning opportunities that will transfer to the WIL learner important and relevant skills and competences. Logbooks designed for WIL learners should be updated and aligned more frequently and also allow for a fair degree of flexibility.

5.2.11 Workplace Resources

Numerous resources must be available in order for a WIL learner to be appropriately developed in the workplace. The Industry Mentors (40,7%) who are responsible for the learners in the workplace indicated that the required resources to adequately develop a WIL learner are insufficient. Among the resources required for proper WIL mentorship in the workplace, the following may be required: the relevant tools, manuals, access to computer, personal protective equipment, stationery, training, stipends, and a dedicated mentor.

5.2.12 Workplace Monitoring

The University of Technology must keep track of the learner's development while they are working. This crucial monitoring visit offers the learner chances for assistance in the form of direction, inspiration, and addressing difficulties encountered at the job. Learners highlighted the concern regarding the lack of university support and lecturer visits while at the workplace (Agwa-Ejon & Pradhan, 2017). This was consistent with the data analysis where 42,6% of WIL learners indicated their displeasure with the absence of monitoring visits from University of Technology staff. The learners are exposed to abuse or neglect by industry because of the academic institutions' poor and non-existent performance in monitoring and assessing the learners, which may be mistaken for apathy. In the end, the organization's current learners' ability to grow is damaged, and it is possible that this will have an adverse effect on how the workplace welcomes new learners.

5.2.13 WIL Preparation

According to the data, 38.8% of WIL students reported that the academic institution did not offer them an adequate number of programs and initiatives to help them prepare for the workplace. The University of Technology's inadequate preparation hinders students' ability to transition into the workforce easily. Despite some academic institutions having established extensive initiatives to close the gap between the classroom and the workplace, industry mentors still responded that there was a need to focus on learner readiness for the work environment.

5.2.14 University of Technology Placement System

Building relationships with business for the purpose of providing access to or promoting opportunities for future WIL learners is the industrial Co-operative Department's primary duty. Once the necessary academic component is met and the learners qualify for placement, their curriculum vitae are submitted to the Co-operative Department. Industry’s first point of contact for the recruiting of learners for WIL opportunities is the Co-operative Department. For this process to be managed, efficient systems and human resources are imperative. The data analysis indicates that most students are happy with the departments' performance, but it also showed that 31,4% of WIL students were unhappy with how well these departments handled learner placements, indicating a need for improvement. The placement of learners into workplaces, the registration of learners for the WIL modules, and the scheduling of workplace monitoring all require adequate and effective processes. To grant the learners the WIL credits, efficient methods are needed for the evaluation of their performance, logbook entries, and reporting. Ineffective methods may delay learners' placement in a company or prevent them from taking advantage of a possible placement opportunity. Efficient systems are required by the Universities of Technology to wholistically manage the WIL program.

5.2.15 University of Technology Resources

Universities of Technology staff are required to travel to various industries located around the province of KwaZulu-Natal for the following purposes:

1. To secure more workplace opportunities for WIL learners.
2. To approve and authorize new workplaces, ensuring the workplace has the capacity, capability, and other resources to offer WIL opportunities.
3. To monitor the progress of WIL learners.
4. To consult with mentors.

For these functions to be efficiently carried out, finances are required for travel, accommodation, and meals. When monitoring visits are carried out, additional staff may be needed to carry out the duties which were normally handled by staff who have been allocated responsibility for monitoring students in the workplace and carry out other WIL related functions. The Department of Higher Education urges that budgets adequately fund the costs associated with WIL visits (DHET, 2011). The data analysis showed that a significant percentage of 33,4% responded that finances for WIL visits posed a challenge.

5.2.16 Industry Mentor Training and Guidelines

To enhance the transfer of occupational skills to the WIL student and to increase the quality of mentoring, workplace mentors must receive training and capacity-building interventions. Without the correct training, industry mentors may provide learners poor advice and guidance that hinder their progress and acquisition of the necessary workplace skills to meet the requirements for the engineering diploma. These skills may also increase learners' chances of finding employment. A sizeable majority of 20,9% of University of Technology staff members said that Industry Mentors do not receive enough capacity building opportunities.

5.3 Response to the open-ended questions

The input from the open-ended question embedded in the survey questionnaire was provided in the form of single words, brief textual phrases, bulleted points, and descriptions. Many of the responses contained a high frequency of certain words. Word clouds can provide an overview by the extracting the most frequent words found in text (Heine, 2014). The open-ended question from the survey questionnaire was analysed qualitatively using word clouds.

5.3.1 Word Clouds

Respondents were asked in the survey questionnaire in free-text to share their opinion around the challenges of 'Work-Integrated Learning'. From the distribution of words as plotted in the word cloud, results were obtained. In Figure 5.19, the bigger the word, the more frequently the word has been used. We find the dominant notions express challenges around the lack of skills, communication, lack of confidence, puntuality and placement which is consistent with the data analysis of the quantitaive phase.

Words frequently used in the responses of the survey participants have been highlighted and visually presented in a word cloud. The prominent appearance in the word clouds allows readers and viewers to appreciate the main message or standpoints of the researcher (McNaught & Lam, 2010). The highlighted and prominent words of in word clouds may be a starting point for a deeper exploration and analysis of specific and relevant subjects (Heimerl, Lohmann, Lange & Ertl, 2014). Word clouds effectively give an impression of what information is present in a query result set and provide a good visualization technique to communicate an 'overall picture' of the text contents, (Heimerl, Lohmann, Lange, & Ertl, 2014). The researcher used word clouds as a qualitative tool to analyse the responses of the WIL learners, University of Technology staff and Industry Mentors.

Whilst the disadvantages of word clouds exist it may still be debated that, the analysis method itself cannot be ignored on these grounds. Many researchers still highly recommend the use of word clouds to aggregate unstructured text data. Word clouds are a common, natural language processing (NLP) method that often forms part of the initial data analytics. Many researchers highly recommend Word Clouds.

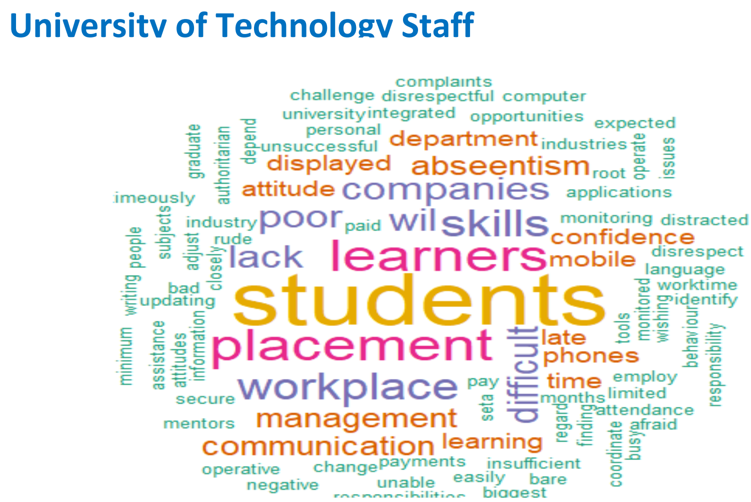


Figure 5.19: Word Cloud -UoT Staff

Learners, management, late, phones, absenteeism, and department are the only words that occur in the word cloud for UoT staff. Attendance and punctuality, as well as the use of cell phones, appear to be issues that UoT staff and management face with learners.

Learners

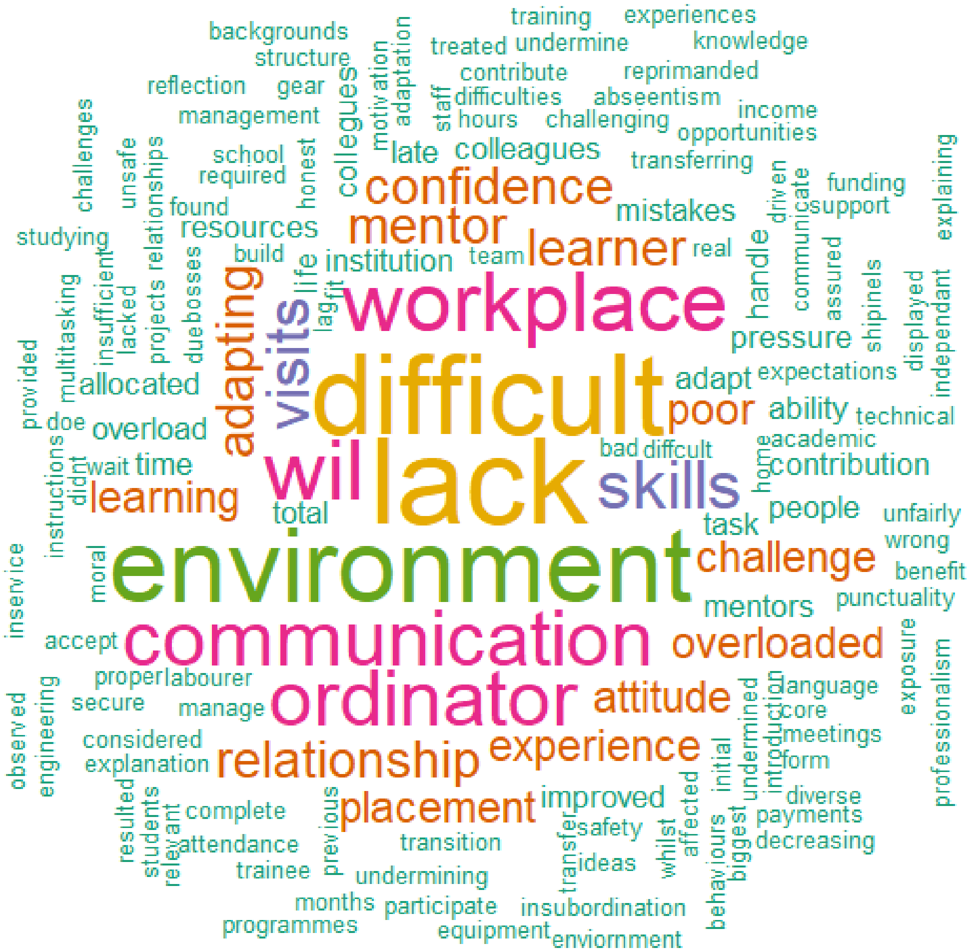


Figure 5.20: Word Cloud – WIL Learners

The only words that appear in the word cloud for learners are environment, communication, coordinate, relationship, and visits. Acclimating and adapting to a completely new **environment** at the workplace can be a challenging experience for learners. Monitoring **visits** are vital to track learners' progress at work, while **communication** and **relationship** building skills with all stakeholders, including lecturers, Industry Mentors, and team members, are required for learners to succeed. Smooth **coordination** of the entire WIL program is crucial for learner success.

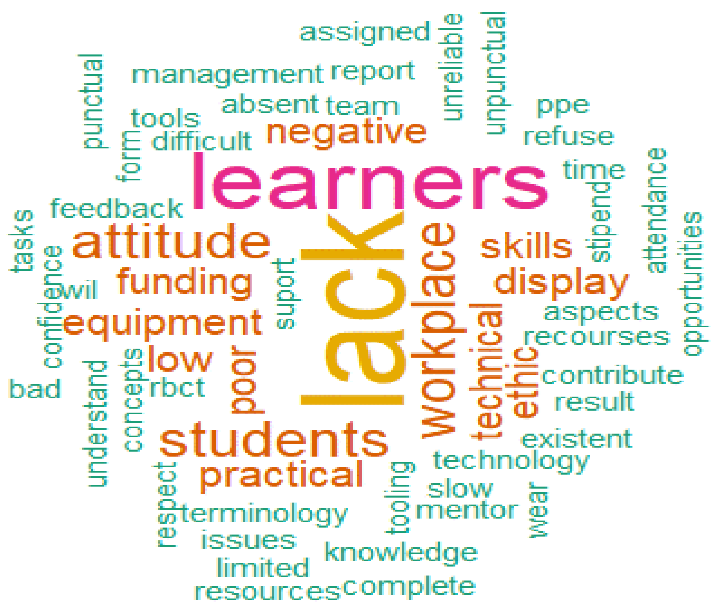


Figure 5.21: Word Cloud - Industry Mentors

The only words that appear in the word cloud for Industry Mentors are negative, technical, ethics, funding, equipment, low and practical. **Technical, practical and equipment** are words that are associated with the workplace, a new environment for the learners. **Funding** specifically for learner stipends are required for mainly for transport expenses without which learners' regular attendance becomes compromised affecting progress. Industry requires high **ethical practices and standards to** which learners are required to comply.

Table 5.9: Word Cloud comparative Table

Prominent Words	Learners	UoT Staff	Industry Mentors
Lack	√	√	√
Difficult/Challenge	√	√	
Environment	√		
Communication	√		
Co-ordinate	√		
Relationship	√		
Placement	√	√	
Attitude	√	√	√
Overloaded/Time	√	√	
Visits	√		
Workplace/Companies	√	√	√
Poor	√	√	√
Skills	√		√
Learning	√		
Confidence	√	√	√
Learners		√	
Management		√	
Late		√	
Phones/Mobile		√	
Absenteeism		√	
Department		√	
Negative			√
Technical			√

Ethics			√
Funding			√
Equipment			√
Low			√
Practical			√

The following words, lack, attitude, workplace, poor and confidence appear prominently in the word clouds for Industry Mentors, UoT staff and the learners, however when pieced together as poor attitude, lack of confidence and lack of workplaces they display negative sentiments.

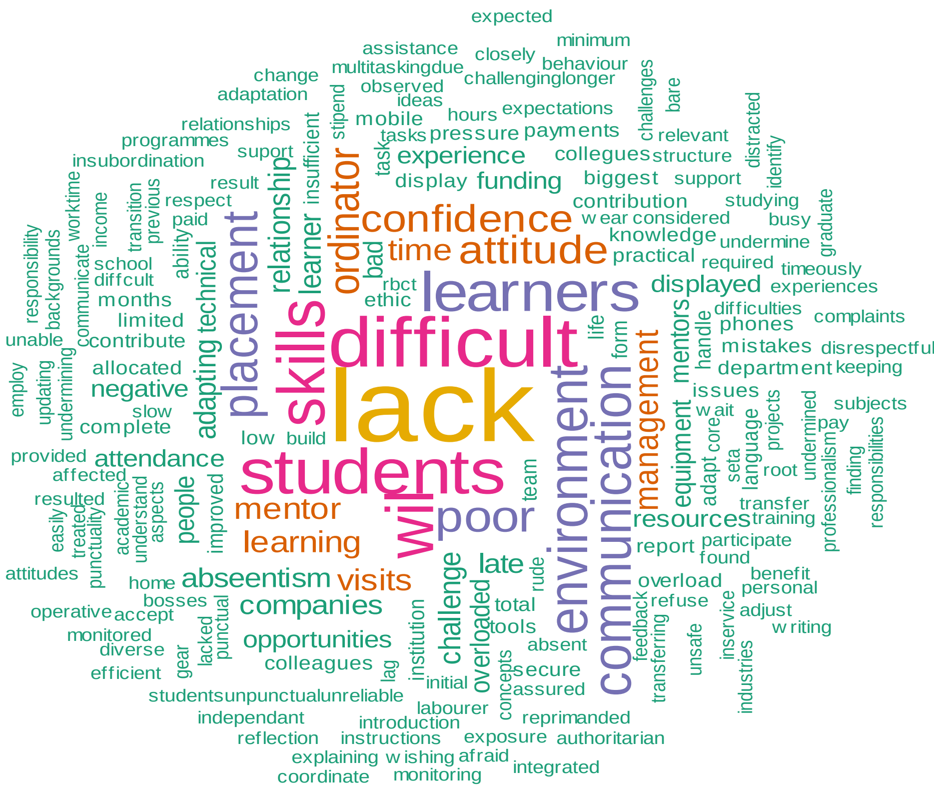


Figure 5.22: Combined Word Cloud for Learners, UoT WIL staff and Industry Mentors

The Word Cloud, Figure 5:22 generated from the qualitative responses for the WIL learners, UoT staff involved WIL and the Industrial Mentors, highlights the following prominent words:

5.3.2 Environment, Workplace, Adapting

Learners find the workplace a new and unfamiliar environment which poses a challenge for the WIL learners. Environments may impact on attainment of goals and tasks, confidence levels, resilience and determination, motivation, problem-solving skills, interpersonal skills among technicians and managers, and attendance (Jindal-Snape, Davies, Collier, Howe & Hay, 2013). The workplace environment, being totally different for the academic includes the plant equipment, machinery, products, computers, increased activity, noise, and various categories of workers, and requires learners to quickly settle and adapt. The adaptation of the WIL learner to the new environment, and the work culture may be considered a major challenge. A high proportion of learners did indicate in the quantitative analysis that there was a lack of preparedness by the University of Technology for the workplace.

