STUDENT PREPAREDNESS FOR WORK INTEGRATED LEARNING (WIL) IN BIOMEDICAL TECHNOLOGY.

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DECLARATION

This is to certify that this is my own work and that it has not been submitted to any other institution.

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DEDICATION

This Masters dissertation is dedicated to my late parents Mrs Y. Govender and Mr A.S Govender and my late father- in-law Mr S Govender, my brothers Ivan, Jerry, Kersy and sister Sharon.

Last but not least, my supportive family, my wife, Ronica, my son Megz and my daughter Soorisha for allowing me time and space to complete this dissertation.

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LIST OF ABBREVIATIONS	
CHE	Council of Higher Education
CPD	Continuous Professional Development
DoB&CT	Department of Biomedical and Clinical Technology
DoH	Department of Health
ECP	Extended Curriculum Programme
EL	Experiential Learning
ELT	Experiential Learning Theory
ETDP	Education, Training and Development Practices
FA	Factor Analysis
FoHS	Faculty of Health Sciences
HEI	Higher Education Institution
HEQC	Higher Education Quality Committee
HPCSA	Health Professions Council of South Africa
HWSETA	Health and Welfare Sector Education and Training Authority
IREC	Institutional Research Ethics Committee
ILP	Integrated Learning Project
KMO	Kaiser-Meyer-Oikin
LP3	Laboratory Practice 3

NHLS	National Health Laboratory Service
SETA	Sector Education and Training Authority
SOP	Standard Operating Procedure
SSIRPP	Science Student Industry Research Placement Program
UoT	University of Technology
UsoT	Universities of Technology
WIL	Work Integrated Learning
WoW	World of Work

ABSTRACT

Background:

According to the Council of Higher Education (CHE), work integrated learning (WIL) is one of the key tools for developing graduate attributes for the world of work (Council on Higher Education, 2011). Biomedical Technology is a highly skilled profession with no room for error since diagnosis and treatment of patients' conditions depend primarily on accurate results. Students enrolled for the National Diploma Biomedical Technology at the Durban University of Technology (DUT) spend two and a half years at the University of Technology (UoT) acquiring formal instruction and a compulsory six month period of WIL at Health Professional Council of South Africa (HPCSA) accredited training laboratories in order to develop into graduates who are work-ready and familiar with organizational practice.

Despite the established benefits of WIL, there is no data which ascertains whether the strategies employed by the Biomedical Technology programme for preparing students for undertaking WIL are actually successful. Nor has there been structured reflection to establish the partnership between the department and the training sites and its effectiveness for WIL. In addition, it would be important to ascertain whether the conditions of the workplace are conducive for WIL. This information would therefore be extremely valuable in informing whether the outcomes for WIL have been optimally achieved and would further influence curriculum review development and delivery.

The purpose of the study therefore, was to determine the degree of work preparedness of students' exposure and experience for WIL through a descriptive analysis of the perceptions of students regarding WIL. In addition, the perceptions of laboratory supervisors on students' preparedness for training at these HPCSA accredited laboratories, as well as the quality of the partnership between the department and the training unit, were also be ascertained.

Methods:

A questionnaire, was the chosen method of data collection. A questionnaire which included quantitative and qualitative components provided a descriptive analysis of the preparedness of students in the Biomedical Technology programme for WIL. A saturation sample of all final year students registered for the National Diploma in Biomedical Technology at the DUT constituted the sample. This constituted students who completed their WIL at HPCSA registered training sites in both private and state laboratories.

Results:

The Cronbach's alpha showed an overall reliability score of excellent degree of internal consistent scoring for the different aspects of the research. Factor analysis results showed moderate inter-correlation and inter-relatedness between the measured variables.

The students were generally satisfied with the beneficial WIL orientation and the workplace orientation programme. The students and supervisors indicated the inadequacy of the practical component at the university, and recommended the purchasing of updated and advanced practical equipment.

The salient findings were that:

- Student's theoretical and ethical knowledge is poor, including under preparedness for the world of work (WoW).
- Inherent increased training cost and supervisor's workload.
- Support from university in terms of communication and engagement needed improvement.

Conclusion:

This study investigated student preparedness for work integrated learning, and raised a variety of issues from both students and supervisors. The good practices in the

Biomedical Technology programmes will be reinforced, and strategies will be formulated and implemented to address the areas of concern, now that it has been formally researched.

This study concluded that students were generally not well prepared for the workplace. The curriculum review of the programme was identified as a concern, particularly in the third year where the WIL is the major component. These findings will certainly inform the WIL offering in the new curriculum, and can be extrapolated to the Health Sciences community at large.

CHAPTER 1

INTRODUCTION AND BACKGROUND OF THE RESEARCH STUDY

1.1. INTRODUCTION

Work-integrated programs started in the United States of America almost a hundred years ago where an engineering lecturer felt that students needed more than classroom teaching in order to gain practical experience and master the skills required for the profession (Sovilla and Varty, 2005). In South Africa, the Universities of Technology (UsoT) (formerly known as Technikons), were engaged in experiential learning (EL), now called work-integrated learning (WIL) (Wessels, 2014). In WIL, theory taught at the UsoT is practised at the workplace as part of the curriculum developed at the university as informed by industry partners (Dorasamy and Rampersad, 2018), and aims to integrate theory with the practical component.

The WIL also encourages building of work and professional relationships with industry partners as a result of a well-established curriculum that equip students with knowledge, skills and attitudes to successfully participate in the world of work (WoW) (Helyer and Lee, 2014). According to Moletsane (2014) there is a need to develop students that are ready for the workplace and these graduates must be able to transfer the knowledge and skills from the classrooms to the workplace.

Although current research indicates the value of WIL in enhancing student work-readiness by preparing students for the transition into the workplace (Chillas et al, 2015; Jackson et al, 2015) as well as in the development of professional skills (Jackson, 2013; Smith et al., 2014), there is still debate with regards to the extent to which WIL contributes to

preparedness and enhanced employability outcomes across disciplines (Peters et al 2014).

1.2. BACKGROUND OF THE STUDY

The workplace has become increasingly competitive and the emerging perspective of employers is that students must enter the workplace with the necessary skills such as soft skills, good oral and written communication abilities, time management, teamwork and initiative which are meant to have been acquired at the university (Dorasamy and Rampersad, 2018). In addition, students will have to prove themselves to gain acceptance, respect and credibility at the workplace by exhibiting the theoretical knowledge gained at the university. Through partnerships with employers, jobs are secured for graduates where they are observed and engage with the students and as a result could be potential employees of the company which can reduce costs for recruitment and induction (Roopnarain and Akoobhai, 2014). Furthermore, organisations want employees who fit into their culture and can then form part of their team.

However, in order to be truly effective in producing students with such attributes, Bates and Hayes (2017) assert that such experiences be embedded in curriculum and must be supported by pedagogical strategies throughout the programme. But in spite of these strategies, there is still a gap in the literature regarding the benefits of WIL, particularly in the South African context (Govender and Walt, 2017), hence a need for further evaluation.

The motivation of this research stems from the broad consensus in the literature that there are challenges in evaluating the effectiveness of WIL with empirical data (Rowe and Zegwaard, 2017), especially with regards to student preparedness. In addition, concerns from the supervisors regarding the lack of preparedness of students when they embark on WIL have been raised at the researcher's department stemming from reports from laboratory supervisors, Curriculum workshops, LP3 Review workshops and from Advisory Board meetings (Department of Biomedical and Clinical Technology files ; minutes – WIL file, Annual performance report).

This is in spite of the very structured WIL programme where the Department of Biomedical and Clinical Technology ensures that students in the Biomedical Technology programme go through all disciplines so that they get to experience the practical aspects of the theory, which was covered at the University.

Briefly, the DUT lecturers in the Biomedical Technology programme visit students and laboratory supervisors at least seven times during the WIL period to check on student progress and any concerns from the laboratory supervisors. Feedback may be elicited verbally during the visits or at the Joint Advisory Board meetings that are held twice a year where LP3 is a standing item on the agenda. Furthermore, another opportunity for communication is at the LP3 Review Workshop where all trainers give a presentation on the past year of LP3 and supervisors together with University lecturers engage in subject committee break away sessions. In addition, the lecturers send out questionnaires to the students and laboratory supervisors for feedback on the current year of training. These questionnaires are in-house that provide useful feedback from all stakeholders. Any shortcomings or gaps are identified and are attempted to be addressed in the year of LP3. Feedback from students and the laboratory supervisors indicate that there were several gaps in the manner in which the programme was being delivered, or in the complexity of the content.

Since the WIL activities are geared to enable students to make an informed choice for specialisation when they qualify, these issues were perceived by the programme as critical for the university and the profession, and thus prompted the need for this study. Therefore, the aim of this study was to determine the perceptions of students and laboratory supervisors on the work preparedness for WIL during the final year of the National Diploma: Biomedical Technology.

1.3. PURPOSE OF THE STUDY

The purpose of this study was thus two-fold: (1) to determine the perceptions of students about the workplace training, in order to ascertain whether they are under prepared for the workplace and (2) as well as the perception of laboratory supervisors on students'

competence in the performance of the clinical techniques and procedures at these laboratories.

The main research question of this research stems from the concerns from the supervisors about the under- preparedness of the students for clinical training.

1.4. OBJECTIVES OF THE STUDY

The study aims to determine the preparedness of students for WIL through the perceptions of students and laboratory supervisors on the preparedness for WIL during the final year of the National Diploma: Biomedical Technology.

The specific objectives are:

1. To determine the perceptions of Biomedical Technology students' about their preparedness for WIL training.
2. To determine the perceptions of the academic laboratory supervisors about the students' preparedness for WIL training.
3. To determine the conditions under which students undergo training during WIL placement.
4. To reflect on the quality of partnerships which exist between the Department of Biomedical and Clinical Technology and the training laboratories.

1.5. SIGNIFICANCE OF THE STUDY

The benefits of WIL are indisputable; however the evidence is informal and anecdotal (Govender and Walt, 2017), with the need for concrete, measurable evidence. A study of this kind has not been conducted with students and laboratory supervisors in the Biomedical Technology Programme from KwaZulu-Natal, or, according to the researcher's knowledge, in South Africa. This study will help the programme identify gaps in student preparedness for WIL, with subsequent refining to the curriculum and thereby

better equipping students when they leave the institution for the work environment. The findings may also be extrapolated to other universities which offer this programme, and even other programmes from the University which have a similar structure for workplace placement.

1.6. CONCLUSION AND STRUCTURE OF THE THESIS:

The remaining chapters of this dissertation are structured as follows: Chapter 2 presents a comprehensive literature review on what exists in terms of the higher education landscape in South Africa, how WIL is contextualised nationally and internationally, and the benefits thereof. This section also explores the approaches to evaluating the effectiveness of WIL on overall student training. The discussions are linked to the objectives of the study. In chapter 3 the study methodology used in the research has been described, this included the study design, the data collection and data analysis, sampling, reliability/validity, limitations and ethical considerations. Chapter 4 includes a comprehensive descriptive and inferential analysis of the results compiled from the data collected as well as a comprehensive, in-depth discussion of the findings of the study. Finally in Chapter 5 the conclusions and recommendations of the study are presented.

In conclusion, the Biomedical Technology programme does not have documented evidence to gauge whether our students are adequately prepared for WIL placement. In view of the concerns around issues regarding student preparedness which have been raised at various departmental fora, it will be very valuable for the programme to ascertain if students are adequately prepared in the current context for WIL. Furthermore, it will also be valuable to determine whether the conditions under which are students are trained enable or impede learning, and whether the partnership between the department and the training laboratories is conducive to achieving the outcomes of WIL.

CHAPTER 2

LITERATURE REVIEW, THEORETICAL AND CONCEPTUAL FRAMEWORK

2.1. INTRODUCTION

The work integrated learning (WIL) is a core component of training received at Universities of Technology (UsoT) since it provides a means of making graduates “work ready” and this in turn, enhances their skills and employability (Jackson, 2013). South African UsoT post 1994, have been through transformation in order to address the imbalances of apartheid and to equip students from diverse backgrounds to cope with the demands of the workplace. The WIL entails a collaboration between the UsoT and the industry to provide mutual benefit for students and their employability needs (CHE, 2011). This study’s aim was to determine the preparedness of students for WIL through the perceptions of students and laboratory supervisors on the preparedness for WIL during the final year of the National Diploma: Biomedical Technology. This chapter covers the context of WIL and its role on education, the global and South African perspectives, theoretical frameworks, the challenges, and the WIL partners.

2.2. THE CONTEXT OF WORK INTEGRATED LEARNING AND ITS ROLE IN HIGHER EDUCATION

There is an expectation that the students will use all the theory taught at the University into a practice based setting (Ferns and Moore, 2012). Makhathini (2016) reaffirms that WIL should promote the integration of theoretical concepts learnt at the University with the workplace practices. It was further iterated that the WIL period constitutes the application of knowledge with developing skills and ensuring a professional attitude towards the workplace. The WIL is a way of preparing graduates for the world of work that the student experiences (Ferns and Moore, 2012). The effectiveness of WIL depends on faculty-student, staff-student, supervisor-student and student-student collaborative and

cooperative partnerships (Gershenfeld, 2014; Smith and Smith, 2010; Crisp and Cruz, 2009).

2.3. WORK INTEGRATED LEARNING FRAMEWORK

The experiential learning theory (ELT) provides a holistic model for the student's learning and a multilinear model for adult development (Kolb, 1984). The "experiential" concept stems from intellectuals origins of Dewy, Lewin and Piaget. The Lewinian and Dewey's models are similar where there is observation and action whereas in Piaget's Model there are various stages of cognitive growth and is referred to as active learning (Kolb, 1984). Cobb (1994) notes the two major trends: cognitive constructivist and social constructivist where it deals with an individual who tries to make sense of the world. These are derived from the Piagetian theory where a learner will try to construct via experience (Piaget, 1977). For purposes of this dissertation Kolb's learning cycle has been chosen since it best reflects the current WIL practice.

There are four modes of Kolb's learning cycle (refer to Figure 1 below) that are concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and finally active experimentation (AE) (Kolb, 1984). Concrete experience (CE) refers to the tangible feelings of the world that we get by relying on our senses (Kolb, 1984). In the transforming or processing experience people tend to watch others who are involved in the experience and tend to reflect on what's happening whilst others just get on with it and start doing things. The people that watch or observe favour reflective observation (RO). Abstract conceptualisation (AC) is when people tend to perceive, grasp or take hold of any new information that may arise when one is thinking about, analysing or planning rather than using sensation as a guide. The fourth mode AE implies the practical learning, which a learner can obtain in a real work setting. The learning is integrated whereby each stage can feed into another stage and can enter the cycle at any stage to follow its sequence. Kolb mentions different people prefer a single learning style. The learning style allows learning to a particular method, namely diverging (CE/RO) where people look at things from various perspectives, assimilating (AC/RO) which involves a logical approach, converging (AC/AE) where people can solve problems using a practical way and finally

accommodating (CE/AE) which involves people using practical and experiential approach (McLeod, 2017).

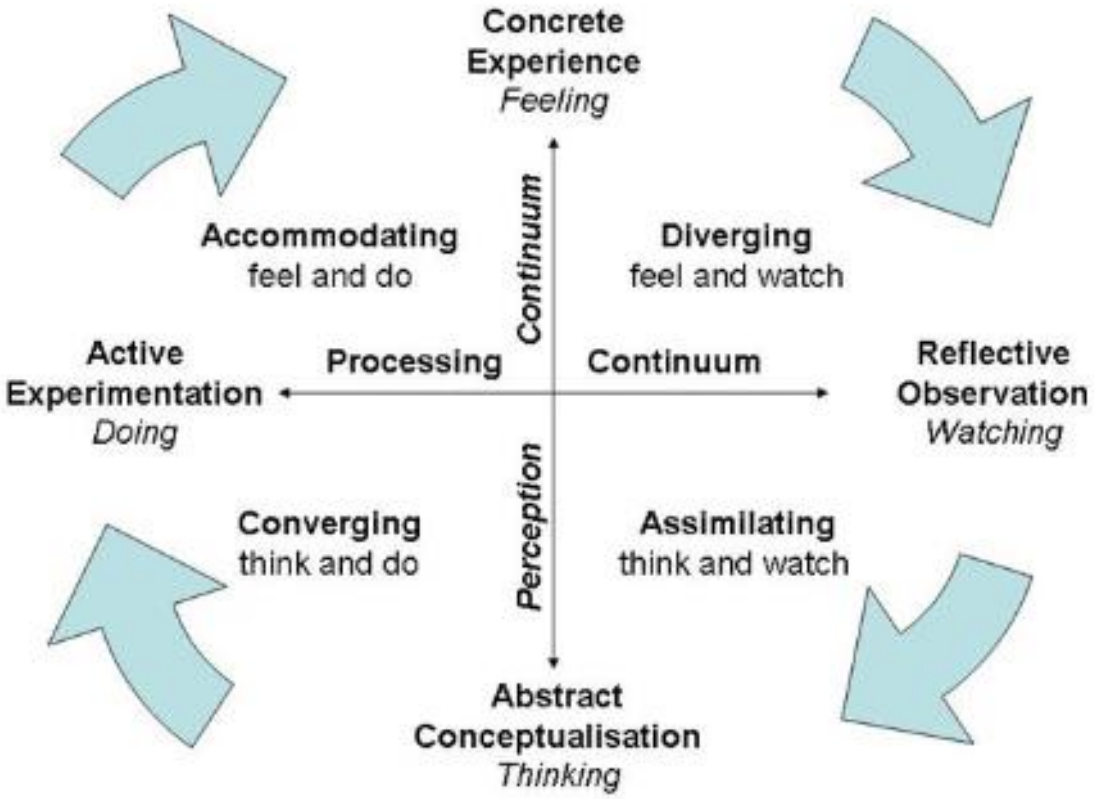

Figure 1 The Experiential Learning Cycle adapted from McLeod 2017

Students then enter the workplace for practical training and get a taste of real-life experience. During this period, in Biomedical Technology, it is a six months rotation, the student is still registered as the WIL component is known as Laboratory Practice 3. In the six months, students rotate through seven disciplines (Table 1) below.

Table 1: Rotational WIL Placement for Individual Student for Laboratory Practice 3

Cycle of Study	Rotational Flow Chart for Student Placement		
Cycle 1	Chemical Pathology (6 Weeks)		
Cycle 2	Haematology (5 Weeks)	Blood Transfusion (1 Week)	
Cycle 3	Cytology (3 Weeks)	Virology (1 Week)	Histology (2 Weeks)
Cycle 4	Microbiology (6 Weeks)		

Table 1 above represents that placements of individual students in various specialist disciplines of Biomedical Technology programme. The varied duration in each specialist discipline is based on the learning outcomes as determined by subject specialists in consultation with industry supervisors and students during the Laboratory Practice 3 workshops that are held prior to WIL placement.

The main work- integrated learning (WIL) stakeholders are the student, the university and the industry (Figure 2) below. The student registers at the university and is provided with the theoretical background.

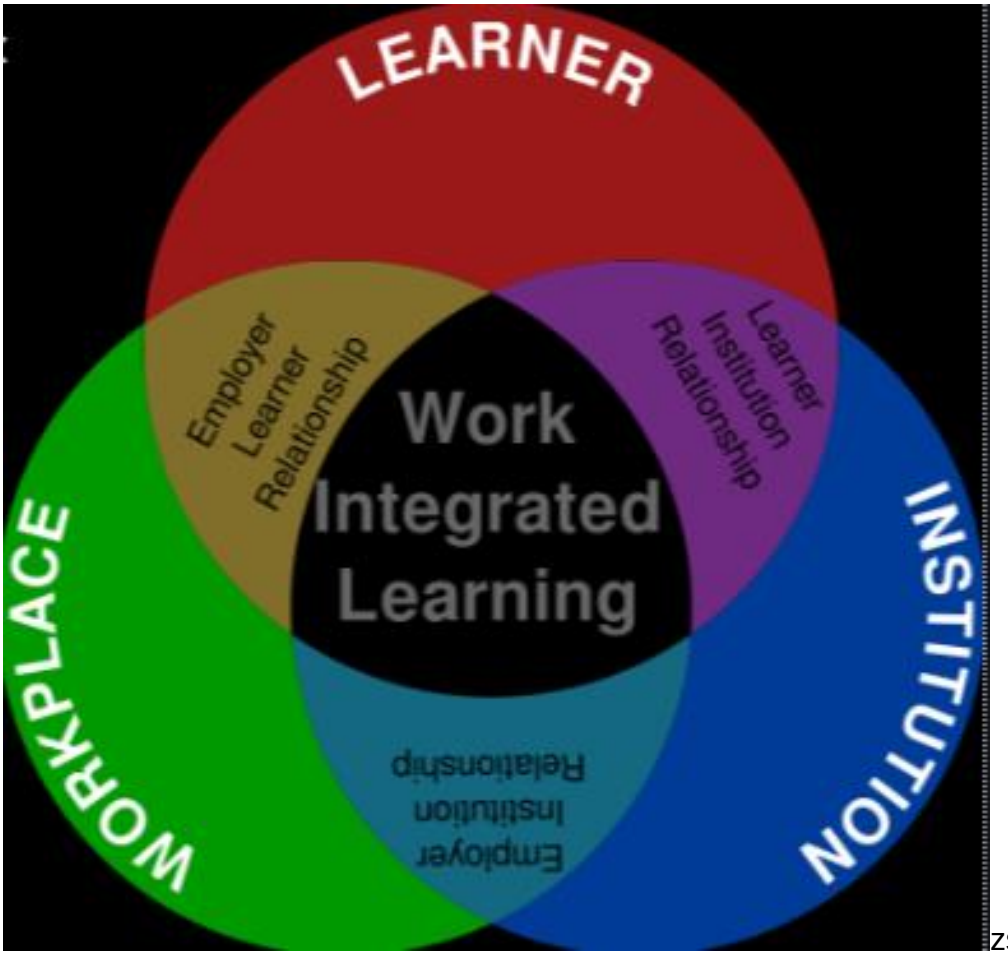

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Figure 2 Relationship between student, the Institution (UoT) and the workplace (Industry) Adapted from Patrick et al. (2008)

The university is in constant contact with the industry and a close liaison exists between the two. Curriculum meetings are held throughout the year and industry partners are always invited for input on the curriculum. There are also advisory boards that are set up which comprises of academic staff, industry as well as students. The student integrates the theoretical knowledge gained at the University. The University interacts with Industry partners through networking via supervisors, work employees and peers to provide a working experience. “Learning is the process whereby knowledge is created through the transformation of experience” (Kolb, 1984).

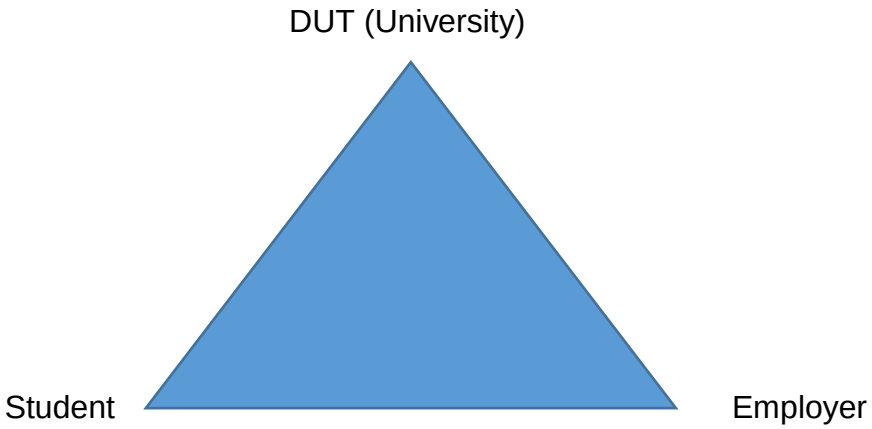

Figure 3 Triangulated diagram of Durban University of Technology, student and the employer

The triangulated diagram (Figure 3) depicts three main components which is the university, the student and the employer. The university (DUT) where the student has registered for the work integrated learning subject, the student who will gain theoretical knowledge and skills from the University, and finally employers who form the dynamic work environment. Key values and skills include professionalism, honesty and integrity, problem solving, adaptability, positive attitude, and leadership to name a few. The employers have a social responsibility to employ graduates but may harness the students so that they may be their potential employees in the future. However, there are other institutions that need to be incorporated like the professional bodies and funders like the Health and Welfare Sector Education and Training Authority (HWSETA) that provides students with bursaries and stipends.

Experiential learning in higher education stems from John Dewey (Kolb, 2014) who believed people learn best by doing. It is known that learning is enhanced when the students are engaged in the studies and learning. For active experimentation students can discuss, debate and create. Concrete experience can be achieved by exploration and review. Construction involve analysis, recall and reflection. Finally abstraction is when students synthesize, plan and hypothesize (Velarde et al, 2014).

South African UsoT post 1994 have been through transformation in order to address the imbalances of apartheid and to equip students from diverse backgrounds to cope with the demands of the workplace. The Higher Education Quality Committee (HEQC) embarked on restructuring higher education (CHE, 2011). An integral part of the restructuring included workshops and publications to academics in order to review their current practices in teaching and learning and to reflect on the purpose of WIL (CHE, 2011). The Biomedical Technology programme at DUT participated in a research project funded by the Council on Higher Education (CHE). The project was entitled "*Quality management of the design and implementation of learning programmes that incorporate work-integrated learning (WIL) and service learning and promotes articulation for learners within the career trajectory".* The objective of this project was to review the curriculum with emphasis on WIL so that there was alignment with the ethos of the HEQC (Medical Technology News, 2006). The CHE further describes WIL as a combination of knowledge gained and practice based skills in the workplace with the intention of students developing through experience in their chosen vocation (CHE, 2011).

There has been a steady call from industry for HEIs to produce graduates who are more ready for the workplace. Graduates who possess the attributes to integrate theory with practical knowledge, have the ability to transfer this knowledge, and use this for innovation, as well as possess the technological savvy associated with the age that we live in (Steven and Fallows, 2000). The WIL component provides the opportunity to achieve this in part, in a real clinical workplace setting (Ferns and Moore, 2012). Employers see advantages in the WIL programme in that students have the opportunity to improve their "soft skills" such as working as a team, keeping up to deadlines and interacting with fellow students, supervisors and clients (Elijido – Ten and Kloot, 2014).

The National Diploma in Biomedical Technology that is offered at the DUT is a structured programme where a learner can complete with a three-year mainstream qualification or a four year extended curriculum programme (ECP). The final six months of both streams is known as Laboratory Practice 3 (LP3), the WIL component where the student is placed at

a Health Professional Council of South Africa (HPCSA) accredited training laboratory. During LP3 the students are exposed to real-life clinical learning experiences in various Biomedical Technology categories. The integrated theory learned from UsoT and the clinical practice at the workplace for holistic and authentic learning process falls under the direct supervision of the resident training supervisor.

Table 2: National Diploma: Biomedical Technology (Mainstream and Extended)

NATIONAL DIPLOMA: BIOMEDICAL TECHNOLOGY (MAINSTREAM)		
Year 1 Semester 1	**Year 2 Semester 1**	**Year 3 Semester 1**
Anatomy and Physiology Module A Chemistry Physics Calculation and Statistics Introduction to Medical Technology	Cellular Pathology 1 Microbiology 1 Blood Transfusion Technology 2 Chemical Pathology 1	Cellular Pathology 3 Microbiology 3 Haematology 3 Chemical Pathology 3
Year 1 Semester 2	**Year 2 Semester 2**	**Year 3 Semester 2**
Anatomy and Physiology Module B Pathophysiology Biochemistry Immunology	Cellular Pathology 2 Microbiology 2 Haematology 2 Chemical Pathology 2	**Work Integrated learning (WIL) in an HPCSA accredited laboratory**

NATIONAL DIPLOMA: BIOMEDICAL TECHNOLOGY (EXTENDED)			
Year 1 Semester 1	**Year 2 Semester 1**	**Year 3 Semester 1**	**Year 4 Semester 1**
Introduction to Medical Technology Foundation Chemistry Foundation Physics	Anatomy and Physiology Module A Laboratory Techniques Foundation Biochemistry Foundation Immunology	Cellular Pathology 1 Microbiology 1 Blood Transfusion Technology 2 Chemical Pathology 1	Cellular Pathology 3 Microbiology 3 Haematology 3 Chemical Pathology 3
Year 1 Semester 2	**Year 2 Semester 2**	**Year 3 Semester 2**	**Year 4 Semester 2**
Pathophysiology Physics Calculation and Statistics Chemistry	Anatomy and Physiology Module B Biochemistry Immunology	Cellular Pathology 2 Microbiology 2 Haematology 2 Chemical Pathology 2	**Work Integrated learning (WIL) in an HPCSA accredited laboratory**

Table 2 lists all the subjects in the mainstream and extended programme that has a duration of three years and four years respectively.

The table 2 above lists all the subjects in the ECP programme that span four years. The WIL component of the Biomedical Technology programme is offered in the third year of

study and its credit value is 0.5 which signifies the importance of WIL in this programme. Furthermore, the programme is cognizant of the role and the presence of the industry partners as reflected by Dorasamy and Rampersad (2018).

Table 3: Learning Programme Structure

Code	Subjects	Year of Study	NQF Level	Nated Credits	Pre-req Code
IMET 101	Introduction to Medical Technology	1	5	0.050	None
CSTA101	Calculation and Statistics	1a	5	0.100	None
CHMB102	Chemistry	1a	5	0.125	None
PYSC105	Physics	1a	5	0.100	None
BIOA202	Biochemistry2	1b	5	0.125	None
IMMU202	Immunology2	1b	5	0.125	None
ANPH114	Anatomy & Physiology(Module A)	1a	5	0.125	None
ANPH124	Anatomy & Physiology(Module B)	1b	5	0.125	None
PAPH201	Pathophysiology 2	1b	5	0.125	None
BLTT201	Blood Transfusion Technology 2	2a	6	0.125	IMMU202
CEPA 101	Cellular Pathology 1	2a	6	0.125	ANPH114, ANPH124,
CPAT101	Chemical Pathology 1	2a	6	0.125	BIOA202, CHMB102
MCGY101	Microbiology1	2a	6	0.125	
HAEM203	Haematology 2	2b	6	0.125	BLTT201, PAPH201
CEPA201	Cellular Pathology 2	2b	6	0.125	CEPA101 PAPH201
CPAT202	Chemical Pathology 2	2b	6	0.125	CPAT101 PAPH201
MCGY203	Microbiology 2	2b	6	0.125	MCGY101 PAPH201
HAEM 303	Haematology 3	3a	6	0.125	HAEM203
CEPA 301	Cellular Pathology 3	3a	6	0.125	CEPA201
CPAT303	Chemical Pathology 3	3a	6	0.125	CPAT202
MCGY301	Microbiology 3	3a	6	0.125	MCGY203
LABP301	**Laboratory Practice 3**	**3b**	**6**	**0.500**	**LABP301**

***A pre-req means this subject must be passed prior to registration (prerequisite)**
a denotes first semester, b denotes second semester

The table 3 above lists all the subjects in the Biomedical Technology programme with its credit values. The WIL component make up the bulk of the qualification credit and equates to 0.5 credits.

2.4. PARTNERSHIPS IN WORK INTEGRATED LEARNING

According to Elijido – Ten and Kloot (2014) there is a three way partnership in WIL; the student, the employer and the University. Elijido –Ten and Kloot (2014) goes further and notes that the partners should be the employers, students, universities as well as the

professional bodies. The DUT experiential learning policy (2006) also states that partnerships should exist between the University, community, private and public sector. The WIL allows students to apply theoretical knowledge learnt at the University in a practical setting at the workplace (Jackson et al 2013).

The Experiential Learning Policy of DUT (DUT, 2006) states that the University will facilitate the placement of students in accredited training sites. The university should approve each site for training in collaboration with professional bodies. The Professional Board for Medical Technology accredits laboratories for training purposes and students spend six months in these training centres (HPCSA FORM 108). In a study to investigate WIL experience in a Science Student Industry Research Placement Program (SSIRPP), Australia, it was found that the timing of these placements are crucial and students feel that the time spent in some settings are insufficient to achieve the competencies to practice (Rayner and Papakonstantinou, 2015).

There is a very close liaison between DUT and the industry partners. There are formal meetings that both attend annually, namely Joint Advisory Board Meetings that are held biannually; yearly Laboratory Practice 3 Review workshops and when the need arises Curriculum workshops. Further, there are informal meetings and communication with all Industry partners. There are memoranda of understanding between the University, Biomedical Technology programme and its partners relating to training and research. An Umbrella Agreement between DUT and the NHLS was established in 2018. There exists a mutually beneficial relationship between the UsoT and the laboratories in training of student Medical Technologists and the laboratory supervisors teaching of our students without any monetary compensation.

In the National Diploma in Biomedical Technology programme, WIL forms an integral component that is has allocated credits, is assessed and is a compulsory requirement in order to attain the qualification. When Biomedical Technology students are placed for experiential learning, they observe and in some cases work on second line specimens under supervision that is specimens that have already been processed and results sent

out. This assists them in their learning process, and together with supervisor mentoring, helps with the development of competency in the field. It is very clear that supervisors play a pivotal role in the training for WIL students. It often happens that when students begin as WIL students they are disorientated and stressed (Murphy, 2001). Support and meaningful feedback from supervisors (Richardson et al, 2009), and a behavioural change are needed to adapt to the work environment. However, some studies show that negative role on the part of the supervisor lead to a demotivated student, and a poor relationship between student and supervisor. This inadvertently affected the degree of learning at the workplace, and was a concern.

In addition, WIL may also provide multiple influences, depending on the context, which may affect the learning and the perceptions thereof of each individual student. The unique environment or context in which learning takes place therefore provides factors or elements that could initiate and/or promote or prevent the acquisition of distinct skills. There are various studies that were done locally and internationally about workplace perceptions (Moletsane, 2011; Rainsbury et al, 2002; Smith and Smith, 2010). It is clear that there are challenges to WIL which may have the potential to promote rather than prevent learning. This area therefore provides a distinctive context for learning, which should be explored.

2.5. CHALLENGES IN IMPLEMENTATION OF WORK INTEGRATED LEARNING

Whilst WIL is a structured component of the Biomedical Technology curriculum, and there are memoranda of understanding and established guidelines for WIL, there are also challenges that are experienced. Griesel and Parker (2009) found gaps between the employer expectations and the outcomes of higher education in a study that focused on graduate attributes from the perspective of employers. The study that Griesel and Parker (2009) undertook about graduate attributes focused on two main issues: a) What employers expect and b) What employers currently get. Surveys and questionnaires was one of the methodological approaches used. Some of the gaps were basic skills and understanding, openness and flexibility and ability to recognize a problem situation. There is support for the implementation of WIL in enhancing graduate employability

(Jackson, 2013). Employers want “work ready graduates” for organizational success (Smith et al, 2014). Some, however mention costs incurred for WIL students due to training students and costs to retain students (Elijido –Ten and Kloot, 2014). The cost incur for induction and use of consumables that are used for training, like reagents, kits and controls. Employers also want graduates that can multi task, work on their own and use time effectively (Jackson, 2013). Graduates should also have multi - skills as to make decisions effectively (Crebert et al, 2004). Further, employers want graduates that have the necessary soft skills and can get on with the task at hand (Jackson, 2013). Studies have shown that graduates usually lack soft skills as compared to hard skills (Rainsbury et al, 2002).

Whannell et al (2015) argues that there is a gap from graduates from higher education institutions who have the theoretical knowledge but cannot apply this practically in the workplace. Therefore there is a requirement for the University to make individuals work ready by combining the theory learnt and put into practice. Employers feel that the University could prepare students better for the workplace (Elijido – Ten and Kloot, 2014). In the same study by Elijido – Ten and Kloot (2014) students should be better prepared when dealing with superiors and improve their attitude towards their prospective employers.

Some employers mention that WIL students are enthusiastic and very keen to learn (Elijido – Ten and Kloot, 2014). It was stated that the “fresh- faced” students are welcome to the atmosphere of the workplace. Most workplaces have no formal induction or orientation as they enter the workplace that is unstructured and learn as “things arise” (Elijido – Ten and Kloot, 2014). An area of concern is the lack of collaboration between the Industry and University where the University is not responding to the Industry needs and not seek advice on the curriculum (Jackson et al, 2017). Jackson (2013) also mentions that the partnership between the Industry and University must be fostered and is important for designing a curriculum that meets the expectation of the community and

industry. Work related learning activities should be included in the curriculum so that the learners are geared for the work environment (Kaider et al, 2017).

In a study conducted by Jackson (2013) many students felt that their learning at the University was inadequate in preparing them for the workplace. In the same study students highlighted certain skills were not taken seriously in the classroom but were developed during placement. In another study by Jackson (2009) some of the key findings was a wide gap in oral and written communication skills which is considered more important in graduates. Other basic skills such as reading, writing and numeracy are considered more important across studies worldwide (Jackson, 2009).

Biomedical Technologists work within the medical team to provide a holistic service to patients (Crebert et al, 2004; Marock, 2008). Work integrated learning does not guarantee a graduate a job in the future but provides the Industry with a student with good practical skills (Moletsane, 2011). The goal should be for learning to take place at the workplace although in some settings the main concern is of production (Moore, 2004).

During the World Association of Cooperative Education (WACE) World Conference in Durban (2013) it was mentioned that students need to be ready for the workplace and this was the responsibility of the HEIs (Higher Education Institutions). It was noted that various programmes need to be implemented to assist the student for the world of work. HEIs should provide the graduate with the skills necessary to be ready for the workplace.

Crebert et al (2004) noted that supervisors have other work commitments and deadlines and thus their work takes precedence over student training. It was mentioned that while the student was at the University, the focus was on student learning and this contrasts at the workplace where the emphasis is on the organisations and clients' needs. Students therefore may be neglected as the supervisor and work staff do not pay attention to them

and thus left unattended. In the present study it was anticipated that the challenges facing WIL would be identified.