5.3.3 Difficult

The word 'difficult' appeared very prominently in the word cloud, implying learners experience at the workplace has negative connotations. The various areas that WIL learners lack, as shown in the quantitative analysis, supports the experience of difficulty to easily adapt to workplace requirements. WIL learners are required to accomplish and complete engineering tasks, deal with engineering problems, and understand various concepts encountering them for the first time.

The sudden change of people environment also negatively affects the WIL learner consequently the affecting the smooth adaptation into the workplace and their performance levels. Building relationships with new colleagues from different walks life, ages, levels of maturity, experiences, qualifications, and different goals, may be daunting to the WIL learners.

The impact of dealing with WIL learners who are unprepared for the workplace experience may in many ways pose difficult challenges for the industry mentor. The mentorship of learners is not the core function of Industry Mentors, who operate in a production environment, often with deadlines to meet.

The is supported by words such as pressure, overloaded and insufficiency. The quantitative analysis shows that learners indicated that the gaps in their theoretical knowledge and practical skills made the workplace experience a difficult one. A high proportion of the Industry Mentors indicated that the WIL learners lack the theoretical knowledge and practical skills required for good and adequate performance in the workplace.

5.3.4 Lack

'Lack' a word which features prominently, may be defined as the state of being without or not having enough of something. For the WIL learner, lack could simply mean being unequipped to perform the engineering related tasks in the workplace. Lack may also imply that the WIL learners' work preparedness programs delivered at the University of Technology is insufficient and misaligned. The quantitative analysis clearly points out the WIL learners are found wanting in practical skills, theoretical knowledge, and computer skills, amongst others.

5.3.5 Communication

Communication skills was highlighted as a learner challenge, in the quantitative analysis phase for learners at the workplace. The word 'communication' appeared frequently in the qualitative responses of the survey questionnaire.

Good communications skills are considered essential skills in the workplace. Communication occurs laterally between colleagues, team members and vertically with managers and senior managers. It is verbal (oral), written and requires reading skills, along with listening skills, in order for accurate understanding of information. The quantitative data analysis supports that communication is a challenge affecting the learner and the workplace.

5.3.6 Confidence

Confident WIL learners will be able to perform at the workplace with the least amount of difficulty. These learners are sure of the abilities to apply themselves at the workplace. Learner confidence is important as they engage with other staff from all levels within the organisation. The data analysis, however, shows that the WIL learners lack the confidence to perform adequately at the workplace, as the result of the combined shortcomings of practical skills, computer skills, communication skills and project management skills.

5.3.7 Co-ordinator Visits

Having spent approximately 2 years in the academic institution, WIL learners have become accustomed to a lecturer-student relationship, with most of the time spent in the classroom and laboratories. Discussing challenges and difficulties with lecturers may have been a normal practice; however, at the workplace, the lecturer presence is missing. The lack of visits from the UoT staff (lecturers, WIL co-ordinators and WIL practitioners), negatively impacts on learner confidence and well-being. During the COVID-19 pandemic, attempts were made to conduct virtual "visits" providing a platform for learners and Industry Mentors to discuss challenges experienced.

5.3.8 Attitude

Attitude has been identified by the quantitative data analysis as a learner challenge, and it may well be a challenge for the mentor as well. 'Attitude' has been highlighted as a frequent word in the word cloud generated for the WIL learner. Negative attitudes between the learner and colleagues or between the learner and mentor may result in the learner left without being mentored, which may lead to a miserable experience for the learner. Moreover, a negative attitude towards the work allocated to the learner, may result in work accomplished haphazardly with no commitment or pride, much to the detriment of the learner's future and future learners.

5.3.9 Overload

Surprisingly, 'overloaded' appeared as a prominent word in the learner word cloud. While at the academic institution, students typically take breaks between lectures, the capacity and pace of WIL learners to complete the assigned activities, reports, and attend meetings in the workplace was a completely different experience. This is a new experience for learners as the production and the operation processes demand maximum outputs from the learners with minimal break times.

5.3.10 Placement

'Placement' refers to the formal process of a WIL registering at the University of Technology learner for the work experience component at a suitable workplace. Applications are made by learners to various workplaces to provide the workplace opportunity. However, when a workplace accepts a learner for the WIL component, the University of Technology has to approve the workplace, then a formal registration for the workplace module is required. This process may be laborious, time-consuming, and cumbersome to all stakeholders.

5.3.11 Management

The word 'management' appears prominently in the word cloud. The management the WIL process and the quality of the experience and learning at the workplace is a complex undertaking and poses numerous challenges for the stakeholders involved, namely, the learner, the University of Technology personnel involved with WIL responsibilities and the workplace (Effeney, 2020). The combined shortcomings of the learner, University of Technology staff involved with WIL activities, and the Industry Mentor, make the management of WIL a challenging task for all stakeholders. The challenges of time, money management and other resources at the University of Technology and the workplace were also highlighted in the quantitative analysis.

The visually prominent and outstanding words in the word cloud are supported by the findings of the quantitative and qualitative analysis.

5.4 Sentiment Analysis

Sentiment analysis connects or matches sentiments to textual words, phrases or expressions indicating opinions of positivity, neutrality and negativity linked to a particular topic, highlighting any relationships to the subject (Nasukawa & Yi, 2003). Sentiment analysis is widely used to capture the emotions prevalent in social, political, and marketing events to determine the opinions on products and services (Cambria, 2017). The sentiment analysis was conducted through the R data science tool. The responses were first cleaned, thereafter mapped using a lexicon algorithm through the R "tidyverse" and "tidytext" packages.

The words in Table 5.10 show the sentiments it triggers. The context of some words used in the comments and responses of the qualitative question may be neutral, but still trigger sentiments.

Table 5.10: Sentiments arising from the highlighted words in the word cloud

Word	Sentiments
Honest, limited, bad, disrespect, challenge, distracted, Confidence, moral	Anger
Pay, attendance, result, mobile, depend, efficient, time	Anticipation
Honest	Trust; fear
Change, honest, difficult, confidence, bad, challenge, Confidence, afraid	Fear
Honest, pay, respect, confidence, found, resources	Joy
Late, unable, unsuccessful, limited, negative, absent, bad, overload	Sadness
Management, personal, employ, pay, mentor, respect, team. Unreliable, confidence, wear, communication, depend, efficient, Assured, resources, moral, school, structure, income, relevant	Trust

Figure 5.23 below shows the sentiments arising from the WIL learner, University of Technology staff and Industry Mentors' comments in response to the open-ended qualitative question.

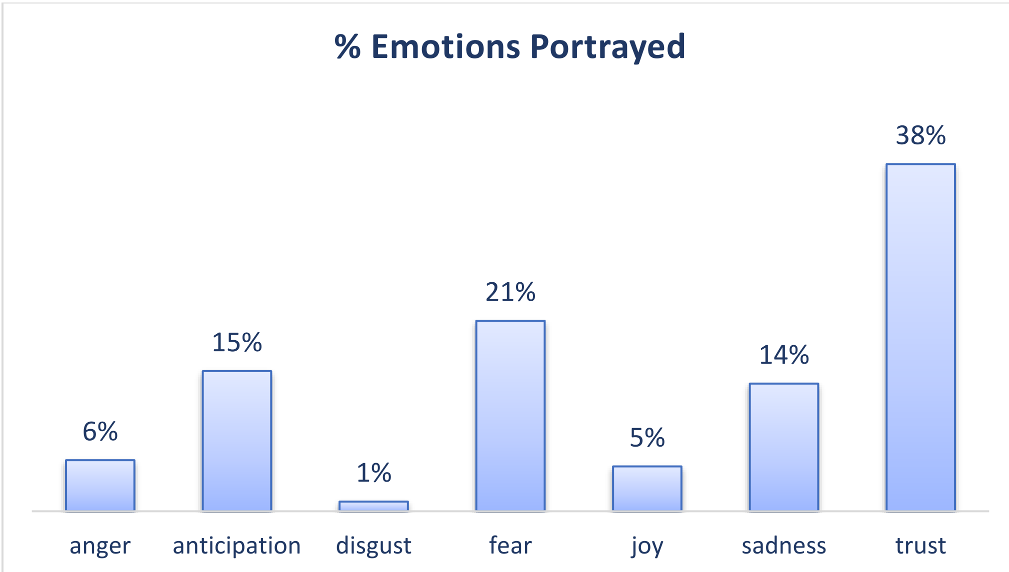


Figure 5.23: Emotions of Participants

5.4.1 Fear

The sentiment fear, a negative emotion, emanated predominantly from the comments in response to qualitative questionnaire. Entering a workplace environment for the first time may introduce a degree of uncertainty and fear to WIL learners caused by the unfamiliarity of the environment, engineering tasks, industry expectations, working with new work team members and the fear of the modern plant equipment, machinery, and hi-tech technology (Gustavsson, 2022).

5.4.2 Trust

Trust is a positive emotion emanating from the responses to the qualitative questions. Strong partnerships and relationships between the university and industry are essential in building trust. Mutual trust between the WIL learner and Industry Mentor produces benefits for all stakeholders. The WIL learner displays greater responsibility and is allowed more exposure to various tasks, building higher levels of competence and productivity (Hauer, 2013).

5.4.3 Anger

Anger resonates with displeasure, annoyance and hostility and is considered a negative sentiment. The WIL challenges experienced by WIL learners, University of Technology staff and the Industry Mentors, may result in behaviour depicting elements of anger.

5.4.4 Sadness

Sadness is considered a negative sentiment, synonymous with unhappiness and disappointment. The range of challenges and difficulty within the WIL umbrella may result in disappointment for all stakeholders including the WIL learners, UoT staff and the Industry Mentors.

5.4.5 Anticipation

Once the academic component of the engineering diploma is completed learners now qualify to be posted at the workplace for the WIL component, creating a sense of excitement in anticipation of an immediate placement opportunity where they can apply their learning. Anticipation may be considered a positive sentiment in this regard. The Industry Mentors, also, may anticipate the opportunity to mentor and develop willing and zealous learners.

5.4.6 Joy

Joy is a positive sentiment. Learners who obtain immediate placement opportunities in reputable organisations will express joy since they will fall within a very privileged group that transfer from the academic institution to the workplace with no delays.

5.4.7 Disgust

Disgust is an emotional response of rejection or revulsion to distasteful, or unpleasant experiences. WIL learners may receive ugly treatment from other team members in the workplace or Industry Mentors may be on the receiving end of bad attitude from WIL learners.

5.5 Qualitative Analysis - Focus Group

The focus group interviews, and the open-ended question included in the survey questionnaire were the sources of the qualitative data. The focus group participants were carefully chosen people who have been involved with WIL activities and processes, but the responders to the open-ended questions were the WIL learners, the University of Technology employees engaging in Work-Integrated Learning activities, and the Industry Mentors.

5.5.1 Focus Group Interviews

Participants of the focus group of six members, included placement officers, a training manager, facilitators, senior technicians, and a corporate director. All focus group members have worked closely with the WIL learners, university of technology staff and Industry Mentors. The transcribed data was analysed and categorised into themes.

Table 5.11 provides more details of the focus group participants.

Table 5.11: Focus Group

Position	Gender	Age	Qualification	WIL Experience
1.HR Manager	Female	32	Honours degree	7 years
2.Placement Officer	Female	27	Diploma	2 years
3.Training Manager	Male	40	Trade Test	15 years
4.Senior Technician	Male	60	Degree	30 years
5.Company Director	Male	45	Master’s degree	10 years
6.WIL Co-ordinator	Female	33	Degree	4 years

5.5.2 Thematic Analysis

The researcher transcribed, coded, and categorised the data gathered from the focus group interviews through a laborious yet very productive process. The data, reflecting the participants’ perceptions that unfolded from the interview responses, were captured by the researcher, and organised into themes and categories as indicated in Table 5.12. Discussion under each theme follows.

Table 5.12: Themes and Categories

Themes	Categories
1. Learners’ Challenges	1.1 Placement Opportunities
	1.2 Preparation
	1.3 Skill Gaps
2. UoT Challenges	2.1 Capacity
	2.2 Knowledge Gaps

3. Industry Mentor Challenges	3.1 Difficult Learners
	3.2 Lack of Resources
	3.3 Mentor Qualities
	3.4 Curriculum Mismatch
4. Stakeholder Engagement	4.1 Communication
5. Relevancy of Diploma	5.1 Labour Market Contribution 5.2 Socio-economic Contribution

5.5.2.1 Theme 1 - Learner Challenges

i. Placement opportunities

On the question of ***Assessing the challenges encountered by WIL learners,*** the challenges associated with learner placement in suitable workplaces were highlighted by the group. The group agreed that there existed a shortage of workplace opportunities as there was a lack of approved and available workplaces. In some cases, learners are used to perform work totally unrelated to the qualification. A focus participant added: "The companies that are willing to house WIL learners tend to drift away from the core qualification and have learners engaged in irrelevant duties, even admin/office work". Another member said: "Learners find it difficult to find appropriate work placements (companies that are workplace approved by the universities) to complete the practical component of the diploma, and some learners end up not graduating". The focus group members summarised the impact of delayed placement with the following points:

1. A delay in placing learners in the industry to get practical and on-the-job experience can sometimes result in the learner losing momentum in putting what he has been taught into practice.
2. This may further lead to a sense of demotivation towards the chosen career path and ultimately loss of interest in his academic and professional progress.
3. This delay also creates a sense of not graduating as the timeframe of graduation shifts further away from the goalpost.
4. The delay sometimes forces a learner to quit pursuing this ambition and pushes them into the job market to start (non-career related work or look abroad for other academic and professional opportunities.

5. The changing career paths, adding to the skills shortage in that specific field.
6. The impact of this delay is also felt by the tertiary institutions as they struggle to complete the latter component of the programs, and this affects the placement statistics and success rates.

ii. Learner Preparation

All members of the focus group agreed that the learners are poorly prepared to meet the workplace requirements. The Human Resources Manager had this to say: “The workplace has become more than a place of reporting for duty; with socio-economic and social media spilling over into the workplace, it has created an environment that divides its focus between hard and soft skills”. However, another focus group member showed how the workplace could benefit the learner: “The WIL program plays a significant role in preparing the learners for the workplace. The model is designed to transfer theoretical knowledge into practice, thus enhancing their employability chances and job opportunities”. Many of the learner concerns were focussed on the lack of cognitive skills, application skills and low confidence levels The researcher captured the following catch phrases the focus group used:

1. Learners have false expectations of the workplace for the following reasons:
    1.1 They expect to be paid salaries.
    1.2 They expect to be guided, mentored, and supported in a similar manner as at the university.
    1.3 They expect time management to be similar to the university where attendance and punctuality is no serious offence.
    1.4 Similar rules apply for deadlines and repetitive work.
2. WIL learners desire an environment that will be nurturing.
3. Learners seek the same treatment they received from the lecturers.
4. Learners must exhibit the proper characteristics and attributes needed in the workplace.
5. Workplace standards include putting in a lot of effort, treating others with respect, being able to work well in a team and under direction, and acting in an ethical and professional manner.
6. Learners struggle to resolve disagreements and conflicting viewpoints.
7. Learners find it difficult to articulate an argument respectfully and constructively.
8. Punctuality, attendance and/or meeting deadlines are critical to the workplace.

From the focus group talks, it is evident that much effort is needed at the UoT to equip the students to be appropriately prepared for a seamless transition into the workplace, given the reasons outlined.

iii. Skills Gaps

Many focus group participants suggested that the WIL learners' level of performance on practical workplace tasks lacked necessary and applicable skills. One member of the focus group commented: “Learners are not prepared to transfer theoretical knowledge into practice”. Another focus group member argued:” “Learners need to gain pivotal work experience that pure theory cannot provide”. Other members of the group mentioned that the learners lack the practical skills required by the workplace. The Senior Technician contributed with this statement: “In this digital era, a huge emphasis is placed on one’s knowledge of technological devices”. With the advent of the fourth and fifth industrial revolutions, the nature of the workplace has changed. Modern technology, including robots, artificial intelligence, mechatronics, and other breakthroughs, have overtaken academic institutions. The Senior Technician, in the focus group added: “Learners need to be taught the skills of the ‘real world’”.

In summary, the findings of the focus group with regard to the Work-Integrated Learning learner challenges support the findings of the quantitative findings; however, the focus group findings extracted some deep and rich information.

5.5.2.2 Theme 2 - University of Technology Challenges

i. Capacity

The members of the focus group acknowledged the enormous responsibility and the dedication required by the University of Technology staff. In their opinion, capacity issues were major contributors to WIL activities being neglected. Lack of funding and resources were raised by the group as key issues. In order to do justice to learners that are placed at workplaces, regular monitoring and communication has to be ensured. However, physical visits for monitoring and approving workplaces require finance, transportation, human resources, and time. The placement officer from the focus group summed up this challenge simply and concisely: “University of Technology staff do not have the resources to effectively administer and supervise WIL”.

ii. Knowledge Gaps

The focus group participants agreed that academic institution staff lacked sufficient awareness of Work-Integrated Learning and depth of expertise. The group members continued by saying that these knowledge gaps were noticeable during the monitoring visits and that since many of the University of Technology staff members were academics first and foremost, it was discovered that they had an inadequate understanding of the tasks they were expected to perform at work. A member of the focus group commented that “the University of Technology staff do not have all the answers”.