2.6. RATIONALE

Partnership between all stakeholders for example the HEIs, the industry and student are critical in order to optimise the student experience of WIL, and minimise challenges in the workplace (Dorasamy and Rampersad 2018).

The WIL is a complex partnership with business, industry and government and cannot be conducted in “silos” and is faced by several dynamics from each of the partners, this forms the basis for the present research (Matoti, Junqueira and Odora, 2011). Furthermore, for WIL to be effective there should be a well-established “stakeholder approach that is based on purpose, needs, commitment, roles and responsibilities, and clear agreements amongst all parties” as noted by Dorasamy and Rampersad (2018). There is limited evidence on the quality of these relationships, with no information available in this programme.

The landscape of higher education has dramatically changed, the new of calibre of student; new learning challenges in addition to other challenges in South Africa (Taylor and Govender, 2013). Peer pressure and experimenting with alcohol and drugs is among the leading challenges in a student’s life. Other challenges that students face is living in crowded areas, poverty, smoking, pregnancies and gangs, all of these create additional barriers to learning in traditional spaces like WIL, where learning has been anecdotally reported to have been accelerated.

There is therefore a clear need for rigorous and methodological analysis of our practices in order to realise and implement best practices (Dorasamy and Rampersad, 2018). To date, no such study has been conducted in this programme in any of the universities in South Africa. Giving cognisance to the unique background with regards to socio-political and economic changes in South Africa, it is critical to conduct a study of this nature, which will yield valuable information about the status of WIL offering. In view of the above, the aim of this study was to determine the perceptions of students about the workplace

training, in order to ascertain whether they are under prepared for the workplace as well as the perception of laboratory supervisors on students' competence in the performance of the clinical techniques and procedures at these laboratories.

CHAPTER 3

RESEARCH METHODOLOGY, DESIGN AND METHODS

3.1. INTRODUCTION

The chapter covers broadly the three tier of research, namely, research methodology, research design and research methods, utilising the interpretive research paradigm to describe, analyse and interpret measured variables. **Research methodology**, which refers to the philosophical and theoretical aspects of the action plan employed to advance knowledge. **Research design** is a systematic process used to integrate research components and associated processes to uncover the truth or answer the research question (Sydenstricter-Neto, 1997). **Research methods** involves the variety of actual techniques that researchers use when studying a given phenomenon (Hammel, 2002).

3.2. SAMPLING DESIGN

3.2.1 THEORETICAL FRAMEWORK

The study is underpinned by empiricism, which holds that all knowledge is acquired through interaction with environment and responsive human senses in order to provide insight into the students' preparedness and the satisfaction of the laboratory supervisors regarding students' 'work-readiness' as a result of education and training at DUT. The interpretivist research paradigm provided philosophical, theoretical and methodological foundation for the research (Joseph, 2004; Alghamdi and Li, 2013).

The research methodology in the interpretive paradigm is most important in understanding how humans make meaning of their lived experiences, and how they contextualise issues of causality and ensuring sensitivity to ambiguity (Robert, 2002). The researcher is mindful that participants possessed "tacit knowledge", that is, they may know more than they can say (Schwatz-Shea, 2004). The strength and power of the interpretivist approach rest with its ability to address the intricacy and meaning of the situations under study (Black, 2006). The research plan was initiated on qualitative textual and verbal data and supplemented

with quantitative numerical data to allow for triangulation of data in the analysis stage of the research process (Mackenzie and Knipe, 2006).

This research study attempted to understand the students' and laboratory supervisors' perceptions about their involvement, role, preparedness and impact of work-integrated learning (WIL) on their learning and teaching, respectively, eliciting participants' responses using questionnaires (Schwandt, 2001). All participants gave a written consent (Appendix G) to participate in the study and were informed that they can withdraw from the study if they so wished to. Ethics approval was granted by the Institutional Research and Ethics committee of the Durban University of Technology (Appendix C). The researcher interacted with the participants to obtain qualitative data that is contextualised and time dependent (Coll and Chapman, 2000). The researcher was cognisant of his own subjectivity which could have arisen when reading the phenomenon, as reported by (Crotty, 1989), since different people may construct meaning in different ways and knowledge is a trait that is culturally derived and historically situated (Scotland, 2012).

3.2.2. STUDENTS AND SUPERVISOR SAMPLING AND RECRUITMENT

This study employed a qualitative dialectic case study approach, and used a range of research methods to collect data which may demonstrate comparable patterns, relationships correlations through triangulation and member check/validation (Gay, 1987). Triangulation involves the practice of viewing things from different perspectives by using different research methods and different sources of data to enable the researcher to obtain a better understanding of the constructs that are being investigated (Denscombe, 2007). Creswell (2002) defined case study as a method of developing an in-depth understanding of the phenomena under study in a bounded system involving the process and procedures of an event.

3.2.3. QUALITATIVE DATA COLLECTION

3.2.3.1 THEORETICAL FRAMEWORK

The research methods used in this research study are survey questionnaire, semi-structured interviews, observation, and programme documentations to collect qualitative and quantitative data from participants. Survey questionnaire consisted of Likert scale of 1-5, strongly disagree and strongly agree, respectively. The research design integrated and sequenced the different WIL instructional activity components in a cohesive and coherent manner, with the intention of analysing the current pedagogical practices in WIL in order to provide a new theoretical framework for WIL in Biomedical Technology programme (Leclercq and Poumay, 2005). Al the questionairres were hand delvered by the researcher and thereafter collected by the researcher. The semi-structured interviews were done face-to-face. The qualitative research design and methods could be repetitively refined, adjusted, expanded, adapted or limited while the researcher was conducting iterative research using interpretivist paradigm (Goetz and LeCompte, 1984).

3.2.3.2. QUESTIONAIRRE ADMINISTRATION

Purposeful sampling technique was used to select information-rich participants in order to answer the research questions, elicit appropriate, relevant and sufficient information, explore their meanings, develop and sufficiently describe the phenomena under study (Fossey et al,. 2002), after informed consent was acquired (Appendix G). Purposeful sampling technique was used to enhance the suitability of sampling, significance and reliability of information collected, and to take advantage of the representation of a variety of experiences and perceptions on the effectiveness, preparedness and work-readiness of the WIL programme (Fossey et al, 2002; Hammel, 2002). The student participants were selected based on the adequacy of time and experience of the programme as they were in their third year of study, and would be able to provide authentic and subjective accounts of their perceptions of the WIL offering (Onwuegbuzie and Leech, 2004).

Samples for qualitative investigations are typically small but are sufficient to adequately answer the research question (Marshall, 1999). According to Sandelowski (1995), “a

common misconception about sampling in qualitative research is that numbers are unimportant in ensuring the adequacy of a sampling strategy". Too large sample size makes extraction of thick, rich data difficult and prone to bias, and too small sample size makes it difficult to achieve data saturation, theoretical saturation and information redundancy (Lincoln and Guba 1985; Flick, 1998; Strauss and Corbin, 1990, Sandelowski, 1995; Morse, 1994). In total there were 33 students recruited and 15 laboratory supervisors from both private and state institutions (see Table 4) below.

Table 4: Sample Population Biological Demographic Characteristics

Africans		**Whites**		**Asians**		**Coloured**		**Total**
15		0		17		1		**33**
Students' Participants								
Male	Female	Male	Female	Male	Female	Male	Female	**Total**
4	11	0	0	5	12	0	1	**33**
Africans		**Whites**		**Asians**		**Coloured**		**Total**
4		**3**		**8**		**0**		**15**
Laboratory Supervisors' Participants								
Male	Female	Male	Female	Male	Female	Male	Female	**Total**
0	4	0	3	1	7	0	0	**15**

Table 4 is a representative of the research study regional participants' demographics, and it includes race and gender. The majority of student participants are mainly from Asian (17) and African (15), with only one student from Coloured. The non-representation from the White group can be attributed to the majority of White students have the tendency to

apply for Homeopathy and Chiropractic programmes. The programme marketing strategy for recruitment is for all schools in the province, and some schools do invite DUT to market the programmes. The laboratory's participants are almost doubled in Asian population (8), Africans 4, and Whites 3, and no Coloureds.

3.3. PILOT STUDY

The researcher conducted a pilot study as part of reliability and validity measures, as well as to check for ambiguity in the questionnaire design. The participants in the pilot study were the Clinical Technology students whose WIL is twelve months uninterrupted in the third year of their study, as well Clinical Technology supervisors. The researcher explained to participants the aim, focus and objectives of the study before the consent was obtained. Six questionnaires were given to Clinical Technology students in both private and state working units while six questionnaires were given to unit supervisors in various training units. All questionnaires were collected, coded and sent to the statistician for analysis and interpretation. There were no ambiguous responses from the Clinical Technology participants. Despite having no ambiguity in the pilot study, the researcher requested a colleague to review the survey questionnaire and interview for comprehensibility.

3.4. WORK INTEGRATED LEARNING PLACEMENT AND RECRUITMENT PROCEDURE

The research participants were placed in various specialised disciplines of Biomedical Technology to gain exposure and experience in the clinical professional setting at both the public and private sector. The placement of students is based on preferred WIL sites, and thereafter where there are opportunities for training. Purposeful sampling and the selection of individuals that are rich and rely on various methods to collect qualitative data (Creswell, 2007). Semi-structured interviews were aligned with the survey questionnaire (Appendix A and B) to corroborate for both students and supervisors, since the type of

interview must be aligned with the purpose of research study and the research questions (Creswell, 2007). This strategy was used since prolonged engagement and active interaction to build trust foster achievement of deeper understanding of the phenomenon under investigation and their emotions, experience as well as perceptions of the subject matter under investigation. These semi structured interviews were used to collaborate the questionnaire for both the students and for the laboratory supervisors. This included students who were be completing their WIL at HPCSA registered training sites in both private and state laboratories as listed in Table 5 below.

Table 5: List of Health Provincial Public and Private Establishments and WIL Students' Placement

HPCSA approved training laboratory	Private / State laboratory	Number of students placed
Ampath Laboratory	Private	6
Lancet laboratory	Private	6
Addington Hospital	Public	7
Inkosi Albert Luthuli Central Hospital	Public	3
King Edward VIII Hospital	Public	3
Madadeni Hospital	Public	1
R K Khan Hospital	Public	7
	Total	**33**

The discussions on the placements of students start at the Laboratory Practice 3 review workshops and are ratified at the Joint Advisory board meetings. There is constant negotiation by the WIL coordinator with the various stakeholders for the number of

students that can be accommodated in each unit. During each placement, the WIL coordinator or subject specific lecturers maintains contact with both the student and the Industry partner, either by phone or email, on at least a weekly basis in certain disciplines. The schedules are drawn up for specified on - site visits. There are 7 categories that the student undergoes and visited at least once, either in the penultimate or final week of cycle.

3.5. INSTRUMENT

A survey in the form of a questionnaire was used to gather data. The student questionnaire included questions on demographics with information on disciplines, preferred laboratories and questions on student expectations which includes the type of training, working environment, the amount of time spent training, level of training and the skills that students are expected to have, etc. The laboratories supervisors' questionnaire also contained questions which included the laboratory details, supervisor qualifications and experience, etc. Additionally there were questions on stakeholder expectations which included skills acquired by students before WIL training, readiness of students for the workplace, work commitments and workplace ethics. Arising from the questionnaires interviews was then used to gain more insight into some of the unexpected findings or any interested aspects. Five students were randomly selected based on the laboratory and availability. We had agreed that I would jot down notes and students had to make allowances for my note-taking. There is always biases with interviews as students are very well aware of the dynamics of the workplace and any negative responses may impact on their choices for full time appointment. However, I did re-iterate that this would be kept confidential and no names and laboratories would be mentioned. With this in mind I managed to ask questions with flexibility and gather useful information that was not reflected in the responses of the questionnaire.

A questionnaire comprising questions, similar in nature to those used in other placement programmes (McIlveen et al., 2011; Papakonstantino, 2013) was used. The questions were structured around the following areas: biographical information, orientation to the work place, training at the University, organisation structure and culture as well as knowledge (Appendix A and B).

3.6. QUALITATIVE DATA COLLECTION

3.6.1. CODING, CATEGORIZATION AND ANALYZING QUALITATIVE DATA

This study used survey questionnaire and semi-structured interviews as the primary research methods to collect both textual and numerical in order to analyze data that was guided by the aims, purpose, and research questions so as to allow research findings to emerge from the themes inherent in the raw data (Nastasi and Schensul, 2005). The initial description of meaning of category was developed and the researcher wrote a memo about how these categories are related and their associated implications to the research process. These categories are linked to one another in terms of their relationships such as hierarchy of categories or commonalities and casual sequencing (Thomas, 2003).

The research study used open coding to identify emerging themes from data with similar meaning, followed by axial coding where codes from open coding were categorized into meaningful categories and further developed, revised and authenticated using constant comparison method to identify any significant changes in the frequency of a specific comment type, code and rating. Finally, the researcher used selective coding to explore and link relationships among core categories by continuous reiterative process of a coding to revise, modify and refine codes of both the questionnaires and interviews (Glaser and Strauss, 1967).

Table 6: Qualitative Coding Process in Inductive Analysis

Initial reading of textual data	Identify the specific segments of information	Label segments of information to create categories	Reduce overlap and redundancy among categories	Create a model incorporating most important categories
Many pages of text	Many segments of text	20 – 30 categories	15 – 20 categories	3 – 8 categories

Source: Adapted from Creswell (2002:266)

Table 6 illustrates the researcher's process of qualitative coding using inductive analysis strategies to read participants' transcripts several times in order to understand the underlying meaning of textual data, identify, develop and group themes and categories

from the raw data, refer to it as data reduction (Creswell, 2002). Data reduction was terminated when the researcher was not able to identify any further themes from the data from participants' comments (Marshall, 1999; Elliot and Gillie, 1998).

3.6.2 PERFORMANCE INDICATORS (PIs) IN EDUCATIONAL RESEARCH

Performance indicators (PIs) in educational research focuses on instructional activities of teaching, learning, and assessment (TLA), and are part of the representation of policies and procedures and be easy to interpret and be immune to response errors (Warren, 1989). The PIs were used to assess the effectiveness of WIL and to identify the utility and satisfactory educational and clinical practices in an attempt to influence the enhancement of relative quality education provision (Warren, 1989). The expectation in Biomedical Technology programme is for students to attain the minimum threshold standards in their learning activities, that is, the output from educational activity should minimize variability (Warren, 1989).

The conditions of the WIL environment were understood with the assistance of the PIs in order to modify the instructional activities to enhance the quality and standard of the offering of the clinical practice modules. The statistical data were aggregated into an indicator that depicted the notion of quality and served as benchmarks, and whole information provided by a system of PIs was greater than the sum of its individual parts (Jaeger, 1978). The PIs can facilitate improvement in the institutional educational policies by increasing the standards of the academics' qualifications (inputs) that can indirectly influence the attainment of thematic learning units learning outcomes (outputs). It is important that PIs are related to one another so that their relationships and changes in these relationships could be ascertained to suggest possible explanations for observed changes in the outcomes.

3.6.3 QUANTITATIVE INPUT INDICATORS, QUALITATIVE PROCESS INDICATORS AND QUANTITATIVE OUTPUT INDICATORS.

The type of PIs may be represented by Input, Process, Output and Outcomes and are divided as indicated in the subheading 3.6.3. above. The main aim of PIs is to assist academics to promote quality teaching and successful student learning in terms of observable and measurable outcomes (Sanders and Kearney, 2008).

The Quantitative Input Indicators (QIIs) measured the facilitation of effectiveness and quality of TLA, for example, workload (academics), infrastructure and study hours (students) as noted by Scheerens et al (2010). The quantitative input indicators focused on departmental teaching, learning and assessment, and used several measures of instructional activities. The effectiveness is measured through student achievement outcomes which are escalated by establishing the most efficient HEIs and lecture-room processes (Allan et al 2009).

The Qualitative Process Indicators (QPIs) are the teaching and learning processes that are used to monitor and improve the effectiveness of teaching and learning together with the students' achievement (Rowe and Lievesly, 2002). The QPIs are used to identify strengths and weaknesses in the teaching, learning and assessment processes as well as students' achievement (Rowe and Lievesly, 2002). The administration of lecturer and subject evaluation questionnaires are not conducted by the lecturer and remain anonymous to avoid fear of intimidation and misuse thereby increasing fairness and trustworthiness. The QPIs are not about rating the academics but about the performance of the department in which they work (Ramsden, 1991).

The Quantitative Output Indicators (QOIs) seek to measure the immediate objectives are achieved that are measured by means of standardized achievement tests. QOIs are key in productivity and effectiveness of educational quality playing a key role in the equity, efficiency and responsiveness of schooling (Scheerens et al., 2010). There are two types of efficiencies, namely internal and external efficiencies and the focus of this study was on internal efficiency focusing on WIL.

3.7 RECRUITMENT AND SELECTION

All final year students in registered for the National Diploma in Biomedical Technology were given the questionnaire whilst at the workplace. The Laboratory supervisors were also given the questionnaire during laboratory visits where students are placed. This was done in the fifth week of the cycle.

3.8 DATA ANALYSIS

3.8.1 THEORETICAL BACKGROUND

The researcher used qualitative content analysis since it is an inductive research method which caters for subjective interpretation of the textual data through the identification of the raw data to generate theory (Stemler, 2001). In this way large volumes of data can be sifted with relative ease. This method allows the researcher to correlate words to help generate a case of probability stemming from both students and supervisors perceptions (Stemler, 2001).

Data gathering and analysis were conducted iteratively. Typically, data analysis for qualitative studies occurs in three phases: description, analysis and interpretation (Burns and Grove 2005). The merits of the approach allowed students and supervisors to freely comment on their individual experiences, enriching the data, and allowing for more complete assessment of the perceived outcomes of the WIL placement (Bryman, 2008). Description involved the researcher familiarizing himself with the data by reading and capturing its essence. The information was then prepared and analyzed. Analysis took place by: open coding, categorizing of data, and identification of themes (DeSantis and Ugarriza, 2000). Themes were then be classified and reduced to reflect relationships and other essential features (Burns and Grove, 2005). A current SPSS version 24.0 package was used for the statistical analysis of the quantitative data. Quantitative data was analysed using Chi square tests and correlational analysis at $p<0.05$.

3.9. RELIABILITY AND VALIDITY

The study design, implementation, analysis and interpretation processes served to maximise the internal validity of the study. All students in the WIL rotation were included, thus avoiding any potential bias related to selection which could compromise the study results.