5.5.2.3 Theme 3 - Industry Mentor Challenges

iii. Difficult Learners

The participants of the focus group mentioned that dealing with troublesome leaners is a significant obstacle faced by the Industry Mentors. The members of the focus group concluded that students have negative opinions toward both the Industry Mentors and their assigned tasks. Some learners show disdain towards the Industry Mentors and completely disobey any directives. The focus group participants also noted that learners who are working on important projects frequently arrive late or decide not to show up at all, endangering the project's success. The following statement was made by one of the focus group participants, summing up this issue: "Learners do not give the Industry Mentors full commitment, do not work hard, are disrespectful, find it difficult to work in a team or take instructions from the mentor, and fail to demonstrate ethical and professional behaviour". The statement, "A wonderful mentor is someone who is willing to educate, transmits skills and information, and have a genuine desire to grow others," was made by another focus group participant. In conclusion, it is important to establish better relationships between Industry Mentors and learners.

iv. Lack of Resources

The lack of resources at work was cited by the focus group as a major weakness or obstacle in delivering effective mentoring to WIL learners. The focus group members emphasised that it was challenging to provide the learners enough time and attention because of the additional mentorship duties on top of their already demanding workload, with a greater focus on productivity. The focus group participants also emphasized the lack of financing for WIL activities. In addition, they said that students who depend on stipends often skip work when payments are late. Workplaces should provide training rooms, computer and internet access, manuals, and simulation rigs to ensure adequate mentoring.

v. Mentorship Quality

The consensus of the members of the group was that Industry Mentors should possess particular skills to help learners change their thinking so they can adjust to workplace expectations and norms. The support, direction, and information that Industry Mentors provide to learners are crucial and vital since they are the ones who initially expose the learners to real-world work situations and industry. The focus group members also suggested that before Industry Mentors could assist students, they first needed to complete coaching and mentoring projects. The Human Resources Manager contributed as follows: "They are dealing with youthful mindsets that are immature in the workplace and as a result, confront a range of issues that are not only related to the job." The participants of the focus group also noted that the Industry Mentor must be patient and understanding as learners may need some time to adjust to a new setting. The focus group members indicated that the following qualities are essential for the Industry Mentor:

1. A willingness to mentor and share knowledge.
2. Being able to transmit skills.
3. Providing relevant information and guidance to the learner.
4. Having a genuine desire to grow learners.
5. Being able to motivate the learner to improve performance.

In summary, the Industry Mentor should be able to embrace the learner's confidence from the start, when the learner lands in the workplace, guiding and directing the learner to fulfil and surpass the outcomes expected from the logbook requirements.

vi. Curriculum Mismatch

The focus group determined that the WIL program created by University of Technology Engineering faculty needs to be reviewed because all group members concurred that Industry Mentors found it difficult to match workplace activities to logbook criteria. "I believe the existing logbook ought to be revisited as there is no balance or a mismatch between the university curriculum and what the sector wants," the Placement Officer stated simply. This evaluation is necessary as a result of the industry's recent adoption of new technology, the transition to Fourth Industrial Revolution compliance, the introduction of robotics, mechatronics, and artificial intelligence, and other factors. The members of the focus group concluded that as industries struggle to remain competitive in a global market, workplace changes would continue. "Industries will have to make drastic changes to become more ecologically friendly," one focus group participant noted. The logbook should incorporate elements of soft skills, cognitive skills, and interpersonal skills, a different participant said, adding that it mostly concentrates on basic abilities. It is evident from the focus group discussion that the University of Technology's curriculum needs to be adjusted to better meet modern workplace needs. In order to address the issues raised by the focus group participants, a curriculum re-alignment process should be considered and embarked upon.

5.5.2.4 *Theme 4 - Relevancy of the Engineering Diploma*

i. Labour Market Contribution

The focus group members agreed that there is a lot of value in WIL programs that give students work-related experiences and skills development before they graduate. Another participant said that through working in teams, where ideas and expertise are shared, students receive valuable job experience that cannot be obtained through pure theory. The following piece of advice was provided by the Placement Officer: "The WIL program significantly contributes to the learners' workplace readiness. The model is made to help people put their theoretical knowledge into practice, improving their chances of finding employment". "The WIL component, despite the challenges, makes the Engineering Diploma attractive as it is critical to industry needs," another member of the focus group explained. The focus group members concluded that because South Africa is a developing country, there is a technical skills gap in the job market and a higher demand for technicians than for engineers. To increase quality and productivity, the industrial sector needs a labour force that is effective, competent, and technically proficient.

ii. Socio-economic Contribution

The participants of the focus group highlighted that because there is a demand for skilled technicians, more access to suitable companies will result in learners graduating earlier and being accessible for employment as engineering technicians on the labour market. Members of the focus group emphasized that in addition to having chances for meaningful employment, technicians also possess the knowledge and abilities to launch their own businesses and create jobs for others. The participants noted that because the learner population pursuing the engineering diploma qualification comes largely from disadvantaged backgrounds, there would be improvement in the socio-economic situation of those previously disadvantaged, along with a major impact on the national unemployment status. The Engineering Diploma qualification helps the formerly underprivileged learners to find meaningful jobs, and the employment offers them a feeling of dignity as they make contributions to the organization and the fiscus, argued a focus group participant in a compelling way.

5.5.2.5 *Theme 5 - Stakeholder Engagement*

i. Communication

According to the focus group, regular, healthy, and honest communication was seen as the key to the effectiveness of WIL interventions. The committee unanimously agreed that collaboration should be used instead of the entrenching of silos by the stakeholders involved in the various components of WIL. Good communication increases responses with appropriate feedback; problems are explained with clarity, so solutions are developed quicker, minimizing downtime, and improving productivity, according to a focus group participant who emphasized its significance of in the workplace. Another participant added that transparent and open communication is essential for enhancing harmonious relationships among the various stakeholders.

5.6 Conclusion

The mixed methods approach was adopted for this research; survey questionnaires were used for the quantitative while the qualitative data was gathered from the responses of the focus group interviews. The quantitative data from the closed-ended questions was statistically analysed and presented in this chapter, using charts, graphs, and tables, A word cloud was generated from responses to the open-ended questions of the survey questionnaire, and a sentiment analysis was further undertaken to gain insight and understanding into the feelings of the participants.

Coded data from the focus group interviews was constructed into themes and thereafter qualitatively analysed. The qualitative findings were presented as textual descriptions, tables and as bullet points.

A discussion of the findings will be offered in Chapter 6, with recommendations including those that arose out of the focus group discussions.

CHAPTER 6

DISCUSSIONS OF FINDINGS

6.1 Introduction

Based on the examination of the data in the previous chapter, this chapter summarizes the key findings. The goal of this study was to increase access to suitable workplaces so that learners who need Work- Integrated Learning opportunities can be absorbed by industry as quickly as possible after completing the academic component of their studies. The study looked into the challenges associated with Work- Integrated Learning that were faced by the staff at Universities of Technology, Industry Mentors, and the learners.

6.2 The Research Objectives

The Research Objectives were outlined as follows:

1. Explore the WIL challenges encountered by Universities of Technology.
2. Assess the WIL challenges experienced by the learners.
3. Explore the challenges experienced by employers/organisations that provide WIL opportunities.
4. Develop a conceptual framework that addresses the identified challenges.
5. Recommend alternate WIL models to mitigate the challenges.

The researcher endeavoured to achieve these objectives and to answer the research associated questions, aimed at improving the uptake of learners seeking WIL opportunities, by increasing access to suitable workplaces. The findings in the data analysis chapter will be evaluated and interpreted to help better understand the WIL challenges encountered.

6.3 Summary of Key Findings

The study discovered that a range of challenges were encountered by the University of Technology staff, WIL learners and the Industry Mentors. The survey feedback indicated that both genders were well represented, as 54 % of males and 46% of females participated in the survey. The age spectrum ranged from participants who were 20 years old to 69 years of age, with several falling into the over-60 bracket.

The focus group interviews highlighted that University of Technology staff participating in WIL activities needed exposure to the industry environment to better understand WIL demands, while the data analysis revealed gaps in the training interventions of Industrial Mentors.

The lack of communication between the various stakeholders involved in WIL related issues was evident from the data analysis; this was compounded by the finding that the learners' communication skills were inadequate for the workplace. Another key finding from the analysis was the lack of resources at the workplace to provide proper mentoring of the learners and the insufficient resources at the Universities of Technology to regularly monitor and support WIL learners while at the workplace. The data analysis revealed a lack of communication between the many parties involved in WIL-related issues, which was exacerbated by the discovery that the learners' communication skills were inadequate for the workplace. The investigation revealed that there were insufficient resources at the workplace and in the universities of technology to adequately mentor and support WIL learners while they were at work. This was another important finding.

Waiting-Time Until Placement: {New Finding}

Findings showed that it can take learners up to two years or longer to find appropriate placement opportunities comply with the mandatory workplace module requirements and obtain the engineering diploma. The prolonged wait for suitable placement opportunity has a negative impact on learners, demotivating them and making them powerless and hopeless. As one's efforts and successful completion of tasks add up to the industry's productivity, having a job makes one feel valuable. Many students give up all chance of graduating and frequently choose less satisfying employment, occasionally working in completely unrelated industries. A significant portion of the learners, due to the long delays, are already in the thirties, an age when one should be settled in a career and begin to start a family. Being unemployed produces an unpleasant situation where boredom, loneliness, uncertainty, concerns about financial matters, emptiness and conflict are rife (Witte, Rothmann & Jackson, 2012). The environment presents opportunities for criminal activity, alcoholism, and drug misuse. The attitude toward work is crucial since it gives life significance (Witte, Rothmann & Jackson, 2012).

The strong demand on the labour market for qualified technicians to meet industry demands is negatively impacted by the delays in graduating. The growth of established industries as well as the emergence of more new industries, have increased the demand for technicians. The skills migration from South Africa brought on by the numerous difficulties and the retirement of older technicians from the system are both contributing factors to the technician shortage. Increasing access to more workplaces will provide Work-Integrated Learning learners with greater placement opportunities.

Communication: {Confirmatory Finding}

The data analysis showed that there was insufficient meaningful communication occurring among stakeholders involved with responsibilities for WIL. The results unequivocally demonstrate that communication problems exist in both the academic and workplace environments. This finding is further supported by Jin (2020), who states that communication practices between industry and academic institutions are found to be lacking. The opportunity to address the variety of WIL concerns and perhaps discover answers, is limited by the absence of cooperation between academic institutions and employers. It is hoped that the industry will embrace honest participation in WIL programs as a result of academic institutions' efforts and determination to forge strong alliances with it through open engagement and open conversations centred on these concerns. On the other hand, when genuine involvement is inadequate or absent, a lacklustre approach from academic institutions may result in limited interest and participation from workplaces.

It is alarming that learners lack effective communication skills in the workplace (Magogwej & Nterekei, 2014). The sharing of information to all relevant stakeholders is key for optimal functioning, making effective communication an essential skill. Good communication skills and practices have been highlighted by the focus group members, as important qualities for learners to thrive at the workplace. For instructions to be properly understood and carried out by the learner and for clear and correct feedback to be provided once the assigned activity has been finished, effective communication between the learner and the Industry Mentor at the workplace is essential. Given proof of the students' success in completing the tasks given to them, more challenging assignments may be handed to them in the future, enabling the Industry Mentor to concentrate on corporate objectives and output targets. Conversely, students with weak communication skills may misread directions, botch tasks assigned to them, give sub-par feedback, and write muddled reports, which would hinder the students' progress and prevent Industry Mentors from finishing their work on schedule. Participating constructively at meetings, giving feedback through presentations, and writing reports all call for professionalism and clearly organized, succinct formats. Given that the primary concerns of industry are output, quality, and cost, learners' performance is a determining factor in whether the workplace allows access to Work-Integrated Learners.

Teamwork: {New Finding}

The study findings clearly point out a major challenge with learners working together with other employees in the workplace. The nature of engineering work is multi-disciplinary, where various skills are required to complete an engineering task, thus bringing together others of different age groups, skills, experiences, and backgrounds. Workplaces requires learners to be able to work in teams, interacting, engaging, and cooperating with others of various age groups, skills, personalities, and backgrounds, yet delivering on common company objectives (Smith & Gibson, 2016: Winborg & Hagg, 2022). Because of their limited knowledge, low skill levels, and small contribution to finishing the assigned tasks, learners lack the confidence to cooperate with other team members. Learners with poor communication skills are further challenged by their inability to collaborate effectively with team members.

A single weak or dysfunctional team member can have a negative impact on the entire performance of a team project. Conversely, the cooperative effort of all compliant team members will ensure that project or production goals are effectively accomplished. Academic institutions should concentrate on ways to enhance team building skills to make the WIL programs more attractive to industry with the intention of gaining more access to workplaces, as the ability to work in a team is a key requirement for learners to function optimally in a workplace.

Technical Skills {Confirmatory Finding}

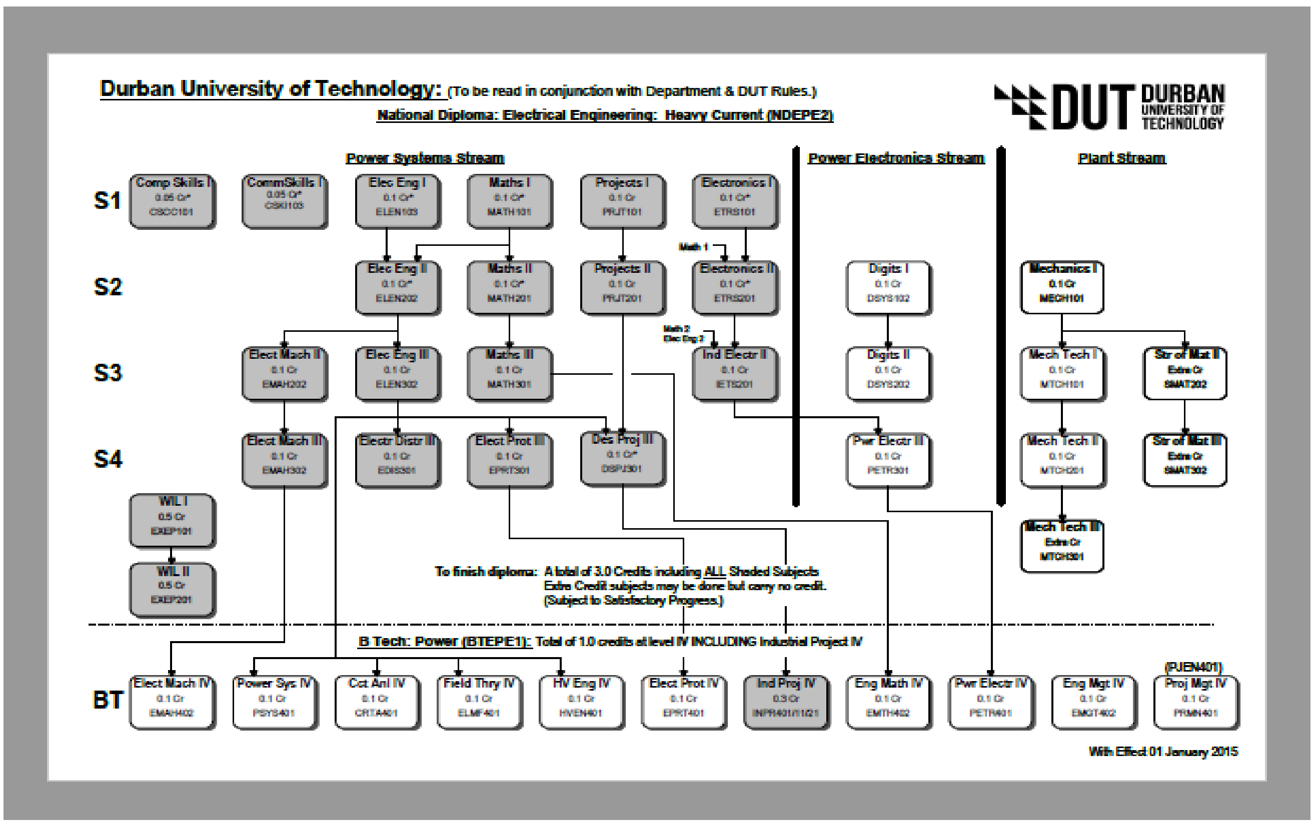


Figure 6.1: Curriculum Flowchart
Source: DUT (2018)

Engineering artisans, technicians and engineers require a range of technical skills to adequately perform their duties. Industry Mentors who have been assigned to assist with learners on the Work-Integrated Learning component of the Engineering Diploma in the workplace, anticipate that learners will have the necessary technical training before being placed there.

The data analysis, however, highlighted project management skill gaps; therefore, consideration should be given to embed more advanced levels of project management components into the Projects I, Projects II, and Design Projects 3 curricula. Computer skills comprise a single module in the complete curriculum, as illustrated in Figure 6.1. Data analysis suggests that the degree of computer skills is insufficient for workplace requirements. Data analysis revealed shortcomings in the interpretation of drawings, as well as deficiencies in practical abilities and application skills Improving these areas is critical for learners to operate properly in the workplace. An examination of the modules in Figure 6.1 reveals that there is no dedicated subject to cater for industrial drawings and documentation; however, an exercise in module redesign is required for adding more drawing components and increasing the complexity of practical tasks and workshop time is essential.

Practical Skills: {Confirmatory}

The data findings are supported by the literature (Field, Hoekel, Kis & Kuczera, 2009) pointed out that learners who are prepared for their placement in the workplace should have a balanced set of general and specialized skills. Typical sets of practical skills required for engineering technicians are listed below:

A. Electrical

1. Circuit design
2. Apply linear systems theory and analysis.
3. Develop electrical schematics.
4. Data collection and analysis
5. Build and operate computer systems.
6. Prepare operational plans.
7. Electronic equipment maintenance
8. Direct construction activities and equipment upkeep

B. Mechanical skills

1. Technical skills
2. Measuring skills
3. Practical, hands-on work
4. Design
5. Fabrication
6. Problem-solving skills

7. Data analysis and evaluation
8. Awareness of health and safety practices

The study findings have shown that learners encounter serious challenges when required to perform practical tasks in the workplace. Because Industry Mentors lack the time to educate or train learners on the details of the actual jobs, learners frequently are merely observers and do not actively participate. Academic institutions are required to keep up with the fast pace of technological changes in industry, as industry has already embraced big data analytics, advanced robotics, mechatronics, artificial intelligence, Internet of Things, and 3-D printing, to increase plant productivity to gain a global competitive edge.

Computer Skills: {Confirmatory}

Computer literacy is fast becoming a prerequisite for working in an industrial setting, but Brink and Joseph (2022) also mention the use of software in the learner development of technicians and engineers. The findings indicated that different levels of computer skills were required to meet occupational needs, showing limitations in the content of the computer skill's programs offered by the academic institutions. According to Brunner and Ehlers (2022), this also holds true for highly automated plants using cutting-edge digital technologies. Because there is a growing need for future skills and core competencies (OECD, 2018; World Economic Forum, 2020; Brunner & Ehlers, 2022), their significance cannot be ignored. There is a mismatch between learners' actual performance and what industry expects of them (Ehlers, 2020; Brunner & Ehlers, 2022).

Even though computer studies are part of the curriculum for engineering learners at the Universities of Technology and learners are at ease using computers and carrying out simple tasks, a higher degree of computer proficiency is needed. The processes of modern automated plants are managed, monitored, and controlled via human machine interfaces. The plants are highly networked and controlled remoted using dynamic graphics. Equipment and machinery are started, controlled, and stopped from a computer terminal, with field information transmitted to the operator terminal through hi-tech sensors.

Giving the students the essential computer skills and more, would help them perform well in the workplace, boosting industry's confidence to hire more students for Work-Integrated Learning.

Interpretation of Drawings and Documents: {New Finding}

Drawings and documentation make up a sizable portion of an engineer and technician's job description. Engineering drawings and documentation serve as a blueprint for engineering construction and are used to convey design concepts and technical information across design processes. Drawings are used by technicians to capture data and information, as well as for troubleshooting and fault-finding during breakdowns and equipment failures.

For the accomplishment of relevant engineering activities, the capacity to understand drawings and comprehend engineering documentation is essential. The examination of the data revealed that students have trouble reading and understanding engineering documentation. Abdullah, Burvill and Field (2011) also found that learners in engineering have trouble understanding and interpreting engineering drawings. Typical drawings used by electrical technicians include the following:

1. Schematic Diagrams
2. Wiring diagrams
3. Block diagrams
4. Pictorial diagrams

An electrical schematic is a diagram that depicts the connections between each wire and component in an electronic circuit. It can tell you practically everything you need to know about how a circuit functions and act as a map for creating or debugging circuits. Drawings also provide information on the specifications of the physical components used in an electrical circuit. The ability of engineering technicians to comprehend and interpret drawings, is a crucial skill. Learners who possess the skills to read and interpret engineering drawings will find their workplaces to be more accommodating.

Project Management Skills: {Confirmatory}

The research reveals that all parties participating in WIL namely, the learners, employees from the University of Technology, and Industry Mentors agree that learners need to improve their project management abilities. The majority of engineering tasks have assigned deadlines and budgets that must be managed as projects. As stated in the literature by Pant and Baroudi (2008), a growing demand for project management skills exists in all sectors of business. EL-Annan (2015) adds that project management is a fast-expanding field, offering the instruments to successfully build strategies that would boost the efficiency and performances of the workplace. Project management includes the management of resources, time, budgets, and risks. Learners are expected to successfully complete tasks allocated to them, project management tools assist them to plan, organize and implement the given tasks with the resources available for the project within a specified timeline.

The academic institutions' exposure of students to project management techniques will tremendously improve their placement prospects.

Lack of Resources: {Confirmatory Finding}

To properly manage the WIL scope, the academic institutions and workplaces need the appropriate resources, without which there is a greater risk of not delivering the intended scope. A lack of a range of resources needed to support the workplace component of Engineering diploma levels has been identified by the study. The findings are corroborated by Msukwini (2017), who raised concerns about the academic institutions' inadequacy to support students pursuing WIL qualifications.

Insufficient Human Resources: {Confirmatory Finding}

The availability of staff to focus on WIL activities is limited and insufficient to manage successfully manage WIL commitments. The following is a summary of the scope of work covered by academic staff involved with WIL:

1. Visiting learners at the workplace
2. Interviewing learners and mentors
3. Placing students
4. Providing support for learners doing WIL
5. Conducting workplace approvals
6. Co-ordinating departmental Advisory Board meetings

The learner and the workplace are negatively affected by a lack of sufficient, adequately trained people, and learner support while based at the workplace, and the whole project may be jeopardized as a result. Unresolved additional duties include dealing with issues between learners and Industry Mentors, a lack of resources, or low learner attendance. Minimising the human resource challenges will ensure learners obtain the support their require and further build confidence in the industrial sector to embrace WIL needs.

The study's findings also highlighted the absence of effective mentoring procedures in the workplace and the need for more qualified Industry Mentors. The impact of mentors on learners is greatly influenced by their commitment, availability, and knowledge of the particular field needed for learner growth (Hillman, 2010: Keating, 2012). The transfer of quality knowledge and skills to learners in the workplace is largely dependent on efficient mentors (Nicolaides, 2006; Keating, 2012). For Industry Mentors to properly carry out their tasks, it is essential that they possess the necessary competencies, skills, and personal attributes.

Funding: {Confirmatory Finding}

The study brought attention to the effect that financing constraints have on interventions for Work-Integrated Learning. The majority of the academic staff engaging in WIL activities must travel to the workplaces, many of which are outside of KwaZulu-Natal, in order to do their work; nevertheless, transport, lodging, and meals come at a significant cost. The departmental budget for WIL activities combined with the support from Co-operative Department is still inadequate. To prevent the Work- Integrated Learning activities from suffering, adequate funding is essential. Alternate funding for WIL may be sourced from the National Skills Fund whose primary activity is focussed on the education and training of learners. Proposals for additional funding could be made to the NSF as it targets to fund institutions within the post-school education and training (PSET) system (National Skills Fund, 2015). Applications to source additional funding may be made for WIL grants to SETAs. Approaches to Industry Partners that absorb learners for work experience may also be an option as the learner stipends are normally funded by SETAs, therefore the workplaces incur no significant cost when hosting learners.

Learner stipends are needed for travel, meals, and lodging when placed at the workplace. The study found that although some students receive very low or no stipends at all, the prevalent problem was that stipend payments were often delayed, making it difficult for students to handle their financial obligations. In line with the research findings, the South African National Skills Fund committed to the following in the revised Strategic Plan for 2015 to 2020:

1. To fund and encourage ongoing research around Work-Integrated Learning.
2. To facilitate stakeholder relationships to build partnerships between the academic institutions and the workplace, through funding mechanisms.
3. To organize and fund initiatives that give students hands-on experience by incorporating WIL into the broader value chain (National Skills Fund, 2015).

Funding is a key requirement to remedy many of the Work-Integrated Learning challenges.

WIL Processes and Systems: {New Finding}

The management of all WIL activities includes the following:

1. Learner registration for the Work-Integrated Learning qualification.
2. Completion of the modules required to qualify for the workplace module.
3. Registration of the workplace module.
4. Scheduling the monitoring visits.
5. Assessing the workplace logbook.
6. Capturing the workplace module assessment results.
7. Maintaining the databases for workplaces.

The study found WIL processes to be cumbersome and bureaucratic. Brink (2018) noted the complex nature of WIL resulted in departmental silos and that sound structures are required to efficiently manage Work-Integrated learning information.

Curriculum and Logbook: {Confirmatory Finding}

The results indicated gaps and misalignment in the content of University of Technology curriculum rendering learners unproductive while at the workplace.

Industry technology has undergone a significant transformation to adopt international standards in order to be globally competitive. Modern factories are highly automated, with equipment and processes that are remotely controllable and can run unattended. In order to improve quality and productivity, the system also offers alarms, trends, and production and analytical data. Advanced technologies are influencing the future of manufacturing by reducing production costs, enhancing the pace of operations, and reducing errors. These technologies include artificial intelligence, the internet of things, robotics, big data, sensor data, cloud integration, machine automation. and 3-D printing, among others. The use of these technologies allows for proactive and predictive maintenance, real-time monitoring, resource optimization, supply-chain visibility, cross-facility operations analysis, and safety features. Improved quality and efficiencies may provide the competitive edge in tough global markets.

According to Hennemann and Liefner (2010), even though graduates possess much theoretical knowledge, the important competencies to function at the workplace are absent. This argument that the academic institutions fail to align the curriculum to meet the skills required by industry is strengthened by several researchers (Luke & Heyns, 2019; Valiente, Zancajo & Jacovkis, 2020; Ibrahim & Nashir, 2022). An attempt to bridge the gap between academic delivery and workplace requirements, research was necessary to develop a framework to explore the industry fourth revolution skills requirements. In order to fill the gap between academic delivery and workplace demands an examination of the skills needed for the fourth industrial revolution, based on research (Maisiri, Darwish & Van Dyk, 2019). A key area of industry focus is the transition into embracing green technology, which reduces human impacts into the environment. Advanced green technologies are used in many industrial sectors, including the automotive industry, waste-water treatment facilities, recycling and waste management systems, self-sufficient structures, renewable energy generation facilities, solar energy, and many others. To keep learners, updated with current business trends, these technologies should be taught in academic institutions.

Attitude: {Confirmatory Finding}

The results of the data analysis indicated that learner attitude towards the workplace experience and the workplace personnel including the Industry Mentor, is poor. The research findings are supported by the literature:

1. The right attitude toward work and colleagues makes a big contribution to an effective and successful organisation.
2. An unfavorable attitude toward one's work, for a variety of reasons, will result in subpar performance and inefficiency (Wang & Gorenstein, 2014).
3. Learners from tertiary institutions have a sense of entitlement and expect to receive high praise and prizes, even while their performance levels are just average (Dasborough, 2015: Dragova-Koleva, 2018).

Employees must be enthusiastic and up-beat about their work, ready to take on any task that is given to them, and capable of finishing it. For the tasks to be successfully completed, it is important to follow the instructions and deadlines that are related to many of the activities. Attendance and punctuality are key indicators, important in measuring how learners feel about their work. Poor attendance and timeliness directly affect the completion of assigned tasks, pushing back deadlines, and reducing productivity. The research findings have shown that learners at the workplace have very high absenteeism levels; the study also found that stipends paid to learners were often delayed which contributed to learners not attending work. It indicated that learners do not have the discipline to be at the workplace on time. Punctuality was found to be a major learner challenge.

Learners are expected to treat Industry Mentors and other team members with respect. They should conduct themselves well, by being courteous and friendly with the Industry Mentors and other work colleagues. When students act disrespectfully toward Industry Mentors and other team members, interactions cease, and communication breaks down. Consequently, the workplace learning suffers, and learners receive little to no attention from Industry Mentors. In turn, future learners may be severely compromised if certain industries decide to close their doors and stop offering opportunities for workplace exposure.

Mentorship - Training and Development: {New Finding}

The research has shown that in order to have a beneficial impact on the learners, the staff from the Universities of Technology and the Industry Mentors who participate in Work-Integrated Learning activities need to be strengthened through capacity building and training interventions. It takes a significant commitment from academic staff and Industry Mentors for learners to extract the most in terms of development and skills upgrading (Velez & Giner, 2015; Hardie, 2018). The development of their human capital is a crucial element of industry's growth and expansion plan to be globally competitive (Linnehan & De Carolis, 2005; Solnet, Kralj, Kay & DeVeau, 2009; Hardie, 2018). Learners receiving regular feedback on their performances and continuous mentorship and support will build their skills and potential (Dunne & Bennett, 1997; Velez & Giner, 2015; Wilkin, 1992; Hardie, 2018). The holistic development of learners during WIL will produce technicians of a high quality for the much-needed labour market pool. The implication is that industry hosting learners would need to develop the supervisory and mentoring quality of the managers and supervisors of the organisation.

On the other side, academic institutions and academics working in the WIL space, must build positive ties with business to offer career assistance (Knight & Yorke, 2003; Hardie, 2018) and develop curricula that are aligned with business needs (Wan, Yang, Cheng, & Su, 2013; Hardie, 2018). Academic staff must possess a thorough and in-depth knowledge of the entire range of WIL processes as well as the procedures, technology, operations, and other requirements of industry.

6.4 Characteristics of Excellent Mentors

Good leadership requires role modelling in the following areas:

1. enthusiasm
2. work commitment
3. ethics
4. customer centeredness
5. communication skills (Linnehan & De Carolis, 2005: Solnet, Kralj, Kay & DeVeau, 2009: Hardie, 2018).

Other traits of effective mentors include the ability to listen, communicate effectively, be flexible, value different viewpoints, be experienced and informed, offer constructive criticism and advice, be open and honest, be able to network, and be resourceful.

The conduct, professionalism, ethics, and zeal to develop learners by the academic staff and industry personnel, including Industry Mentors bear strong influences on the learners’ development and attitude. Learners depend on the guidance and support of the mentors for their direction on their career prospects, expecting dedicated time commitments and performance feedback with counselling. They further desire the experienced Industry Mentors, to transfer technical knowledge and skills and information concerning plant processes and systems.

Industry Mentors should take part in a range of training interventions to improve their mentoring skills in order to guarantee that learners get the most out of the WIL experience. Industry mentors must also have a solid grasp of the National Diploma engineering curricula, the outcomes of the workplace module, and the logbook activities in order to properly advise students. The academic staff must be familiar with and knowledgeable about working practices, industrial technologies, plant procedures, safety, and other policies, in order to be able to provide learners with meaningful guidance.

6.5 Conclusion

WIL challenges were highlighted in this chapter's discussion of the important findings from the data analysis, which were confirmed and supported by the literature review. The combined effect of these difficulties has significantly influenced industries' resistance to opening access to the workplaces, which has caused many students to encounter lengthy waiting times before obtaining appropriate placement options, thus delaying their graduation. Learners that could have been engaged in meaningful employment, during the lengthy waiting period before being absorbed into industry, join the already large group of unemployed youth. The opportunity of these learners to be lured into criminal activities becomes real as these learners are idle for long periods of time.

Due to a lack of qualified technicians to fulfil industry demand, the labour market suffers as well. Industry is forced to import the skills necessary for the effective running of the industrial plants given the lack of qualified and experienced technicians. The highly competitive global market forces businesses to operate at very high productivity and quality standards. The shortage of skilled labour is exacerbated by the brain and skills drain currently happening in South Africa. Political instability, economic crises, high crime levels in South Africa are causing an exodus of highly skilled resources to other countries that offer better opportunities.

The next chapter will discuss the recommendations which emanate from the study, focussing on mitigating the WIL challenges revealed, namely, the challenges encountered by the WIL learners, the University of Technology staff involved with Work-Integrated Learning activities and the employers that provide opportunities for WIL.

The researcher will also propose an alternate model for the workplace module designed to mitigate many of the challenges revealed in the study.

CHAPTER 7

Conclusions and Recommendations

7.1 Introduction

The core focus of the study was to investigate the challenges experienced by the learners from the South African Universities of Technology, pursuing the Engineering Diploma qualifications, in gaining access to suitable workplaces to fulfil the workplace module. Understanding the challenges would assist in crafting policies to develop potential solutions. The study exposed a range of challenges encountered by the University of Technology, the learners, and the Industrial Mentors.