The trustworthiness of qualitative research relies on the wealth of information gathered, how well the researcher interprets the data that was collected, coding, testing and understanding the stated data (Hoepfl, 1997). The way the interview was carried out and its interpretation made the research valid (Kvale, 1992). Furthermore, trustworthiness replaces validity and reliability in qualitative research (Lincoln and Guba, 1985). It encompasses truth, value, credibility, applicability, transferability, consistency, dependability, neutrality and reliability confirmable, which was implemented in all the steps of the research. Finally, the validity of this instrument was strengthened by the fact that all the questionnaires was administered by the researcher. Triangulation of data was done using the questionnaires, the interviews and the curriculum and can be used in both quantitative and qualitative studies. Triangulation is the application and combination of various research methodologies in the study of the same occurrence that increases the validity of a research by gathering many viewpoints and methods (Lechner, 2001; Yeasmin and Rahman 2012). The researcher used Cronbach's alpha coefficient to measure the reliability of all items (see Table 9) showing high consistency of the constructs and their stability (Nunnaly and Bernstein, 1994).

3.10. FACTOR ANALYSIS

Factor analysis (FA) is a statistical technique whose main goal is data reduction. A typical use of factor analysis is in survey research, where a researcher wishes to represent a number of questions with a small number of hypothetical factors. Factor techniques are applicable to a variety of situations. Factor analysis is done only for the Likert scale items. Certain components are divided into finer components. This was explained in the rotated component matrix. The goal of FA is to describe a set of p random variables that are

observable and measurable in terms of smaller numbers (m<p) called components which were determined in a common factor model called loadings.
This can be described as: $X_1 = a_{i1}F_1 + a_{i2}F_2 + \ldots + a_{im}F_m$
Where X_1 is the ith variable, a_{i1} is the jth factor loading for the ith variable, and F_1, $F_2 \ldots F_m$ are the uncorrelated common factors.

This research used FA using mathematical procedures to summarize data in order to easily interpret and understand relationships and patterns (Yong and Pearce, 2013; Child, 2006). The researcher used five – scale Likert type responses for FA and ensured that near identical meanings were excluded for FA (Comrey, 1978). The five-point Likert scale that was used ranged from 1-Strongly agree to 5-Strongly disagree.

The main purpose for FA is to reduce “variable complexity to greater simplicity” (Kerlinger, 1979).This can essentially be a valuable analytical tool when the researcher is required to make subjective decisions to seek what are the factors in the data through a series of steps and to address the decisions or judgements at each individual step (Keiffer, 1999). Henson et al (2004) notes that factor analysis aims to reproduce the relationships between the variables with a small number of factors.

The matrix table is preceded by a summarised table that reflects the results of Kaiser-Meyer-Olkin and Bartlett's Test. The requirement is that KMO Measure of Sampling Adequacy should be greater than 0.50 and Bartlett's Test of Sphericity less than 0.05. In all instances, the conditions are satisfied which allows for the factor analysis procedure.

3.11. ETHICAL CONSIDERATIONS

Permission to conduct the study and ethical approval was sought from the following stakeholders: the Department of Health. State and private laboratories and the DUT ethics committee Ethical approval was received in September 2016 by the DUT IREC that has the following reference: IREC 10/16 (See Annexure C).

As part of the ethical considerations included the right to autonomy and confidentiality, avoiding harm, fair treatment and seeking informed consent was maintained. In accordance with the recommendations of Brink et al (2006), the following ethical considerations were observed in the study:-

1. Respect for persons as autonomous individuals, protecting the participant's right to either participate or not in the study.
2. The right to anonymity and confidentiality: There is a risk to the professional reputation of participants, as well as the risk of participant identification based on the research data collected. However, these risks was mitigated by ensuring anonymity (allocating numerical numbers to participants). No demographic or personal data was collected. Any data containing area of employment, registrations, training institution or mention of specific patient incidents by the participants was restricted to the research investigators and not for publication.
3. Avoiding harm: No physical, psychological, emotional, social or financial harm was inflicted on those participating in this study.
4. Right to fair treatment: The participants could withdraw from participating in the study at any time and also all those who were eligible to participate did have a fair chance to do so.
5. Informed consent: Each study participant was requested to sign a consent form, which contained a full description of the purpose of the study, data collection and intended use.
6. The study participants were made aware that participation is voluntary and that they would receive no compensation. The completed questionnaires were allocated a numerical number to ensure confidentiality. A copy of the research results will be sent to them if they wish to receive feedback.

3.12. CONCLUSION

This chapter described the research methodology that was used in the study. It mentioned the WIL placement, procedure as well as sampling. It went on to describe the data collection and the statistical analysis that was used. Finally the ethical considerations were mentioned.

CHAPTER 4

RESEARCH DATA MANAGEMENT, ANALYSIS AND FINDINGS

4.1. INTRODUCTION

The management and analysis of data, and deliberations on findings is the focus of this chapter using descriptive and interpretive strategies to analyse, summarise and compare data in order to establish any relationships and patterns in the data (Yong and Pearce, 2013). The survey questionnaire for both students and Laboratory Supervisors consisted of, in the main, work-integrated learning (WIL), orientation, student preparedness, workplace behaviour and quality. Furthermore, the surveys contained questions and statement on Lickert Scale from 1-5, with 1: Strongly Disagree and 5: Strongly Agree.

Importantly, interpretive research analysis demanded the research to immerse oneself with research data, and have the ability to analyse and interpret from a position of empathic understanding (Terre Blanche et al., 2006). Sequential/interim analysis was adopted at the beginning of the process of data collection through conceptualisation of verbal and textual data (Pope et al, 2000). This was followed by grouping data into categories and in vivo coding, that is, naming categories derived from participants' responses, and open coding to identify the categories emerging from the data (Strauss and Corbin, 1990; Dey, 1993).

In an attempt to respond to the objectives of the study, we find it sensible to state the objective as indicated in Chapter 1:

- To determine the perceptions of Biomedical Technology students about their work preparedness for WIL training.

- To determine the perceptions of the Laboratory Supervisors with regard to students' for WIL training.
- To determine the conditions under which students undergo training during WIL placement period.
- To reflect on the quality of partnerships which exist between the Department of Biomedical and Clinical Technology and the training laboratories.

4.2. QUALITATIVE RESEARCH DATA ANALYSIS TECHNIQUES

The research study used some of the grounded theory concepts and principles such as sensitization and familiarization in order to have a general feeling of reference and guidance in dealing with empirical occurrences. According to Denzin and Lincoln (2005), one significant characteristic of qualitative data is that it does not yield up its meaning easily. Therefore, it is essential to be working continuously with data to build theory so that its implication and value will not be missed, as the research analysis continues. As the process of theory building unfold, emerging concepts from data were compared and contrasted with reviewed literature to determine assumptions, and only thereafter, these were refined and explained to develop more theory (Pauleen and Yoong, 2004).

Word-based techniques, for example, repetitions, and physical manipulation, for example, pawing were used to proofread the material and simply underline key phrases. This was referred to as the ocular scan method or eyeballing (Sandelowski, 1995; Ryan and Bernard, 2000). As the researcher, I felt at ease as I was handling the data multiple times and get more familiar with participants' responses.

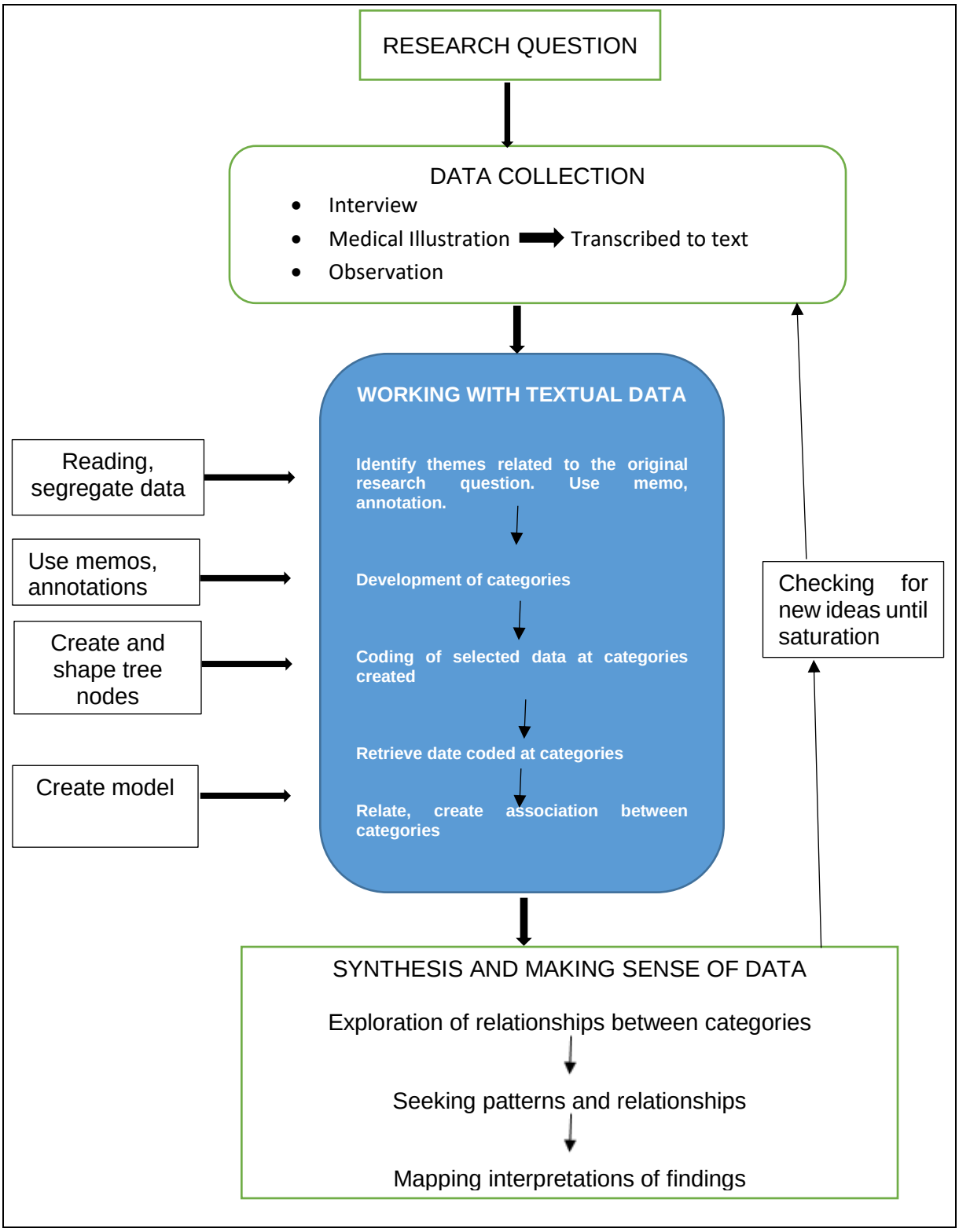

Figure 4: Qualitative Data Analysis Flowchart: Wong (2008)

A key aspect of qualitative data analysis as shown in Figure 4 is to group raw data into

themes and categories based on the valid and reliable inferences using inductive reasoning. From the reviewed literature, theory and researcher's insight themes are generated at the outset of data gathering and follows throughout the analysis and the interpretation. The respondents, both the students and supervisors provided the data as they answered the questionnaires and well as data gained from the interviews. These were recorded and coded. The coding process had to be checked on an on-going basis to prevent drifting as noted by Schilling (2006). As one continues new and different themes appear and thus needs to be added. This also needs to be checked repeatedly and checked for consistency throughout the process (Miles and Huberman, 1994; Weber 1990).

4.3. QUANTITATIVE DATA ANALYSIS AND INTERPRETATION

In quantitative research, the focus is on descriptive statistics in order to describe the key features of collected data targeting to quantitatively summarise a data set and not necessarily the participants' responses and experiences regarding work-integrated learning (WIL). The descriptive statistics on the percentage marks obtained by students from different disciplines in Biomedical Technology programme during WIL placement, including the Integrated Learning Project (ILP), which is presented orally before the panel that is representative of both public and private Laboratory Supervisors. Descriptive statistics on the marks of students were calculated to establish mean, standard deviation, most extreme differences (absolute, positive and negative), test statistics and asymptomatic significance (2-tailed test) using One-Sample Kolmogorov-Sminorv Test.

Table 7: One-Sample Kolmogorov-Sminorv Test for Various Biomedical Technology Disciplines During Work-Integrated Learning (WIL) Placement

		CHEM PATH	HAEM	CELL PATH	MICRO	ILP	Final
N		33	33	33	33	33	33
Normal Parameters[a,b]	Mean	82.2727	81.0909	78.7879	96.8485	76.1818	81.3030
	Std. Deviation	10.18354	9.04974	7.02566	5.20889	7.97439	4.48250
Most Extreme Differences	Absolute	.194	.166	.097	.273	.103	.231
	Positive	.109	.101	.048	.273	.055	.114
	Negative	-.194	-.166	-.097	-.254	-.103	-.231
Test Statistics		.194	.166	.097	.273	.103	.231
Asymp. Sig. (2-Tailed)		.003[c]	.021[c]	.200[c,d]	.000[c]	.200[c,d]	.000[c]
a. Test distribution is normal; b. Calculated from data; c. Lilliefors significance correction; d. This is a lower bound of the true significance.							

In descriptive statistic for the students' percentage marks as illustrated in Table 7, a large standard deviation would indicate that the data points are far from the mean, which means that there is a significant difference between the scores of the students' marks in different disciplines in Biomedical Technology programme. A small standard deviation would indicate that the marks are clustered closely around the mean, which means there is no significant difference between the marks of the students (Gay, 1987).This means that students had marks similar to each other and not widely varied.

Table 8: Gender and Age Distribution

Age Range		Gender		Total
		Male	Female	
22 – 25	Count	6	18	24
	% within Age	25%	75%	100%
	% within Gender	85.7%	85.7%	
	% of Total	21.4%	64.3%	85.7%
26 – 28	Count	1	3	4
	% within Age	25%	75%	100%
	% within Gender	14.3%	14.3%	
	% of Total	3.6%	10.7%	14.3%

The calculations on Table 8 for gender and age distribution show the percentage within age for males and females is 25% and 75% for both age range, respectively, giving the ratio of 1:3. It is evident that females are more interested in health science programme comparative to males, who aspire to enrol in Engineering and Information Technology as the numbers are high in these courses.. The percentage within gender show 86% for males and females for age range 22 -25, and 14% for males and females for the age range 26-28. In summary, the Biomedical Technology programme admits younger age group relative to older group, which corresponds with expected youth who enters higher education and completing in record time.

4.4. SECTION B: STUDENT ORIENTATION AT THE WORKPLACE

The Cronbach's alpha coefficient was calculated and used to measure reliability of the items of the student questionnaire as shown in in Table 9, and show high internal consistency of the constructs and their stability (Nunnaly and Bernstein, 1994). In all the sections Cronbach's alpha coefficient was greater than Bagozzi and Yi's (1998) threshold of 0.6 and exceeds Nunnaly and Bernstein's (1994) threshold of 0.700, thus showing a degree of consistency and reliable for data analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) for this set of variables was greater than 0.500 and the Bartlett's Test of Sphericity (BTS) tests the hypothesis that all the correlation matrix is indeed an identity matrix that is all the diagonal elements are 1 and off – diagonal elements are 0 and this means that all of the variables are uncorrelated. If the Sig. value for this set of data is less than the alpha level ($p \leq 0.05$), it implies that the null hypothesis is rejected and that the population matrix is an identity matrix. This analysis therefore meet this requirement for all sections.

In sections B, C and D of the student and supervisor questionnaires, factor analysis was conducted to achieve data reduction, due to the large number of variables. Factor analysis was done only for the Likert scale items. Certain components divided into finer components. This is explained below in the rotated component matrix.

Table 9: Students Reliability Statistics, Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) and Bartlett's Test of Sphericity (BTS)

Sections	Number of Items	Cronbach's Alpha Coefficient
B. WIL Orientation	9	0.91566
C. Workplace Orientation	17	0.96849
D. Quality of Teaching and Learning at the Workplace	17	0.96849
Overall	41	0.97786

Sections	Kaiser-Meyer-Olkin Measure of Sampling	Bartlett's Test of Sphericity (BTS)		
		Approx. Chi Square	df	Sig.
B. WIL Orientation	0.776	222.923	36	0.000
C. Workplace Orientation	0.573	561.377	136	0.000
D. Quality of Teaching and Learning at the Workplace	0.636	484.545	105	0.000

In the section on orientation for WIL from DUT the following two components were identified, Component 1 Health and Safety Orientation and Component 2 referred to as DUT workshops for WIL preparation as is seen in Table 9.

The values in the orientation for WIL table represents the varied component loadings of Section B: Orientation. Table 10 and Figure 5 below are representations of the Likert Scale percentages for the statements and questions using Varimax and Kaiser Normalisation rotation methods. The responses from the students was used and theoretical knowledge from the researcher and from reviewed literature to back up and generate theory and conceptual understanding.

Table 10: Rotated Component Matrix: Orientation for WIL

Rotated Component Matrix[a]			
B Orientation for WIL		**Component**	
		1	**2**
B1	The Health and safety aspects of the work environment were clearly explained to me	0.839	0.030
B2	The orientation which I received from the Biomedical Technology programme was useful in preparing me for WIL	0.395	0.743
B3	There were adequate workshops on work preparedness conducted during the Biomedical Technology programme	0.199	0.927
B4	I was briefed on the timetable, i.e. the schedule of training	0.884	0.304
B5	I was made aware of the WIL co-ordinator	0.791	0.319
B6	I was given a departmental handbook and the rules were explained to me	0.564	0.470
B7	I knew the reporting structures in the department and the Faculty	0.712	0.546
B8	I was made aware of the practical and theoretical outcomes for the WIL component	0.785	0.421
B9	The workshops were beneficial and prepared me for WIL	0.207	0.940
	Key Scales for Colour Coding of Factors: B Orientation for WIL		
	1.Health and Safety Orientation	2. DUT Workshops for WIL Preparation	

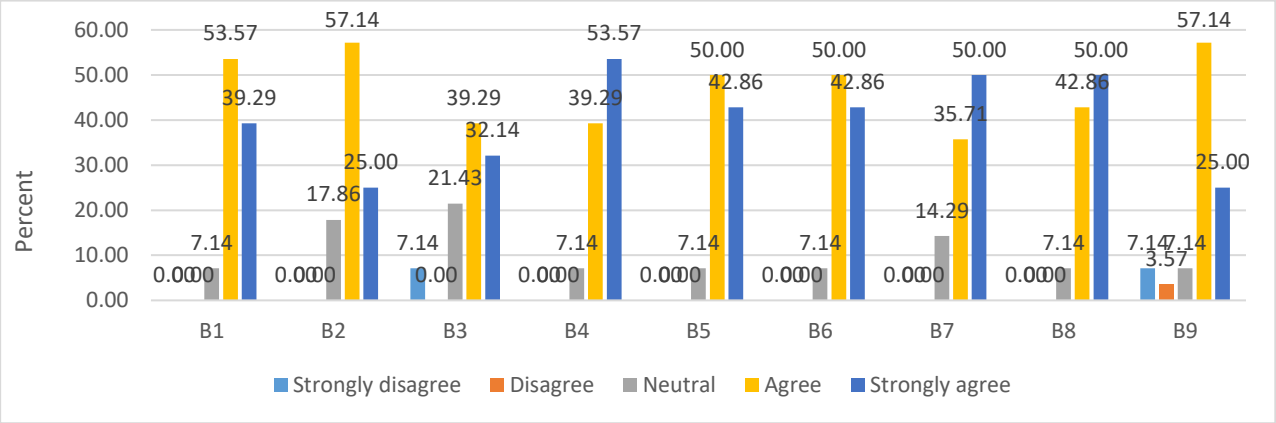

Figure 5: Orientation for Work Integrated Learning

The Table 10 above and Figure 5 above show the Factor Analysis and percentage response. The result of 0.884 is the loading of the variable B4 on Component 1 and as it is elevated it shows the strength of the relationship with Component 1. Almost all (96%) responded positively that the health and safety aspects of the work environment were explained to them, they were made aware of the WIL coordinator and that they were given a departmental handbook with rules explained to them. Biomedical Technologists work within the medical team to provide a holistic service to patients (Crebert et al, 2004; Marock,

2008). As Biomedical Technology students, they sometimes work with other health care professionals, for example bone marrow work and thus they should be aware of all health and safety aspects. The results 0.743, 0.927 and 0.940, are loading on B2, B3 and B9, respectively which is high on Component 2 and students, in the researcher's opinion have responded that DUT provided workshops for WIL preparedness and orientation. They noted that the orientation that they received by the Biomedical Technology was adequate in preparing them for the workplace. There should be clear guidelines for orienting students (Rampersad and Dorasamy, 2018).