This chapter will conclude the study by summarising the key findings of the study relative to the research aim and research questions, as well as the value and the contributions of the study. Recommendations will be made to mitigate some of the challenges that the study identified and include the proposal of a new model for WIL. The limitations of the study will be reviewed and opportunities for future research will be proposed.

7.2 Overall Findings

The findings revealed various WIL challenges, which cumulatively could have contributed towards the lack of suitable workplace opportunities. Based on the study findings a collaborative approach is required to build strong relationships amongst the stakeholders to address the identified WIL challenges, in order to gain greater access to workplaces. However, overcoming the obstacles would require substantial effort, dedication, and resolve from all parties involved and accountability for the success of Work-Integrated Learning.

7.2.1 Communication

The study's findings confirmed the communication gap among all parties participating in WIL activities and responsibilities. If they are not already in place, policies to improve frequent and efficient communication between the various stakeholders should be created in order to enhance and foster healthy relationships and partnerships with the goal of increasing access to workplaces and providing learners with high-quality workplace experiences. Because they work so closely with the learners, it is crucial to include the Industrial Mentors in conversations about WIL.

7.2.1.1 University of Technology

The findings indicated a lack of good communication practices within the departments of the Universities of Technology and with industry. Table 7.1 below provides some recommendations to be considered with the hope of improving communication.

Table 7.1: Recommendations to improve communication at the University of Technology

Recommendations	
University of Technology	1.Establish good interdepartmental communication practices . The engineering department, the co-operative department, the engineering faculty, human resources, and the marketing department are all responsible for WIL issues, yet they all work in silos. The following is recommended: 1.1 Co-operative Department to hold regular physical or virtual meetings to discuss and debate WIL issues. 1.2 Co-operative Department to share relevant WIL information to all departments via media platforms, email, or other means. 1.3 Through presentations and information desks, all departments should participate in the UoT's World of Work exhibition. 2.Update learners with feedback and from Advisory Board meetings must be on industry issues. 3.Strengthen links and communicate frequently with industry partners, both physically and electronically. 4.Host workshops to ensure engagement between Industry Mentors and WIL practitioners to discuss specific concerns. 5.Acquire more WIL financing, develop funding proposals, tender submissions, and communicate with funding bodies such as SETAs (Sector Education and Training Authorities) and the National Skills Fund. 6.Attend workshops provided by SETAs, the National Skills Fund, and other funding agencies to be updated on the criteria and processes required for grant and funding applications. 7.Participate in organized meetings and workshops with other academic institutions that offer WIL programs to discover best practices and WIL implementation ideas, creating healthy relationships. 8.Develop Policies in line with the above recommendations.

7.2.1.2 Work-Integrated Learning Learner

The learner interacts with many different individuals while at the academic institution and the workplace. The study found that learners do not possess the required level of communication skills. Table 7.2 itemises some recommendations to improve the learner communication skills.

Table 7.2: Recommendations to improve the communication levels of WIL learners

Recommendations	
WIL Learner	1.Enhance personal communication skills content in the curriculum. 2.Upskill and further strengthen lecturers' and WIL practitioners' communication abilities through additional training initiatives. 3.Co-operative Department to establish information sharing sessions with learners qualifying for placement. 4.Co-operative Department to set up helpdesks to provide WIL learners with assistance on WIL related issues and placement opportunities. 5.Schedule mandatory feedback sessions between WIL learners and industry mentors, with individual reports prepared by each learner and Industry Mentor. 6.Increase the quality of communication with Industry Mentors by following instructions, concentrating on workplace tasks, attending all feedback meetings, and producing appropriate reports. 7.Develop excellent relationships with team members and management by maintaining a positive attitude, attending all meetings, and following all job instructions. 8.Academic institutions must adopt policies in accordance with the principles above.

7.2.1.3 Industry Mentors

Throughout the workplace experience, learners collaborate with Industry Mentors. The management of communication with learners, team members, management, and academic staff is a crucial aspect of the function of an Industry Mentor. The recommendations in Table 7.3 below can help Industry Mentors communicate more effectively with the necessary parties.

Table 7.3: Recommendations to improve the communication levels of Industry Mentors

Recommendations	
Industry Mentor	1.Schedule physical and virtual engagement sessions to enhance communication with learners. 2.Engage with learners on technical, social, and financial issues. 3.Expose learners to participate in team talks and meetings to improve learners' confidence levels and communication skills. 4.Allow learners to perform presentations at meetings, 5.Schedule time to discuss learners progress and logbook activities. 6.Hold meaningful feedback sessions with University of Technology staff to build strong relationships. 7.Participate actively in the monitoring visitation sessions of the academic institution, providing input on learner performance, difficulties, and recommendations for improvement. 8.Attend Advisory Board meetings at UoT to actively participate by raising workplace challenges and contributing to the improvement of curriculum and other WIL-related issues.

7.3 Theoretical Knowledge

The research's conclusions showed a disconnect between the theoretical information acquired in academic settings and the knowledge needed in the industrial environment. The best performance of learners at work and the development of high-level workplace skills is dependent on their understanding of plant machinery, equipment, and procedures. A list of suggestions to improve the theoretical knowledge needed in the workplace is shown in Table 7.4.

Table 7.4: Recommendations to enhance the theoretical knowledge for workplace relevance

Recommendations	
Theoretical Knowledge	1.Align curriculum to include current industry requirements. 2.Ensure academic staff acquire industry experience. 3.Ensure curriculum includes technical language. 4.Teach Theory of industry technology. 5.Include examples of plant equipment and the components, plant processes and systems in the curriculum.

7.4 Practical Skills

The study findings indicated that the level of learners' practical skills at the time of placement did not match workplace requirements. The fundamental basic practical skills should be in place, in order for learners to acquire higher levels of technical skills. Table 7.5 provides a list of recommendations to improve the practical skills of learners while at the academic institutions.

Table 7.5: Recommendations to improve Practical Skills at the University of Technology

Recommendations	
Practical Skills	1.Include more practical tasks in the curriculum. 2.Build more laboratories and workshops. 3.Equip laboratories and workshops with modern high-tech equipment. 4.Allow learners to undertake vocational work in industries or Skill Development Centres.

7.5 Computer Skills

The research findings show that the requirement of computer skills at the workplace is far more demanding than those gained by the learners from the Universities of Technology. To be able to compete in a global market, industries have embraced technology, thus widely automating, and computerising a significant proportion of the plant equipment, machinery, and processes. Higher levels of computer skills are required for the operation, programming and configuring of modern plants. Table 7.6 provides a summary of recommendations to enhance the computer skills of learners while at the academic institution.

Table 7.6: Recommendations to improve the computer skills of learners

Recommendations	
Computer Skills	1.Enhance computer skills programs in curriculum. 2.Equip computer labs with sufficient and functionable computers. 3.Include similar software applications that are used by industry. 4.Design assignments to be computer generated. 5.Provide opportunities for learners to use PowerPoint presentations.

7.6 Drawings and documentation

According to the study's findings, learners had challenges when interpreting and comprehending documents and drawings at the workplace. When working on projects, diagnosing issues, and ensuring safety standards, technicians and engineers frequently employ technical drawings and documentation. A collection of suggestions is provided in Table 7.7 to help learners become better at reading and comprehending technical documentation.

Table 7.7: Recommendations to improve understanding of technical drawings

Recommendations	
	1.University of Technology to include drawings and documentation as a module or partial module.

Drawings And Documentation	2.Use samples and templates of drawings and documentation from industry. 3.Create scenarios for learners to develop and create drawings and documentation. 4.Use simulation packages to read, interpret and troubleshoot from drawings. 5.Invite industry technical personnel to deliver lectures on drawings. 6.Lecturers to spend time in industry to become familiar with industrial drawing and documentation.

7.7 Project Management

The study findings indicated that learners lacked good project management skills. Engineering projects form a significant portion of technicians workload and project management skills are critical to the successful completion of these projects. Table 7.8 provides a summary of recommendations to improve the project management skills of learners.

Table 7.8: Recommendation to improve project management skills

Recommendations	
Project Management	1.University of Technology to include a project management module in the curriculum. 2.Expose learners to project management tools and instruments. 3.Create scenarios for learners to develop project management skills. 4.Familiarise learners with simulation and software project management packages. 5.Learners to develop presentations using project management applications. 6.Include a design project to be managed by project management tools. 7.Invite external assessors s from industry to rate the project management portfolio for the designed project.

7.8 Teamwork

Learners' ability to work in a team was revealed by the study as a challenge in the workplace. Most engineering related tasks or projects in the workplace require collaborative efforts from team members who possess different skills and experiences for successful delivery and completion. Table 7.9 below provides a list of recommendations to enhance teamwork skills.

Table 7.9: Recommendations to improve working in a team

Recommendations	
Teamwork	1.Increase group work projects and assignments. 2.Delegate problem solving tasks to groups. 3.Include teamwork characteristics when assessing group projects. 4.Create scenarios for learners to develop teamwork skills. 5.Provide opportunities to build leadership skills. 6.Provide opportunities to develop collaborative skills. 7.Include a design project to be managed by project management tools. 8.Invite external assessors s from industry to rate the project management portfolio for the designed project.

7.9 WIL registration

According to the study's findings, registration for the workplace module was discovered to be difficult and time-consuming. The seamless placement of learners would benefit immensely from the primary focus at the workplace on productivity, which would require the least amount of time, resources, and documentation.

A list of suggestions for enhancing the registration process is provided in Table 7.10.

Table 7.10: Recommendations to improve the WIL registration process

Recommendations	
Work-Integrated Learning Registration	1.Simplify the registration procedure by making it online and totally automated. The potential employer's placement offer should be submitted to the academic institution online with short timelines set for approval. 2.Educate and capacity build learners on the registration process while at the academic institution. Online training interventions should be used to guide employers and Industry Mentors through the registration processes. 3.The online registration system should be designed to immediately accept placement offers and register learners for already approved workplaces.

7. 10 Work-Integrated Learning Advocacy

The study's findings demonstrated that in order to generate more interest from industry, WIL needed more promotion and marketing. The promotion of the WIL qualification's many advantages and benefits should help attract the attention of business, thereby expanding the pool of suitable workplaces for learners. An overview of the suggestions for enhancing the promotion of WIL is provided in Table 7.11.

Table 7.11: Recommendations to improve WIL advocacy

Recommendations	
Work-Integrated Learning Advocacy	1.Create a dedicated website for WIL providing information on the WIL programs offered, WIL benefits, Industry Partners, testimonials from WIL learners, Industry Mentors, and other relevant information. 2.Organize Work-Integrated Learning conferences for all WIL stakeholders, including pertinent research presentations, debates, question and answer sessions, and breakaways.

	3.Market the benefits of WIL via multi-media platforms such as radio, television, podcasts, webcasts, brochures, emails, and a website. 4.Encourage staff and doctoral students to conduct research for paper publication in reputable journals and doctoral studies on WIL topics. 5.Academic staff should be educated as WIL ambassadors and should promote WIL programs while conducting workplace monitoring visits. 6.Incentivize industry partners that offer placement opportunities for learners by providing recognition and bursaries to its personnel.

7.11 Logbook Tasks and Scope

The study found that the logbook tasks required to be completed by the learners while at the workplace were not aligned to industry provisions and requirements. Some industries can provide opportunities for learners to be exposed to engineering tasks that may not be included in the logbooks. Table 7.12 provides recommendations to improve the alignment and scope of the logbook tasks.

Table 7.12: Recommendations to improve the alignment and scope of the Logbooks

Recommendations	
Logbook Tasks Alignment and Scope	1.Academic institution to undertake an In-depth study of industry scope. 2.Broaden the scope of the logbooks. 3.Comparison and alignment of industry scope and curriculum. 4.Intensify discussion with Industry Mentors to identify suitable tasks for WIL learners. 5.Identify potential industry projects. 6.Design of logbook together with inputs from Industry Mentors.

7. 12 Workplace Resources

The study findings revealed that the workplace lacked the resources required to sufficiently support the learners while at the workplace. Relevant tools, manuals, access to computers, personal protective equipment, stationery, training, stipends, and a dedicated mentor are some important resources required to support learning at the workplace. Table 7.13 provides a list of recommendations to improve workplace support of the learners.

Table 7.13: Recommendations to improve Workplace Resources

Recommendations	
Workplace Resources	1.Increase mentoring capacity in the industry by training and appointing additional technicians and engineers as mentors. 2.Provide learners with appropriate and relevant engineering tools to properly complete the various tasks assigned to them. 3.Provide access to computers and printing facilities for the generation of reports, drawings, and other documents. 4.Provision of personal protective equipment such as overalls, gloves, ear protection, hard hats, safety shoes and goggles. 5.Train industry mentors through coaching and mentoring programs, in addition to the capacity building programs provided by the UoT. 6.Adequate stipends to be paid to timeously to learners to cover transport and lunch requirements. 7.UoTs to generate resource matrix for workplace to determine gaps.

7. 13 Workplace Monitoring

The study findings indicated that learners' progress was not adequately monitored during their placement at the workplace. For the length of time learners spend at the workplace, the frequency of monitoring visits should be more than the current stipulation of a single visit or two. Table 7.14 gives a summary of recommendations to improve workplace monitoring.

Table 7.14: Recommendations to improve Workplace Monitoring

Recommendations	
Workplace Monitoring	1.Academic staff to increase the number of monitoring visits during the WIL period. 2.Academic staff to engage with Industry Mentors, team members and management during monitoring visits. 3.Should include online engagement with learners to monitor learner progress and challenges. 4.Learners to submit frequent technical reports to the academic. institution on a regular basis. 5.Request frequent performance reports from Industry Mentors during WIL duration. 6.Lecturers and Industry Mentors to participate in the final assessment of WIL learners.

7.14 WIL Preparation

The study found that learners were not adequately prepared for the workplace. The workplace can be an unfamiliar and intimidating environment for learners who have been poorly prepared as the plant environment is vastly different from the academic institution. Table 7.15 provides a list of recommendations to improve the preparation of learners for the workplace.

Table 7.15: Recommendations to improve learner preparation for the workplace

Recommendations	
	1.Learners should become familiarized with the workplace module from inception at the academic institution.

WIL Preparation	2.Site visits to industry should be scheduled during academic study. 3.Logbook tasks, maintenance and signage should be discussed with learners prior to being placed. 4.Registration processes should be explained to learners prior to placement. 5.Logbook activity should include learners to receive orientation and induction at the workplace.

7.15 Attitude

The study findings also revealed that learners possessed challenges with regards to the attitude displayed towards their work, the academic staff, and Industry Mentors. This negative attitude may strongly impact on learner development and contributes to the limited workplace access. Table 7.16 provides a list of recommendations to address poor learner attitudes.

Table 7.16: Recommendations to improve learner attitudes

Recommendations	
Learner Attitude	1.Academic staff and Industry Mentors should be examples of good conduct, behaviour, and respect. 2.Learners should be treated as adults by the academic and industry staff. 3.Attitude and personal and interpersonal skills should be included in every module. 4.Academic staff and Industry Mentors should give a listening ear to learners. 5.Learners to be provided with support, counselling, and guidance. 6.Learners to be developed to be positive thinkers. 7.Interventions to improve learners' punctuality.

	8.Responsible attendance should be developed at the academic institution and the workplace.

7.16 Alternate WIL Models

The Work-Integrated Learning model adopted by the Universities of Technology is the placement of learners in the workplace over two semesters spanning a full year. However, based on the research results and for the various challenges uncovered in this study, alternate WIL models may assist in easing the lengthy "wait time" till placement, thus allowing learners to graduate sooner. Table 7.16 represents the conventional WIL model where learners require placement in industry for a year.

Table 7.17: Current conventional WIL Model

Current WIL Model	
(P1) Six months in industry	(P2) Six months in industry
▪ Tasks as per logbook	▪ Tasks as per logbook

7.16.1 Multi Industry Placement Model

Numerous specialised industries produce or provide services for one or a few engineering components. For instance, some industries are experts exclusively in motors, while others only work with transformers, and yet work with motor control panels. However, exposing the learner to a variety of these specialty sectors could assist cover the whole logbook scope. None of these specialist industries can fully cover the extent of the logbook duties alone. A possible application of the Multi Industry Placement Model is shown in Table 7.18**.**

Table 7.18: Multi-Industry Placement Model

Multi-Industry Placement Model					
(P1) Six months in industry			(P2) Six months in industry		
Industry 1	Industry 2	Industry 3	Industry 4	Industry 5	Industry 6

▪ Tasks as per logbook	▪ Tasks as per logbook

Many industries specialize in specific aspects of engineering and, as a result, are inappropriate for providing placement opportunities to learners because they only provide exposure to a few components of the logbook. A flexible strategy that allows learners to register in a variety of specialized workplaces will still allow the learner to complete the entire logbook requirement, but the management and administration of such a model may be more complex.

7.16.2 Skills Development Centre Model (Partial)

This model recommends that learners spend six months in a Skills Development Training Centre immediately after completing the academic component of the engineering diploma, then placed in industry. The model provides the learners the opportunity to make secure a workplace while at the training centre. The learners' curriculum vitae is enhanced with the practical skills gained at the training centre. The first six months at the training centre focuses on hand skills, power tools and health and safety modules which are important for the workplace. Table 7.19 represents the Partial Skills Development Centre Model.

Table 7.19: Partial Skills Development Centre Model

Practice 1 (P1) **Six Months in Skills Development Training Centre**	**Practice 2 (P2)** **Six Months in Industry**
1. Hand Skills 2. Power Tools 3. Health and Safety 4. Welding 5. First Aid	1. Logbook Tasks for P2

7.16.3 Skills Development Centre Model

This model proposes the full workplace module be achieved in the training centre. The first six months will focus on the basic engineering skills; however, the second six months will focus on higher levels of specialised skills which include a project.

Many of the P1 requirements are linked to engineering skills that can be obtained via a Skills Development Provider. The Skills Development Provider is equipped with the required tools, equipment, and machinery, as well as competent and trained trainers, to impart the relevant knowledge and skills for various workplace modules. However, for Practice 2, learners may be allocated projects or activities that may be aligned very closely to typical industrial projects that they would manage when placed at a workplace, which require research, design, and collaboration with consultants and suppliers. A task or project determining and optimizing the energy consumption of a training centre, for example, would be analogous to determining the energy consumption of an industrial engineering workshop. However, due to the limitations and constraints imposed by the restricted number of projects that may be done in its setting, the Skills Development Provider may only be able to provide opportunities for a few learners. This model will be useful to learners who were unable to secure WIL in the workplace. Table 7.20 indicates the full Skills Development Centre Model.

Table 7.20: Skills Development Centre Model

Practice 1 (P1) **Six Months in Skills Development Training Centre**	**Practice 2 (P2)** **Additional Six Months in Skills Development Training Centre**
1. Hand Skills 2. Power Tools 3. Health and Safety 4. First Aid 5. Welding	1. Specialised Skills 2. Drawings and Documentation 3. Project Design and Development 4. Project Presentation

7.16.4 Community Service Projects Model

Projects carried out by engineering learners may have a significant positive impact on rural communities. For these communities, a variety of mechanical and electrical projects might be planned. Different engineering initiatives might be specifically created for the agriculture industry. Rural areas also have sufficient of room and promise for renewable energy installations. Due to the significantly reduced travel requirements and costs, learners who live in rural areas make excellent candidates for participation in these programmes. Learners are responsible for overseeing projects from start to finish, including the creation and completion of all project documentation. A basic model for community service projects is shown in Table 7.21.

Table 7.21: Community Service Project Model

Community Service Project Model	
Practice 1	Practice 2
1. Preparatory work 2. Project Planning 3. Design 4. Drawings 5. Budgeting 6. Procurement	1. Implementation of Project 2. Commissioning 3. Reporting

7.16.5 Simulation

Instead of learners waiting for placement opportunities for lengthy periods, specific tasks can be simulated in the interim by learners. This model is an appropriate alternative to placement in a workplace where the workplace environment or setting to accomplish WIL tasks is replicated. The learner may still be assigned an Industrial Mentor who would remotely monitor and mentor their development; however, the learners may virtually visit the workplace, processes, and operations. The actual task will be conducted in a simulated setting or on simulators. Programming and configuration of robotic devices, PLCs, drives, and motor control circuits, for example, may keep learners busy until a placement opportunity becomes available. Given the simulation component, a reduction in Work-Integrated Learning time may be permitted; a well-designed Simulation Model, on the other hand, may allow learners to complete the entire workplace program. Off-site infrastructure setup for engineering simulation purposes incurs high costs in terms of space, equipment, machinery, tools, and additional human resources. Participation in virtual platforms and other technological interventions such as simulations, robotics, and software programs paired with artificial intelligence, positions learners to operate more easily in the workplace and boosts employment opportunities. Table 7.22 provides a breakdown of the Simulation Model.

Table 7.22: Simulation Model

Simulation Model	
Practice 1	Practice 2
1.Wiring of simulated process or plant or machine, drives, programmable logic controllers, etc. 2.Installation of accessory pieces of equipment, sensors, transmitters, etc. 3.Calibration of equipment 4.Power up and Testing 5.Development of Drawings and documentation	1.Configuration of Drives 2.Programming of Programmable Logic Controllers 3.Design, simulation, and faultfinding of Motor Control Circuits 4.Programming, configuration, and setting up and faultfinding robotics

7.16.6 Hybrid Model

Combining the various models is also suggested as an alternative. In the cases where learners may have difficulties in obtaining full WIL placement at a workplace, the only option available being brief periods of exposure in the aforementioned models will cumulatively cover the full complement of workplace modules. For the modules completed at each stage, the logbook tasks require completion and signing off. The management and administration of this would be complicated, but with the use of virtual platforms and technology, this model could be properly controlled and managed while maintaining quality. The main advantage will be that learners who were unable to obtain WIL in the workplace will be able to complete the WIL component of the National Diploma and graduate. Any combination of the following models may be considered:

1. Industry Placement Model
2. Multi Industry Placement Model
3. Skills Development Centre Model
4. Community Service Model
5. Simulation Model

Table 7.23 shows the hybrid model with the duration to be determined agreed upon in conjunction with the academic institution.

Table 7.23: Hybrid Model

Hybrid Model							
Model	Duration	Model	Duration	Model	Duration	Model	Duration
Industry and Multi-Industry Placement Model	To be agreed by UoT	Skills Development Centre Model	To be agreed by UoT	Community Service Model	To be agreed by UoT	Simulation	To be agreed by UoT

7.17 Technology, Innovation, People and Systems (TIPS) framework

Successful results may be produced when the Technology, Innovation, People, and Systems (TIPS) framework is applied within the world of work (Anderson, 2018)**.** The Introduction of Technology, Innovation, developing or the acquisition of the correct human resources and the enhancement of organisational processes and systems within the Work-Integrated Learning umbrella, will strongly contribute towards addressing many of the inherent challenges. Figure 7.1 represents the core elements of the leadership framework benefits of linking and integrating the TIPS domains with each other.

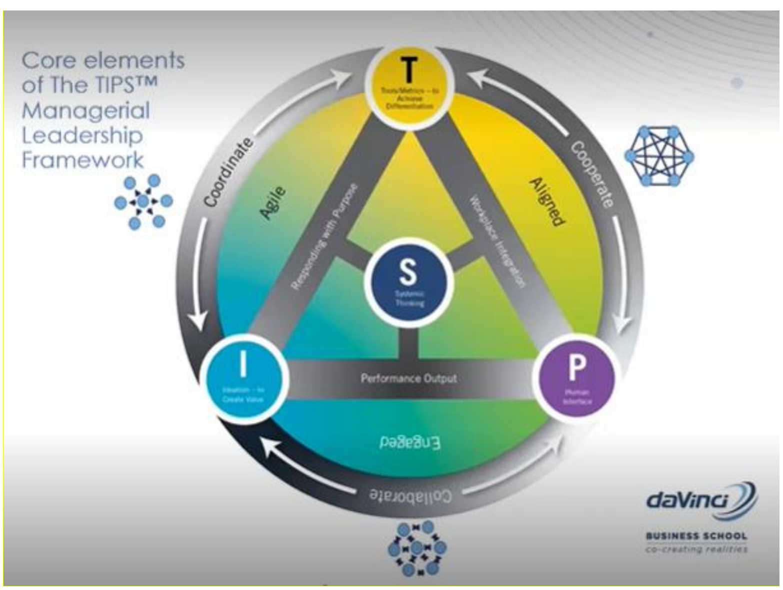


Figure 7.1: TIPS Leadership Framework
Source: Fuller (2023)

Figure 7.2 below, further details the actions organisations that embrace the TIPS model may pursue in order to improve and solve complex problems.

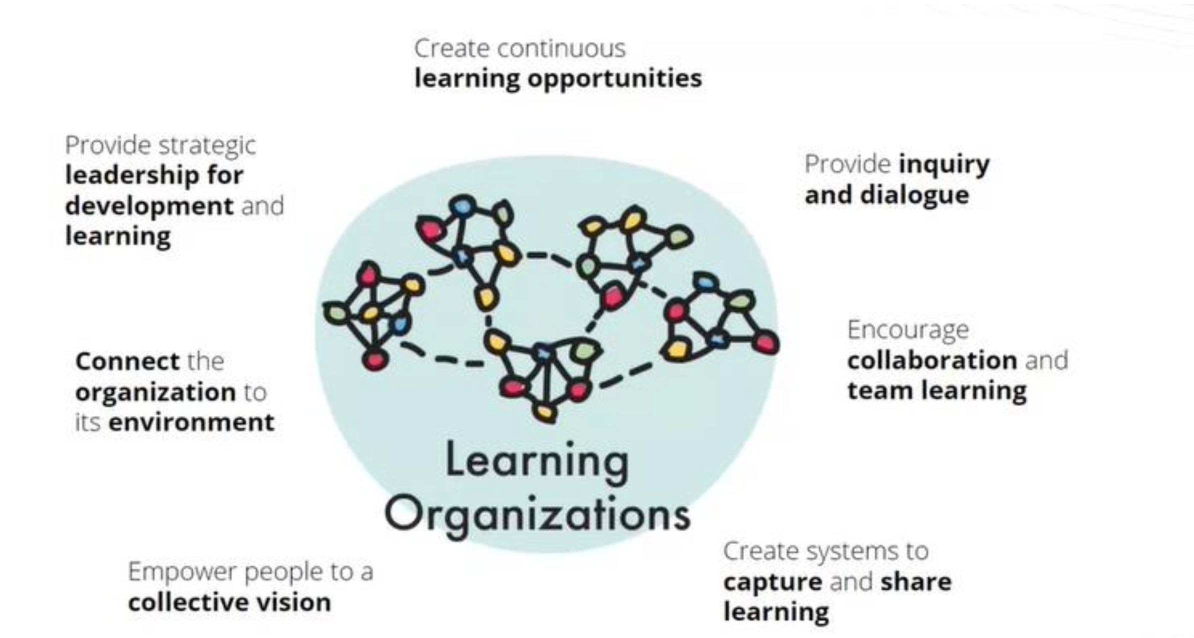


Figure 7.2: TIPS action items
Source: Fuller (2023)

TIPS Implementation

Technology

1.Specialised tools for Practical Tasks

2.Upgrading of infrastructure, laboratories, and workshops

3.Computer hardware and software.

4.Project Management Tools

5.WIL registration Portal

6.WIL website

7.IT facilities

8.Virtual Platforms for Monitoring

Innovation

1.Development of alternate WIL models

2.Strategies for Interdepartmental communication enhancement

3.Inclusion of communication activities in curriculum

4.Alignment of curriculum to enhance knowledge on industrial technology

5.Development of new practical tasks

6.Development of additional IT-related tasks

7.Redesign of curriculum and assessments to include industrial drawings and documentation

8.Addition of Project Management module to curriculum

9.Development of additional group work activities and group assignments

10.Development of assessment tools for group presentations

11.Creation of a fully online simple registration system with short timelines and automatic registration for approved workplaces

12.Online Strategies for marketing and advocacy of WIL

13.Hosting of WIL conferences and workshops

14.Publication of research papers on WIL topics

15.Amendments of logbook tasks to current technology at workplace to include robotics, mechatronics, and high-tech technology

16.Designing of flexible logbook tasks

17.Development of checklist or resource matrix for workplace compliance

18.Design of Virtual and Remote Engagement and Monitoring Tools

19.Development of WIL preparation programs

20.Inclusion of personal and inter- personal skills in every module.

People

1.Upskilling Industry Mentors on remote mentoring techniques

2.Training and Upskilling of Industry Mentors and Academic staff on communication techniques

3.Equipping learners with relevant resources

4.Upskilling of lecturers in software packages, robotics, and artificial intelligence

5.Training of lecturers on industrial drawings and documentation

6.Upskilling of lecturers on Project Management Tools

7.Capacity building of academic staff to become WIL ambassadors

Systems

1.Systems to administer and manage alternate WIL models

2.Development of internal policies and processes for delivering alternate WIL models

3.Accounting systems for budget provisions and expenditure for additional technology

4.Tender Application Processes

5.Budgeting Processes

6.Scheduling of UoT and Workplace engagements sessions

7.Planning and Scheduling of additional practical tasks

8.Scheduling and timetabling increased computer laboratory time

9.Planning and scheduling of more teamwork activities

10.Online registration process for WIL

11.Planning and scheduling of additional monitoring visits

12.Learner support, counselling, and guidance processes and systems

7.18 Recommended Policies

Implementing the recommendations may entail the drafting, development, or modification of policies. Table7.24, shows a list of policies and their respective goals.

Table 7.24: Recommended Policies

Proposed Policy	Purpose
Interdepartmental Communications Policy	To improve the coomunication between the Engineering Departments, Co-operative Department, Marketing, and other departments.
WIL financing Policy	To source finances for WIL interventions, infrastructure development, equipment, and learner stipends
Industry Partner Communication Policy	For the improvement of relationships between the academic institutions and industry partners.

Academic/Industry exchange Policy	▪ To provide industry exposure to academic staff and industry staff with academic experience. ▪ To utilize the expertise of facilitators, assessors, and moderators from industry
Industry Mentor Upskilling Policy	▪ To upskill Industry mentors with mentoring skills. ▪ To guide conduct and deliverables of appointed mentors.
Information sharing Policy	To share WIL related information and updates to all departments, learners, and industry.
Curriculum Amendment Policy	▪ For the improvement of offering up to date content aligned to industry requirements. ▪ To amend the logbook criteria to cater for industry requirements.
WIL advocacy Policy	To influence a dedicated strategy for the marketing of WIL qualifications, the setting up and maintenance of a dedicated WIL website.
Workplace Monitoring Policy	▪ To enhance the effectiveness of workplace monitoring visits. ▪ To include virtual and remote monitoring of learner progress.
WIL Policies to adopt other WIL modalities:	To incorporate the recommended WIL modalities, including the following: ▪ Muli-Industry Placement, ▪ Skills Development Centre Model, ▪ Simulation Model, ▪ Hybrid Placement Model.

7.19 Contributions of the Study

7.19.1 Personal benefits from the study

The researcher's personal life has been greatly touched by the study journey. Even though the researcher was committed to many other highly prioritised tasks, he nonetheless found time and resources to complete the study, which required a lot of sacrifice and dedication. He developed important organizational and time management abilities along the process. The study's completion and generation of potential solutions to the numerous problems plaguing the Work-Integrated Learning environment, as well as contributions to WIL learners, Industry, and Mentors, humbles the researcher, and that such a significant contribution could be made by him.

7.19.2 Professional contributions

The research output clearly outlined the challenges that the Universities of Technology, Industries, and organs of state should examine and draft policies and regulations to address them. Typical policies around funding, Industry Mentor selection, punctuality and attendance should be drafted. The researcher is in the final stages of publishing a paper arising out of this study to share the research output to the academic community.

7.19.3 Benefits to the Universities of Technology and Industries

The research findings have provided significant insight into the difficulties that employers and technology universities face. It is urged that academic personnel, learners, and Industry Mentors continue to develop and expand their capacities. Technology gaps should be filled, as well as those in more sophisticated computers, software programs, laboratories, and marketing tools. It may also be beneficial to enhance the procedures and systems for WIL registration, induction, learner placement, and monitoring.

Further benefits for industries that participate in WIL programs are:

1. Tax incentive for offering learner workplace opportunities.
2. Excellent skills transfer to WIL learners contributes meaningfully to the organization.
3. Increased productivity.
4. Increased pool of skilled technicians.
5. Improved relationships with WIL stakeholders.
6. Make More Informed Decisions on WIL matters.
7. Compete More Effectively.
8. Organisations have much to benefit from the research output.

7.19.4 WIL continuous improvement loop

The learning outcomes of the qualification particularly the workplace component, which is guided by the criteria outlined in the logbook, are critical to the success of WIL programs. Reports from monitoring visits, learner POE and workplace assessments, and concerns addressed by industry during Advisory Board sessions provide feedback on learner performance and workplace challenges. Enhancement of the workplace learning outcomes and learner performance are expected when remediation and corrective action are taken. WIL learning outcomes may change as a result of changes in labour market demands, technology improvements in the workplace, and regulatory changes. Figure 7.3 graphically represents a continuous process to whollistically improve WIL.