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) for this set of variables was 0.573 which is greater than 0.500 and the Bartlett's Test of Sphericity (BTS) tests the hypothesis that all the correlation matrix is indeed an identity matrix, that is all the diagonal elements are 1 and off – diagonal elements are 0 and this means that all of the variables are uncorrelated.

Table 11: WORKPLACE ORIENTATION

C Workplace Orientation		Component		
		1	2	3
C1	I received an orientation programme at the workplace	0.397	0.671	0.542
C2	I knew who I was going to report to	0.504	0.736	0.256
C3	I was familiar with the work-flow of the lab that I was placed in	-0.001	0.944	0.086
C4	I was introduced to other staff members	0.371	0.853	0.064
C5	I was oriented on the rules and regulations of the workplace	0.577	0.733	0.172
C6	I was made aware of the code of conduct of the workplace	0.569	0.601	0.184
C7	I was aware of the work times	0.576	0.668	0.262
C8	I was made aware of protocols relating to leave, sick leave and absence from work	0.801	0.243	0.187
C9	I was made aware of the ethics of the workplace	0.881	0.272	0.177
C10	The tea break and lunch breaks was communicated to me, and also the duration	0.689	0.451	0.357
C11	I was aware of the protocol that needs to be followed in the event of a needle stick injury	0.640	0.346	0.370
C12	At the workplace I was required to sign a register	0.704	0.187	0.002
C13	I was aware of all Health and Safety aspects at the workplace	0.626	0.310	0.346
C14	I was immunised against Hepatitis	0.489	-0.030	0.624
C15	I was made aware of the dangers and risks of TB and HIV in the workplace	0.776	0.229	0.309
C16	I was able to interact easily and respectfully with people from other cultures	0.204	0.134	0.718
C17	On the first day at the workplace I was able to cope with the work on hand	0.044	0.216	0.893
	Key Scales for Colour Coding of Factors: Orientation at the Workplace			
	1. Health and safety awareness at the workplace	**2. Conduct at the workplace**	**3. Culture**	

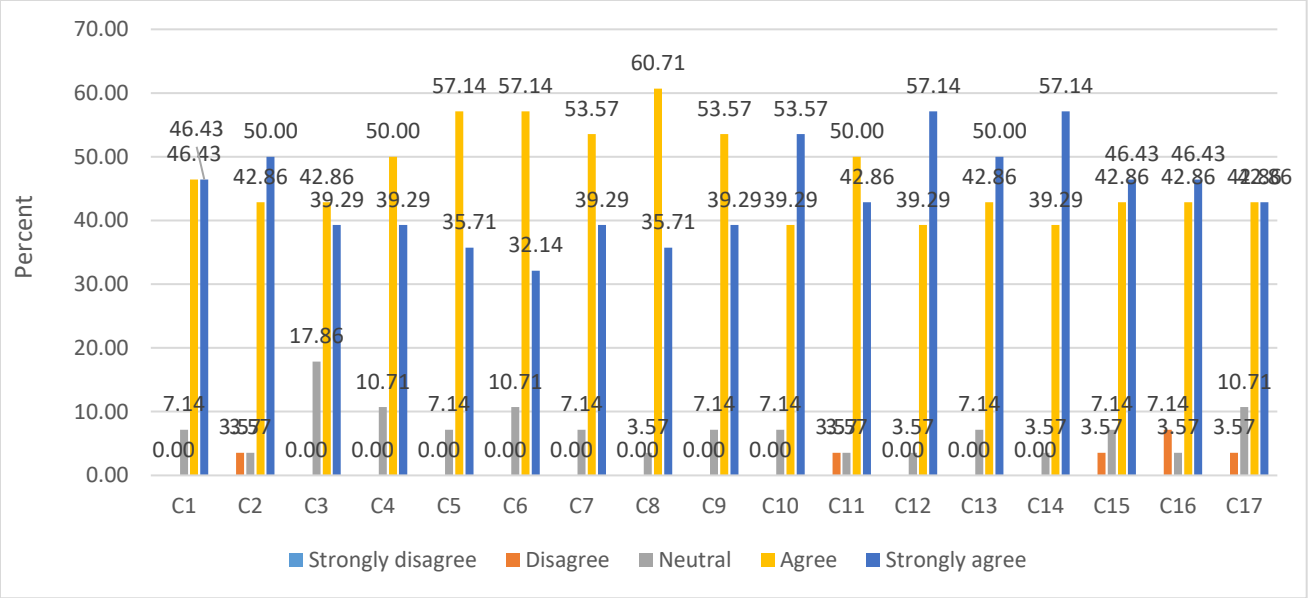

FIGURE 6: WORKPLACE ORIENTATION

The factor analysis of the orientation that students received at the workplace identified the following components, 1 Health and safety awareness at the workplace, 2 Conduct at the workplace and 3 Culture as seen in Table 11.

The values in the Orientation in the Workplace tables represent the varied component loadings of Section C. Table 11 above and Figure 6 above are representations of the Likert Scale percentages for statements and questions identified for Factor analysis using extractions methods and Varimax with Kaiser Normalisation rotation methods. The responses from the students were used, and where applicable theoretical and knowledge from the researcher and all reviewed literature to support and used as well as generated theory and concrete understanding.

The values in Table 11 represents all the varied component loadings of section C: Orientation in the Workplace with their associated variables and Figure 6 is the representation of the Likert scale percentages for all related questions. The results 0.881 and 0.776 are the loadings for variables C9 and C15 respectively onto Component 1: Health and safety awareness at the workplace showing moderate inter - correlation and inter-relatedness between the variables. The majority of the students (93%) knew who to

report to while a few (7%) was not sure who to report of the first day at the workplace (C2). 92% (C9) of the students were made aware of the ethics of the workplace. 89% (C15) were made aware of aware of the dangers and risks of TB and HIV in the workplace.

The result of 0.944 is a loading for variable C3 and the result of 0.853 which is a loading variable for C4 contributes highly onto Component 2: Conduct at the Workplace. 82 % of the students knew the workflow of the laboratory while 89% of the students was introduced to other staff members. For students to work effectively, they should be guided by experienced workers (Dorasamy and Rampersad 2018). These worker have a wealth of knowledge with number of years behind them and can impart good practices to the students as they can advise students what to do and what not to do.

The value of 0.718 is a loading for C16 and the value of 0.893 is a loading for C17 contributes moderately to high onto Component 3: Culture. 89% of the students noted that they were able to interact easily and respectfully with people from other cultures. The landscape of higher education has dramatically changed, the new of calibre of student; new learning challenges in addition to other challenges in South Africa (Taylor and Govender, 2013). One of the main challenges students face is cultural differences in the university and in the workplace. In South Africa, we enter the workplace with various racial groups and it is very important to understand the various culture so that we do not infringe on another culture, behave badly and ridicule another as there should be harmony at the workplace as much time is spent here. It is clear that the programme is doing enough to address this issue.

Cronbach's Alpha Score, Kaiser-Meyer-Olkin Measure of Sampling Adequacy, and Bartlett's Test of Sphericity: Quality of teaching / learning at the training unit

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMOMSA) for this set of variables was 0.636 which is greater than 0.500 and the Bartlett's Test of Sphericity (BTS) tests the hypothesis that all the correlation matrix is indeed an identity matrix, that is all the diagonal elements are 1 and off – diagonal elements are 0. This means that all of the variables are uncorrelated.

Table 12: Rotated Component Matrix: Training Unit Quality of Teaching and Learning

	D Quality of Teaching and Learning	Component		
		1	2	3
D1	There was a structured learning programme in the workplace which allowed me to achieve the outcomes for WIL	0.692	0.524	0.209
D2	There are structured academic meetings at the laboratory which helped to increase my theoretical knowledge in the field	0.935	0.259	0.026
D3	I had regular contact with the laboratory supervisor to discuss my learning	0.933	0.184	0.241
D4	I had adequate time to study at the workplace	0.747	0.304	0.073
D5	The duration of the WIL component in this discipline was adequate for me to achieve my outcomes in this discipline	0.874	0.403	0.064
D6	There was alignment of the curriculum to the expectations of the workplace	0.648	0.647	-0.026
D7	The time that I had spent at DUT prepared me adequately for the workplace	0.311	0.841	0.310
D8	The theoretical knowledge that I gained while studying at DUT was adequate for what was expected at the workplace	0.294	0.865	0.054
D9	The theoretical knowledge that I gained while on campus was relevant for what was expected at the workplace	0.399	0.797	0.272
D10	The equipment / methods that I used in the workplace was similar to that in the Department of Biomedical and Clinical Technology	-0.020	0.190	0.710
D11	The practical sessions at the university prepared me for all the tasks that were performed at the workplace	0.040	0.526	0.695
D12	I was adequately prepared to cope with the tasks allocated to me	0.371	0.718	0.354
D13	I was able to answer questions posed to me by the laboratory supervisors regarding the theoretical aspects taught at the University	0.402	0.630	0.277
D14	I have regular contact with the University lecturer to discuss my learning	0.236	0.039	0.900
D15	A workshop at DUT prepared me adequately for my entry to clinical training	0.115	0.161	0.948
	Key Scales for Colour Coding of Factors: Quality of Teaching and Learning			
	1.Workplace training for achievement of WIL outcomes	2. DUT theoretical training for WIL	3.DUT practical training for WIL	

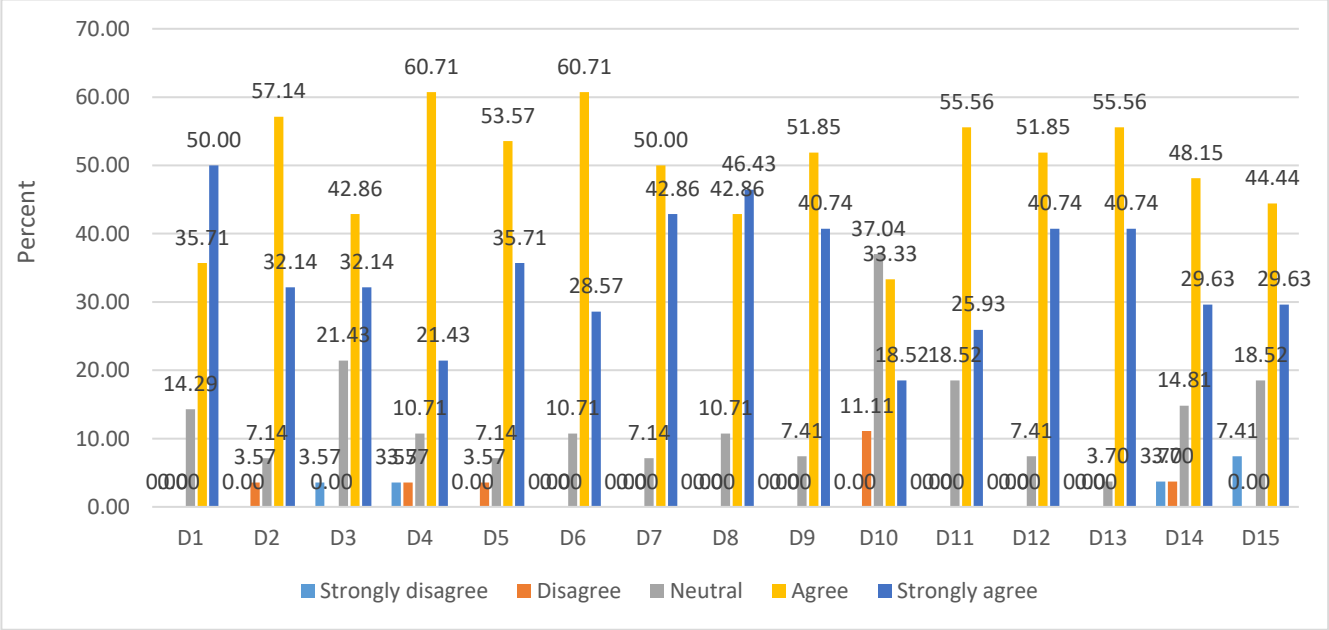

FIGURE 7: Quality of teaching / learning at the training unit

The factor analysis of the quality of teaching and learning at the workplace identified the following components, 1 Workplace training for achievement of WIL outcomes 2 DUT theoretical training for WIL and 3 DUT practical training for WIL as seen in Table 12. The values in the Quality of Teaching and Learning tables represent the varied component loadings of Section D. Table 12 above and Figure 7 above are representations of the Likert Scale percentages for statements and questions identified for Factor analysis using extractions methods and Varimax with Kaiser Normalisation rotation methods. The responses from the students were used, and where applicable theoretical and knowledge from the researcher and all reviewed literature to support and used as well as generated theory and concrete understanding.

The values in Table 12 represents all the varied component loadings of section D: Quality of Teaching and Learning tables with their associated variables and Figure 7 is the representation of the Likert scale percentages for all related questions. The results 0.935 and 0.933 are the loadings for variables D2 and D3 respectively onto Component 1: Workplace training for achievement of WIL outcomes showing high inter - correlation and inter-relatedness between the variables. The majority of the students (89%: D2) indicated that there are structured academic meetings at the laboratory which helped to increase their theoretical knowledge in the field. Seventy-five percent (75%) (D3) of the students had regular contact with the laboratory supervisor to discuss their learning. The WIL is a way of preparing graduates for the world of work that the student experiences (Ferns and Moore, 2012). One student noted that, "*Meeting new people in a new environment that was not familiar was hard to get used to at first*". Another student mentioned that, "*The WIL program was a bit long in duration, we were made to watch and sit and not help out. We must be given tasks to do by our trainer and try to help our trainer or supervisors in their task at hand"*.

The value of 0.841 is a loading for D7 and the value of 0.630 is a loading for D13 contributes moderately to high onto Component 2: DUT Theoretical training for WIL. A very large number of the students (93%) noted that the time that they had spent at DUT

prepared them adequately for the workplace. The "*students are very unstable when pipetting and preparing solutions*" was noted by a laboratory supervisor. Most students (96%) indicated that they were able to answer questions posed to them by the laboratory supervisors regarding the theoretical aspects taught at the University. Some employers mention that WIL students are enthusiastic and very keen to learn (Elijido – Ten and Kloot, 2015). The mainstream students spend two and a half years at the university while the Extended Curriculum Programme (ECP) students spend three and a half years at the university gathering all the theoretical knowledge to equip themselves for their chosen profession.

The value of 0.900 is a loading for D14 and the value of 0.948 is a loading for D15 contributes high to Component 3: DUT practical training for WIL. Most of the students (78%) have pointed out that they had regular contact with the University lecturer to discuss their learning. A few supervisors raised the issue of practicals at the university and that "*the link between theory and practical is often forgotten*". However one student mentioned that, "*The practicals need to be updated according to the work environment*". A large number of the students (74%) stated that a workshop at DUT prepared them adequately for their entry to clinical training. One student mentioned that, "*Everyone in the workplace was kind and welcoming and always ready to answer any questions. They were ever willing to help with the presentation and completing our training lists*". Another student noted that they, "*Got a real feel of the working environment*". A conducive work environment can ensure that staff use their working hours in a productive and effective manner. There should not be tension among working staff and a generally happy staff will minimize errors especially in Biomedical Technology where there is no room for mistakes. Students can blend well in these conditions and will assist them in their learning as the staff will assist them without prejudice. Students will be better exposed to all facets of the workplace and this will help them in the learning of their chosen discipline.

Section analysis was done to determine scoring patterns per statement for student orientation at DUT for WIL as per section B of the student questionnaire. The results were first presented using summarised percentages for the variables that constitute each

section. Results were then further analysed according to the importance of the statements. To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The variables with p-values of less than 0.05 were considered statistically significant and referred to health and safely orientation for the workplace, the WIL training schedule, and departmental rules pertaining to WIL, theoretical and practical outcomes for WIL as is seen in Table 13 below.

Table 13: Summary of the scoring patterns for student orientation at DUT

		Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
The Health and safety aspects of the work environment were clearly explained to me	B1	0	0.0 %	0	0.0 %	2	7.1 %	15	53.6 %	11	39.3 %	0.009
The orientation which I received from the Biomedical Technology programme was useful in preparing me for WIL	B2	0	0.0 %	0	0.0 %	5	17.9%	16	57.1 %	7	25.0 %	0.025
There were adequate workshops on work preparedness conducted during the Biomedical Technology programme	B3	2	7.1 %	0	0.0 %	6	21.4%	11	39.3 %	9	32.1 %	0.087
I was briefed on the timetable, ie the schedule of training	B4	0	0.0 %	0	0.0 %	2	7.1 %	11	39.3 %	15	53.6 %	0.009
I was made aware of the WIL co-ordinator	B5	0	0.0 %	0	0.0 %	2	7.1 %	14	50.0 %	12	42.9 %	0.012
I was given a departmental handbook and the rules were explained to me	B6	0	0.0 %	0	0.0 %	2	7.1 %	14	50.0 %	12	42.9 %	0.012
I knew the reporting structures in the department and the Faculty	B7	0	0.0 %	0	0.0 %	4	14.3%	10	35.7 %	14	50.0 %	0.066
I was made aware of the practical and theoretical outcomes for the WIL component	B8	0	0.0 %	0	0.0 %	2	7.1 %	12	42.9 %	14	50.0 %	0.012
The workshops were beneficial and prepared me for WIL	B9	2	7.1 %	1	3.6 %	2	7.1 %	16	57.1 %	7	25.0 %	0.000

It was statistically significant that 93% of the students indicated that the Health and safety aspects of the work environment were clearly explained to them. Most of the students (82%) felt that the orientation which they received from the Biomedical Technology programme was useful in preparing them for WIL. The orientation that the Biomedical Technology Programme provided was very useful to students in that they are presented with important information of the programme, reporting structures of the University, conduct of students and a host of other relevant information. Students were also briefed

on rules and regulations of the Department and the University, health and safety matters, do's and don'ts among others.

There were a divergent of views of the students when they were asked if the workshops were beneficial and prepared them for WIL. There were 18% of the students that indicated that the workshops were not beneficial and did not prepare them for the workplace. Usually an orientation programme is held on the first day of lectures. However, it was found that this was information overload and thus the Department and the University decided to have a week of orientation. These are usually half day sessions so that the student can absorb much information as possible. A laboratory supervisor commented when asked what are the weaknesses of the programme, "*Ethical conduct and a pre WIL workshop to inform student what to expect*". We do, however, have a LP3 seminar where there are several presentations to assist students, supervisors and the academic lecturers in improving WIL. It may be noted that this aspect needs to be reviewed.

4.5. SUPERVISOR SURVEY QUESTIONNAIRE

4.5.1 Section A: Biographical Data

This section summarises the biographical characteristics of the laboratory supervisors in terms of gender, race, years of professional experience, years of experience training students, whether they work in private or state laboratories and the discipline in which they were qualified.

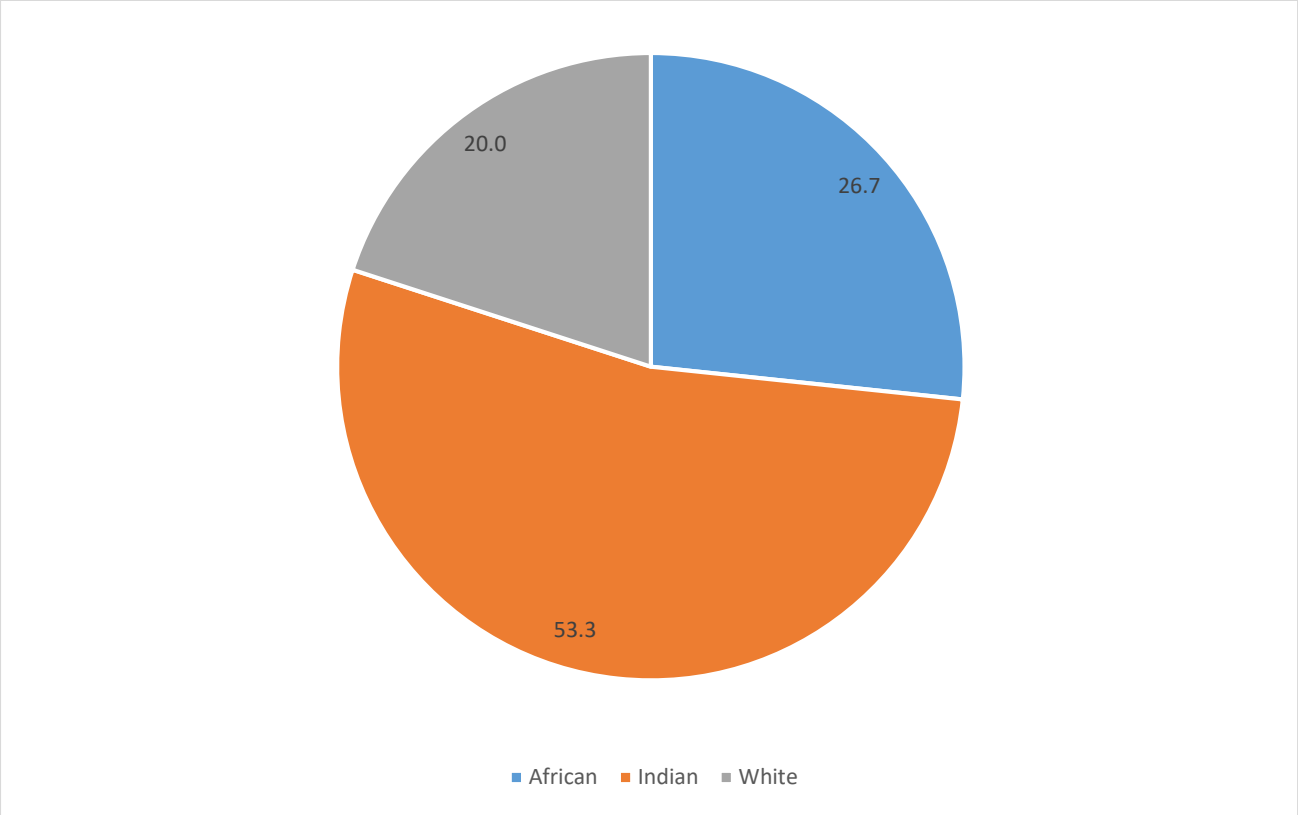

Figure 8: Different race groups of Laboratory supervisors

Figure 8 represents the racial distribution, majority of supervisors 53% (8/15) were Indian and the rest were African and White.

Language used by Supervisors

Table 14: Language of communication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	12	80.0	80.0	80.0
	isiZulu	1	6.7	6.7	86.7
	Both	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

Majority of the supervisors (80%) communicated with the students in English as is seen in Table 14.

Supervisor's Qualifications

Table 15: Highest Qualification of Supervisors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	B Tech	10	66.7	66.7	66.7
	B Tech; BSc	1	6.7	6.7	73.3
	Masters	2	13.3	13.3	86.7
	M Tech, National Diploma	1	6.7	6.7	93.3
	NHD	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

It was found that 67% (10/15) of the supervisors had a B Tech Biomedical Technology qualification, 3 had Masters qualifications and one supervisor had the National Diploma as is seen in Table 15.

Type of training laboratory

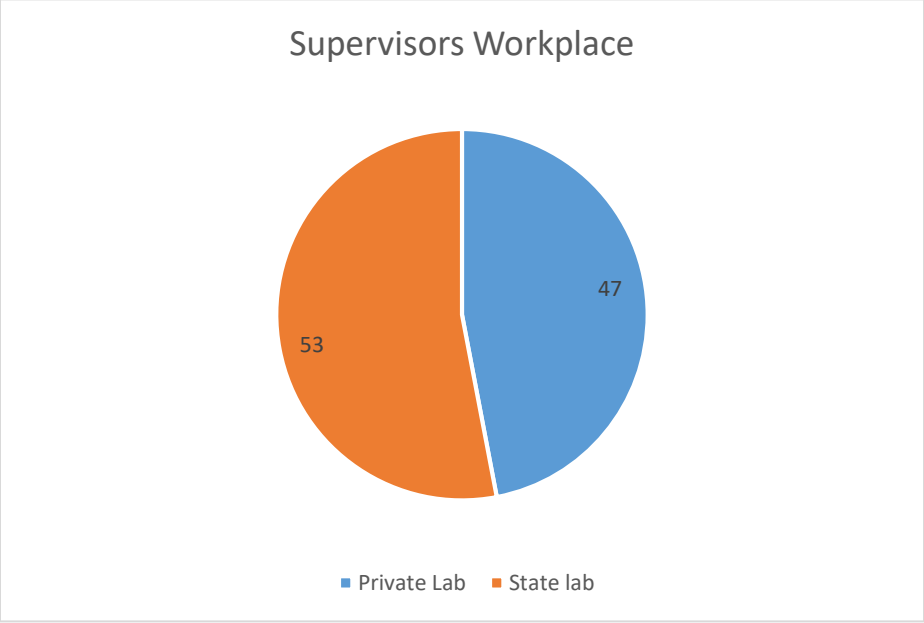

Figure 9 : Supervisor's place of work

Students are placed in both state and private laboratories, almost an equal number of responsed were received from the state and private laboratories as is seen in Figure 9.

Years of Supervisor Training Experience

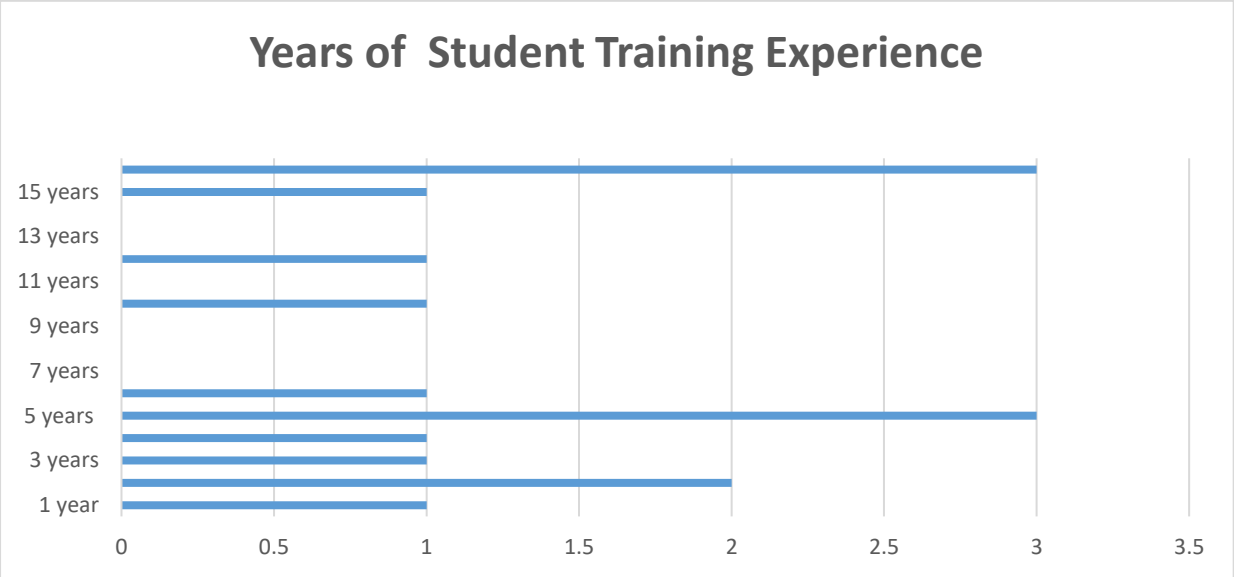

Figure 10: Number of years of supervisor training experience

Most of the supervisors had more than 1 year of training experience and this varied from 2 years to 30 years as is seen in Figure 10.

Type of prior training for student WIL supervision

Figure 11: Supervisor Training

The supervisors received various types of training including WIL workshops, Train the Trainer workshops and Education, Training and Development Practices Sector Education

and Training Authority (ETDP). The **ETDP SETA** is a vital link in terms of the various South African **SETAs** that were set up between 1998 when the Skills Development Act was first promulgated and the **SETAs** began operating in 2000. Almost half of the supervisors 47 (7/15) reported that they did not receive any training.

4.5.2 Section B: Student Orientation at the Workplace

Section analysis was done to determine scoring patterns per statement for student orientation at the workplace for WIL according to the supervisor responses as per section B of the supervisor questionnaire. The results were first presented using summarised percentages for the variables that constitute each section. Results were then further analysed according to the importance of the statements.

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The variables with p-values of less than 0.05 were considered statistically significant and referred to the supervisors orientating students on health and safely orientation for the workplace, lines of communication, health and safety and work timeframes as is seen in Table 15.

Table 16: Summary of the supervisor scoring patterns for student orientation at the workplace

		Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
My unit has a structured orientation programme for new WIL students	B1	0	0,0%	0	0,0%	0	0,0%	4	26,7%	11	73,3%	0,071
Overview of the structure of the organisation?	B2.1	0	0,0%	0	0,0%	0	0,0%	3	20,0%	12	80,0%	0,020
Time frames – start and finish times, lunch and tea breaks?	B2.2	0	0,0%	0	0,0%	0	0,0%	3	20,0%	12	80,0%	0,020
Participation of students in CPD activities?	B2.3	2	13,3%	4	26,7%	2	13,3%	4	26,7%	3	20,0%	0,856
What students do in the event of a needle stick injury?	B2.4	0	0,0%	1	6,7%	1	6,7%	4	26,7%	9	60,0%	0,010
Health and safety in the workplace?	B2.5	0	0,0%	0	0,0%	0	0,0%	3	20,0%	12	80,0%	0,020

Also the challenge of TB and HIV in the workplace?	B2.6	0	0,0%	0	0,0%	3	20,0%	3	20,0%	9	60,0%	0,091
The proper line of communication?	B2.7	0	0,0%	0	0,0%	0	0,0%	3	20,0%	12	80,0%	0,020
The procedure with regard to disputes regarding relationships at the workplace	B2.8	0	0,0%	1	6,7%	4	26,7%	4	26,7%	6	40,0%	0,334
There is a student disciplinary procedure at my Institution	B3	0	0,0%	0	0,0%	3	20,0%	6	40,0%	6	40,0%	0,549
Students do sign a register on arrival and departure	B4	0	0,0%	0	0,0%	1	6,7%	2	13,3%	12	80,0%	0,001
There is a structured assessment that takes place in the laboratory	B5	0	0,0%	0	0,0%	0	0,0%	4	28,6%	10	71,4%	0,109

There was a statistical significant difference in various responses. A significant higher number of supervisors (p = 0.02) agreed / strongly agreed that at orientation the overview of the structure of the organisation was mentioned. At orientation students were informed of the start and finishing times as well as lunch breaks.

All the supervisors agreed that their units had a structured orientation programme for new WIL students. However, the aspect of Continuous Professional Development (CPD) being covered in the orientation ranged from both agree to disagree. This is a point of concern as this is crucial for the Biomedical Technology students to be informed as it is mandatory for all Health personnel to be part of a CPD Programme that is administered by the HPCSA. CPD activities is vital as it allows for new knowledge and cutting edge technology to be imparted by all participants. There is usually one point per hour and Biomedical Technologists require 25 points in a year. Of this it is mandatory to obtain 5 points on ethics.

Students, at the orientation, were informed of what to do in the event of a needle stick injury, made aware of the Health and Safety of the organisation and all supervisors agreed that at the orientation the challenge of TB and HIV in the workplace was covered. It was also agreed by all the supervisors that at the orientation at the workplace, the proper lines of communication was explained to the students. However, it was concerning that 30% of the supervisors did not cover the procedure with regard to disputes regarding relationships

at the workplace but most supervisors agreed that there is a student disciplinary procedure at their Institution and this was mentioned at the workplace orientation. One supervisor mentioned that, "*Emphasis on Experiential Training Adherence to avoid/reduce the concern of Injury on Duty (IOD) for students as they are not medically covered".* This may necessitate the programme to introduce such a workshop as a CPD activity, going forward.

It was mentioned at the orientation at the workplace that students do sign a register on arrival and departure as this was noted by almost all supervisors. All supervisors agreed that there is a structured assessment that takes place in the laboratory and this was relayed to the students during the orientation process at the workplace. One student indicated that, "*Training was sufficient. It made me able to choose the disciplines of my choice for internship*". In the Biomedical Technology programme students are exposed to all disciplines and thus can make an informed decision on which discipline they would choose for their internship. Another student noted when asked if there were any challenges, "*Yes working and studying at the same time*". This is a growing process for the students where they need to plan themselves on time management and how to find a common compromise between working and studying.

4.5.3 Section C: Student preparedness for work integrated learning

Using section analysis, it was found that the statistically significant variables regarding the supervisors' perceptions on the students prior preparation for WIL from the UoT were as follows: the students displayed an adequate theoretical background of the profession and discipline, and the students were able to work independently after being trained in the laboratories by the supervisors.

Table 17: Supervisor perception of students preparedness for work integrated learning

		Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
The students displayed adequate theoretical background of the profession / discipline	C1	0	0,0%	1	6,7%	8	53,3%	5	33,3%	1	6,7%	0,026
The practical sessions that were held at the University were useful in assisting students at the workplace	C2	1	6,7%	1	6,7%	6	40,0%	5	33,3%	2	13,3%	0,119
I feel that students were adequately prepared for the world of work	C3	0	0,0%	3	20,0%	7	46,7%	4	26,7%	1	6,7%	0,172
Students are able to perform tasks independently after being adequately trained	C4	0	0,0%	1	6,7%	3	20,0%	9	60,0%	2	13,3%	0,016

Most supervisors (60%) indicated that the students did not display adequate theoretical background of the profession / discipline. This is of concern as students are entering the workplace are lacking important theoretical knowledge when they reach the workplace. The impact of this has been widely described by employers in that it they have to spend time teaching what should have been covered at the university. This concern was also voiced by the students that is important "*to revise each day of the work that was done on that day even it's for an hour*." During the supervisors interviews this was probed and that the students were taught content but forgot them by the time they enter the work arena. One supervisor indicated that, "*They have been adequately prepared*". This however, was discrepant with what the students described on this matter as one student indicated that lecturers should "*Elaborate a bit more on instrumentation*" and another student mentioned that "*Since there is more automation in the lab, I feel there should be emphasis placed on understanding the equipment during campus especially*". Students also mentioned that, "*It all goes together. It makes sense when you get clear understanding in it*." There is an

expectation that the students will use all the theory taught at the University into a practice based setting (Ferns and Moore, 2012).

It was also mentioned by the supervisors that the practical sessions that were held at the University were not useful in assisting students at the workplace. Some students pointed out the need for more authentic practicals and fundamental understanding of the equipment basic design and principles of operation. One student noted, "*The practicals need to be updated according to the work environment*", and "*Add more practicals*" and "*practicals at University should be reviewed*". A supervisor noted that, *"UoT should have a refresher programs before the students are sent to the training Labs".* The researcher is aware that what occurs in practical sessions at the University may not be sufficient and may not mimic the real- life settings, the lecturers are trying to fill this gap however some of the equipment on campus cannot compare to what is in the industry. Graduates who possess the attributes to integrate theory with practical knowledge, have the ability to transfer this knowledge, and use this for innovation, as well as possess the technological savvy associated with the age that we live in (Steven and Fallows, 2000). Therefore there will be a smooth transition for the student and will cope with the workplace. This finding may elicit a need to refine the orientation programme for WIL preparedness in the programme.

Another concern was that 67% of the supervisors felt that students were inadequately prepared for the world of work. One supervisor mentioned that, "*students tend not to remember their theory covered at the University. Some students tend to struggle to answer basic baseline questions*". Another supervisor mentioned that, "*Students attitudes towards the working Industry need to be improved*". Students corroborated this by indicating that they need a recap at the end of the lecture session, for example two question and answer sessions or an exemplar of real-life workplace scenario to shed light on the taught concepts and principles. One student noted that, "*The WIL program was a bit long in duration, we were made to watch and sit and not help out. We must be given tasks to do by our trainer and try to help our trainer or supervisors in their task at hand*". However, most supervisors noted that students were able to perform tasks independently

after being adequately trained. A supervisor indicated that, ""*The main strength of the program is that it allows the students to get an idea of what it is like to work in a clinical laboratory. It allows the student to combine the theory they learnt at the University*". However another supervisor stated that "*The link between theory and practical is often forgotten*".