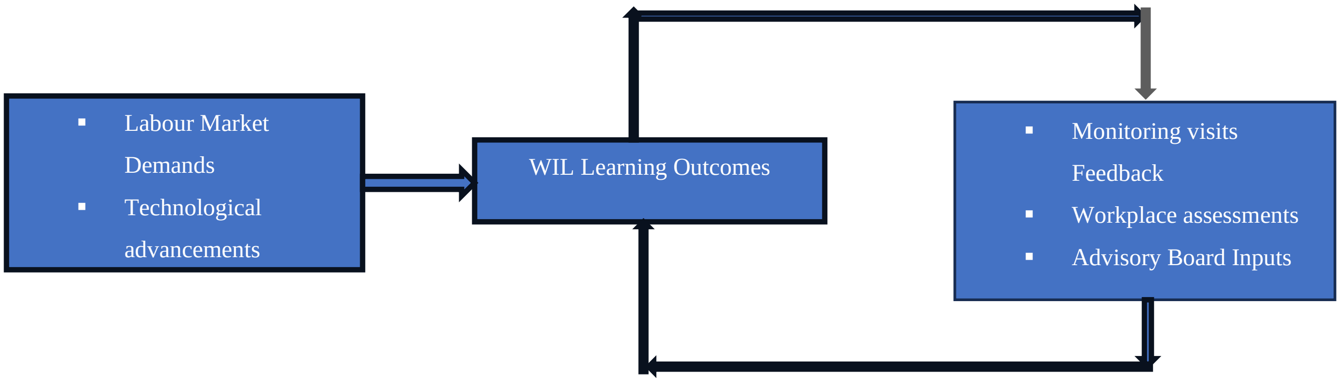


Figure 7.3: WIL Continuous Improvement Loop
Source: Developed by Researcher

7.19.5 Recommended Framework for WIL

Table 7.25 represents a recommended an wholictally integrated framework developed for WIL.

Table 7.25: Recommended Framework for WIL

Areas of Improvement	UoT	Industry Mentor	Learner	Other
1. Wait - Time till Placement	Recognise alternate WIL models. 1.Conventional WIL Model 2. Multi-Industry Placement Model 3. Partial Skills Development Centre Model 4. Skills Development Centre Model 5. Community Service Project Model	Participation in remote mentoring.	Compliance with process and submission of required documentation.	MOUs with Skills Development Providers, Community Leaders.

	6. Simulation Model 7. Hybrid Model			
2.Policy Development	Development of internal policies for delivering alternate WIL models.	Policy development for remote mentoring		DHET policy development for alternate WIL models.
3.Funding	Budget provisions for: 1.Training 2.Equipment 3.WIL marketing 4.Learner Stipends. Submit Funding proposals and tender applications to funding organisations.	Budget Provisions for : 1.Training 2.Tools 3.Learner Stipends	Management of stipends for transportation to and from workplace.	SETAs NSF Funding organisations
4.Communication	Strategise interdepartmental communication enhancement, upskilling of staff, engagement between UoT and industry. adjustment of communication module, inclusion of communication activities in logbook	Develop Mentors: Coaching & mentoring training. Upskilling on UoT WIL processes.	Completion of reports. Participation in meetings. Participation in mentor feedback sessions. Create and deliver Powerpoint presentations.	Stakeholder Engagement with SETAs NSF, Funding agents and DHET

5.Theoretical Knowledge	Alignment of Curriculum Addition of industrial technology. Amendment of logbook tasks.	Equipping learner with technical manuals, drawings.	Undertaking of individual research and personal knowledge enhancement.	
6.Practical Skills	Amendment of curriculum and logbook. Scheduling of additional laboratory and workshop time. Upgrading of infrastructure.	Scheduling and exposure to additional practical tasks. Provision of tools, including specialized tools.	Successful completion of all allocated practical tasks.	
7.Computer Skills	Amendment of curriculum and logbook Schedule increased computer laboratory time. Additional investment in computer hardware and software.	Scheduling of increased exposure to computer related tasks, Provision of access to computer and IT facilities.	Submission of reports using Word, Excel, and other packages. Prepare computer generated presentations. Development of drawings using CAD.	
8.Drawings & Documentation	Amendment of curriculum and logbook. Inclusion of examples of industrial drawings and documentation into class lessons and assessments.	Provision of industry drawings and documents at the workplace. Enforcement of logbook tasks	Generation of CAD drawings. Submission of industry required documents for tasks worked on.	

9.Project Management	Addition of Project Management module to curriculum. Amendment of logbook	Provision of access to Project Management (PM) tools. Provision of Guidance and Training on PM tools.	Use of PM tools to report on progress and completion of tasks and projects.	
10.Teamwork	Development of additional group work activities and group assignments. Development of assessment tools for group presentations.	Allowance for more teamwork, team reporting, and team presentations.	Acceptance of working as a group. Showing respect and co-operation to team members. Completion of assigned responsibilities competently.	
11.Registration Process	Creation of a fully online simple registration system with short timelines and automatic registration for approved workplaces.	Provision of computer facilities for learner registration. Generation of placement offer with minimum delays.	Use of online registration system instead of manual processes.	
12.WIL Advocacy	Creation of WIL marketing platforms, design of dedicated WIL website. Hosting of WIL conferences and workshops. Publication of research papers research. Allocation of WIL topics for Doctoral studies.	Advertisement of placement opportunities onto WIL website.	Attachment of WIL testimonials to website. Encouragement of learners to become ambassadors for WIL	

13.Logbook Alignment	Amendments of logbook tasks to current technology at workplace to include robotics, mechatronics, high-tech technology. Designing of flexible logbook tasks.	Exposure of learners to high end engineering technology and relevant logbook tasks.	Acceptance of industry engineering technology tasks. Undertaking of individual research. Study of manuals and functionality of hi- tech equipment	
13.Workplace Resources	Development of checklist or resource matrix for workplace compliance.	Provision of adequate and quality mentors, learner support, tools, computer facilities, stipends, and PPE.	Provision of feedback on availability of resources to academic monitor and on reporting channels.	
14.Workplace Monitoring	Scheduling of additional monitoring visits. Engagement with Industry Mentors and learners, both physically and virtually.	Attend scheduled monitoring visits by the Industry Mentor. Participation in the feedback sessions.	Attendance and participation in scheduled monitoring visits.	
13.WIL Preparation	Development of Orientation and workplace introduction and induction programs for WIL preparation.	Conducting the orientation, induction, and introduction of new learners to workplace and mentor. Explanation of the rules, regulations, policies, health, and safety practices.	Attend induction programs and compliance to company rules and regulations.	
14.Learner Attitude	Inclusion of personal and inter- personal skills in every module. Provision of support, counselling, and guidance for learners.	Engagement of learners on personal and interpersonal topics for discussion. Provision of support, counselling, and guidance for learners.	Attendance of all guidance and counselling sessions.	

7.19.4 Societal benefits

WIL learners may complete their education more quickly and be prepared to enter the workforce. Graduates have a sense of accomplishment. Graduating students may easily find employment because there is a need for trained technicians. Some highly competent technicians might decide to start their own businesses and hire others, thereby lowering unemployment. Many of the formerly underprivileged students come from low-income households, but they may now improve their life and lift their communities out of poverty. Students who are actively working, as opposed to being idle, will not commit crimes. Learners who are employed can now take part in the economy.

7.20 Limitations of the Study

The researcher considered the financial, logistical and time constraints and contained the research to the following limitations.

1. The study included the Durban University of Technology and the Mangosuthu University of Technology; both universities are located, in the province of KwaZulu-Natal, South Africa. The study could be conducted at other academic institutions across the country.
2. The study was conducted using data from the industries based in KwaZulu-Natal, South Africa only. Industries from around the country could be included in the study.
3. The study focused specifically on the mechanical and electrical diplomas offered at the Universities of Technology. It could have explored other qualifications bearing a WIL component.
4. The role of the Industry Mentor, their qualifications, experience, skills, and personality were not adequately probed.

7.21 Future Research

Though the research was limited to the province of KwaZulu-Natal, South Africa, the findings should hold true if replicated in the other provinces as well. Likewise, the recommendations emanating from this study could also be applied accordingly. The research was centred on the challenges around workplace access for the University of Technology mechanical and electrical diploma's Work-Integrated Learning workplace module. It is therefore recommended that further research be done for other engineering and non-engineering qualifications that carry a workplace component.

To accelerate the stimulation of the economy, the South African government has identified strategic projects which requires a drastic increase in the pool of artisans and has invested exorbitant funding in the apprenticeship training program. The constraint for apprenticeship programs, however, is the lack of suitable workplaces being available. Although the recommendations from this study may assist in increasing access to workplaces, it is designed specifically to meet the need of engineering technicians. It is therefore recommended that further research be conducted exploring the workplace challenges for the rolling out of apprenticeships.

Industry Mentors play a critical role in shaping and empowering learners with the relevant technical skills, knowledge, and attitudes. The study touched on the Industry Mentors role in developing the technicians while based at the workplace. The capabilities and competencies of the Industry Mentors were not measured in this study. Criteria such as the qualifications, experience, skills, training, and personality of the Industrial Mentors were not adequately dealt with as well. Further research in this area is recommended.

7.22 Conclusion

The main aim of the study was to increase access to suitable workplaces for the learners that pursue the electrical and mechanical engineering diploma qualifications at the Universities of Technology. The study investigated the challenges encountered by the academic staff, the learners, and the Industry Mentors. A summary of the findings and the recommendations was provided in this chapter. The chapter outlined alternate models for WIL to assist mitigate many of the challenges the current model presents. In addition, the chapter presented potential areas of future research to be undertaken.

The study successfully investigated the many challenges encountered by the learners, the academic staff involved in WIL activities and the Industry Mentors, bringing to light a range of challenges, the difficulties, constraints, limitations, shortcomings, and gaps which, when addressed, should foster better relationships and understanding among all the WIL stakeholders. It will also hopefully generate increased accessed to workplaces. Thus, the body of knowledge has been enriched through the contributions made by this study. Many leads to potential future research associated within the WIL umbrella have been recommended to strengthen understanding in this arena if WIL.

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Annexure 1

The Da Vinci Institute for Technology Management (Pty) Ltd
PO Box 185, Modderfontein, 1645, South Africa T e l + 2 7 1 1 6 08 1 33 1 F a x + 27 1 1 6 0 8 1 3 8 0 www .davinci.ac.za

Reference: 02621
Date: 10 September 2021

Ethical Declaration

I, the undersigned, hereby declare that the Doctorate Research of the student named below has received ethical clearance from The Da Vinci Institute Ethics Committee. The student and supervisor will be expected to continue to uphold the Da Vinci Institute's Research Ethics Policy as indicated during the application.

Proposed Title: Work-Integrated Learning Challenges

Student Name: Soobramoney Jayanathan

Student number: 5173

Supervisor: Prof Krishna Govender

Co-Supervisor: N/A

Period: Ethics approval is granted from 2021/09/10 to 2022/03/31

HKlopper

____

Chairperson: Research & Ethics Committee

Prof HB Klopper
Executive Dean: Research and Institutional Partnerships

Annexure 2

Directorate for Research and Postgraduate Support
Durban University of Technology
Tromso Annexe, Steve Biko Campus
P.O. Box 1334, Durban 4000
Tel.: 031-3732576/7
Fax: 031-3732946

8th September 2021 Mr Jayanathan Soobramoney

c/o Innovation and Technology Management The Da Vinci
Institute for Technology Management

Dear Mr Soobramoney

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that the Institutional Research and Innovation Committee (IRIC) has granted **Full Permission** for you to conduct your research "Work-Integrated Learning Challenges" at the Durban University of Technology.

The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

We would be grateful if a summary of your key research findings would be submitted to the IRIC on completion of your studies.

Kindest regards.

Yours sincerely

DR LINDA ZIKHONA LINGANISO
DIRECTOR: RESEARCH AND POSTGRADUATE SUPPORT DIRECTORATE

Annexure 3

MUT
MANGOSUTHU
UNIVERSITY OF TECHNOLOGY

UMLAZI KWAZULU-NATAL
PC Box 12363 Jacobs 4026 Durban
Tel: 031907 7450

04 October 2021 REF:

RDO/ 11/2021

Mr Jay Soobramoney DaVinci Institute

Dear Mr Soobramoney

PROTOCOL: 'Work-Integrated Learning Challenges.'

The MUT Research Ethics Committee considered your application at their meeting held on 13 September 2021. It is my pleasure to inform you that permission to conduct the research project above was granted.

The approval is valid for two years from 13 September 2021. Any changes to the project must immediately be brought to the attention of the MUT Research Ethics Committee.

Your acceptance of this approval denotes your compliance with South African National Research Ethics guidelines (2004) and the MUT Research Ethics Policy, Procedures and Guidelines

Good luck with your research.

Yours sincerely,

Dr A Mienie
Director:
Research

Annexure 4 -Unplaced Learners 2018.

Date : 11-JUL-2023 18:42

DURBAN UNIVERSITY OF TECHNOLOGY
STUDENTS NOT REGISTERED FOR INSERVIC
(Program : KRISHJ272)

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73 rows selected.

**** End Of Report ****

Engineering Research

Dear Participant, your assistance in completing the following questionnaire will be gratefully appreciated and your contribution will impact positively in identifying challenges in the area of Work-Integrated Learning in South Africa. The research endeavours to provide potential solutions to the challenges that the research will highlight.

~~* Indicates required question~~

1. Please specify your gender *

Mark only one oval.

- Female
- Male

2. Please specify your age *

Mark only one oval.

- 19 or younger
- 20-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49
- 50-54
- 55-59
- 60-64
- 65-69
- 70 or older

3. Which of the below best describes you? * *Mark only one oval.*

- University of Technology staff *Skip to question 32*
- Industry mentor *Skip to question 4*
- Learner *Skip to question 75*

Industry Mentor

4. Please indicate your designation * *Mark only one oval.*

- Artisan
- Supervisor
- Technician
- Engineer
- Other:

5. Please indicate your highest educational qualification * *Mark only one oval.*

- Matric
- Diploma
- Degree
- Post Degree
- Other:

6. Please indicate your industrial experience *

Mark only one oval.

- 1 - 3 years
- 3 - 5 years
- 5 - 10 years
- 10 - 15 years
- 15 or more years

7. Communication between the University of Technology and workplace is * adequate.

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

*

8. The Industry Liaison Committee (Advisory Board) is a productive and informative forum.

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

*

9. The University of Technology process for placement of learners at the workplace is simple

Mark only one oval.

Strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly agree

*

10. The canvassing of the University of Technology, to secure more workplace opportunities, are adequate.

Mark only one oval.

Strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly agree

*

11. The usage of media, website, newsprint and other channels by the University of Technology used to attract workplaces opportunities is adequate.

Mark only one oval.

Strongly disagree
1 ⬭
2 ⬭
3 ⬭
4 ⬭
5 ⬭
Strongly agree

12. The logbook tasks is aligned to Industry requirements *

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

13. The workplace provides the full scope of the logbook requirements. *

Strongly disagree

1

2

3

4

5

Strongly agree

Mark only one oval.

14. The learner is able to apply the theory learnt at the University of Technology *

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

15. The learner’s communication skills is acceptable for your industry requirements.

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

16. The learner’s practical skills is adequate to perform related tasks in the workplace. *

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

17. You understand the role and responsibilities as ‘mentor’ to perform the mentoring duties of a University of Technology learner. *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

18. The training/explanation on your mentoring role (from the University of Technology) is adequate. *

Mark only one oval.

	Strongly disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly agree

19. Was your workplace assessed by the University of Technology for "work * integrated learning" provision?

Mark only one oval.

*

Yes

No

20. The learner's maturity level in terms of responsibility is acceptable for industry requirements.

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

21. The learner's maturity level, in terms of accountability, is acceptable for industry requirements *

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

*

22. The learner's maturity level, in terms of work ethic is acceptable for industry requirements.

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

23. The learner' ability to work in a team is acceptable for industry requirements *

Mark only one oval.

Strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly agree

24. What are the areas of lack amongst the University of Technology learners ? * (More than 1 box may be ticked).

Check all that apply.

- [ ] Theoretical Knowledge
- [ ] Practical Skills
- [ ] Computer Skills
- [ ] Communication Skills
- [ ] Work Ethic
- [ ] Punctuality
- [ ] Attendance
- [ ] Interpretation of Drawings and Documents
- [ ] Project Management Skills
- [ ] Working in a Team
- [ ] Attitude Other:
- [ ] ______________________

*

25. What are the areas of excellence amongst the University of Technology learners ? (More than 1 box may be ticked)

Check all that apply.

- [ ] Theoretical Knowledge
- [ ] Practical Skills
- [ ] Computer Skills
- [ ] Communication Skills
- [ ] Work Ethic
- [ ] Punctuality
- [ ] Attendance
- [ ] Interpretation of Drawings and Documents
- [ ] Project Management Skills
- [ ] Working in a Team
- [ ] Attitude Other:
- [ ] ____________________

26. The workplace is sufficiently resourced to support student development during * Work-Integrated Learning.

Mark only one oval.

*

Strongly disagree
1
2
3
4
5
Strongly agree

27. The workplace is sufficiently resourced with the relevant tools and equipment to perform the required tasks as per the Work-Integrated Learning logbook.