Another supervisor indicated that, "*The programme is not keeping pace with the new technology in the laboratory*". The University needs to keep up–to–date with the continuous changes in the Industry, with new developments and new technology (Roopnarain and Akoobhai, 2014). The student's response indicated that, "*The practicals need to be updated according to the working environment".* Another student stated that it was difficult to view slides "*when you are not used on growth culture on unpure growth*". The researcher is aware that what occurs in practical sessions at the university may not be sufficient and may not mimic the real- life settings; there is a constant drive for the lecturers to fill this gap, however this is precluded by some of the equipment on campus being incomparable to what is in the industry. Since universities and industries ought to collaborate to ensure that WIL takes place and that the teaching and learning in the programme is compliant with the industry with cutting-edge technology (Cilliers and Smit 2014), it may be necessary to strengthen the relationships with industry partners as far as the curriculum design goes, particularly for the practicals.

4.5.4 Section D: Workplace Behaviour

The only statistically significant variable that was identified in the supervisor responses on workplace behaviour was that the students were able to communicate well as is seen in Table 18.

Table 18: Supersivor's perceptions of students behaviour at the workplace

		Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
Students adhered to dress code	D1	0	0,0%	0	0,0%	3	20,0%	9	60,0%	3	20,0%	0,091
The students were able to communicate well	D2	0	0,0%	1	6,7%	1	6,7%	13	86,7%	0	0,0%	0,000
Students did interact with people from different cultures to achieve workplace goals	D3	0	0,0%	0	0,0%	4	26,7%	9	60,0%	2	13,3%	0,074
The students did have knowledge of ethics in the profession and the workplace	D4	0	0,0%	1	6,7%	5	33,3%	7	46,7%	2	13,3%	0,108
The training of student impact financially to my organisation	D5	0	0,0%	2	13,3%	5	33,3%	3	20,0%	5	33,3%	0,615
Student training is part of my workload	D6	0	0,0%	2	14,3%	3	21,4%	3	21,4%	6	42,9%	0,463

Most of the supervisors (80%) mentioned that students adhered to dress code and the majority of the supervisors stated that the students were able to communicate well. One supervisor stated that students need to, "*To learn and understand how to behave professionally, the clothes they wear, the way in which they speak*". With regards to cultural interaction at the workplace responses ranged from neutral to strongly agree. A moderate number of supervisors (73%) agreed that students did interact with people from different cultures to achieve workplace goals while 27% of the supervisors did not agree.

In South Africa, cultural diversity in the work arena is when workplace institutions have employees from various backgrounds; regardless of race, religion, creed and culture. Thus a diverse pool of people are employed, and this benefits the company as well as its employees. This is essential since in South Africa, workplaces, schools and universities are increasingly consisting of various cultural, racial, and ethnic groups. It is important that

we can learn from one another, but first we must have a level of tolerance about each other in order to facilitate partnerships and teamwork. Students enter the workplace with various types of ethnic groups, different cultural backgrounds and students need to blend with all these diverse groups, work together in coherence with one another, to understand and work together amicably with the various type of people. The Biomedical Technology programme actively strives to inculcate this, and a strategy used is that students are encouraged to do group work and thus placed into teams with diverse groupings and encouraged to mix with all the various types of students, to learn, embrace and accept the various cultures of their class mates.

A varied response was received from supervisors that students did have knowledge of ethics in the profession and the workplace; 40% of the supervisors believed that this was not the case whilst 47% agreed. One supervisor mentioned that, "*They need to be made aware what is expected from them in the working environment. The importance of Ethics especially in their discipline*". Dorasamy and Rampersad (2018) noted that ethics is about respecting the culture of an organisation but at the same time upholding ones honour.
In South Africa workplace ethics are the rules and procedures that should be carried out by the employer and the employees to maintain a professional company culture and to build a better relationship with their customers by providing better services. One student mentioned that they need to, "*Have an open mind because different labs are not the same. Be polite to everyone, don't judge anyone, respect everyone even cleaners because they might teach you more, maybe what the campus did not tell you as they won't cover everything*. A supervisor reported that, "*I think that the students need to be spoken to about ethics in general and work related Ethics. I feel that the students need to be encouraged to change their mind set from a student one to a more mature attitude, changing a mind set of " what the world can do for me" to " what can I do for the world / my community / my employer?" The students must be made to understand the importance of Contracts and not to break contracts. Employers enter into contracts with employees as a way of stipulating what the Employer is prepared to do for their employee and what they require of the Employee. Students need to made aware of the implications of their sometimes , self-centred, actions and how breaking a contract affects the Employer and*

their fellow students especially as Training Institutions offer bursaries to students and in return promise them positions in the company to be trained and employed as full time employees afterwards. Training Laboratories, especially the private ones, are only able to offer a small number of positions. Bursary students are held against these positions and if they decide to break their contract halfway through their internship to go elsewhere, they should realise that they have prevented a fellow student from getting the position they held and the training Laboratory cannot employ other students into their previously held position because it will affect the training Programme which starts in January of the year of internship and continues for the next 12 months in order to write the Board Exam the following year in March."

Another response from the supervisors that the training of students impact financially on their organisation: here 47% mentioned that it did not impact on their company while 53% of the supervisors agreed that it did impact financially. This divergence of views may be explained by the various disciplines in Biomedical Technology where reagents, kits and other consumables are used for training students, and themselves vary in prices. Some of these are costly and are purchased by the organisations at their own cost. Students do not get stipends from the workplace and rely on funding from their bursaries, own funding and assistance from the HWSETA. One supervisor noted that, "*These days we, as in Private Training Laboratories , are finding it difficult to retain the LP3 students that we spend time and money training, for internship and eventual employment. I am not sure if this can be remedied within WIL as it appears to be purely a money issue (the Training Institution offering more money is the preferred Training Lab)".* Some, however mention costs incurred for WIL students due to training students and costs to retain students (Elijido –Ten and Kloot, 2014). There are costs in the induction of new employers and employers bear costs like reagents and kits that students train with.

A moderate number of supervisors (67%) indicated that student training is part of their workload whilst 33% mentioned that student training is not part of their workload. Crebert et al (2007) noted that supervisors have other work commitments and deadlines and thus their work takes precedence over student training. A laboratory supervisor indicated that,

"*There is a lot of work to mark with the students and the practicals are time consuming to fit into the work schedule*". However, one student stated that LP3, "helped me understand the work better. Better exposure". Supervisors tend to neglect students and they are concentrating on their own job description. Thus students are told to remain in a confined area and no "hands on" are done by students. A student noted that, "*Students should be rostered to a bench with Tech instead of being left together alone in a room for the whole cycle*." Another student indicated that, "*The WIL program was a bit long in duration, we were made to watch and sit and not help out. We must be given tasks to do by our trainer and try to help our trainer or supervisors in their task at hand"*. Some supervisors leave students unattended for long periods and this is not conducive to training, while some of the supervisors go the extra mile and make time to train our students.

4.5.5 Section E: Quality of partnerships between DUT and Industry

Table 19: Supervisors' perceptions of the quality of partnerships between DUT and the Laboratories

		Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
I received support from the Department of Biomedical and Clinical Technology i.e. in providing me with academic structure; practical manuals and scheme of work	E1	0	0,0%	1	6,7%	3	20,0%	8	53,3%	3	20,0%	0,068
I had adequate meetings with the Department	E2	0	0,0%	1	6,7%	6	40,0%	7	46,7%	1	6,7%	0,042
There were opportunities to raise concerns with the Department	E3	0	0,0%	1	6,7%	5	33,3%	7	46,7%	2	13,3%	0,108
There was adequate communication in terms of placement of students and the number of students that laboratories can accommodate	E4	0	0,0%	0	0,0%	1	6,7%	10	66,7%	4	26,7%	0,015
Communication from the Department with regards to WIL was sent to me timeously	E5	0	0,0%	0	0,0%	2	13,3%	9	60,0%	4	26,7%	0,074
The changing needs in industry were adequately addressed in the programme curriculum	E6	1	6,7%	2	13,3%	2	13,3%	9	60,0%	1	6,7%	0,004
I would like to receive additional training on the Lecturing, Teaching and Assessment (LTA) methods to improve the interaction and training of students	E7	0	0,0%	2	13,3%	3	20,0%	3	20,0%	7	46,7%	0,269
I did communicate and provide feedback to the Department	E8	0	0,0%	0	0,0%	3	20,0%	9	60,0%	3	20,0%	0,091
I am invited for curriculum meetings at the UoT	E9	0	0,0%	1	6,7%	3	20,0%	8	53,3%	3	20,0%	0,068
I am satisfied with the assessment of the WIL programme	E10	0	0,0%	1	6,7%	4	26,7%	7	46,7%	3	20,0%	0,172
There is an opportunity to communicate any shortcomings of the WIL programme with the department	E11	0	0,0%	0	0,0%	3	20,0%	9	60,0%	3	20,0%	0,091

The statistically significant variables that were identified in the supervisor responses on quality of partnerships between the DUT and the laboratories were as follows: it was felt that there were adequate meetings with the UoT, there was good communication for student placement in terms of the students that could be accommodated by the laboratories. The fact that the changing industry needs were being addressed by the curriculum was also found to be a signficant variable, where there was a divergence of views ranging from negative to positive on the Likert scale.

There was a divergent of views when supervisors reacted to the the statement that they received support from the Department of Biomedical and Clinical Technology that is in providing them with the academic structure; practical manuals and scheme of work. Of concern is that 27% of the supervisors who stated that they did not get the Department's support and no academic support like practical manuals and scheme of work given to them. A significant number of supervisors (93%) indicated that there was adequate communication in terms of placement of students and the number of students that laboratories can accommodate. There were also a large number of supervisors (87%) noted that they had communication from the Department with regards to WIL and was sent to them timeously. Communication with all training managers / supervisors takes place months prior to the students going to the workplace. The WIL coordinator communicates to the stakeholders to ensure all students are placed and this is ratified at the first Joint Advisory Board Meeting. Perhaps the training managers do not inform their laboratory supervisors about their interaction with the University. Another contact with all stakeholders is at the LP3 review workshop where all relevant people are invited. It is vital to keep in touch with the industry partners early in the year to ensure that there is placements for all students

There was also a divergence of views when supervisors were asked if they had adequate meetings with the Department. It is concerning that 47% of the respondents noted that they did not have adequate meetings with the Department. However all laboratory supervisors are invited to the LP3 review workshop but we find only a small percentage

attend. At these meetings supervisors would have opportunities to raise concerns with the Department. At the Joint Advisory meetings, the training managers and representatives of various disciplines form part of the Advisory committee thus all laboratory supervisors are not present. However all are invited to the LP3 review workshop. The attendance registers should be scrutinized and established which of the supervisors did not attend and flag this. The staff in the programme can also email or call those that do not attend and find out the reasons thereof.

There was a divergent of views when supervisors were asked if the changing needs in industry were adequately addressed in the programme curriculum. The majority of the supervisors (67%) agreed that this was addressed but it is concerning that 33% of the supervisors disagreed and one supervisor mentioned that, "*The programme is not keeping pace with the new technology in the laboratory*". Cilliers and Smit (2014) indicated that in some institutions the process of preparation for the students are imbedded in the curriculum and thus no duplication occurs. Employers can influence the curriculum with new ideas and ever changing technology (Roopnarain and Akoobhai, 2014). The work arena is dynamic and constantly changing. New instruments, methodology and techniques are changing at a rapid pace. Therefore the Biomedical Technology programme should be kept abreast with the cutting edge technology. Simultaneously the curriculum needs to meet this requirement and evolve with the changing times. There are several ways of incorporating new methods and techniques into the curriculum may occur when the Biomedical Technology have curriculum meetings with all stakeholder and this occurs several times a year.

A significant number of supervisors (67%) agreed that they would like to receive additional training on the Lecturing, Teaching and Assessment (LTA) methods to improve the interaction and training of students. One supervisor mentioned that, "*New assessors need training concerning the WIL programme*". The training of Biomedical Technology students is dynamic and there are always staff leaving and new staff filling posts to supervise and train students. Thus new supervisors need to be orientated and the Biomedical Technology department should ensure that the new supervisors be trained as supervisors.

Most supervisors (80%) mentioned that they did communicate and provide feedback to the Department.

It must be mentioned that during LP3, the WIL coordinator sends feedback forms to all students and supervisors. However, a handful of supervisor's forms are returned but a high percentage of students forms. Perhaps a deadline should be given to the supervisors and if not received, the Programme should arrange to collect these important feedback forms. In addition, it is of concern that 27% of the supervisors indicated that they are not invited for curriculum meetings at the UoT. Curriculum champions in the Biomedical Technology programme sent invites to all training heads and perhaps this does not go to all supervisors at the workplace. Perhaps the attendance registers should be closely monitored and those supervisors who constantly do not attend should be identified.

There is a divergence of views where 33% of the supervisors indicated that they are not satisfied with the assessment of the WIL programme. This is worrying as this is essential for the programme to succeed. However, 80% of the supervisors noted that there was an opportunity to communicate any shortcomings of the WIL programme with the department.

CHAPTER 5
DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1. INTRODUCTION AND GOOD PRACTICE

Reviews of WIL practice in South Africa is very limited, particularly in the Health Sciences (Sibiya 2014; Moletsane 2015). The few studies are confined to disciplines like Nursing, Radiography and the Hospitality industry. The main findings in the studies were that our students were generally not well-prepared for WIL and the noteworthy concerns that were raised related to provision of ethics training for students, students' poor attitudes towards the working industry, and lack of professionalism. In addition, inadequate theoretical background of the profession / discipline and disjuncture between content taught at the university and what students were exposed to at the workplace emerged as the main concerns.

Jackson (2013) mentions that WIL provides a means of making graduates "work ready" and this in turn enhances their skills and employability**.** However, for this to occur, an optimal interplay between the university, student and external stakeholders must occur. This is clearly not the case, since fissures relating to the theoretical as well as the practical training of students were evident from both students' and supervisors' responses. These findings are not unique to our study, and, they have been reported recently by Jackson et al (2017). The author also reported, in a subsequent publication (Jackson et al, 2017), that the lack of collaboration between the Industry and University where the University is not responding to the Industry needs and not seeking advice on curriculum revision, as was the case in our study, may minimise any potential benefits of WIL. This therefore emphasizes the need for the interdependence of the all stakeholders in a collaborative and cooperative partnership (Gershenfeld, 2014; Smith and Smith, 2010; Crisp and Cruz, 2009). Another area of concern was that almost half of the supervisors claimed that they did not have adequate meetings with the department, and a third of supervisors were not satisfied with the WIL assessments. This once again, exposes a potential crack in the delivery of WIL, and may also explain the pitfalls seen in both the curriculum design and assessment. Although the tension between academic goals (curriculum design) and

productivity in industry is known to exist, and is acknowledged by the researcher, Coll (2007) asserts that education must be the main factor in any WIL programme. In view of this, the programme needs to urgently strengthen its relationships with subject specialists to address the apparent gaps which may be present in certain specialities, especially since the new degree is currently being rolled out. This would be beneficial in capitalising on the accelerated learning which WIL potentially provides through experiential learning.The emphasis should be on collaboration with industry to introduce cutting edge technology that is seen in the laboratories, and needs to be embedded in the curriculum and supported by pedagogical strategies throughout the programme (Bates and Hayes, 2017).

The experiential learning in higher education arose from John Dewey (Kolb, 2014) who believed people learn best by doing. It is established that learning is enhanced when the students are engaged in studies and learning. In spite of the finding that students initially lacked skills that are essential for employment, our study illustrated Dewey's theory, as there was consensus with regards to the value of WIL in the workplace. Both students and supervisors expressed that students got "hands-on" exposure to real-life settings in the industry and that they were able to acquire the requisite skills in spite of not having an initial adequate theoretical background at the university. These findings also support those by Hall and others who reported that WIL experiences impacted on the development of graduate attributes for employability (Hall et al. 2004).

Another area of concern was the financial impact of training on the workplace, where the implication is that students may not be exposed to all aspects of the particular sub-discipline in an attempt to save costs on consumables. As mentioned by Moore (2004), the goal of WIL should be for learning to take place at the workplace, and this may be jeopardised when production is prioritised over teaching, thus precluding students from attainment of the requisite graduate skills, competencies and attributes for employment (Moletsane, 2011).

According to the researcher's knowledge, this is the first study of this nature where students and supervisors were given an opportunity to reflect on WIL practices in Biomedical Technology programme. The study has yielded insightful findings as discussed above. Other strengths are as follows:

- There was a good response rate, as more than 70% for both students and supervisors responded.
- Supervisors felt that the Biomedical Technology programme selected students who were able to cope with the complexities of the programme content, as evidenced in the high quality pass rates in the WIL modules (>75%).
- Although students may not have had sufficient theoretical knowledge in all disciplines, the study highlighted that they still possessed suitable graduate attributes which made them ambitious to progress in their careers and succeed.

5.2. LIMITATIONS OF THE STUDY

This study reports the following potential limitations:

- Academic staff were not subjected to the survey. It would have closed the loop to hear the Biomedical Technology staffs' point of views.
- Hawthorne effect - the students were given the questionnaire by the researcher who is a lecturer in the programme, thus students may have been biased in the answering of the tool.
- Undeniably, the researcher acknowledges that the sampling strategy may seem statistically unrepresentative in the eyes of the positivists, but it is informationally representative as data was obtained from participants who are representative of other persons with similar characteristics (Sandelowski, 1995; Onwuegbuzie and Leech, 2004).

5.3. RECOMMENDATIONS

In view of the feedback elicited from both students and supervisors, the following recommendations are made:

- Students require a refresher course. It was suggested that prior to students going out for WIL, important sessions should be held to recap aspects of the curriculum so that students have a smooth transition into the workplace. This has been emphasised previously by constructive feedback by laboratory supervisors at workshops and at Joint Advisory Board meetings. Makhathini (2016) reaffirms that WIL should promote the integration of theoretical concepts learnt at the University with the workplace practices.

- Supervisors require the LP3 review workshop where the previous year's offering is reviewed and recommendations / changes made. It is also an opportunity for all stakeholders to meet, known as Subject Committees where specialists from specific disciplines interact to improve the subject/discipline. Resolutions from this workshop was tabled at the Joint Advisory Board Meetings for ratification. The value of WIL review has been clearly established in the literature. In a study with interior design students, it was noted that skills sets were evaluated and evaluated again when implementing the new curriculum (Smit 2015). It is important to reflect on the current practice, identify any shortcomings, gaps or areas that require improving so that it could be implemented in the next cohort of students for best practice.

- Soft skills need to be reinforced in students throughout their stay at the University. This will assist students so that they have a smooth transition from the university to the working environment. The employers see advantages in the WIL programme in that students have the opportunity to improve their "soft skills" such as working as a team, keeping up to deadlines and interacting with fellow students, supervisors and clients (Elijido – Ten and Kloot, 2014).

- More practical sessions for students need to be done, in order to keep in line with Industry in terms of advancement. All medical sciences programmes have practical sessions at the university, with most mimicing that in the workplace. This is essential so that they get to know what happens in real-life settings and thus are prepared for the world of work. Biomedical Technologists work within the medical team to provide a holistic service to patients (Crebert et al, 2004; Marock, 2008).

- Continuous Professional Development (CPD) should be covered in the orientation at the workplace. This is crucial for the Biomedical Technology students to be informed as it is mandatory for all Health personnel to be part of a CPD Programme that is administered by the HPCSA. At the laboratories there are journal clubs held weekly in academic institutions, National and local conferences, workshops and on-line activities in order to obtain points for CPD. It is essential for all healthcare personnel to update their knowledge and skills so that at the end, the client or patient benefits (HPCSA CPD website). Points for activities that have been accumulated for a period of twelve months and if noncompliant they are given six months to comply.

- A fair number of the supervisors did not cover the procedure with regard to disputes regarding relationships between students and supervisors at the workplace. Hence a workshop should be offered to supervisors on conflict resolution. The importance of these skills has been reported by the human resource section and laboratory supervisors who undergo this on a regular basis. The value of a workshop of this nature with help staff familiarize with these matters and should it occur they will be able to cope with it and hopefully resolve such issues with minimal disruption to the teaching and learning activities.

- Supervisors claim that they are not involved in the designing of the Biomedical Technology curriculum, in spite of being invited. It is established that for WIL to be successful, all parties need to participate. The department will have to explore

alternate strategies to involve industry and elicit their participation, given its importance. For example, academic meetings may have to be scheduled during the weekends so that more supervisors are available to attend. In addition, a concerted effort needs to be made to develop an Allumni database.

- The attitude of students was concerning to supervisors. It was noted that students do not take the workplace seriously, do not greet staff at the workplace, come in late or do not call when they are ill to name a few. The employer's main complaint is the attitude of students as noted by Patrick et al (2008). These aspects will need to be included in the orientation programme for WIL preparedness, going forward.

5.4. CONCLUSION

This study investigated student preparedness for work integrated learning, and raised a variety of issues from both students and supervisors. The good practices in the Biomedical Technology programmes will be reinforced, and strategies will be formulated and implemented to address the areas of concern, now that it has been formally researched. It also adds impetus to involvement of industry stakeholders in all aspects of BHSc curriculum, so that these issues may be avoided, or minimally, identified early. These findings will certainly inform the WIL offering in the new curriculum, and will be shared with the Health Sciences community at large, which is its main contribution, and will assist future students entering the programme.

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APPENDIX A

Student Survey Questionnaire

Dear student

Thank you for taking the time to complete this questionnaire. This questionnaire invites your views on your preparedness for Work Integrated learning (WIL). To generate the most accurate information regarding this area, please do your best to provide answers as honestly as possible. While most of the questions are Likert-scale in nature, I have also included a few open-ended questions in the last section of the questionnaire to enable you to raise concerns or highlight solutions. Completion of the questionnaire will take approximately 15 minutes. Your contribution is highly valued and will be used to increase understanding of WIL and all information will be confidential. Your personal details will not be disclosed and any data used in the final report will not be linked to you.

Please place a tick or notes where relevant

Section A:

Demographics: Student

Male		**Black**		**Indian**		**Code**	
Female		**Coloured**		**White**		**Date of Birth**	
		Others				**Mainstream or ECP**	
Number of years in NDBMT			**Previous qualifications**			**Previous work experience**	

B. Orientation: Please reflect on the orientation that you received at DUT in order to prepare you for WIL:

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. The Health and safety aspects of the work environment were clearly explained to me.	
2. The orientation which I received from the Biomedical Technology programme was useful in preparing me for WIL.	
3. There were adequate workshops on work preparedness conducted during the Biomedical Technology programme.	
4. I was briefed on the timetable, i.e. the schedule of training.	

5. I was made aware of the WIL co-ordinator.	
6. I was given a departmental handbook and the rules were explained to me.	
7. I knew the reporting structures in the department and the Faculty.	
8. I was made aware of the practical and theoretical outcomes for the WIL component.	
9. The workshops were beneficial and prepared me for WIL.	

C: Orientation at workplace

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. I received an orientation programme at the workplace.	
2. I knew who I was going to report to.	
3. I was familiar with the work-flow of the lab that I was placed in.	
4. I was introduced to other staff members.	
5. I was oriented on the rules and regulations of the workplace.	
6. I was made aware of the code of conduct of the workplace	
7. I was aware of the work times.	
8. I was made aware of protocols relating to leave, sick leave and absence from work.	
9. I was made aware of the ethics of the workplace.	
10. The tea break and lunch breaks were communicated to me, and also the duration.	
11. I was aware of the protocol that needs to be followed in the event of a needle stick injury.	
12. At the workplace I was required to sign a register.	
13. I was aware of all Health and Safety aspects at the workplace.	
14. I was immunised against Hepatitis.	
15. I was made aware of the dangers and risks of TB and HIV in the workplace.	
16. I was able to interact easily and respectfully with people from other cultures.	
17. On the first day at the workplace I was able to cope with the work on hand.	

D: Quality of teaching/learning at the training unit

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. There was a structured learning programme in the workplace which allowed me to achieve the outcomes for WIL.	
2. There are structured academic meetings at the laboratory which helped to increase my theoretical knowledge in the field.	
3. I had regular contact with the laboratory supervisor to discuss my learning.	
4. I had adequate time to study at the workplace.	
5. The duration of the WIL component in this discipline was adequate for me to achieve my outcomes in this discipline.	
6. There was alignment of the curriculum to the expectations of the workplace.	
7. The time that I had spent at DUT prepared me adequately for the workplace.	
8. The theoretical knowledge that I gained while studying at DUT was adequate for what was expected at the workplace.	
9. The theoretical knowledge that I gained while on campus was relevant for what was expected at the workplace.	
10. The equipment / methods that I used in the workplace was similar to that in the Department of Biomedical and Clinical Technology	
11. The practical sessions at the university prepared me for all the tasks that were performed at the workplace.	
12. I was adequately prepared to cope with the tasks allocated to me	
13. I was able to answer questions posed to me by the laboratory supervisors regarding the theoretical aspects taught at the University.	
14. I have regular contact with the University lecturer to discuss my learning.	
15. A workshop at DUT prepared me adequately for my entry to clinical training.	

E: Open ended questions:

1. Elaborate on the areas which need to be improved on or revised.

2. Were there any highlights of your training? Kindly explain.

3. Were there any challenges that you experienced at the workplace? Please state.

4. What can you suggest that will improve students coming after you in these areas? Kindly substantiate

5. Which of the various disciplines you enjoyed the most. Please explain.

APPENDIX B

Supervisor Survey Questionnaire

Dear Academic Laboratory supervisors

Thank you for taking the time to complete this questionnaire. This questionnaire invites your views on your preparedness for Work Integrated learning (WIL). To generate the most accurate information regarding this area, please do your best to provide answers as honestly as possible. While most of the questions are Likert-scale in nature, I have also included a few open-ended questions in the last section of the questionnaire to enable you to raise concerns or highlight solutions. Completion of the questionnaire will take approximately 25 minutes. Your contribution is highly valued and will be used to increase understanding of WIL and all information will be confidential. Your personal details will not be disclosed and any data used in the final report will not be linked to you.

Academic Laboratory supervisors

A Biographical information:

1. What is your race?	
2. What is your language of communication?	
3. What are your qualifications?	
4. How much experience do you have in the profession?	
5. Do you work in private or public / parastatal organisation?	
6. How many student (s) do you take for WIL placements?	
7. Which discipline are you responsible for in your laboratory for student training?	
8. How long have you been training students?	
9. What type of training have you received in order to facilitate WIL?	

B Student Orientation

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. My unit has a structured orientation programme for new WIL students.	
2. If you replied yes to the above question, does the orientation programme cover the following?	
2.1 Overview of the structure of the organisation?	

2.2 Time frames – start and finish times, lunch and tea breaks?	
2.3 Participation of students in CPD activities?	
2.4 What students do in the event of a needle stick injury?	
2.5 Health and safety in the workplace?	
2.6. Also the challenge of TB and HIV in the workplace?	
2.7 The proper line of communication?	
2.8 The procedure with regard to disputes regarding relationships at the workplace.	
3. There is a student disciplinary procedure at my Institution.	
4. Students do sign a register on arrival and departure.	
5. There is a structured assessment that takes place in the laboratory.	

C Student preparedness for WIL:

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. The students displayed adequate theoretical background of the profession / discipline.	
2 The practical sessions that were held at the University were useful in assisting students at the workplace.	
3 I feel that students were adequately prepared for the world of work.	
4 Students are able to perform tasks independently after being adequately trained.	

D Workplace behaviour

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. Students adhered to dress code.	
2. The students were able to communicate well.	
3. Students did interact with people from different cultures to achieve workplace goals.	
4. The students did have knowledge of ethics in the profession and the workplace.	
5. The training of student impact financially to my organisation.	
6. Student training is part of my workload.	

E Quality of Partnership between Department and Industry (Department means Department of Biomedical and Clinical Technology)

Please indicate your response to each of the questions by using the following key:

5 Strongly agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly disagree

1. I received support from the Department of Biomedical and Clinical Technology i.e. in providing me with academic structure; practical manuals and scheme of work.	
2. I had adequate meetings with the Department.	
3. There were opportunities to raise concerns with the Department.	
4. There was adequate communication in terms of placement of students and the number of students that laboratories can accommodate.	
5. Communication from the Department with regards to WIL was sent to me timeously.	
6. The changing needs in industry were adequately addressed in the programme curriculum.	
7. I would like to receive additional training on the Lecturing, Teaching and Assessment (LTA) methods to improve the interaction and training of students.	
8. I did communicate and provide feedback to the Department.	
9. I am invited for curriculum meetings at the UoT.	
10. I am satisfied with the assessment of the WIL programme.	
11. There is an opportunity to communicate any shortcomings of the WIL programme with the department	

Open ended Questions:

1. Are there any aspects of the training that needs attention? Please specify.

2. How can student preparedness be improved prior to going to the workplace? Kindly elaborate.

3. What do you consider the strengths of the Biomedical Technology Programme? If there is please substantiate.

4. What do you consider the weaknesses of the Biomedical Technology Programme? If there is, please indicate.

5. Are there any additional challenges that you face with regards to the training of WIL students? If so, kindly elaborate.

APPENDIX C IREC APPROVAL

DUT
DURBAN UNIVERSITY OF TECHNOLOGY

Institutional Research Ethics Committee
Faculty of Health Sciences
Room MS 49, Mansfield School Site
Gate 8, Ritson Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2900
Fax: 031 373 2407
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

14 September 2016

IREC Reference Number: **REC 10/16**

Mr D Govender
68 Lapwing Avenue
Arena Park
Chatsworth
4092

Dear Mr Govender

Student preparedness for Work Integrated Learning (WIL) in Biomedical Technology

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the questionnaire has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letters.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Yours Sincerely,

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2016 -09- 14
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

APPENDIX D

Derrick Govender

From: Kamalanathan Govender <Kamalanathan.Govender@lancet.co.za>
Sent: 31 March 2016 09:34 AM
To: Derrick Govender
Subject: RE: Permission required for Research : D Govender

Hi Derrick,

Permission to undertake your research with Lancet has been approved.

Regards
Kamy

From: Derrick Govender [mailto:derrickg@dut.ac.za]
Sent: 2016-02-24 11:35 AM
To: Kamalanathan Govender
Subject: Permission required for Research : D Govender

Good day Mr Govender

I am presently a lecturer at DUT (Derrick Govender) and in the process of completing my Master's Degree in Health Sciences. Attached is a detailed Letter for Permission and a Provisional Ethical approval letter from the University to conduct the study within your organisation. I envisage commencing this research study as soon as possible.

Please keep me informed of any other information that you may require.

Regards

MR DERRICK GOVENDER
Lecturer: Biomedical Technology
Department of Biomedical & Clinical Technology
Faculty of Health Sciences
Durban University of Technology
P O Box 1334, Durban 4000, South Africa
Tel: +27 31 373 5292
Fax: +27 31 373 5295 / Fax to email: +27 086 332 4853
Email: derrickg@dut.ac.za
www.dut.ac.za

APPENDIX E

Academic Affairs and Research
Modderfontein Road, Sandringham, 2031
Tel: +27 (0)11 386 6142
Fax: +27 (0)11 386 6296
Email: babatyi.kgokong@nhls.ac.za
Web: www.nhls.ac.za

NATIONAL HEALTH LABORATORY SERVICE

03 June 2016

Applicant: Mr Derrick Govender
Institution: Durban University of Technology
Department: Biomedical and Clinical Technology
Contact Number: 031 373 5292

Re: Approval to conduct a study at the National Health Laboratory Service (NHLS) – KwaZulu Natal

Your application to undertake a research project titled '**Student Preparedness for Work Integrated Learning (WIL) in Biomedical Technology**' has been reviewed. This letter serves to advise that the application has been approved.

Please note that the approval is granted on your compliance with the NHLS conditions of service and that the study can only be undertaken provided that the following conditions have been met.

- Full Ethics clearance have been obtained from an approved local Ethics Committee
- Processes are discussed with the laboratory manager and/or the pathologist and are agreed upon
- Confidentiality is maintained at participant and institutional level and there is no disclosure of personal information or confidential information as described by the NHLS policy.
- A final report of the research study and any published paper resulting from this study are submitted and addresses to the NHLS Academic Affairs and Research office and the NHLS has been acknowledged appropriately.

Please note that this letter constitutes approval by the NHLS Academic Affairs and Research. Once all requirements have been met, please contact the National Technical Training Manager: Ms Zandile Cele who will provide approval and communicate with the relevant people.
Email:zandile.cele@nhls.ac.za, and Tel: 0113860496

Yours sincerely,

Dr Babatyi Malope-Kgokong
National Manager: Academic Affairs and Research

APPENDIX F

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE:
eThekwini District Office

Physical Address : 83 Kind Cetshwayo Highway, Mayville, Durban, 4001
Postal Address: P Bag X54318, Durban 4000
Tel: 031 - 2405308 Fax: 031 2405555 Email: somaroo@ukzn.ac.za

11 April 2016

Dear Mr Govender

Re: Student preparedness for Work Integrated Learning (WIL) in Biomedical Technology.

I have pleasure in informing you that your application to conduct research in Ethekwini district has been approved at the following health care facilities:

i. King Edward,
ii. Addington,
iii. IALCH, and
iv. RK Khan hospitals.

Please note the following:

i. All research activities must be conducted in a manner that does not interrupt clinical care at the health care facility,
ii. logistical details must be arranged with the CEO/medical manager /operational manager of the facility,
iii. this research project should only commence after final approval by the KwaZulu-Natal Health Research and Knowledge Unit, and full ethical approval, has been granted, and
iv. a report of your findings should be forwarded to the Ethekwini district office on completion of your project.

Yours sincerely

H Somaroo (Dr)
Medical Officer- Public Health Medicine

APPENDIX G

LETTER OF INFORMATION

Dear participant

I would like to thank you for taking time from your busy schedule and kindly allow me to inform you about the prospective study.

I am currently registered at the University with the intention of completing a Master's Degree. The aim of the study is to gain an insight into the students and supervisors perceptions on the readiness of students for the workplace.

Title of the Research Study:

Readiness for Work Integrated Learning (WIL) in Biomedical Technology – student and supervisor perspective

Principal Investigator/s/researcher: Dhanasagren Govender (Derrick) NHD – Medical Technology

Co-Investigator/s/supervisor/s: Dr R Prakaschandra: Phd (Cardiology) and Prof T Puckree: Phd (Physiotheraphy)

Brief Introduction and Purpose of the Study:

Biomedical Technology is a highly skilled profession with no room for error since diagnosis and treatment of patients' conditions depend primarily on accurate results, demanding highly competent and appropriately skilled professionals. Students enrolled for the National Diploma Biomedical Technology at the Durban University of Technology spend two and a half years at the UoT acquiring formal instruction and a compulsory six month period of clinical training (WIL) at HPCSA accredited training laboratories scheduled in the final six months of the programme in order to develop into graduates who are work-ready and familiar with organizational practice. Despite the established benefits of WIL, there is no data which ascertains whether the strategies employed by the Biomedical programme for developing students' employability skills are actually successful.

This information would be therefore extremely valuable in informing whether the outcomes for WIL have been optimally achieved and would further influence curriculum development and delivery.

The purpose of this study therefore is to determine the perceptions of students about the workplace training in enhancing their workplace readiness and the perception of laboratory supervisors on students' preparedness for training at these HPCSA accredited laboratories

Outline of the Procedures: Questionnaires will be administered to both the final year Biomedical Technology students and all the laboratory supervisors. A follow up questionnaire will be administered to the student once the WIL component has commenced. A majority of the questions will be close – ended requiring you to tick in the appropriate box. At the end there will be a few open ended questions where you will at liberty to comment and give valuable input.

Risks or Discomforts to the participant: Not applicable

Withdrawal from the study:

Your participation is entirely voluntary and you are under no obligation. If you decide to take part an information sheet will be given to you and you are required to sign a consent form. If you decide to withdraw later, you may do so without providing any reason.
Remuneration: No remuneration will be offered for participating in the study
Cost of the study: you will not be asked to cover any costs that is associated with this study.
Research – related injury: Not applicable.
Benefits: The benefits of this study may stem from the findings as it will determine the outcomes of the WIL programme as well as inform the Industry of the findings of the readiness of our students for the workplace. There may be two publications that may arise from this study.
Confidentiality: Kindly note that you will remain anonymous. Also names of employers will also be kept confidential.
Persons to Contact in the Event of Any Problems or Queries:
(Supervisor and details) Please contact the researcher (Mr D Govender tel no. 031 3735292), my supervisor Dr Prakaschandra (tel no. 031 3735411) or the Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.
General:
Potential participants must be assured that participation is voluntary and the approximate number of participants to be included should be disclosed. A copy of the information letter should be issued to participants. The information letter and consent form must be translated and provided in the primary spoken language of the research population e.g. isiZulu.

Thanking you in advance for you time and valued participation in this study. A copy, if required of the research results will be sent to you.

Kind regards
D Govender
Lecturer: Biomedical Technology.

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**
_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Please note the following:

Research details must be provided in a clear, simple and culturally appropriate manner and prospective participants should be helped to arrive at an informed decision by use of appropriate language (grade 10 level - use Flesch Reading Ease Scores on Microsoft Word), selecting of a non-threatening environment for interaction and the availability of peer counseling (Department of Health, 2004)

If the potential participant is unable to read/illiterate, then a right thumb print is required and an impartial witness, who is literate and knows the participant e.g. parent, sibling, friend, pastor, etc. should verify in writing, duly signed that informed verbal consent was obtained (Department of Health, 2004).

If anyone makes a mistake completing this document e.g. wrong date or spelling mistake a new document has to be completed. The incomplete original document has to be kept in the participant file and not thrown away and copies thereof must be issued to the participant.

References:

Department of Health: 2004. *Ethics in Health Research: Principles, Structures and Processes* http://www.doh.gov.za/docs/factsheets/guidelines/ethnics/

Department of Health. 2006. *South African Good Clinical Practice Guidelines*. 2nd Ed. Available at: http://www.nhrec.org.za/?page_id=14