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

28. The workplace is sufficiently resourced with access to information, related to the operation. *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

*

29. The workplace provide a reasonable stipend/ remuneration to cover the transport costs for the Work-Integrated Learning learner.

Mark only one oval.

Strongly disagree

1 ⬭
2 ⬭
3 ⬭
4 ⬭
5 ⬭

Strongly agree

30. The following is provided by the workplace (More than 1 box may be ticked). *

Check all that apply.

- ☐ Personal protective equipment
- ☐ Tools
- ☐ Meals or meal allowance
- ☐ Transport
- ☐ Other: ____________________

31. Please describe or list or Work-Integrated Learning challenges you have experienced as a mentor/industry representative.

____
____
____
____
____

Skip to section 5 (End)

University of Technology staff

32. Please indicate your designation *

Mark only one oval.

- ⬭ Co-Op Practitioner
- ⬭ Head of Department
- ⬭ Lecturer
- ⬭ Work-Integrated-Learner Coordinator Other:
- ⬭ _______________

33. Please indicate your education (more than 1 box may be ticked) *

Check all that apply.

- Trade test
- Matric
- Diploma
- Degree
- Post-Degree

34. Please indicate your industrial experience *

Mark only one oval.

- 1 - 3 years
- 3 - 5 years
- 5 - 10 years
- 10 - 15 years
- 15 or more years

35. The University of Technology is sufficiently resourced with staff to perform * Work-Integrated Learning functions

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

36. The University of Technology is sufficiently resourced with respect to finances * to perform Work-Integrated Learning functions

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

37. There University of Technology has an adequate supply of vehicles available for visiting learners at the workplace *

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

*

38. The process to schedule monitoring visits of learners at workplace is simple *

Mark only one oval.

Strongly disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly agree

*

39. The academic engineering department is sufficiently resourced for workplace monitoring visits

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

40. Did you receive any training interventions to improve your performance on Work-Integrated Learning functions from the University of Technology * *Mark only one oval.*

*

Yes

No

*

41. You are familiar with the services provided by the co-operative education department

Mark only one oval.

	Strongly disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly agree

42. The communication levels between the co-operative education department and YOUR engineering department is adequate *

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

The communication levels between the co-operative education department *

43. and learners requiring placement are adequate

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

44. The communication levels between the co-operative education department and workplaces is adequate *

Mark only one oval.

Strongly disagree
1 ⬭
2 ⬭
3 ⬭
4 ⬭
5 ⬭
Strongly agree

*

45. The communication levels between YOUR engineering department and workplaces is adequate

Mark only one oval.

Strongly disagree
1 ⬭
2 ⬭
3 ⬭
4 ⬭
5 ⬭
Strongly agree

*

46. The Industry Liaison Committee (Advisory Board) is a productive and informative tool

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

*

47. The frequency of the Industry Liaison Committee (Advisory Board) meetings is acceptable

Mark only one oval.

Strongly disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly agree

*

48. The Industry Liaison Committee (Advisory Board) meetings is well represented by Industry

Mark only one oval.

Strongly disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly agree

*

49. The co-operative education department's system for learner placement after lodging of learner curriculum vitae and statement of results is effective

Mark only one oval.

Strongly disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly agree

50. YOUR engineering department's system for placement of learners is effective *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

*

51. The co-operative education department's system for the monitoring of learners at the workplace is effective

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

52. YOUR Engineering Department's system for the monitoring of learners at the workplace is satisfactory *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

53. The statement of results of learners qualifying for placement are timeously forwarded to the co-operative education department *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

*

54. The workplaces give feedback to the co-operative education department when it provides placement opportunities to learners

Mark only one oval.

Strongly disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly agree

55. The workplace gives feedback to YOUR engineering department when it provides placement opportunities to learners *

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

56. YOUR engineering department provides feedback to the co-operative education department when learners are registered for the workplace component *

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

57. The time taken for co-operative education department to place learners is acceptable *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

58. The marketing interventions of the University of Technology in growing the industrial network to increase workplace opportunities is adequate *

Mark only one oval.

Strongly disagree

1
2
3
4
5

Strongly agree

59. The University of Technology usage of media, website, newsprint and other channels used to attract workplaces opportunities is adequate *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

60. The workplace logbook is reviewed frequently to ensure the alignment with changes in technology at the workplace *

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

61. The communications skills transferred to the learner from the University of Technology is sufficient for workplace requirements *

Mark only one oval.

Strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly agree

62. The practical skills transferred to the learner through the institutional program is sufficient to perform related tasks in the workplace *

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

63. The workplace mentors are sufficiently experienced to perform the mentoring role *

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

64. The training/guidelines provided by the University of Technology to workplace mentors is adequate *Mark only one oval.* *

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

65. What would you consider to be the percentage of the workplaces approved by the University of Technology to the total number of workplaces wherein learners are placed? *

Mark only one oval.

- ◯ 0 - 9 %
- ◯ 10 - 19 %
- ◯ 20 - 29 %
- ◯ 30 - 39 %
- ◯ 40 - 49 %
- ◯ 50 - 59 %
- ◯ 60 - 69 %
- ◯ 70 - 79 %
- ◯ 80 - 89 %
- ◯ 90 - 100%

66. The learner's responsibility level at the time of work placement is acceptable for industry requirements *

Mark only one oval.

	Strongly disagree
1	( )
2	( )
3	( )
4	( )
5	( )
	Strongly agree

67. The learner's accountability level at the time of work placement is acceptable for industry requirements *

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

68. The learner's work ethic at the time of work placement is acceptable for industry requirements *

Mark only one oval.

Strongly disagree
1 ◯
2 ◯
3 ◯
4 ◯
5 ◯
Strongly agree

69. What would you consider as areas of lack amongst the University of * Technology learners? (More than 1 box may be ticked).

Check all that apply.

- [ ] Theoretical Knowledge
- [ ] Practical Skills
- [ ] Computer Skills
- [ ] Communication Skills
- [ ] Work Ethic
- [ ] Punctuality
- [ ] Attendance
- [ ] Interpretation of Drawings and Documents
- [ ] Project Management Skills
- [ ] Working in a Team
- [ ] Attitude Other:
- [ ] ______________________

70. What would you consider as areas of excellence amongst the University of Technology learners (More than 1 box may be ticked) *

Check all that apply.

- [ ] Theoretical Knowledge
- [ ] Practical Skills
- [ ] Computer Skills
- [ ] Communication Skills
- [ ] Work Ethic
- [ ] Punctuality
- [ ] Attendance
- [ ] Interpretation of Drawings and Documents
- [ ] Project Management Skills
- [ ] Working in a Team
- [ ] Attitude Other:
- [ ] ____________________

71. The guidance provided by the department and the University of Technology to learners with regards to the process of registration for the Work-Integrated Learning program is adequate *

Mark only one oval.

Strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly agree

*

72. The information provided by the University of Technology about the process of securing Work-Integrated Learning opportunities through the institution is sufficient

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

73. The overall assistance and support provided by the University of Technology in securing a workplace for Work-Integrated Learning is sufficiently adequate *Mark only one oval.* *

Strongly disagree

1

2

3

4

5

Strongly agree

74. Please describe or list or Work-Integrated Learning challenges you have experienced as an University of Technology staff member

Skip to section 5 (End)

Learner

75. Please state your Work-Integrated learning status *

Mark only one oval.

- Unplaced
- Registering for P1
- Busy with P1
- Busy with P2
- Completed P1 and P2

76. The University of Technology has sufficient capacity (staff, finance, vehicles) to * perform Work-Integrated Learning functions

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

*

77. Adequate monitoring visits were performed by the academic staff while you were at the workplace.

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

78. The engineering department is sufficiently resourced to perform workplace monitoring visits *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

79. There were sufficient University of Technology programmes and interventions to enhance your understanding of Work-Integrated Learning *

Mark only one oval.

*

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

*

80. The communication levels between learners qualifying for Work-Integrated Learning and the co-operative education department is adequate

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

*

81. The communication levels between learners qualifying for Work-Integrated Learning and the engineering department is adequate

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

82. The communication levels between co-operative education department and the learner while at the workplace is adequate *

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

83. The communication levels between the engineering department and the learner while at the workplace is adequate *

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

*

84. The communication levels between the engineering department and the mentor at the workplace is adequate

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

*

85. The communication levels between the co-operative education department and the mentor at the workplace is adequate

Mark only one oval.

*

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

86. Feedback from the engineering department providing information regarding Industry Liaison Committee (Advisory Board) meetings and Work-Integrated Learning issues raised is given to learners *

Mark only one oval.

*

Strongly disagree

1

2

3

4

5

Strongly agree

87. The co-operative education department's system for placement of learners is very effective *

Mark only one oval.

	Strongly disagree	
1		◯
2		◯
3		◯
4		◯
5		◯
	Strongly agree	

88. The engineering department system for placement of learners is very effective *

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

89. The co-operative education department staff performs adequate monitoring visits to learners at the workplace *

Mark only one oval.

	Strongly disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly agree

*

90. The engineering department staff performs adequate monitoring visits to learners at the workplace

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

91. The engineering department’s system for the monitoring of learners at the workplace is well organised *Mark only one oval.* *

Strongly disagree
1
2
3
4
5
Strongly agree

92. How long did you wait for the arrangement of a workplace from co-operative * department after you submitted your curriculum vitae (cv) to them?

Mark only one oval.

*

- 1 - 3 months
- 3 - 6 months
- 6 months - 1 year
- 1 - 2 years
- More than 2 years
- None as yet

93. The marketing strategy of the University of Technology in growing the industrial network to increase workplace opportunities is adequate

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

94. The University of Technology's usage of media, website, newsprint and other channels used to attract workplaces opportunities is adequate *

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

95. The logbook tasks are aligned to the tasks at the workplace *

Mark only one oval.

Strongly disagree
1
2
3
4
5
Strongly agree

96. The workplace provides the full scope of the logbook requirements *

Strongly disagree
1
2
3
4
5
Strongly agree

*

Mark only one oval.

97. Much of the theory learnt at the University of Technology was applied in the workplace

Mark only one oval.

Strongly disagree
1 ( )
2 ( )
3 ( )
4 ( )
5 ( )
Strongly agree

*

98. The level of your work preparedness provided by the University of Technology with regards to communication skills is acceptable for industry needs

Mark only one oval.

	Strongly disagree
1	
2	
3	
4	
5	
	Strongly agree

99. Your work preparedness level with regards to practical skills from the University of Technology is acceptable to perform related tasks in the workplace *

Mark only one oval.

	Strongly disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly agree

100. Your workplace "mentor" successfully performs the mentoring duties *

Mark only one oval.

Strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly agree

101. The workplace mentor's attitude towards you, as the learner, is acceptable *

Mark only one oval.

Strongly disagree
1 ( )
2 ( )
3 ( )
4 ( )
5 ( )
Strongly agree

102. Your mentor's attitude towards others is acceptable *

Mark only one oval.

Strongly disagree
1 ( )
2 ( )
3 ( )
4 ( )
5 ( )
Strongly agree

103. Your mentor's knowledge about the logbook tasks is acceptable *

Mark only one oval.

Strongly disagree

1

2

3

4

5

Strongly agree

104. What are the areas did you lack while at the workplace? (More than 1 box may be ticked)

Check all that apply.

- [ ] Theoretical Knowledge
- [ ] Practical Skills
- [ ] Computer Skills
- [ ] Communication Skills
- [ ] Work Ethic
- [ ] Punctuality
- [ ] Attendance
- [ ] Interpretation of Drawings and Documents
- [ ] Project Management Skills
- [ ] Working in a Team Other:
- [ ] ____________________

105. What are the areas of excellence you displayed during Work-Integrated * Learning at the workplace?(More than 1 box may be ticked)

Check all that apply.

- [ ] Theoretical Knowledge
- [ ] Practical Skills
- [ ] Computer Skills
- [ ] Communication Skills
- [ ] Work Ethic
- [ ] Punctuality
- [ ] Attendance
- [ ] Interpretation of Drawings and Documents
- [ ] Project Management Skills
- [ ] Working in a Team
- [ ] Other:

*

106. The workplace is sufficiently resourced to support your development as a Work-Integrated learner

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

*

107. The workplace is sufficiently resourced with tools and equipment your development during Work-Integrated Learning

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

*

108. The workplace is sufficiently resourced with information related to the operation through the availability of manuals and other information *Mark only one oval.*

Strongly disagree
1
2
3
4
5
Strongly agree

109. Please indicate the monthly stipend or allowance during Work-Integrated * Learning

Mark only one oval.

- None
- Less than R1,000 per month
- R1,000 - R2,000 per month
- R2,000 - R3,000 per month
- R3,000 - R5,000 per month R5,000
- - R10,000 per month more than
- R10,000 per

110. Did the workplace provide the following?(More than 1 Box may be ticked) *

Check all that apply.

- [ ] Personal protective equipment
- [ ] Tools
- [ ] Meals or meal allowance
- [ ] Transport
- [ ] Other:

111. The knowledge and information provided by the department and the University of Technology with the process of registration for your Work Integrated Learning program was adequate *

Mark only one oval.

Strongly disagree

1
2
3
4
5

Strongly agree

112. Please indicate the number of times an application was made using each of the * listed methods to secure a Work-Integrated Learning opportunity

Mark only one oval per row.

	0 applications	1-5 applications	6-10 applications	11-20 applications	21 or more applications
Internet					
Telephonic					
Email					
Social media					
Knock on door					
Co-operative education department					

113. How many different workplaces were you exposed to for you to complete * your P1 and P2

Mark only one oval.

- None
- One
- Two
- Three or more

114. Please indicate the number of years you have been waiting for Work * Integrated Learning opportunity after completing all your academic subjects *Mark only one oval.*

less than 1 year

1 - 2 years

2 - 3 years

3 - 4 years4 - 5 years more than 5 years

115. Which of the following structured programs were you exposed to as part of * Work-Integrated Learning? (More than 1 box may be ticked)

Check all that apply.

- Theoretical Short Course
- Practical Skills Program
- Completed P1 at Training Centre

116. What was your average aggregate of your S4 results *

Mark only one oval.

40 - 49 %

50 - 59 %

60 - 69 %

70 - 79 %

80 - 89 %

90 - 100 %

117. Health and Safety is sufficiently covered during the academic program *

Mark only one oval.

	Strongly disagree
1	◯
2	◯
3	◯
4	◯
5	◯
	Strongly agree

118. Please detail any other challenges you experienced with regards to Work-Integrated learning

____

____

____

____

____

Skip to section 5 (End)

End

Thanks you for your time. The survey has now ended

Annexure 5- Questionnaire 2

WIL challenges -Focus Group Interview

1. ***Evaluate the current WIL interventions for the following:***

    a. *Preparing WIL learners for the workplace.*

i *What is your perceptions of the interventions for learner preparation for the workplace.*

ii *What is your perceptions of the current training interventions for University staff involved in WIL.*

iii *What is your perceptions of the current training and development interventions of Industry Mentors?*

iv *How can the preparation of WIL learners be improved?*

v *How can the training for University staff be improved?*

vi *How can the training and development for Industry Mentors be improved?*

    b. *Training of University staff involved in WIL activities.*

i *What is your perceptions of the interventions for learner preparation for the workplace.*

ii *What is your perceptions of the current training interventions for University staff involved in WIL*

iii *What is your perceptions of the current training and development interventions of Industry Mentors?*

iv *How can the preparation of WIL learners be improved?*

v *How can the training for University staff be improved?*

vi *How can the training and development for Industry Mentors be improved?*

    c. *Training of industry mentors for WIL activities.*

vii *What is your perceptions of the interventions for learner preparation for the workplace.*

viii *What is your perceptions of the current training interventions for University staff involved in WIL*

ix *What is your perceptions of the current training and development interventions of Industry Mentors?*

How can the preparation of WIL learners be improved?

i *How can the training for University staff be improved?*

ii *How can the training and development for Industry Mentors be improved?*

.

2. Review the contributions and impact of the current University of Technology Diploma in Engineering

i. *Evaluate the contributions of qualified technicians to the economy.*

ii. *Evaluate the contributions to the labour market.*

iii. *Evaluate the contribution to the socio-economic status of the previously disadvantaged.*

iv. *Evaluate the relevancy of the engineering diploma to industry needs.*

3.Assessing WIL challenges

i *Assess the challenges encountered by WIL learners.*

ii *Assess the challenges encountered by the UoT staff in WIL related activities.*

iii *Assess the WIL challenges encountered by Industry Mentors.*

iv *Assess any other challenges that will impact negatively on WIL.*

4.WIL contributions and improvements.

i *What improvements can be made to mitigate WIL challenges?*

ii *What improvements can be made to increase access to workplaces?*

iii *What training framework and strategies are needed to recommend a new WIL programme for the UoT engineering diploma?*

5. What are the impacts when the placement of learners is delayed for long time?